airTran℠

AIRWAYS

B717-200

AIRCRAFT OPERATIONS MANUAL

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AIRWAYS

TECHNICAL PUBLICATIONS

MANUAL # ______________________

COPY # ______________________

LOCATION ______________________

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AirTran

B717-200

AIRCRAFT OPERATIONS MANUAL CONTENTS

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AIRCRAFT OPERATIONS MANUAL

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Original Issue Date: 9/17/99

REVISION RECORD

Revision No.	Revision Date	Date Revised	Initials
1	6/21/00		
2	10/19/00		
3	12/29/00		
4	2/16/01		
5	4/19/01		
6	6/26/01		
7	1/15/02		

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LIST OF EFFECTIVE PAGES

FAA APPROVED
EFF DATE:
01/16/02
D.O. IDENTIFER
SO-FSDO-15

POI Martin Polomski
SIGNATIURE:

LIST OF EFFECTIVE PAGES (cont.)

EMERGENCY NON-ALERTS
(EMER NON-ALERTS)
1 . . . . . . REV 7 . . . . . 01/15/02
2 . . . . . . ORIG 09/17/99
3 . . . . . . ORIG 09/17/99
4 . . . . . . REV 7 . . . . . 01/15/02
5 . . . . . . ORIG 09/17/99
6 . . . . . . REV 7 . . . . . 01/15/02
7 . . . . . . REV 7 . . . . . 01/15/02
8 . . . . . . REV 7 . . . . . 01/15/02
9 . . . . . . REV 7 . . . . . 01/15/02
10 . . . . . REV 7 . . . . . 01/15/02
11 . . . . . REV 7 . . . . . 01/15/02
12 . . . . . REV 7 . . . . . 01/15/02
13 . . . . . REV 7 . . . . . 01/15/02
14 . . . . . REV 7 . . . . . 01/15/02
15 . . . . . REV 7 . . . . . 01/15/02
16 . . . . . REV 2 . . . . . 10/19/00

ABNORMAL ALERTS
(AIR)
1 . . . . . . ORIG 09/17/99
2 . . . . . . ORIG 09/17/99
3 . . . . . . ORIG 09/17/99
4 . . . . . . ORIG 09/17/99
5 . . . . . . ORIG 09/17/99
6 . . . . . . ORIG 09/17/99
7 . . . . . . REV 2 . . . . . 10/19/00
8 . . . . . . ORIG 09/17/99
9 . . . . . . ORIG 09/17/99
10 . . . . . REV 2 . . . . . 10/19/00
11 . . . . . ORIG 09/17/99
12 . . . . . ORIG 09/17/99

(CONFIG)
1 . . . . . . ORIG 09/17/99
2 . . . . . . ORIG 09/17/99
3 . . . . . . ORIG 09/17/99
4 . . . . . . ORIG 09/17/99
5 . . . . . . ORIG 09/17/99
6 . . . . . . ORIG 09/17/99

(ELEC)
1 . . . . . . REV 5 . . . . . . 4/19/01
2 . . . . . . REV 5 . . . . . . 4/19/01
3 . . . . . . REV 3 . . . . . 12/29/00
4 . . . . . . REV 5 . . . . . . 4/19/01
5 . . . . . . REV 5 . . . . . . 4/19/01
6 . . . . . . REV 5 . . . . . . 4/19/01
7 . . . . . . ORIG 09/17/99
8 . . . . . . ORIG 09/17/99

(ENG/APU)
1 . . . . . . ORIG 09/17/99
2 . . . . . . ORIG 09/17/99
3 . . . . . . ORIG 09/17/99
4 . . . . . . ORIG 09/17/99
5 . . . . . . ORIG 09/17/99
6 . . . . . . ORIG 09/17/99
7 . . . . . . ORIG 09/17/99
8 . . . . . . ORIG 09/17/99

(FUEL)
1 . . . . ORIG 09/17/99
2 . . . . ORIG 09/17/99
3 . . . . ORIG 09/17/99
4 . . . . ORIG 09/17/99
5 . . . . ORIG 09/17/99
6 . . . . ORIG 09/17/99

(HYD)
1 . . . . REV 7 . . . . . 01/15/02
2 . . . . REV 7 . . . . . 01/15/02
3 . . . . REV 7 . . . . . 01/15/02
4 . . . . REV 7 . . . . . 01/15/02
5 . . . . REV 7 . . . . . 01/15/02
6 . . . . REV 7 . . . . . 01/15/02
7 . . . . REV 7 . . . . . 01/15/02
8 . . . . REV 7 . . . . . 01/15/02
9 . . . . REV 7 . . . . . 01/15/02
10 . . . . . . REV 7 . . . . . 01/15/02

(MISC)
1 . . . . ORIG 09/17/99
2 . . . . ORIG 09/17/99
3 . . . . ORIG 09/17/99
4 . . . . ORIG 09/17/99

ABNORMAL NON-ALERTS
(NON-ALERT)
1 . . . . REV 7 . . . . . 01/15/02
2 . . . . REV 7 . . . . . 01/15/02
3 . . . . REV 7 . . . . . 01/15/02
4 . . . . REV 7 . . . . . 01/15/02
5 . . . . REV 7 . . . . . 01/15/02
6 . . . . REV 7 . . . . . 01/15/02
7 . . . . REV 7 . . . . . 01/15/02
8 . . . . REV 7 . . . . . 01/15/02
9 . . . . REV 7 . . . . . 01/15/02
10 . . . . . . REV 7 . . . . . 01/15/02
11 . . . . . . REV 7 . . . . . 01/15/02
12 . . . . . . REV 7 . . . . . 01/15/02
13 . . . . . . REV 7 . . . . . 01/15/02
14 . . . . . . REV 7 . . . . . 01/15/02
15 . . . . . . REV 7 . . . . . 01/15/02
16 . . . . . . REV 7 . . . . . 01/15/02
17 . . . . . . REV 7 . . . . . 01/15/02
18 . . . . . . REV 7 . . . . . 01/15/02
19 . . . . . . REV 7 . . . . . 01/15/02
20 . . . . . . REV 7 . . . . . 01/15/02
21 . . . . . . REV 7 . . . . . 01/15/02
22 . . . . . . REV 7 . . . . . 01/15/02
23 . . . . . . REV 7 . . . . . 01/15/02
24 . . . . . . REV 7 . . . . . 01/15/02
25 . . . . . . REV 7 . . . . . 01/15/02
26 . . . . . . REV 7 . . . . . 01/15/02
27 . . . . . . REV 7 . . . . . 01/15/02
28 . . . . . . REV 7 . . . . . 01/15/02
29 . . . . . . REV 7 . . . . . 01/15/02
30 . . . . . . REV 7 . . . . . 01/15/02
31 . . . . . . REV 7 . . . . . 01/15/02
32 . . . . . . REV 7 . . . . . 01/15/02
33 . . . . . . REV 7 . . . . . 01/15/02
34 . . . . . . REV 7 . . . . . 01/15/02

LEVEL 1 AND IEVEL 0 ALERTS
(ALERTS)
1 . . . . ORIG 09/17/99
2 . . . . ORIG 09/17/99
3 . . . . ORIG 09/17/99
4 . . . . ORIG 09/17/99
5 . . . . ORIG 09/17/99
6 . . . . ORIG 09/17/99
7 . . . . ORIG 09/17/99
8 . . . . ORIG 09/17/99
9 . . . . ORIG 09/17/99
10 . . . . . . ORIG 09/17/99
11 . . . . . . ORIG 09/17/99
12 . . . . . . ORIG 09/17/99
13 . . . . . . ORIG 09/17/99
14 . . . . . . ORIG 09/17/99
15 . . . . . . ORIG 09/17/99
16 . . . . . . ORIG 09/17/99
17 . . . . . . ORIG 09/17/99
18 . . . . . . ORIG 09/17/99
19 . . . . . . ORIG 09/17/99
20 . . . . . . ORIG 09/17/99
21 . . . . . . ORIG 09/17/99
22 . . . . . . ORIG 09/17/99
23 . . . . . . ORIG 09/17/99
24 . . . . . . ORIG 09/17/99
25 . . . . . . ORIG 09/17/99
26 . . . . . . ORIG 09/17/99

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LIST OF EFFECTIVE PAGES (cont.)

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LIST OF EFFECTIVE PAGES (cont.)

EMER EQUIP (EMEREQUIP)
TOC-1. . . REV 1 . . . . . .6/21/00
TOC-2. . . ORIG 07/19/99
1 . . . . REV 1 . . . . . .6/21/00
2 . . . . REV 1 . . . . . .6/21/00
3 . . . . REV 1 . . . . . .6/21/00
4 . . . . REV 1 . . . . . .6/21/00
5 . . . . REV 1 . . . . . .6/21/00
6 . . . . REV 1 . . . . . .6/21/00
7 . . . . REV 1 . . . . . .6/21/00
8 . . . . ORIG 09/17/99
9 . . . . ORIG 09/17/99
10 . . . . . . ORIG 09/17/99
11 . . . . . . ORIG 09/17/99
12 . . . . . . ORIG 09/17/99
13 . . . . . . ORIG 09/17/99
14 . . . . . . REV 1 . . . . . .6/21/00
15 . . . . . . REV 1 . . . . . .6/21/00
16 . . . . . . ORIG 09/17/99
17 . . . . . . ORIG 09/17/99
18 . . . . . . REV 1 . . . . . .6/21/00
19 . . . . . . REV 1 . . . . . .6/21/00
20 . . . . . . ORIG 09/17/99

ENGINES & APU (ENG & APU)
TOC-1 . . . . REV 1 . . . . . .6/21/00
TOC-2 . . . . REV 1 . . . . . .6/21/00
1 . . . . REV 1 . . . . . .6/21/00
2 . . . . REV 1 . . . . . .6/21/00
3 . . . . REV 1 . . . . . .6/21/00
4 . . . . REV 1 . . . . . .6/21/00
5 . . . . REV 1 . . . . . .6/21/00
6 . . . . REV 1 . . . . . .6/21/00
7 . . . . REV 1 . . . . . .6/21/00
8 . . . . REV 1 . . . . . .6/21/00
9 . . . . REV 1 . . . . . .6/21/00
10 . . . . . . REV 1 . . . . . .6/21/00
11 . . . . . . REV 1 . . . . . .6/21/00
12 . . . . . . REV 1 . . . . . .6/21/00
13 . . . . . . REV 1 . . . . . .6/21/00
14 . . . . . . REV 1 . . . . . .6/21/00
15 . . . . . . REV 1 . . . . . .6/21/00
16 . . . . . . REV 1 . . . . . .6/21/00
17 . . . . . . REV 1 . . . . . .6/21/00
18 . . . . . . REV 1 . . . . . .6/21/00
19 . . . . . . REV 1 . . . . . .6/21/00
20 . . . . . . REV 1 . . . . . .6/21/00
21 . . . . . . REV 1 . . . . . .6/21/00
22 . . . . . . REV 1 . . . . . .6/21/00
23 . . . . . . REV 1 . . . . . .6/21/00
24 . . . . . . REV 1 . . . . . .6/21/00

FIRE WARNING AND
PROTECTION (FIRE)
TOC-1. . . ORIG 09/17/99
TOC-2. . . ORIG 09/17/99
1 . . . . ORIG 09/17/99
2 . . . . ORIG 09/17/99
3 . . . . ORIG 09/17/99
4 . . . . ORIG 09/17/99
5 . . . . . . ORIG 09/17/99
6 . . . . . . ORIG 09/17/99
7 . . . . . . ORIG 09/17/99
8 . . . . . . ORIG 09/17/99
9 . . . . . . ORIG 09/17/99
10 . . . . . ORIG 09/17/99
11. . . . . . ORIG 09/17/99
12 . . . . . ORIG 09/17/99
13 . . . . . ORIG 09/17/99
14 . . . . . ORIG 09/17/99

FLIGHT CONTROLS (FLT)
TOC-1 . . REV 1 . . . . . . 6/21/00
TOC-2 . . ORIG 09/17/99
1 . . . . . . REV 1 . . . . . . 6/21/00
2 . . . . . . REV 1 . . . . . . 6/21/00
3 . . . . . . REV 1 . . . . . . 6/21/00
4 . . . . . . REV 1 . . . . . . 6/21/00
5 . . . . . . REV 1 . . . . . . 6/21/00
6 . . . . . . REV 1 . . . . . . 6/21/00
7 . . . . . . REV 1 . . . . . . 6/21/00
8 . . . . . . REV 1 . . . . . . 6/21/00
9 . . . . . . REV 1 . . . . . . 6/21/00
10 . . . . . REV 1 . . . . . . 6/21/00
11. . . . . . REV 1 . . . . . . 6/21/00
12 . . . . . REV 1 . . . . . . 6/21/00
13 . . . . . REV 1 . . . . . . 6/21/00
14 . . . . . REV 1 . . . . . . 6/21/00
15 . . . . . REV 1 . . . . . . 6/21/00
16 . . . . . REV 1 . . . . . . 6/21/00
17 . . . . . REV 1 . . . . . . 6/21/00
18 . . . . . REV 1 . . . . . . 6/21/00

FUEL (FUEL)
TOC-1 . . REV 1 . . . . . . 6/21/00
TOC-2 . . REV 1 . . . . . . 6/21/00
1 . . . . . . ORIG 09/17/99
2 . . . . . . ORIG 09/17/99
3 . . . . . . REV 1 . . . . . . 6/21/00
4 . . . . . . ORIG 09/17/99
5 . . . . . . ORIG 09/17/99
6 . . . . . . ORIG 09/17/99
7 . . . . . . ORIG 09/17/99
8 . . . . . . ORIG 09/17/99
9 . . . . . . ORIG 09/17/99
10 . . . . . ORIG 09/17/99
11. . . . . . ORIG 09/17/99
12 . . . . . ORIG 09/17/99

HYDRAULICS (H)
TOC-1 . . REV 1 . . . . . . 6/21/00
TOC-2 . . ORIG 09/17/99
1 . . . . . . REV 1 . . . . . . 6/21/00
2 . . . . . . REV 1 . . . . . . 6/21/00
3 . . . . . . REV 1 . . . . . . 6/21/00
4 . . . . . . REV 1 . . . . . . 6/21/00
5 . . . . . . REV 1 . . . . . . 6/21/00
6 . . . . . . REV 1 . . . . . . 6/21/00
7 . . . . . . REV 1 . . . . . . 6/21/00
8 . . . . . . REV 1 . . . . . . 6/21/00
9 . . . . REV 1 . . . . . .6/21/00
10 . . . . . . REV 1 . . . . . .6/21/00

ICE & RAIN PROT (ICE)
TOC-1 . . REV 1 . . . . . .6/21/00
TOC-2 . . REV 1 . . . . . .6/21/00
1 . . . . ORIG 09/17/99
2 . . . . ORIG 09/17/99
3 . . . . ORIG 09/17/99
4 . . . . ORIG 09/17/99
5 . . . . ORIG 09/17/99
6 . . . . ORIG 09/17/99
7 . . . . ORIG 09/17/99
8 . . . . ORIG 09/17/99
9 . . . . ORIG 09/17/99
10 . . . . . . REV 1 . . . . . .6/21/00

INSTR & NAV (INST)
TOC-1 . . REV 1 . . . . . .6/21/00
TOC-2 . . REV 1 . . . . . .6/21/00
TOC-3 . . REV 1 . . . . . .6/21/00
TOC-4 . . ORIG 09/17/99
1 . . . . ORIG 09/17/99
2 . . . . ORIG 09/17/99
3 . . . . ORIG 09/17/99
4 . . . . ORIG 09/17/99
5 . . . . ORIG 09/17/99
6 . . . . ORIG 09/17/99
7 . . . . ORIG 09/17/99
8 . . . . ORIG 09/17/99
9 . . . . ORIG 09/17/99
10 . . . . . . ORIG 09/17/99
11 . . . . . . REV 1 . . . . . .6/21/00
12 . . . . . . REV 1 . . . . . .6/21/00
13 . . . . . . REV 1 . . . . . .6/21/00
14 . . . . . . REV 1 . . . . . .6/21/00
15 . . . . . . REV 1 . . . . . .6/21/00
16 . . . . . . REV 1 . . . . . .6/21/00
17 . . . . . . REV 1 . . . . . .6/21/00
18 . . . . . . REV 1 . . . . . .6/21/00
19 . . . . . . REV 1 . . . . . .6/21/00
20 . . . . . . REV 1 . . . . . .6/21/00
21 . . . . . . REV 1 . . . . . .6/21/00
22 . . . . . . REV 1 . . . . . .6/21/00
23 . . . . . . REV 1 . . . . . .6/21/00

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SIGNATIURE:

LIST OF EFFECTIVE PAGES (cont.)

24	REV 1	6/21/00
25	REV 1	6/21/00
26	REV 1	6/21/00
27	ORIG	09/17/99
28	ORIG	09/17/99
29	ORIG	09/17/99
30	ORIG	09/17/99
31	ORIG	09/17/99
32	REV 1	6/21/00
33	ORIG	09/17/99
34	ORIG	09/17/99
35	ORIG	09/17/99
36	ORIG	09/17/99
37	ORIG	09/17/99
38	ORIG	09/17/99
39	ORIG	09/17/99
40	ORIG	09/17/99
41	ORIG	09/17/99
42	REV 1	6/21/00
43	ORIG	09/17/99
44	ORIG	09/17/99
45	ORIG	09/17/99
46	ORIG	09/17/99
47	ORIG	09/17/99
48	ORIG	09/17/99
49	ORIG	09/17/99
50	ORIG	09/17/99
51	ORIG	09/17/99
52	REV 1	6/21/00
53	ORIG	09/17/99
55	ORIG	09/17/99
56	ORIG	09/17/99
57	ORIG	09/17/99
58	ORIG	09/17/99
59	ORIG	09/17/99
60	ORIG	09/17/99
61	ORIG	09/17/99
62	ORIG	09/17/99
63	ORIG	09/17/99
64	REV 1	6/21/00
65	ORIG	09/17/99
66	ORIG	09/17/99
67	ORIG	09/17/99
68	ORIG	09/17/99
69	REV 1	6/21/00
70	ORIG	09/17/99
71	ORIG	09/17/99
72	ORIG	09/17/99
73	ORIG	09/17/99
74	ORIG	09/17/99
75	ORIG	09/17/99
76	ORIG	09/17/99
77	ORIG	09/17/99
78	ORIG	09/17/99

LNDG GEAR & BRKS (LG)

TOC-1	REV 1	6/21/00
TOC-2	ORIG	09/17/99
1	REV 1	6/21/00
2	REV 1	6/21/00
3	REV 1	6/21/00
4	REV 1	6/21/00
5	REV 1	6/21/00
6	REV 1	6/21/00
7	REV 1	6/21/00
8	REV 1	6/21/00
9	REV 1	6/21/00
10	REV 1	6/21/00
11	REV 1	6/21/00
12	REV 1	6/21/00
13	REV 1	6/21/00
14	REV 1	6/21/00

WEIGHT AND BALANCE (W)

TOC-1	REV 1	6/21/00
TOC-2	ORIG	09/17/99
1	REV 3	12/29/00
2	ORIG	09/17/99
3	REV 3	12/29/00
4	REV 1	6/21/00
5	ORIG	09/17/99
6	REV 1	6/21/00
7	REV 6	6/26/01
8	REV 6	6/26/01
9	ORIG	09/17/99
10	REV 1	6/21/00
11	REV 6	6/26/01
12	REV 6	6/26/01
13	REV 6	6/26/01
14	REV 6	6/26/01
15	REV 6	6/26/01
16	REV 6	6/26/01
17	ORIG	09/17/99
18	ORIG	09/17/99
19	ORIG	09/17/99
20	ORIG	09/17/99

PERFORMANCE (P)

TOC-1	ORIG	09/17/99
TOC-2	ORIG	09/17/99
1	REV 3	12/29/00
2	ORIG	09/17/99
3	ORIG	09/17/99
4	ORIG	09/17/99
5	ORIG	09/17/99
6	ORIG	09/17/99
7	ORIG	09/17/99
8	REV 3	12/29/00
9	REV 3	12/29/00
10	ORIG	09/17/99
11	ORIG	09/17/99
12	REV 3	12/29/00
13	REV 3	12/29/00
14	REV 3	12/29/00
15	REV 3	12/29/00
16	ORIG	09/17/99
17	REV 3	12/29/00
18	ORIG	09/17/99
19	REV 3	12/29/00
20	REV 3	12/29/00
21	REV 3	12/29/00
22	ORIG	09/17/99
23	ORIG	09/17/99
24	ORIG	09/17/99
25	ORIG	09/17/99
26	ORIG	09/17/99
27	ORIG	09/17/99
28	ORIG	09/17/99
29	REV 4	2/16/01
30	REV 4	2/16/01
31	REV 4	2/16/01
32	REV 4	2/16/01
33	REV 4	2/16/01
34	REV 4	2/16/01
35	ORIG	09/17/99
36	ORIG	09/17/99
37	ORIG	09/17/99
38	ORIG	09/17/99
39	ORIG	09/17/99
40	ORIG	09/17/99

TRAINING (T)

TOC-1	REV 1	6/21/00
TOC-2	REV 1	6/21/00
1	ORIG	09/17/99
2	REV 1	6/21/00
3	REV 1	6/21/00
4	REV 1	6/21/00
5	REV 1	6/21/00
6	REV 1	6/21/00
7	REV 1	6/21/00
8	REV 1	6/21/00
9	REV 1	6/21/00
10	REV 1	6/21/00
11	REV 1	6/21/00
12	REV 1	6/21/00
13	REV 1	6/21/00
14	REV 1	6/21/00
15	REV 1	6/21/00
16	REV 1	6/21/00
17	REV 1	6/21/00
18	REV 1	6/21/00
19	REV 2	10/19/00
20	REV 1	6/21/00
21	REV 1	6/21/00
22	REV 1	6/21/00
23	REV 1	6/21/00
24	REV 1	6/21/00
25	REV 1	6/21/00
26	REV 1	6/21/00

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EFF DATE:
01/16/02
D.O. IDENTIFER
SO-FSDO-15

POI Martin Polomski
SIGNATIURE:

LIST OF EFFECTIVE PAGES (cont.)

FAA APPROVED
EFF DATE:
01/16/02
D.O. IDENTIFER
SO-FSDO-15

POI Martin Polomski
SIGNATIURE:

AOM BULLETINS RECORD

AOB NUMBER	ISSUE DATE	TITLE	RESCIND DATE
00-40	7/22/00	Dispatch For Flight Unpress S-2	
00-41	8/28/00	Nuisance Faults	
00-43	10/19/00	Procedure Turn	
00-44	10/26/00	Landing at VPS	
00-45	11/24/00	2nd Cert	
00-47	11-29-00	717 Issues	
00-48	12-13-00	FMS Fail Interim Procedure	
00-49	12-20-00	De-icing Revised S-22	

AOB NUMBER	ISSUE DATE	TITLE	RESCIND DATE

TABLE OF CONTENTS

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LIMITATIONS

INTRODUCTION

The following limitations are taken from the FAA approved Boeing flight manual. AirTran imposed limitations that are more restrictive than the FAA/Boeing limits will be indicated by an asterisk (*).

AIR CONDITIONING

For takeoff, the FLOW switch on the Overhead Panel must be in NORM.

ALTITUDE - MAXIMUM OPERATING

Maximum operating altitude is 37,000 feet.

AUTOLAND

Autolands are not permitted.

AUTOPILOT

During takeoff, do not engage the autopilot below 500 feet AGL.

When initiating a Go Around the autopilot must be disengaged. The auto pilot can be reengaged at 500 feet AGL.

Do not conduct an auto coupled (ILS or autoland) approach if “STAB OUT OF TRIM” alert illuminates for longer than 3 seconds.

For non-precision approaches, the autopilot must be disengaged no lower than the applicable minimums minus 50 feet.

AUXILIARY POWER UNIT (APU)

The maximum altitude for APU starting is FL 370.

APU air must be off for takeoff and inflight operations.

APU starter motor duty cycle is limited to three consecutive start attempts. Wait 30 minutes prior to further start attempts.

OPERATIONAL LIMITS

OPERATION	MAXIMUM EGT	MAXIMUM ROTOR SPEED
All Operations	Red Boxed Digits When Limits Exceeded	

CERTIFICATE WEIGHT LIMITS

MAXIMUM WEIGHTS (POUNDS)			
TAXI	TAKEOFF	LANDING	ZERO FUEL
122,000	121,000	104,000	98,000

The Center of Gravity Envelope table is located in the Weight and Balance chapter.

CONTAMINATED RUNWAYS

Maximum contamination for takeoff and landing are: Standing Water and/or Slush - 1/2 inch; Dry Snow - 4 inches

ENGINE CROSSWIND LIMITATIONS FOR TAKEOFF

The engine limiting crosswind component is 40 knots. For crosswind components greater than 40 knots or tailwind components greater than 10 knots, only taxi and ground handling is allowed, with engine N1 limited to 50%.

CRUISE BUFFET ONSET BOUNDARY

Refer to the Performance section.

EMERGENCY LIGHTS

The emergency light system must be armed for all flight operations.

ENGINE LIMITS

OPERATION		OPERATING CONDITIONS		
		TAKEOFF	**MAXIMUM CONTINUOUS THRUST**	**STARTING (GROUND AND FLIGHT)**
TGT Limits		Red Line (5 minutes)	Amber Line	Red Line
Maximum Oil Temperature (°C)		Red Line and Red Boxed Temperature		
Maximum Rotor Speeds	N1(%)	Red Line	Red Line	N/A
	N2(%)	Red Line	Red Line	N/A

In the event of an engine failure during takeoff or go-around, a total time of 10 minutes at takeoff thrust is allowed.

Oil Pressure normal operating limits are green arc. Maximum and minimum oil pressures are indicated by a boxed red value.

Oil pressures between 35 and 45 PSI are undesirable and should be tolerated only for completion of the flight, preferably at reduced power settings.

Use of N1 mode for takeoffs is prohibited.

ENGINE STARTER DUTY CYCLE

- 3 minutes on, 15 seconds off
- 3 minutes on, 15 seconds off
- 3 minutes on, 15 minutes off
- After 15 minutes wait (above) repeat cycle.

EVACUATION SYSTEM

The slide girt bars must be inserted in the floor fittings at the forward entry and forward service door prior to departure from the passenger loading ramp and must remain in position until arrival at the unloading ramp.

When carrying any individuals in the cabin compartment, the emergency operating handle on the aft pressure bulkhead door must be exposed and normal operating handle covered prior to departure from the passenger loading ramp. Both handles must remain in this configuration until arrival at the unloading ramp.

ENVIRONMENTAL ENVELOPE

Refer to the Performance section.

FLAPS

Takeoff with flap settings of less than 5° is prohibited.

FLIGHT CREW - MINIMUM REQUIRED

Two pilots.

FLIGHT MANAGEMENT SYSTEM (FMS)

Use of FMS PROF mode is prohibited.

Range calculations, fuel management, and engine out terrain clearance must not be predicated on FMS use.

Lateral navigation (NAV) must not be engaged to the flight director and/or autopilot until airplane is above 400 feet AGL.

Lateral navigation (NAV) must be manually disengaged for landing approach when 50 feet below minimums.

When operating in IRS NAV only, the airplane position must be verified using other navigation systems if available.

The FMS shall not be used in the area North of 80 degrees North latitude, and in the area South of 60 degrees South latitude.

FUEL

Jet A and Jet A1 fuel should be used for the B-717. Consult maintenance for other alternate fuels.

Do not reset any tripped fuel pump circuit breakers.

Maximum fuel temperature is 54°C. Minimum fuel temperature for Jet A is - 40°C and for Jet A1 is - 47°C.

FUEL - BALLAST

Fuel may be loaded into the center tank for ballast purposes provided the following conditions are met:

Completion of flight, including reserve fuel, does not require the use of ballast fuel.

The ZFW and CG includes the weight of the ballast fuel.

Consult the Weight and Balance Section for ballast fuel procedures.

FUEL LOADING

If main tanks are full, additional fuel may be added to the center tank to attain maximum ramp weight.

If main tanks are not full, fuel in the center tank must be calculated as part of the ZFW, and the CG (including all fuel in the center tank) must be within aircraft CG limitations.

FUEL MANAGEMENT

After takeoff, center tank fuel shall be emptied prior to using main tank fuel. If ballast fuel is being carried, the center tank shall be emptied to the ballast fuel value prior to using main tank fuel.

For all takeoffs and landings, two pumps must be operating in each main tank unless extra reserve fuel is loaded in accordance with the MEL/CDL.

Maximum permissible fuel unbalance weight for taxi, takeoff, inflight, and landing is 1,500 pounds.

LANDING GEAR AND BRAKES

Brake pressure for parking is 1700 PSI minimum to assure at least 8 hours parking time.

Do not set parking brake if “BRAKE OVERHEAT” alert is displayed.

Do not take off if any brake temperature exceeds 170°C.

MACH TRIM

Maximum airspeed with malfunctioning or inoperative Mach Trim Compensator (MTC) is .78 Mach.

PRESSURIZATION - CABIN

Maximum cabin differential pressure is 7.86 PSI.

Maximum emergency relief pressure is 8.27 PSI.

If operating in manual mode, takeoff, and land unpressurized.

REVERSE THRUST

Inflight movement of reverse thrust levers or use of inflight reverse thrust is prohibited.

Do not use asymmetric reverse thrust for directional control.

The following limitations are applicable when the airplane is using reverse thrust for power back:

Thrust reversers on both engines must be operative.

Application of brakes while backing is prohibited.

Power back is not authorized when winds are higher than 25 knots, ice, snow, or slush is on the ramp or during periods of heavy rain.

RUDDER POWER

The rudder hydraulic power must be on for takeoff.

RUDDER - MANUAL RUDDER CONTROL

Do not attempt an approach or missed approach at a speed less than 144 KIAS (until landing is assured) when “RUDDER PWR OFF” alert is displayed.

SPEED BRAKES

Speed brakes must not be used with flaps extended beyond 20°.

Do not move spoiler/speed brake lever to ground spoiler position in flight.

SPEED LIMITATIONS

Pertinent speed limitations are placarded or computed and displayed on the Primary Flight Displays (PFD).

Design Speed Charts

MAXIMUM SPEEDS
VMO = 340 knots
MMO = .82

SLATS EXTEND SPEED
KIAS = 280
Mach No. = .57

FLAP ANGLE	KIAS/Mach (MAX)
0 to 10° degrees	280/.57
10.1 to 20° degrees	240/.57
25° degrees	220/.57
40° degrees	200/.57

GEAR SPEEDS
Mach No. = .70
Landing Gear Retraction = 250 KIAS*
Landing Gear Extension = 300 KIAS
Landing Gear Extended = 300 KIAS

* Cumulative system tolerances may dictate a maximum of 230 KIAS to achieve positive gear retraction.

TAILWIND FOR TAKEOFF AND LANDING

Limiting tailwind component for takeoff and landing is 10 knots.

TAKEOFF

Use of FLEX takeoff power is prohibited under the following conditions:

- Contaminated runway
- Anti-skid inoperative
- An MEL or CDL item which effects the Max Takeoff Weight
- Tailwind component
- Windshear (known or suspected)
- Engine Anti-ice on
- Engine instrument inoperative
- Deicing/anti-icing fluids on the aircraft

WINDSHIELD HEAT/CRACKED WINDSHIELD

Windshield heat must be on and checked for all operations except as follows:

- Do not operate windshield heat on cracked windshield.
- Do not exceed 315 KIAS below 10,000 feet when windshield heat is inoperative on any windshield.
- Cracked Captain's, Center, or First Officer's windshield operating limits below 10,000 feet are:
    - Outer glass cracked: Under 315 KIAS.
    - Inner glass cracked: Under 235 KIAS.

WINDSHEAR GUIDANCE

Use of the flight director or coupled windshear guidance with one engine inoperative is prohibited.

WING LANDING LIGHTS

Wing landing light motors should be allowed to cool for 1.5 minutes after initial extension or retraction and 3.5 minutes after each subsequent extension or retraction.

Lamps should not be ON in still, ambient air for periods of over 10 minutes, due to excessive heat buildup.

WING ICE DETECTION

Do not takeoff with WING ICE DET alert displayed.

TABLE OF CONTENTS

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NORMAL PROCEDURES

INTRODUCTION

This subsection shows the normal division of duties between flight crew members. These procedures must be followed to maintain maximum crew coordination and efficiency.

CAPTAIN

The Captain is the pilot-in-command and retains final authority for all actions directed and performed. The Captain will perform his preflight duties and ensure the aircraft is prepared for departure. A discussion of Captain duties and responsibilities is located in the Flight Operations Manual (FOM), Section 2.

FIRST OFFICER

The First Officer is second-in-command and, in the event the Captain is incapacitated in flight, assumes the Captain's duties and responsibilities and conducts the flight to the point of next intended landing, or such other point as his judgement may dictate. The First Officer should proceed to the airplane as soon as possible, perform the preflight inspection, and ensure the aircraft is properly fueled and serviced. The First Officer normally calculates the performance data. A discussion of First Officer duties is located in the Flight Operations Manual (FOM), Section 2.

NORMAL USE OF RADIO

Because of its power source (Emergency DC Bus), VHF COMM-1 should be considered for use in ATC communications in-flight; however, radio usage will be at the Captain's discretion. VHF COMM-2 is normally used for company communications, and for communications on the ground.

First Officer handles all communications while on the ground. The pilot-not-flying (PNF) handles all enroute communications.

When entering the ramp area with Ground Control selected on COMM-1, Ramp Control may be selected on COMM-2.

CHECKLIST USAGE

USE OF THE CHECKLIST IS MANDATORY. CHECKING ITEMS BY MEMORY IS NOT ACCEPTABLE.

Checklists are used to verify that certain critical or essential steps have been accomplished.

It is the Captain's responsibility to see that the checklist is used properly. However, the pilot flying will explicitly call for all checklists at the proper time. If a checklist has not been called for at the proper time, the crew member responsible for reading the checklist shall request that it be read. When the airplane is moving, the pilot not taxiing/flying normally reads the checklist, with pilots responding as required. The Captain will specifically call for all checklists on the ground.

The challenge-response procedure will be used. The crew member challenging shall read directly from the checklist in a slow and audible manner. The crew member responding to the challenge will likewise answer in a slow and audible manner, ensuring that each item is checked using the phrase shown on the checklist.

Checklists marked as (Silent) will be accomplished by the PNF and the only verbal response required will be "________ Checklist Complete" (i.e. "Climb Checklist Complete").

Many of the items on the checklist may be accomplished prior to actually picking up and reading the checklist. The pilot may use a flow pattern to perform checklist items and then use the checklist to "check his work". In this event, the checklist must still be read by the First Officer/PNF with the appropriate challenge/responses. If the crew has properly carried through the required procedures, no action is usually necessary or no control need be positioned in completing the checklist. However, any action which has not been performed or completed when challenged must be completed before the next checklist challenge is read. Skipping checklist items with the intent of "coming back to it later" is unacceptable. If the item cannot be accomplished when read, the crewmember designated to perform the action should respond with "Standby" and the checklist will resume when the crewmember states the item is complete.

If reading of a checklist is interrupted for any reason, the last item called before the interruption will be repeated before continuing the checklist. When a checklist is complete the crew member challenging/reading will acknowledge by stating that it is completed; i.e., "Climb Checklist Complete."

Once a checklist has begun, it is Company policy that neither crewmember shall leave a duty station. If a checklist is interrupted before the engine is started due to a flight crewmember leaving his/her duty station, the checklist must be started again from the beginning. For example, if you have begun the Before Start checklist and the flight attendant asks that you assist with something in the back, the checklist must be begun again from the top. Under normal circumstances, once begun, the checklists should be completed with both crew members remaining at their normal duty stations.

Each crew member is responsible for his own checklist items and responses. However, each crew member should cross check the other to ensure that the proper action has been taken. Any nonstandard response should be resolved before continuing the checklist.

Notes and symboled challenges are read only when they apply. When a response is preceded by a solid line "________" the actual number(s) are included in the response.

After accomplishing the required actions, the checklist shall be called for and read. It will be responded to by the Captain (C), First Officer (FO), both pilots (BOTH), Pilot Flying (PF), or the Pilot Not Flying (PNF), as indicated on the checklist.

BEFORE START... Items above the dashed (- - -) line are read prior to engine start. Items below the dashed line are read when ready to start engines. The pilot starting the engines will perform the flow pattern.

NOTE

> If engines will be started during pushback, the First Officer will start engines so that the Captain can maintain outside vigilance.

BEFORE TAXI... Read just prior to airplane movement under its own power. The pilot starting will perform the flow pattern. Challenge by the First Officer, response by the Captain.

BEFORE TAKEOFF... Items above the dashed (- - -) line are read during taxi-out. Items below the dashed line are read when cleared into position for takeoff and must be completed prior to beginning the takeoff roll. Challenge by the First Officer.

CLIMB... Accomplished after passing 3,000 feet AGL. The pilot not flying will read and respond to the checklist silently.

IN RANGE... Should be accomplished just prior to descending through transition level. Any items that are necessary to set prior to this (i.e. hydraulic pumps) can be accomplished as necessary prior to reading the checklist.

NOTE

> The pilot flying should not brief the approach while flying. He should transfer control of the aircraft to brief the approach.

LANDING... Read after gear extended for landing. Challenge by PNF.

AFTER LANDING... Read after departing active runway. Accomplished silently by the First Officer.

PARKING... Read after airplane is parked and both engines have been shut down. Challenge by First Officer, response as indicated.

TERMINATING... Read if airplane will be shut down for an extended period.

AREA OF RESPONSIBILITY

In the 717-200, an area of responsibility concept is used. Each crewmember is assigned a cockpit area of responsibility where he/she can initiate action in accordance with Normal Operating Procedures. Supplemental and Non-Normal Procedures are initiated at the direction of the Captain. Actions falling outside a crewmember’s area of responsibility are also initiated at the direction of the Captain. Controls that are common to both areas, such as flight controls, throttles, flight guidance and trim, are usually positioned by the PF. These areas are in addition to areas normally monitored by each pilot; for example, each pilot would normally monitor his/her respective flight instruments and the engine and alert display (EAD).

Use the following guidelines for the operation of the multifunction control and display units (MCDUs) and flight control panel:

1. Actions requiring an input on one of the MCDUs for the FMS are normally accomplished by the PNF. Any inputs which alter the airplane's flight profile should be coordinated by both crewmembers before execution.
2. When the autoflight mode is engaged the controls that affect the flight profile are usually positioned by the PF. If the airplane is being flown manually, inputs to the flight control panel should be made by the PNF at the direction of the PF. PF should verify all direction inputs.

   When the PF wants to set up the Flight Control Panel for a planned turn, altitude change, or airspeed change, he will state: "PRESET HEADING/ALTITUDE/AIRSPEED to <u>(desired number)</u>." The PNF will then preset the HEADING/ALTITUDE/AIRSPEED into the window. When the PF actually wants to initiate the change in HEADING/ALTITUDE/AIRSPEED, he will state "SET HEADING/ALTITUDE/AIRSPEED to <u>(desired number)</u>".

CREW COORDINATION

The greatest safety and proper crew coordination can only be achieved when each crewmember performs the duties and functions for which he/she is responsible.

When the PF wants to transfer control of the aircraft, the PF will state "YOU HAVE THE AIRCRAFT." The PNF will then respond, "I HAVE THE AIRCRAFT," and assumes control. The other pilot will then relinquish the controls and assume PNF duties.

B-717 AUTOMATION

B-717 pilots must be proficient in operating their aircraft at all levels of automation. It is imperative that each pilot understands what is available and can select the appropriate amount of automation.

The degree of automation can vary and can affect crew workload. It is the responsibility of the Captain to ensure that the level of automation is consistent with the aircraft's operating environment. In situations where a significant number of routing changes may have been issued by ATC, or in the case of last minute changes within a terminal area, lower levels of automation should be used.

It is important that both pilots are constantly aware of FMS programming. During ground operations both pilots should be aware of, and cross check, FMS inputs. If the takeoff and departure are anything but standard, the PF should brief changes during the takeoff briefing. Above all, both pilots should be aware of the PF's intentions.

If the autopilot is engaged, the PF should make the mode selections. If the PF is manually controlling the aircraft, the PNF should perform the mode selections at the direction of the PF. This goes to the heart of good CRM and deviations from this standard should be avoided unless due to unforeseen circumstances. In-flight changes to the FMS should be accomplished by one pilot. If both pilots are "heads down" in the cockpit, a potentially dangerous situation is created. This is even more important in the terminal area.

The PF has the direct responsibility for the aircraft's flight path. This responsibility should not be delegated to an automatic system. If there are discrepancies between a charted airway or procedure and the FMS database, the chart is the final authority. The aircrew must ensure that FMS guidance agrees with the charts. Do not couple the FD to the FMS unless the active leg and altitude have been reviewed.

FMS approaches demand high levels of proficiency. Situational awareness, briefings, and communication are needed for safe operations. FMS programming and briefings should be completed prior to arrival in the terminal area. The FMS should be examined to confirm that all waypoints, courses, distances, and missed approaches conform to the published printed charts.

While departing, enroute, and approaching the airport, all appropriate charts will be opened and available. Pre-plan so that FMS programming can be completed during low workload phases of flight. The key to successful automation is good CRM and avoiding complacency. Automation was never designed to make decisions for the crewmember, but rather make decisions easier. Maintaining proficiency in automation, and knowing when and how to use it, will ensure a safe operation.

PREFLIGHT

The preflight inspection is broken into areas of responsibility based on location of switches and time constraints on the pilots. The Inspections discussed below detail which pilot will usually have responsibility for completing the list of actions. However, both pilots should be familiar and capable of performing all checks in case conditions require the absence of one pilot.

Airplane Safety Inspection (Normally FO's Responsibility)

Airplane Position

> Observe the general area around the aircraft for hazards to safety of airplane and personnel.
>
> Observe that wheel chocks are in place.

Maintenance Personnel

> If maintenance is in progress, confer with maintenance personnel to determine if the work will prevent activation of any airplane system.

Flight Control Surfaces

> Observe that personnel or ground equipment are not within range of control surface full travel.
>
> Observe flap/slat position and spoiler position.

Landing Gear Doors

> Observe that main and nose landing gear doors are closed.

Cockpit Safety Inspection (Normally FO's Responsibility)

Log Book **(Log Book should be reviewed by both pilots. The Captain must ensure that logbook entries are complete and the aircraft is cleared for flight)**.

> Examine log book for previous discrepancies. Observe that uncorrected items not required for dispatch are placarded appropriately and noted in log. Verify that maintenance performed on the airplane is signed off. Review status of log with other crewmember.
>
> If electrical power is available, review STATUS page and compare open discrepancies with log book.

Circuit Breakers

Observe all circuit breakers are closed. If any circuit breaker is open and not placarded or collared, call maintenance. Circuit breakers may be open if they are placarded or collared open by maintenance.

Do not reset any tripped fuel pump circuit breakers.

One reset of any other tripped circuit breaker may be attempted after a two minute (approx) cooling period. If the circuit breaker trips again, do not attempt another reset.

Indiscriminate pulling or resetting of circuit breakers for systems or components may cause unanticipated results because of systems interrelationship.

Cockpit Equipment

Fire Axe - Installed and secured.

Life Vests (3) - on board.

Escape Ropes - installed, properly stowed and secured.

QRH, MEL/CDL, and Runway Analysis Manual - on board.

Oxygen Cylinder

Check oxygen cylinder supply valve is open. Rotate knob one-half turn toward valve CLOSE and then back to full OPEN to verify valve is not jammed

Check cylinder pressure. Pressure of 1800 PSI is considered full. Crew Oxygen requirements are 1350 PSI with 2 pilots and an observer, or 950 PSI with 2 pilots only.

Verify OXY LINE PRESS gage is in normal range.

Protective Breathing Equipment (PBE) - installed and tamper-evident seals intact.

Fire Extinguisher - installed, serviced, safetied, and secured.

Gear Pins (3) - on board.

Aft Overhead Panel

Verify that the GROUND SERVICE ELEC PWR switch is as required.

Verify that the Oxygen Pressure is in the Green Band.

Verify that all loops in the ENG FIRE DET SYS are in BOTH.

Verify that the CARGO SMOKE DET SYS are in NORM.

Hydraulics Control Panel

Verify hydraulic AUX and TRANS pump switches are OFF.

AIR Control Panel

Verify L and R PACK switches are OFF.

Gear Handle

Verify gear handle is down.

SPD BRK Lever and FLAP/SLAT Handle

Verify SPD BRK lever is in full forward and DISARMED position.

The FLAP/SLAT handle should be UP. If not, confirm no maintenance work in progress. Retract ONLY after clearing the area.

If the lever is UP, but the flaps/slats have drooped, ensure area is clear before applying hydraulic pressure.

FUEL Switches

Verify engine FUEL switches are OFF.

WX RADAR Panel

Verify weather radar mode selector is OFF.

Preliminary Cockpit Preparation (Normally FO's Responsibility)

EMER PWR Switch/BATT Switch

Verify EMER PWR selector is in the OFF position. Move BATT switch to ON and rotate knob 90 degrees clockwise to lock the switch in the ON position.

Establishing Electrical Power

Verify DC BUS TIE and L and R BUS TIE switches are in AUTO. Verify L GEN, APU and R GEN switches are ON.

- External Power Available (External Power AVAIL Light Illuminated). Move the External Power Switch to ON and the GROUND SERVICE ELEC Power Switch to OFF. All Buses are now powered.
- External Power not available, start APU to provide electrical power as follows:

Move EMER PWR Switch to ON.

Accomplish FIRE TEST

MASTER WARNING/MASTER CAUTION Lights...... OFF

ENG and APU LOOPS Switches .... BOTH

FIRE TEST Switch .... TEST

Hold FIRE TEST switch down. Successful test is indicated by:

- Fire bell.
- Voice fire warning from each engine and APU.
- Illumination of both MASTER WARNING lights and both ENG FIRE handles. (Only Captain's MASTER WARNING light will illuminate if using Emergency Power).

The following alerts will be displayed on the EAD:

- "ENG L FIRE"
- "ENG R FIRE"
- "APU FIRE"
- "PODS TEST PASS" (If performing test on Emergency (battery) Power, the level 1 "PODS TEST FAIL" will illuminate instead).

Push MASTER WARNING light and observe voice warning and fire bell are silenced. Release FIRE TEST switch and observe all alerts and warnings are extinguished.

Move START PUMP switch to ON.

Verify APU AIR switch is OFF and FIRE CONT switch is in the NORM position.

Move APU MASTER switch to momentary START position and release to RUN position.

NOTES

The APU start may be delayed up to approximately 40 seconds to allow the inlet door to reach full open position.

APU bleed air is inhibited for 2 minutes after an APU start is initiated.

When APU electrical power is established, move the EMER PWR selector to OFF, select appropriate right main fuel pump switch to ON and move START PUMP switch to OFF.

Reaccomplish FIRE TEST to ensure First Officer's MASTER WARNING light is operational, and to obtain a "PODS TEST PASS" level 0 alert.

IRS Initialization

NOTE

Do not move airplane while IRU's are aligning. Normal passenger loading or wind gusts will not affect alignment.

Rotate IRS mode selectors to NAV. Observe A/C STATUS page is displayed. Verify entries on both MCDU's are accurate and identical. Verify ACTIVE DATA BASE date is current.

Select F-PLN INIT page on MCDU, enter data required on this page and INITIALIZE IRS.

NOTE

If INITIALIZE IRS prompt is not selected within 10 minutes of selecting NAV, the NAV/OFF lights will begin flashing.

HYDRAULICS Control Panel

WARNING

Ensure area is clear before applying hydraulic pressure.

Push HYD cue switch on SCP. Move hydraulic AUX pump switch to ON and observe right hydraulic pressure display indicates in normal range. Move hydraulic TRANS pump switch to ON and observe hydraulic pressure display indicates in normal range. Confirm HYD CONT RUDDER switch light is out.

Leave the AUX and TRANS pump switches ON for the exterior inspection in order to check the brake wear indicators. After the exterior inspection, move hydraulic AUX and TRANS pump switches to OFF.

GALLEY Power

Verify GALLEY Power ON.

Air Conditioning

If Air Conditioning is required, verify ISOL switch is open. Move APU AIR switch to ON. Move L and R PACK switches to AUTO. Rotate TEMP selectors to AUTO and adjust to achieve desired cockpit and cabin temperatures. If using Gasper Fan without Packs on, open the ram air valve by turning the RAM AIR switch to ON.

EMER LT Switch

Move EMER LT switch to ON and observe emergency light in cockpit illuminates. Move EMER LT switch to ARM and observe emergency light in cockpit extinguishes.

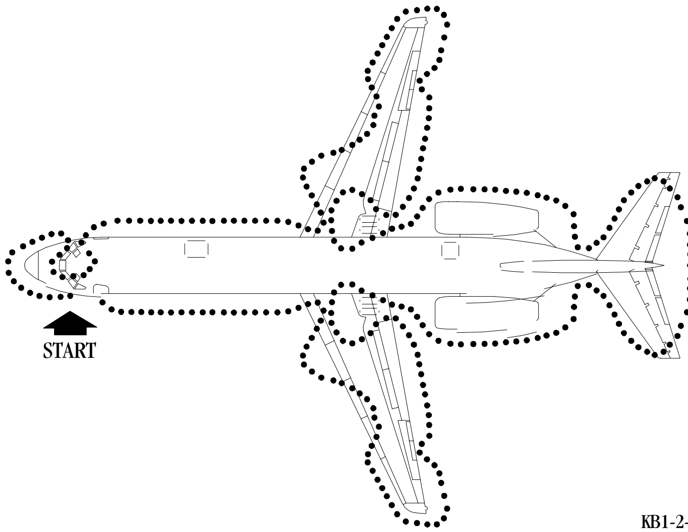
NOTE

Operation of EMER LT switch in ON should be limited to a maximum of 1 minute to preserve batteries and extend bulb life.

Parking Brake

Set the parking brake.

EXTERIOR INSPECTION



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Exterior Inspection (Normally FO's Responsibility).

It is assumed that all maintenance activity is completed and all service and access panels or doors are closed and properly secured. While inspecting the overall condition of the airplane, as well as the specified areas, observe no damage exists, no obstructions to inlets and outlets, and no fluids are leaking. When any abnormalities are detected, contact maintenance.

Inspect the following for proper configuration/acceptable conditions.

Nose Section

- Wheel well lights ON.
- External power access panel circuit breakers set.
- Angle of attack vane condition.
- Windshields condition.
- Radome latched/condition.

Nose Gear and Wheelwell

- Wheel well lights condition.
- Landing and taxi lights.
- Nose gear assembly condition.

Tire inflation/condition.

Strut extension.

Steering bypass pin (as required).

Nose gear safety pin removed.

Nose gear doors and spray deflector condition.

Ground shift mechanism.

Electronic compartment access door closed/handle locked.

Right Forward Fuselage

Ram air temperature probe and pitot tubes condition; free from obstructions and covers removed.

CAUTION

The RAT probe reaches temperatures which could cause burns if handled immediately after landing.

Oxygen blowout disk intact.

Forward service door checked.

Forward cargo door checked.

Static ports free of foreign objects.

Right ground floodlight condition.

Wing leading edge floodlight condition.

Forward fuel shroud drain condition.

Brake cooling inlet free of foreign objects.

Lower Center Fuselage

Antennas condition.

Gear door hydraulic bypass handle stowed.

CAUTION

There is no cockpit indication if the gear door hydraulic bypass handle is not stowed, but the doors are shut.

Right Wing and Landing Gear

WARNINGS

Do not enter wheelwell area if the wheelwell door is open and the landing gear door bypass handle is in the normal position.

Obtain safety clearance prior to pressurizing the hydraulic system when the wheelwell doors are open.

Vortilon condition.

Wing inboard lower surface condition.

Slats and slat track cover doors condition.

Refueling panel and defueling valve access panel checked.

Fuel tank vent free of foreign objects.

Wingtip ram air vent free of foreign objects.

Wingtip and landing lights condition.

Seven static dischargers condition.

Aileron and tabs condition and faired.

Spoiler panels condition and faired.

Flaps and flap fairings condition.

Overwing cabin emergency exits checked.

Upper anticollision light condition.

Vertical stab condition.

Horizontal stabilizer trim motor access panel condition.

Rudder limiter pitot tube condition.

Gear doors, spray deflector, skid pad condition.

CAUTION

Do not step on the spray deflector.

Main gear safety pin removed.

Strut extension.

Shimmy damper condition.

Shimmy damper reservoir checked.

Main gear assembly condition.

Tire inflation/condition.

Brake wear indicator (brakes must be set).

Spoiler bypass handle ON.

CAUTION

If a spoiler bypass handle is not in the ON position, there will be no indication in the cockpit until the Before Takeoff checklist is accomplished (aileron movement).

Wheelwell light condition.

Lower anticollision light condition.

Aft fuel shroud drain condition.

One drain is located adjacent to the right main gear door aft outboard corner, the other is located approximately four feet aft and inboard of the first drain slightly right of the fuselage centerline.

Emergency Overwing Exit light condition.

Right Engine

Engine nacelle flood light condition.

Engine inlet cover removed.

Engine P-20/T-20 probe condition.

Engine nosecone and nosecone tip condition.

Nacelle fairing doors and inspection doors latched/condition.

Strake condition.

Outboard Thrust Reverser lockout pins.

Engine exhaust cover removed.

Inboard Thrust Reverser lockout pins.

Right Aft Fuselage

Aft cargo door checked.

Pylon vent free of foreign objects.

APU compartment ventilation exhaust free of foreign objects.

Reverser bypass door latched/condition.

External conditioned air service door.

Aft fuel vent mast condition.

Tail bumper and strike indicator condition.

APU exhaust and shroud cooling outlet free of foreign objects.

Tailcone condition.

Tail compartment access door latched/condition.

Two tailcone static dischargers condition.

Empennage

Rudder and tab condition.

Horizontal stabilizer condition.

Elevators and tabs condition.

Six elevator static dischargers condition.

Left Engine

(same as right engine).

Left Aft Fuselage

Lavatory service door latched/condition.

Cabin pressurization outflow valve condition.

Tail compartment temperature vent free of foreign objects.

Tailcone external release normal (prerelease) position.

Air conditioning pack exhaust.

APU air inlet door condition.

APU fire panel access door.

External air service door secured.

Reverser bypass door secured.

Waste service panel door secured.

Left Wing and Landing Gear

(same as right wing and landing gear).

Left Forward Fuselage

Brake cooling inlet.

Wing leading edge floodlight.

Potable water.

Check quantity of potable water and ensure service door is closed.

Static ports.

Cabin pressure relief valves.

Ground floodlight.

Radio rack venturi outlet.

Vertical stabilizer ram air inlet.

External power access panel: verify wheel well lights off.

Once Exterior Inspection is complete turn off the AUX and TRANS hydraulic pumps and ensure all exterior lights are as required.

B-717 NORMAL CHECKLIST

AirTran

B717-200 NORMAL CHECKLIST
06/21/00

BEFORE START

EAD	Checked	C
Status Page	Checked	C
Fuel Quantity	_____ Lbs	BOTH
Seat Belts/No Smoking	On	C
Oxygen Masks/Pressure	Checked	BOTH
FMS	Set	BOTH

Status Page	Checked	FO
Beacon	On	FO
Hyd Pumps (All)	On	C
Parking Brake	Set or Off	C
Papers & Logbook	On-Board	C
FMS and V Speeds	Set	BOTH
Flap T.O. Selector	Set	BOTH
Shoulder Harness	On	BOTH
♦ Pack/Isolation Switches	Set	FO

♦ BEFORE TAXI

Pack/Isolation Switches	Set	C
Ice Protection	Set	C
Door Lights	Out	C
Cockpit Door	Locked	FO

♦ BEFORE TAKEOFF

Flight Controls & Brake Temp	Checked	BOTH
Flaps	_____°	BOTH
Fuel Quantity	_____ Lbs	BOTH
Trim Controls.	Set / ___ ANU	BOTH
Spoilers	Armed	C
Takeoff Briefing & FCP	Complete & Set	PF
Altimeter	Set & X-Ckd	BOTH
Cabin Secure	Received	F/O

F/A Signal	Given	FO
Radar, Transponder	Set	FO
EAD	Checked	BOTH

CLIMB (Silent)

Hyd Aux/Trans Pump Switches	Off	PNF
Gear	Up	PNF
Flaps/Slats	Up and Stowed	PNF
Spoilers	Disarmed	PNF

♦ Reaccomplish these checklists items and checklists if both engines are not started at the gate.

IN RANGE

FMS	Set	BOTH
DH/MDA	Set	BOTH
Landing Data and Briefing	Complete	PF
Hyd Pumps (All)	On	BOTH
Ice Protection	Set	PNF
Seat Belt Sign	On	C
Shoulder Harness.	On	BOTH
Altimeters	Set & X-Ckd	BOTH

LANDING

F/A Signal	Given	PNF
Landing Gear	Down-3 Green	BOTH
Spoilers	Armed	C
Flaps	_____°	BOTH
EAD	Checked	BOTH

AFTER LANDING (Silent)

Flaps	18°	FO
Spoilers	Forward & Disarm	FO
APU	As Required	FO
Radar, Transponder	Off/Standby	FO
Flaps/Slats (just prior to entering gate)	Up	FO

PARKING

Seat Belt Sign	Off	C
Parking Brakes (If Chocked)	Released	C
Hyd Aux/Transfer Pump Switches	Off	FO
Air Conditioning	Set	FO
Fuel Control Panel	Set	FO
Ice Protect Control Panel	Off	FO
Exterior Lights	Off	FO
Status Page	Checked	FO

TERMINATING

Cabin Emergency Lights	Off	FO
Pack Switches	Off	FO
Emergency Power Selector	Off	FO
IRS	Off	FO
Ground Service Power	As Required	FO
Battery Switch	As Required	FO

FAA APPROVED
Effective Date: 06-28-00
D.O. Identifier: Orlando FSDO-15
P. O. I.: For William E. Miller
Signature:

FINAL COCKPIT PREPARATION [EXPANDED BEFORE START PROCEDURE]

The Final Cockpit Preparation is separated into an area normally performed by the Captain, and an area normally performed by the First Officer. **Both pilots should be capable of performing the entire preflight.** This preparation, in conjunction with the preflight inspections previously described, prepares/tests panels and components prior to initiating the BEFORE START checklist.

Captain's Final Cockpit Preparation

Cockpit Voice Recorder

Plug headset into the CVR panel and momentarily push TEST button. A steady tone will sound and the STATUS light should illuminate for approximately 1 second indicating that the system is working properly.

ANTI-SKID Switch Light

Verify ANTI-SKID OFF switch light is extinguished.

CARGO SMOKE Panel

Verify CARGO SMOKE DET SYS panel switches are in NORM on Aft Overhead Panel.

Push and hold CARGO SMOKE TEST button and verify:

- Voice Warning "CARGO SMOKE".
- Illumination of both MASTER WARNING lights and the "PUSH" portion of each agent discharge switch light (4).

The following alerts are displayed on the EAD:

- "CARGO SMOKE FWD".
- "CARGO SMOKE AFT".
- "CRG SMK TEST PASS" will be momentarily displayed.

GPWS Control Panel (Enhanced GPWS)

Verify GPWS TERRAIN OVRD switch light is extinguished and guard is down.

Observe the mode box on the lower right corner of the Captain's and/or FO's ND. If TERRAIN is not displayed on ND, push WX/TERR switch and verify that TERRAIN is displayed in the box.

Momentarily hold the GPWS switch in the TEST position. The following visual and aural annunciations will be present:

Visual –

- TERRAIN TEST displayed in the ND mode box.
- Lights are illuminated in the BELOW G/S switch.
- “GPWS FAULT” and “TERRAIN FAIL” level 1 alerts are displayed on the STATUS page.

Aural messages –

- “GLIDESLOPE”
- “WHOOP-WHOOP, PULL-UP”
- “TERRAIN AHEAD, PULL-UP”

If a check of all aural and visual annunciations is desired, hold GPWS switch until “GLIDESLOPE” is heard on cockpit speakers.

During aural annunciations, a terrain test pattern will begin to display on each ND on which TERRAIN DISPLAY has been selected.

CABIN PRESS Panel

Verify CABIN PRESS SYSTEM SELECT MANUAL switch light is extinguished and CABIN PRESS VALVE is OPEN.

ELECTRICAL Panel/Emergency Power

NOTE

If “BAT CHARGING” alert is displayed, do not perform emergency power test since an invalid test will result.

Rotate EMER PWR selector to ARM and observe EMER PWR ON light illuminates and “EMER POWER TEST” alert is displayed.

After approximately 1 minute, observe “EMER PWR TST FAIL” alert is not displayed.

APU Panel

When APU electrical power or air is required, and EXT electrical power is in use, accomplish Engine/APU Fire test and start APU as follows:

Verify APU AIR switch is OFF and the FIRE CONT switch is in the NORM position. Move the RIGHT main fuel pump switch to ON. Move APU MASTER switch to start position momentarily and release to run position.

NOTES

The APU start may be delayed up to approximately 40 seconds to allow the inlet door to reach full open position.

APU bleed air is inhibited for 2 minutes after an APU start is initiated.

AIR Control Panel

Verify ISOL switch is OPEN. Move APU AIR switch to ON. Move L and R PACK switches to AUTO. Rotate CKPT TEMP and CABIN TEMP selectors to AUTO and adjust to achieve desired cockpit and cabin temperatures. If using the Gasper Fan without Packs ON, open the ram air valve by turning the RAM AIR switch ON.

ICE PROTECTION Control Panel

Push AIR DATA HEAT switch to ON. Verify WING and TAIL AIR FOIL anti-ice switches are OFF. Verify WINDSHLD ANTI-FOG switch is OFF. Move WINDSHLD ANTI-ICE switch to ON. Move and hold WING ICE DET switch in TEST position. Observe “WING ICE DET PASS” alert is displayed, then release switch. Verify L and R ENG anti-ice switches are OFF.

FUEL USED RESET Button

Push FUEL synoptic cue switch. Push FUEL USED RESET button and observe FUEL USED counters decrease to zero.

Annunciator Light Test

Push and hold ANNUN LT TEST button. Observe MASTER WARNING and MASTER CAUTION lights illuminate. Observe all annunciators and segmented filament readouts on glareshield illuminate. Observe overhead panel annunciator lights illuminate. Observe system display control panel annunciator lights illuminate. Observe pedestal annunciator lights illuminate. Release ANNUN LT TEST button.

NOTE

STABILIZER TRIM OFF Switch Light, STICK PUSHER PUSH TO INHIBIT Switch Light and ENGINE START (L,R) switches will not illuminate.

PULL TO DIM Switch

Verify switch is in desired position.

FUEL Control Panel

Select FUEL synoptic. Ensure fuel quantity channel indicates “A”. Place all fuel pump switches with fuel in tanks to ON. Ensure fuel pumps are operating. Compare fuel in tanks with total fuel quantity -- if there is a difference check ballast fuel page on MCDU. Compare total fuel with dispatch requirements and verify fuel is correctly distributed. Ensure fuel crossfeed is operational by moving FUEL X FEED lever to ON and checking that the crossfeed valve on the synoptic is green.

ENGINES Control Panel

Verify L and R FADEC MODE switch lights are extinguished.

Verify IGNITION switch is AUTO.

Verify Start Pump is OFF.

Windshield Wipers (Both)

Verify wipers are parked.

NOTES

Do not operate wipers on dry glass.

If wipers are not parked, move windshield WIPER selector to PARK (momentary). Observe wipers move to park position. Release selector.

Holding selector in PARK too long may cause motor to recycle or overheat.

Exterior/Interior Lights

NOTE

Test exterior lights as required for flights.

Set DOME light button, and THNDRSTRM switch as required.

Rotate OVHD PNL/FLOOD and INSTR and PED PNL/FLOOD light knobs to adjust lights to desired intensity.

Set CKT BKR LT switch OFF.

Move SEAT BELTS and NO SMOKE switches to ON.

Verify L and R LDG LT switches are in RET.

Verify NOSE LT switch is OFF.

Verify WING/NACL light switch is OFF.

Verify L and R GND FLOOD LT lights are OFF.

Verify NAV light is ON.

Set LOGO light as required.

Verify BCN and HI-INT lights are off.

Move STBY COMP switch to BRT. Adjust sighting mirrors to observe standby compass. Verify standby compass light is illuminated. Cross-check airplane heading with standby compass. Move STBY COMP switch to OFF.

Captain’s EIS/Flight Control Panel

Select to IN. Select BAROSET to QNH. Rotate inner BAROSET control knob to desired setting. Select HDG readout to MAG. Select TRFC, DATA, and VOR/NDB switches as desired. Verify all selections appear on PFD or ND. Set MINIMUMS control knob to RA position.

On flight control panel, confirm IAS/MACH display window reads appropriate airspeed. Confirm HDG/TRK display window reads HDG and displays appropriate heading.

Confirm bank angle selector is in AUTO, AFS OVRD OFF switches are up and altitude display window reads appropriate altitude.

FLIGHT NO. Indicator

Rotate thumbwheels on FLIGHT NO. indicator to display current flight number.

Engine/APU Fire Test

If not previously accomplished, perform FIRE TEST.

MASTER WARNING/MASTER CAUTION Lights . . . . . .OFF

ENG and APU LOOPS Switches . . . . BOTH

FIRE TEST Switch . . . . .TEST

Hold FIRE TEST switch down. Successful test is indicated by:

- Fire bell.
- Voice fire warning from each engine and APU.
- Illumination of both MASTER WARNING lights and both ENG FIRE handles.

The following alerts will be displayed on the EAD:

- “ENG L FIRE”
- “ENG R FIRE”
- “APU FIRE”
- “PODS TEST PASS”

Push MASTER WARNING light and observe voice warning and fire bell are silenced. Release FIRE TEST switch and observe all alerts and warnings are extinguished.

Captain’s Oxygen Mask/Interphone

Rotate INT volume control knob clockwise to mid position. Rotate overhead volume control knob to mid position.

Verify mask storage box doors are closed. Verify regulator control knob is selected to 100%.

Move and hold the INT/RADIO switch to INT, push the TEST/RESET switch and observe a momentary “hiss” sound over the interphone system (as the mask pressurizes). Observe the flow indicator blinks. The flow indicator will appear yellow during positive oxygen flow and black when no oxygen is flowing.

NOTE

During mask operation, the flow indicator will alternate between black and yellow as the user inhales and exhales, or will be steady yellow if the mask is set to EMER.

Observe the flow indicator is black in color. This indicates the mask is fully pressurized and no oxygen leaks exist. Release the INT/RADIO Switch.

Rotate the regulator control knob to EMER. Push the TEST/RESET switch. Observe the flow indicator is a steady yellow in color. Rotate the regulator control knob to 100%. Observe the flow indicator is black. Release the TEST/RESET switch. Observe an audible drain of oxygen from the mask. Any time the TEST/RESET switch is released, an audible drain of oxygen from the mask should be heard.

Captain’s Audio Control Panel

Set audio control panel as desired.

Captain’s Source Input Select Panel

Verify EIS SOURCE selector is vertical. Verify all lights on panel are extinguished.

Display Units

Verify display units are powered and appropriate indications are present.

NOTE

Autopilot box will remain amber until V speeds are confirmed. Autothrottle box will remain amber until engine is started and IRU’s are aligned.

Gear Warning/Brake Pressure

Observe three green gear lights are illuminated. Select CONFIG synoptic, verify three green gear lights are illuminated and verify configuration display is complete. Observe “GEAR DOOR OPEN” alert is not displayed. Pull gear handle out of down detent but not up. Observe gear lights indicate red on the instrument panel and the synoptic. Release gear handle to down detent and observe all gear indications return to green.

NOTE

A blanked-out portion of the tires/brakes display indicates a component failure in the brake temperature monitor system. If any portion of the display is blanked out, call maintenance.

Verify brake pressure indications are normal.

Integrated Standby Instrument System (ISIS)

Adjust display intensity to desired level. Verify no red X displayed.

Verify ATT FAIL is not displayed. Verify altimeter setting agrees with current altimeter setting. If not, rotate BARO knob to desired altimeter setting.

Verify attitude indicator is aligned. If not properly aligned, push ALIGN switch.

SPD BRK Lever

Verify SPD BRK lever is in full forward and DISARMED position.

CAUTION

Use caution when pressurizing hydraulic systems or moving flight controls to ensure ground personnel cannot be injured.

Takeoff Warning/Throttles

Move both throttles full forward to the gate and observe takeoff visual warnings are displayed and takeoff aural warning sounds. Move throttles to idle and observe takeoff visual warnings are no longer displayed and takeoff aural warning is silenced.

FUEL X FEED Lever

Verify FUEL X FEED lever is in OFF.

FLAP/SLAT Handle

Verify FLAPS/SLAT handle is UP/RET.

FLAP T.O. SELector

Verify FLAP T.O. SELector is set for takeoff flap setting or in STOW.

FUEL Switches

Verify both engine FUEL switches are OFF.

Stabilizer

Select CONFIG synoptic.

While holding the trim switch (i.e. trimming the aircraft), raise switch guard and push STABILIZER TRIM Brake Switch to OFF. Observe amber OFF switch light illuminates and STAB TRIM OFF alert is displayed and trim motion stops. Release the captain's or first officer's trim switch, push STABILIZER TRIM Brake Switch ON and observe amber OFF light extinguishes and the STAB TRIM OFF alert is no longer displayed.

Push and hold both ALT LONG TRIM Switches to NOSE UP position and observe the stabilizer position indicator moves in NOSE UP direction.

Push and hold both ALT LONG TRIM Switches to NOSE DN and observe stabilizer position indicator moves in NOSE DN direction. Release both ALT LONG TRIM Switches.

Push and hold both First Officer control wheel trim switches to NOSE UP and observe the stabilizer position indicator moves in NOSE UP direction.

Push and hold both First Officer control wheel trim switches to NOSE DN and observe stabilizer position indicator moves in NOSE DN direction. Release both control wheel trim switches.

Push and hold both Captain's control wheel trim switches to NOSE UP and observe the stabilizer position indicator moves in NOSE UP direction.

Push and hold both Captain's control wheel trim switches to NOSE DN and observe stabilizer position indicator moves in NOSE DN direction. Release both control wheel trim switches.

Control Column

From either position, reach across pedestal and grasp the vertical inboard portion of the control wheel. Smoothly push forward on the vertical inboard portion of either control wheel with one hand while holding the opposite wheel steady. If the columns are disconnected, the application of 20-30 pounds of force will cause noticeable movement (over an inch) in one column without a corresponding movement on the opposite side. If the columns are properly connected, neither column should move.

VHF COMM Panels (Both)

Verify communication radios are checked and set for taxi and takeoff as desired.

System Display Control Panel (SDCP)

Push STATUS cue switch and review all items on STATUS page.

Push ENG cue switch.

Weather Radar

Test weather radar system. Push WX/TERR switch on ECP to have WXR OFF displayed on the ND, and ensure that the ND is not displaying the PLAN mode. GAIN control to AUTO. Weather radar MODE selector to TEST.

Observe sweep of three concentric test pattern rings with colors from top to bottom being red, yellow and green with a magenta center.

Predictive Windshear Aural Messages - "Monitor Radar Display", "Go Around, Windshear Ahead", "Windshear Ahead... Windshear Ahead." Check that "WSHR AHEAD" is amber and then red on

PFD. Check that "PRED WINDSHEAR FAIL" displays as a level 1 alert on the EAD. Test complete, turn Mode selector to OFF.

Transponder/TCAS

Select 1 or 2 with ATC switch on ATC/TCAS panel. Set desired transponder code. Rotate mode selector to TEST. PFD will display RA recommended vertical speed. ND will display four threat level symbols/ data tags.

Observe aural messages "TCAS SYSTEM TEST OK" sounds. Rotate mode selector to STBY.

Rudder/Aileron Trim

Verify RUDDER TRIM and AILERON TRIM are set to zero.

This ends the Captain's Final Cockpit Preparation. The Flight Management System (FMS) preparation should be reviewed by both pilots, so it will be discussed after the First Officer's Final Cockpit Preparation.

First Officer's Final Cockpit Preparation

First Officer's Oxygen Mask/Interphone

Rotate INT volume control knob clockwise to mid position. Rotate overhead volume control knob to mid position.

Verify mask storage box doors are closed. Verify regulator control knob is selected to 100%.

Move and hold the INT/RADIO switch to INT, push the TEST/RESET switch and observe a momentary "hiss" sound over the interphone system (as the mask pressurizes). Observe the flow indicator blinks. The flow indicator will appear yellow during positive oxygen flow and black when no oxygen is flowing.

NOTE

During mask operation, the flow indicator will alternate between black and yellow as the user inhales and exhales, or will be steady yellow if the mask is set to EMER.

Observe the flow indicator is black in color. This indicates the mask is fully pressurized and no oxygen leaks exist. Release the INT/RADIO Switch.

Rotate the regulator control knob to EMER. Push the TEST/RESET switch. Observe the flow indicator is a steady yellow in color. Rotate the regulator control knob to 100%. Observe the flow indicator is black. Release the TEST/RESET switch. Observe an audible drain of oxygen from the mask. Any time the TEST/RESET switch is released, an audible drain of oxygen from the mask should be heard.

First Officer's Audio Control Panel

Set audio control panel as desired.

First Officer's Source Input Select Panel (SISP)

Verify EIS SOURCE selector is vertical. Verify all lights on panel are extinguished.

First Officer's EIS Control Panel

Select to IN. Select BAROSET to QNH. Rotate inner BAROSET control knob to desired setting. Select HDG readout to MAG. Select TRFC, DATA, and VOR/NDB switches as desired. Verify all selections appear on PFD or ND. Set MINIMUMS control knob to RA position.

FMS

Verify flight plan. When weight and balance data is completed, enter appropriate data, V-speeds, and set stab trim.

NOTE

Normally the pilot flying the leg (at Captain's discretion) will program, and the pilot not flying will check the FMS flight plan.

COCKPIT PREPARATION ON A THRU FLIGHT

The thru flight check (below) may be accomplished instead of a complete preflight when: it is **not** the first flight of the day, there was **not** a crew change, and a TERMINATING check was **not** accomplished.

Circuit Breakers

Observe all circuit breakers are closed. See Circuit Breaker in Cockpit Safety Inspection Section for more information.

IRS Initialization

Select F-PLN INIT page on MCDU, enter data required on this page.

Ice Protection Panel

AIR DATA HEAT - ON; WINDSHLD ANTI-ICE - ON

FUEL USED REST Button - Reset

Observe FUEL USED counters decrease to zero.

Fuel Control Panel

Place appropriate PUMP switches to ON, compare fuel in tanks to total fuel, compare total fuel to dispatch requirements.

Exterior/Interior Lights

Set lights as required. Ensure SEAT BELTS and NO SMOKE switches are ON.

EIS/Flight Control Panel

Set MINIMUMS control knob to RA, set BAROSET to appropriate amount, set IAS/MACH display to proper airspeed, set HDG/TRK to appropriate heading, set FEET /METER to appropriate altitude.

Flight Number Indicator - Set

O2 Mask/Interphone

Press TEST button and ensure Oxygen Flow Indicator blinks yellow. Ensure regulator knob is selected to 100%.

Audio Control Panel - Ensure set for departure.

Display Units - Verify correct displays are present.

Status Page.

Flap T.O. Selector - STOW or set to takeoff flap setting.

VHF Comm - Set as desired for departure.

FMS - Enter (and check) required data.

The following items are accomplished just before engine start. The Captain will call for these items by asking for the Before Start Checklist Below the Line.

STATUS PAGE - Verify nothing on STATUS PAGE prohibits engine start.

BEACON Light - Verify ON.

HYDRAULICS Control Panel

Move hydraulic AUX/TRANS pump switches to ON. (All hydraulic switches will then be ON.)

Parking Brake - Set or Off based on requirements.

Papers and Logbook - Confirm papers and logbook are on board.

FMS and V-Speeds - Enter/check appropriate data, V-Speeds, and stab trim.

Flap T.O. Selector - Rotate thumbwheel to desired flap setting or verify in “STOW”

Shoulder Harness - Verify On.

♦Pack and ISOLation switches - Verify OFF and OPEN.

(The diamond indicates that if only one engine is being started [for long taxi times or holds] this item or checklist will be reaccomplished prior to starting the second engine.)

ENGINE START

NOTES

This is the automatic start sequence. This procedure can be used for all normal starts unless tailwind is greater than 10 knots. In that case refer to Engine Start with 10 Knots Tailwind found in the Supplementary Chapter.

Normal start sequence is left engine followed by right engine. Start one engine at a time.

Engine Start Switch - ON

Pull ENG START switch and observe switch light illuminates. Call "OIL PRESSURE RISING".

FUEL switch - ON

Move FUEL switch to ON. Monitor for normal fuel flow indication and ignition. When N1 rotation is observed, Call "N1".

CAUTION

Confirm the fuel switch is in the ON position by jiggling the switch and pushing down.

NOTE

If the engine has been shut down for more than 20 minutes but less than 5 hours, a 30 second engine windmill is built into the start cycle. The 30 seconds starts when N2 reaches 15%.

TGT rises

If necessary, discontinue start to prevent exceeding TGT limits.

NOTE

The engine should not start with static TGT greater than 150°C. However, if it does start, it may result in start TGT limit exceedance.

Approximately 40% N2

Observe ENG START switch pops in, switch light extinguishes, and START VLV L/R OPEN (ENG) does not illuminate.

(continued)

Ground Idle RPM

N2 and N1 indications stabilize at ground idle RPM. TGT and ENG OIL quantity/pressure indicate normal range.

CAUTION

Observe TGT differential after both engines are started and the engines are stabilized. The TGT difference should not exceed 40°C. Ensure APU air is off when comparing TGT.

♦BEFORE TAXI

AIR Control Panel

Move PACK switches to AUTO.

Move ISOL switch to AUTO.

ICE PROTECTION Control Panel

Set engine and airfoil anti-ice as required for conditions.

Ice Protection information is provided in the Supplementary Section.

Door Lights

Verify all door lights are out.

Cockpit Door

Door must be closed and locked prior to aircraft movement.

♦BEFORE TAKEOFF

APU AIR and MASTER Switches

Move APU AIR switch to OFF. If APU is not to be used for electrical power, shut down APU.

NOTE

APU and engine bleed air cannot be used simultaneously to provide air to the same pack, i.e. if the APU is on it will take precedence over engine bleed.

Flight Controls and Brake Temp

Select CONFIG synoptic. Rotate control wheel to full left and full right. Observe spoiler boxes indicate full deflection. Rotate wheel to neutral position. Move control column full aft and full forward, then neutral. While in full forward position, observe green indication of ELEV boxes. Hold nosewheel steering to prevent nosewheel movement. Operate rudder pedals full left, full right, then neutral, while observing RUD position boxes for corresponding green indicators.

NOTES

Any test that does not result in the appropriate display of green boxes will require maintenance prior to takeoff.

The elevator green box appears when pushing the control column forward. The green box <u>may</u> appear when moving the control column aft - this requires no crew or mx action.

Ensure brake temp does not exceed 170 degrees C.

FLAP/SLAT Handle

Verify FLAP T.O. SEL indicator shows planned setting for takeoff, and select the FLAP/SLAT handle to the desired takeoff setting.

Fuel Quantity

Ensure required dispatch fuel is on board at takeoff.

Trim Controls

Determine the horizontal stabilizer setting from the FMS. Adjust the horizontal stabilizer until the stabilizer position indicator agrees with the computed stabilizer setting.

Verify aileron and rudder trim centered.

Auto Spoilers

Arm spoilers.

If the spoiler will not arm pull the spoiler handle up and aft approximately 1/2 inch until the handle can be fully armed.

Takeoff Briefing

Confirm proper runway is set.

PF briefs takeoff according to the FOM.

FCP

Verify flight control panel speed, heading, and altitude are set as required.

Altimeter

Set and cross-check the altimeters.

Cabin Secure

Ensure flight attendants have given “CABIN SECURE” and closed/locked the door.

The following items are accomplished just prior to takeoff.

Flight Attendant (F/A) Signal

Notify Flight Attendants to be seated for departure.

Weather Radar

If required, turn weather radar to ON and adjust for departure.

Transponder

Rotate mode selector to TA/RA.

Landing/Exterior Light

When cleared for takeoff, move L and R LDG LT switches to EXT ON, NOSE LT switch to LAND, WING NACL to ON, push GND FLOOD LTS to ON, and push HI INT light switch to ON.

EAD

Review EAD for alerts, reminder messages and green box.

CAUTION

Any TGT split of 40°C between engines during any phase of flight or after landing should be entered as a Logbook item. If observed prior to being airborne, contact maintenance.

TAKEOFF

CONDITION	PILOT FLYING	PILOT NOT FLYING
Cleared for takeoff.	Align airplane on runway and confirm heading.	
Power advance.	When airplane is aligned with the runway, PF set throttles to approximately 80% N1. Verify symmetrical thrust. Call “AUTO FLIGHT, SET TAKEOFF POWER.” Captain will keep hand on throttles until reaching V1. Verify autothrottles advance to T/O thrust.	Select AUTO FLIGHT, call “AUTO FLIGHT” and verify T/O THRUST is displayed in the FMA ALTITUDE window. Call “POWER SET” when engines are at T/O thrust setting. Monitor engine indication and adjust throttles as required to establish and maintain takeoff EPR.

NOTE

Engines should be operated at idle for at least 5 minutes before takeoff. Power required for taxiing, including short power applications, is considered equivalent idle power for warm-up purposes. Some decrease in oil quantity is normal at takeoff thrust. As thrust is reduced for climb, oil quantity will rise.

CONDITION	PILOT FLYING	PILOT NOT FLYING
When airspeed reaches 80 knots	Verify airspeed is 80 knots, and T/O CLAMP in the FMA ALTITUDE window "CHECK." **NOTE** If throttles fail to clamp, disengage autothrottles and continue the takeoff with manual throttle control.	Verify T/O CLAMP in the FMA ALTITUDE window and call "80 KNOTS." **NOTE** If throttles fail to clamp, call "NO CLAMP."
V1 speed.	Place both hands on the control wheel.	Call "V1".
VR speed	Smoothly rotate at approximately 2.5 degrees per second until pitch bar is centered.	Call "VR."
V2 speed		Call "V2."
Positive rate of climb.	After receiving POSITIVE RATE call from PNF, call "GEAR UP."	Verify and call "POSITIVE RATE." Upon direction from PF, retract gear and call "GEAR UP."

CLIMB

<table>
<tr><th>PILOT FLYING</th><th>PILOT NOT FLYING</th></tr>
<tr><td>Continue acceleration to and maintain V2+10, pitch attitude commanded on flight director, or if no flight director - pitch attitude of 15 to 20 degrees.</td><td>Monitor speed and pitch.</td></tr>
<tr><td>At or above 500 feet AGL and when desired, call “AUTO FLIGHT.”</td><td>Push AUTO FLIGHT switch and call “AUTO FLIGHT” when engaged.</td></tr>
<tr><td colspan="2">NOTE
The autopilot will engage in the existing roll and pitch mode.</td></tr>
<tr><td>Below CLB THRUST altitude, call “SET PROF” or “SET ALTITUDE” as desired.</td><td></td></tr>
<tr><td colspan="2">NOTES
“SET PROF” (when approved for use) or “SET ALTITUDE” are available above 400 feet AGL. Setting will cause T/O CLAMP to change to T/O THRUST and will make automatic thrust reduction at CLB THRUST altitude.
“SET ALTITUDE” requires speed to be set at acceleration altitude unless altitude is captured.</td></tr>
<tr><td>After reaching acceleration altitude call “SET SPEED”. At flap retract speed, call “FLAPS UP.”</td><td>Confirm flap retract speed has been reached. Move FLAP/SLAT handle to 0/EXT and call “FLAPS UP.”</td></tr>
<tr><td>After reaching slat retraction speed, call “SLATS RETRACT.”</td><td>Confirm slat retract speed has been reached. Move FLAP/SLAT handle to UP/RET, and call “SLATS RETRACT.” Verify 250 PITCH on FMA speed window, a pitch decrease and an airspeed increase. Monitor acceleration and vertical and horizontal navigation.</td></tr>
</table>

PILOT FLYING	PILOT NOT FLYING
Call for “CLIMB CHECKLIST” at or above 3000 feet. Captain will turn off landing lights at his/her discretion.	When operations permit, move hydraulic TRANS and AUX pump switches to OFF. Disarm spoiler handle and stow FLAP T. O. SELector. Check EAD for alerts and status. Call “CLIMB CHECKLIST COMPLETE” when accomplished.
At 10,000 feet, verify acceleration to enroute climb speed.	Call “10,000 FEET.” Move WING/NACL and GND FLOOD lights to OFF. If no turbulence expected, give “FLIGHT ATTENDANTS, DEPARTURE CHECK.” If turbulence is expected give “FLIGHT ATTENDANTS DEPARTURE CHECK, KEEP YOUR SEATS.”
At transition altitude call “29.92.”	At transition altitude call “29.92.”

Both pilots will use headsets with boom microphones below 18,000 ft.

IN RANGE

NOTE

The IN RANGE checklist should normally be accomplished prior to transition level.

ATIS

Acquire the destination weather information from ATIS or other appropriate source.

FMS Set For Approach

Select/confirm desired destination, STAR, and runway. Verify desired landing flap setting. Edit VAPP speed if necessary.

NOTE

VAPP is the greater of VREF + 5 or VREF + wind additive. Wind additive is 1/2 Headwind + Gusts, not to exceed 20 kts.

DH/MDA

On EIS control panel, set MINIMUMS control knob to RA or BARO as required. Rotate MINIMUMS control knob to correct decision height or minimum descent altitude as appropriate for approach being flown.

Landing Data and Crew Briefing

This should include the standard FOM briefing as well as FMS and NAV radio setup.

Hydraulic Pumps

Move hydraulic AUX and TRANS Pump switches to ON. (All hydraulic pumps will be ON.)

Ice Protection

Ensure Ice Protection ON when required.

SEAT BELTS Sign

Move SEAT BELTS sign to ON when appropriate.

Shoulder Harness

Both pilots and cockpit observer put on shoulder harness.

Altimeters

At transition level, set the correct barometric setting and cross-check all altimeters.

PREPARATION FOR LANDING

Exterior Lights

At 10,000 feet MSL, move WING/NACL and GND FLOOD lights to ON and give flight attendants “ARRIVAL CHECK.”

Landing lights are normally EXT ON when the landing gear is extended.

NOTE

On manual flown approaches the PNF will normally (at Captain’s discretion) set airspeed. On autopilot approaches the PF will normally (at Captains discretion) set airspeed.

Slats

When ready to extend slats, PF calls "SLATS EXTEND, SET SPEED 190 (or as required)." PNF confirms airspeed is below slat operating speed and moves FLAP/SLAT handle to 0/EXT. PNF verifies slat extension on the PFD and calls "SLATS EXTENDED."

PF decelerates to an appropriate speed above VMIN for existing configuration.

Flaps

When appropriate, PF calls "FLAPS 18, SET SPEED 160 (or as required)." PNF confirms below limiting speed, moves FLAP handle to 18 and calls "FLAPS 18." PF slows to an appropriate speed for configuration.

PILOT FLYING	PILOT NOT FLYING
	Approximately 15 miles prior to landing, alert cabin.
Call "LANDING GEAR DOWN, LANDING CHECKLIST."	Verify below limiting airspeed, then move gear handle DOWN and observe 3 green lights illuminate and red GEAR UNSAFE lights extinguish. Initiate LANDING CHECKLIST.
The Captain will raise the SPOILER handle to ARM position.	
Request "FLAPS 25, SET SPEED _______." (This step is optional if ATC pattern/speed directives require.)	Repeat command and place flaps at 25.
Request "FLAPS 40, SET SPEED ________." **NOTE** Use other flap settings when required.	Repeat command. Verify below limiting airspeed, then move FLAP/SLAT handle to requested position. Call degrees of flaps setting when checklist requires.
Both pilots should check EAD for alerts and reminder messages.	
	Announce "LANDING CHECKLIST COMPLETE."

LANDING ROLL

<table>
<tr><th>PILOT FLYING</th><th>PILOT NOT FLYING</th></tr>
<tr><td>At approx. 30 feet AGL, verify throttles start to retard to idle.
After touchdown, lower nosewheel to the runway while raising reverse thrust levers to reverse idle and apply reverse thrust.</td><td>Ensure throttles are retarded to idle.
Advise PF of thrust reverser deployment by calling “REVERSE” when they depict green.</td></tr>
<tr><td colspan="2">NOTES
For automatic deployment of spoilers, throttles must be at idle. If throttles are above idle at touchdown, spoilers may deploy and retract.
If SPOILER lever does not move aft or does not remain at EXT position, PNF calls “NO SPOILERS.” Captain moves lever aft to full extend position.
There should be no effort to delay lowering the nosewheel to the runway; aerodynamic braking is ineffective and is not a recommended deceleration technique.</td></tr>
<tr><td>Apply reverse thrust as runway and conditions dictate.</td><td></td></tr>
<tr><td colspan="2">NOTE
If difficulty in maintaining directional control is experienced during reverse thrust operation, reduce thrust as required and select forward idle if necessary to maintain or regain control. Do not attempt to maintain directional control by using asymmetric reverse thrust.</td></tr>
<tr><td>At 80 KIAS, smoothly move reverse levers to be at reverse idle by 60 knots. At 60 knots, move reverse levers to forward idle unless additional reverse is required. If First Officer is the PF, the Captain will take control of the airplane at his discretion.</td><td>Monitor airspeed during deceleration. At 80 KIAS, call “80 KNOTS.” At 60 KIAS, call “60 KNOTS.”</td></tr>
<tr><td colspan="2">CAUTION
To minimize the possibility of FOD, thrust reversers should be stowed by 40 knots whenever possible.</td></tr>
</table>

AFTER LANDING (SILENT)

Exterior Lights

The Captain will retract the landing lights and use the nose taxi light for taxi. The FO will turn OFF the WING/NACL, GND FLOOD and HI-INT lights.

Spoilers

Departing the runway, the Captain retracts the spoilers and calls "FLAPS 18 DEGREES, AFTER LANDING CHECKLIST."

NOTE

Flaps/slats should be in the 18° position for taxi-in to minimize foreign object ingestion.

Observe spoiler lever moves forward to RET position.

Flaps/Slats

Move FLAP/SLAT handle to 18° detent.

APU

Start APU as required.

Weather Radar

Rotate mode selector to OFF.

Transponder

Rotate Transponder selector to STBY.

Flap/Slat Handle

Move Flap/Slat handle to UP/RET just prior to entering the gate. Verify flaps move to zero.

WARNING

If Flaps/Slats are not retracted prior to parking, leave handle at 18º detent until area is cleared.

NOTE

Do not retract the Flap/Slat Handle if damage could occur due to icing conditions.

PARKING

APU/EXT Power

When APU electrical power is to be used, verify the APU generator switch is ON and the ON light is illuminated.

When external electrical power is to be used, verify the EXT power switch is ON and the AVAIL light is illuminated.

FUEL Switches

Move engine FUEL switches to OFF.

NOTES

Confirm fuel flows drop to zero after fuel switches are moved to OFF. Observe corresponding FUEL OFF annunciation on EAD as well as decreasing N1, TGT, and N2.

Engines should be operated at or near idle until “ENGINE COOL” alert is displayed (3 minutes) to avoid possibility of thermal distortion in turbine section of engines.

SEAT BELT Sign

Move SEAT BELT switch to OFF.

PARKING BRAKE

Release parking brakes when wheel chocks are in place.

CAUTION

If 10 minutes after parking the warmest brake is less than 260°C and decreasing, and the “BRAKE OVERHEAT” light is not displayed on the EIS, then no waiting period or inspection is required prior to taxiing. If a brake is hotter than 260°C, or the “BRAKE OVERHEAT” light is displayed, a full 50 minute (ramp time) waiting period and a check of the tire pressures is required.

CAUTION

If the “BRAKE OVERHEAT” alert if displayed, ensure chocks are installed and leave parking brake off.

NOTE

When parking, it is recommended that nosewheels be in approximately center position before forward motion is stopped.

HYD Aux /Transfer Pump Switches

Move hydraulic AUX and TRANS pump switches to OFF.

Air Conditioning

Move APU AIR switch to ON. Move ISOL switch to OPEN.

Provide appropriate air conditioning for ground operations.

NOTE

If APU is OFF, move L and/or R PACK switches to OFF in order to ensure the instrument cooling fan operates

FUEL Control Panel

Move fuel boost pump switches to OFF except for a fuel pressure source for the APU (if operating).

ICE PROTECT Control Panel

Push AIR DATA HEAT switch OFF. Verify WING and TAIL AIR FOIL anti-ice switches are OFF. Move WINDSHLD ANTI-FOG and ANTI-ICE switches to OFF. Verify ENG L and R anti-ice switches are OFF.

Exterior Lights

Push BCN light switch to OFF. The NAV lights are left ON. LOGO lights will be OFF during daylight and when terminating.

SDCP STATUS Page

Push the STATUS cue switch and review STATUS page for discrepancies. If any discrepancies are displayed, make appropriate entries in log book.

TERMINATING

Cabin EMER LT Switch

Move EMER LT switch to OFF and observe emergency lights (top of overhead panel) are extinguished and the “EMER LTS DISARM” alert is displayed.

PACK Switches

Move L and R PACK switches to OFF.

NOTE

Unless system is to be used, move both PACK switches to OFF to prevent inadvertent cabin pressurization if outflow valve and all exits are closed.

EMER PWR Selector

Rotate the EMER PWR selector to OFF and observe the “EMER PWR SW OFF” alert is displayed.

NOTE

Do not move EMER PWR selector to OFF until the N2’s for both engines indicate 0.0%.

IRS

Move IRS selectors to OFF.

GROUND SERVICE PWR

If GROUND SERVICE PWR is required, verify EXT AVAIL light is illuminated. Move APU MASTER switch to OFF. Move GROUND SERVICE ELEC PWR switch to ON. Move EXT power switch to OFF.

If GROUND SERVICE PWR is not required, verify APU MASTER switch is OFF and EXT power switch is OFF.

BATT Switch

Move BATT switch to OFF.

NOTE

After APU shutdown with no external power, the BATT Switch will not be turned OFF for at least 90 seconds. Also, verify that the APU parameters on the System Display-Secondary Engine page disappear prior to moving BATT switch to OFF. The Battery On alerting horn will sound as soon as AC power is lost to the aircraft. This horn can be silenced by pressing the Mechanic Call Button and will remain silenced for 10 minutes.

After APU shutdown with external power connected, the EXT power switch on the Electrical Power Control Panel or the Ground Service Panel switch must remain on for at least 90 seconds.

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TABLE OF CONTENTS

SUPPLEMENTARY PROCEDURES

INTRODUCTION

This section contains normal operating procedures which are not, in most cases, related to a specific phase of flight or are not performed at all in a routine flight.

AIR CONDITIONING USING APU AIR

ISOL Switch . . . . OPEN

APU AIR Switch . . . . ON

L/R PACK Switches . . . . .AUTO

CKPT/CABIN TEMP Selectors. . . . . .AUTO

AIR CONDITIONING FLOW . . . . OBSERVE

LOW FLOW INDICATED

NO

Operate only one air conditioning system.
[END]

CABIN TEMP . . . . OBSERVE

TEMPERATURE ABOVE 24°C

NO

No further crew action required.
[END]

L PACK Switch . . . . .AS DESIRED

*****

DISPATCH FOR UNPRESSURIZED FLIGHT

The 717 is not approved for unpressurized dispatch at this time

*****

DISPATCH WITH PRESSURIZATION CONTROL IN MANUAL

CABIN PRESS SYSTEM Switch . . . . MANUAL

CABIN PRESS MANUAL Rate Selector. . . . . CLIMB

Observe outflow VALVE indicator moves to full VALVE OP.

Altitude SCHED Placard. . . . . CHECK

Determine desired cabin altitude from SCHED placard on cabin pressure selector panel.

After takeoff (as soon as practical),

Move CABIN PRESS MANUAL rate selector to DESC until outflow valve position indicates 1/3 of indicator toward VALVE CL, then release.

After slats retract and during climb,

Adjust outflow valve to indicate 500 FPM cabin climb on secondary engine page synoptic. If required, move outflow valve toward VALVE CL to decrease cabin climb rate.

NOTE

Power changes will affect cabin climb/descent rates. Increasing engine thrust will increase air input into airplane necessitating opening of outflow valve to maintain the desired climb/descent rate. Decreasing engine thrust will have opposite effect.

At cruise cabin altitude,

Adjust outflow valve to indicate zero FPM cabin rate on synoptic.

At start of descent.

Reduce power slowly. Be prepared to move manual selection toward VALVE CL to maintain zero cabin rate change. When engine power is reduced to desired level, move manual selector to obtain 300 FPM rate of cabin descent. Move selector toward VALVE CL to increase and toward VALVE OP to decrease descent rate.

When below 10,000 feet MSL, decrease cabin differential pressure at a rate to ensure cabin is depressurized prior to starting approach.

*****

TAKEOFF WITH AIR CONDITIONING PACKS OFF

NOTE

This procedure is based upon use of Runway Analysis Charts for takeoff with both packs off. It allows for extra gross weight for takeoff.

Prior to takeoff,

On the MCDU, select the TAKEOFF page and select PACKS OFF (2L). The L/R PACK switches will be in AUTO for takeoff.

After takeoff,

Passing 3,000 AGL, packs will automatically come on (verify).

*****

USING APU AIR FOR SUPPLEMENTAL AIR CONDITIONING AFTER ENGINE START

ISOL Switch . . . . OPEN

L/R PACK Switches . . . . .AUTO

APU AIR Switch . . . . ON

CKPT and CABIN TEMP Selectors . . . . .AUTO

Adjust temperature selectors as desired.

*****

GROUND REFUELING

The B-717 fuel system has automatic controls for refueling. The refueling function is available with AC or DC power on the aircraft. When the nose oleo switch senses the aircraft is on the ground, DC power becomes available to the refueling control panel.

A diagram of the fueling panel in on page 10 of this chapter. All numbers in this section correspond to numbers on the fueling panel diagram.

The POWER switch [6], on the refueling control panel, controls the electrical power for the selector displays and the fill valves. In the OFF position, the POWER switch removes electrical power. With the POWER switch in the ON position, AC and DC power is available to the refueling components.

The MANUAL VALVE CONTROL switch [8], on the refueling control panel, connects and controls electrical power to all of the fill valves. This switch usually stays in the ELECTRIC position. When the MANUAL VALVE CONTROL switch is in the MANUAL position, none of the fill valves operate electrically.

The fuel fill valve switches (LEFT MAIN TANK, CENTER TANK, and RIGHT MAIN TANK) [12], on the refueling control panel, independently connect the related fill valve controls to the load selector display and float switches.

NOTE

Maximum pressure fueling is 50 PSI.

WARNING

Do not operate the radar during refueling or near trucks or containers that contain flammable or explosive liquids.

WARNING

The fuel unit and aircraft must be grounded correctly to prevent a fire hazard.

Auto Refueling

The AUTO position is for refueling to a specified level. The load selector stops the fuel at the value set by the operator.

Control panel POWER switch [6] . . . . ON

Check blue power light [7] . . . . ON

The fuel quantity shows in the related fuel quantity indication window [15] of the load selector display.

NOTE

If external electrical power is not available to supply the aircraft load buses, aircraft battery POWER will automatically be supplied to the ground refueling circuit when the fueling control panel power switch is placed in the "ON" position. Battery power should not be used if external electrical power is available.

CAUTION

If electrical power is lost at the ground refueling station (blue light is out), discontinue automatic refueling immediately, and continue refueling using the manual mode of operation.

MANUAL VALVE CONTROL switch [8] . . . . ELECTRIC

AUTO/OVERRIDE switch [9] . . . . AUTO

Make sure you can see the total fuel load before the refueling starts.

SELECT QUANTY buttons [10] . . . . PUSH

Hold until the total fuel load is shown in the TOTAL FUEL QUANTITY [11] window.

Applicable TANK FUEL FILL VALVE switch [12] . . . . . . AUTO/OPEN

If the fuel fill valve does not operate with electrical power. Then manually select TANK FUEL FILL VALVE [13] to OPEN.

Turn the nozzle valve lever on the refueling nozzle [5] to OPEN.

Check the position of the fuel fill valve switches [12] to make sure the applicable fuel fill valve manual levers [13] are in the OPEN position.

NOTE

The center tank fuel valve cannot open if the fuel quantity selected is less than the main tanks total capacity.

NOTE

If one or more fuel fill valves do not open with electrical power, refer to pressure refueling of the airplane without electrical power.

To start refueling:

START/STOP button [14] . . . . PUSH

(The load selector display energizes the fill valve control and the related fill valve opens).

Monitor the applicable tank on the FUEL QUANTITY indicator window [15] (or magnetic fuel measuring sticks if fuel quantity indicators do not operate).

When the TOTAL FUEL QUANTITY window indicator or fuel measuring stick reading equals the selected fuel total:

Check each tank fuel fill valve manual lever [13] . . . . CLOSED

Fuel valve switches [12] . . . . CLOSED

NOTE

The time necessary for the fill valves to close electrically is from 2 to 3 seconds.

To Stop Refueling:

START/STOP button [14] . . . . PUSH

If one of the valves does not close as described above, perform the following:

Related Fuel Fill Valve switch [12] . . . . CLOSED

Related Tank Fuel Fill Valve manual lever [13]. . . . . CLOSED

Manual Valve Control switch [8] . . . . ELECTRIC

Refueling Control Panel POWER switch [6]. . . . . .OFF

Refueling Nozzle Valve lever [3]. . . . . CLOSE

Refueling Nozzle [5] . . . . REMOVE

Adapter Cap [2] . . . . .INSTALL/LOCK

Refueling unit/aircraft grounding cable . . . . REMOVE

Override Refueling

The OVERRIDE position is for refueling the tanks to full. The operator uses the specified fill valve switches [12] (LEFT MAIN TANK, CENTER TANK, AND RIGHT MAIN TANK) to independently open and close the fill valves. Procedural changes between override refueling and auto refueling are discussed below. The numbering system used corresponds to the auto refueling procedure (above).

Control panel POWER switch [6] . . . . ON

Check blue power light [7] . . . . ON

The fuel quantity shows in the related fuel quantity indication window [15] of the load selector display.

NOTE

If external electrical power is not available to supply the aircraft load buses, aircraft battery POWER will automatically be supplied to the ground refueling circuit when the fueling control panel power switch is placed in the “ON” position. Battery power should not be used if external electrical power is available.

CAUTION

If electrical power is lost at ground the refueling station (blue light is out), discontinue automatic refueling immediately, and continue refueling using the manual mode of operation.

MANUAL VALVE CONTROL switch [8] . . . . ELECTRIC position

On the load selector display:

AUTO/OVERRIDE switch [9] . . . . OVERRIDE

OVERRIDE shows in the PRESELECT TOTAL window.

Make sure you can see the total fuel load before the refueling starts.

Applicable TANK fill valve switches [12]. . . . . AUTO/OPEN

If the fuel fill valve does not operate with electrical power, manually select the TANK FUEL FILL VALVE [13] to OPEN.

Turn the nozzle valve lever on the refueling nozzle [5] to OPEN.

Check the position of the fuel fill valve switches [12] to make sure the applicable fuel fill valve manual levers [13] are in the OPEN position.

NOTE

The center tank fuel valve cannot open if the fuel quantity selected is less than the main tanks total capacity.

NOTE

If one or more fuel fill valves do not open with electrical power, refer to pressure refueling of the airplane without electrical power.

To Start Refueling:

START/STOP button [14] . . . . PUSH

(The load selector display energizes the fill valve control and the related fill valve opens).

Monitor the applicable tank on the FUEL QUANTITY indicator window [15] (or magnetic fuel measuring sticks if fuel quantity indicators do not operate).

The fill valves close when the float switches for the related tank sense the tank is full.

To Stop Refueling:

START/STOP button [14] . . . . PUSH

If one of the valves does not close as described above, perform the following:

Related Fuel Fill Valve switch [12] . . . . CLOSED

Related Tank Fuel Fill Valve manual lever [13]. . . . . CLOSED

Manual Valve Control switch [8] . . . . ELECTRIC

Refueling Control Panel POWER switch [6] . . . . .OFF

Refueling Nozzle Valve lever [3]. . . . . CLOSE

Refueling Nozzle [5] . . . . REMOVE

Adapter Cap [2] . . . . .INSTALL/LOCK

Refueling unit/aircraft grounding cable . . . . REMOVE

Manual Refueling

If electrical power is not available, the aircraft may still be pressure fueled by manually opening and closing the appropriate valves. Manual fueling procedures are:

Using the plumb bob located in the right side of the nose gear wheel well, determine the pitch and roll attitude of the aircraft. Call Maintenance Control with this information to obtain the appropriate magnetic dripless stick corrections for fuel load measurement.

Open the fueling control panel access door.

Hook up the fueling nozzle and ground wires.

To put fuel in an individual tank:

TANK FUEL FILL VALVE manual lever [13]. . . . . OPEN

FUELING NOZZLE VALVE [3] . . . . OPEN

Slowly open the fueling nozzle valve and commence fueling.

MAGNETIC FUEL MEASURING STICKS . . . . MONITOR

When the necessary fuel load is in each tank.

Respective TANK FUEL FILL VALVE[13] . . . . CLOSED

Fueling Nozzle . . . . REMOVE

Adapter Cap. . . . . INSTALL AND LOCK

Ground Fuel Transfer

To transfer fuel on the ground perform the following:

FUEL BOOST PUMPS (in cockpit) . . . . ON

Turn fuel boost pumps on for fuel tank with too much fuel.

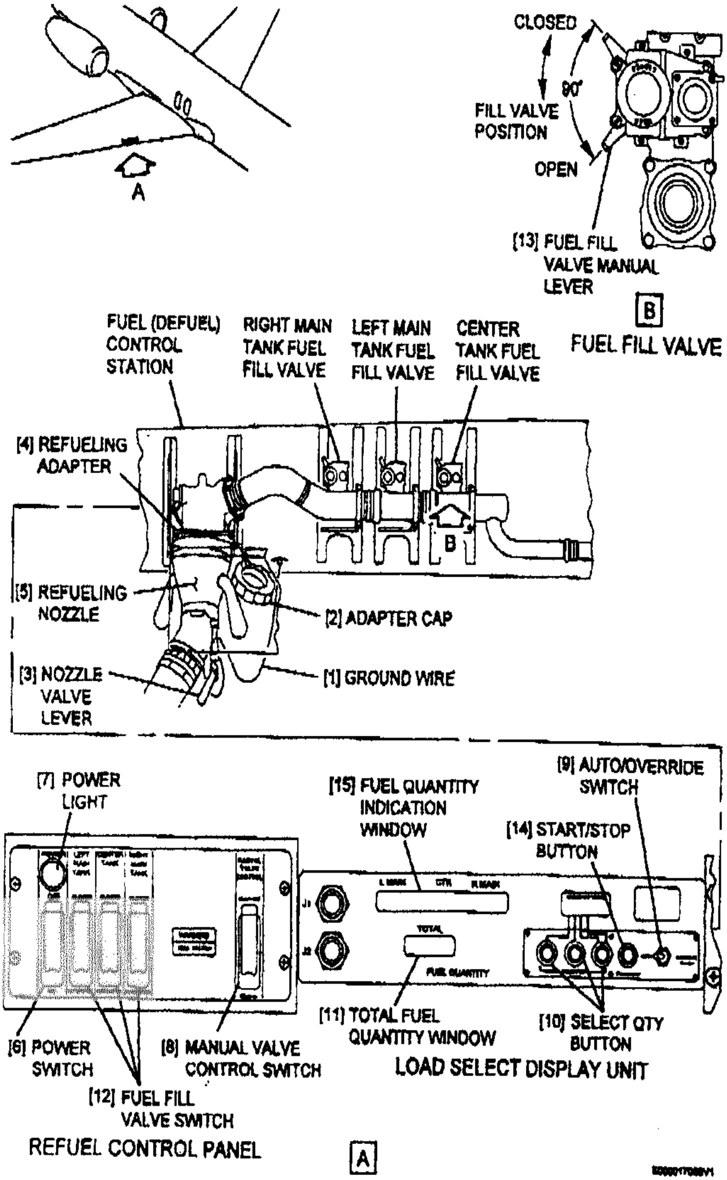
DEFUELING VALVE . . . . OPEN

TANK FUEL FILL VALVE (tank that should receive fuel) . . . . . OPEN

CROSSFEED VALVE (in cockpit) . . . . OPEN

Only necessary if fuel will be transferred from the left main tank to any other tank.

Diagram of Fueling Control Station



APU INFLIGHT START

APU MASTER Switch . . . . START/RUN

NOTES

The APU start may be delayed up to approximately 40 seconds to allow inlet door to reach full open position.

If APU has not started after cranking for 2 minutes following release of start switch to run, APU will auto abort start.

The first APU start is factored into the battery life and will not reduce battery life time below 60 minutes.

*****

ENGINE START - BATTERY PROCEDURE

If AC power is unavailable, an engine may be started using DC power only from the battery. Use an external source of pneumatic air supply. Since the isolation valve will not operate, the right engine will be started first. The autostart feature will not be available, and the EEC will not abort the start for TGT or start timer exceedences. The flight crew must observe all limits and be prepared to abort the start.

Before Starting Engines Checklist . . . . ACCOMPLISH

BATT Switch. . . . . ON

EMER PWR Selector . . . . ON

Fire Warning. . . . . CHECK

Parking Brake . . . . SET

NOTE

Brake pressure indication is not available until normal AC power is established.

START PUMP Switch. . . . . ON

BCN Lights Switch . . . . ON

Start Clearance . . . . ESTABLISHED

ENG START SWITCH . . . . ON

Pull ENG START SWITCH and observe switch light illuminates. Call “Oil Pressure Rising” and “N1” rotation.

ENGINE OBTAINS DRY MOTORING SPEED . . . . . Fuel Switch ON

(continued)

If there is a tailwind in excess of 10 knots, do not select Fuel Switch to ON until positive N1 rotation.

Do not select Fuel Switch to ON with TGT higher than 150°C.

If engine has been shut down longer than 20 minutes and less than 5 hours, dry motor the engine at max motoring speed for 30 seconds prior to selecting Fuel Switch to ON.

Closely monitor TGT and abort start if TGT rise is not indicated within 20 seconds of selecting Fuel Switch to ON.

Discontinue start if necessary to avoid exceeding 700°C.

CAUTION

Max red line TGT displayed will be 850°C. For this reason diligence by the crew is required to ensure 700°C starting limit is not exceeded.

Observe starter duty limit of 3 minutes max starter ON time.

When engine reaches approx 40% N2 the ENG START switch will pop in. Monitor all engine parameters and turn Fuel Switch to OFF if they are not indicating normal range.

Normal Electrical Power . . . . Establish

NOTE

Verify system display panel indications are normal after engine generator power is established.

EMER PWR Selector . . . . OFF then ARM

FUEL/AIR/ELECTRICAL Control Panels . . . . AS REQUIRED

Reaccomplish the BEFORE STARTING ENGINES checklist.

Left Engine . . . . Start with Air Cart or Crossbleed as Required

*****

ENGINE START - CROSSBLEED PROCEDURE

Ramp Check. . . . . .HAZARD AREA CHECK

PACK Switches (both) . . . . .OFF

ISOL Switch . . . . OPEN

Pneumatic Pressure . . . . MINIMUM 35 PSI

Advance throttle of the operating engine to obtain 35 psi minimum.

Engine Start . . . . Start engine using normal procedures

(continued)

At starter release,

Throttle (engine providing pneumatic pressure) . . . . .IDLE
ISOL Switch . . . . .AUTO
PACK Switches (both) . . . . AS REQUIRED

*****

ENGINE START - EXTERNAL AIR CART PROCEDURE

Whenever the Auxiliary Power Unit (APU) is not functioning, engine starts will be accomplished using an external electrical power source and an air start unit. The B-717 requires a substantial amount of external air in order to start the engines. If an adequate start unit is not available then two (2) units will be used with a Y connector for the start.

Before starting engine, the signalman must confer with he Captain. This exchange will be a review of the situation and any special action that may be required. This discussion may be face to face or via headset. After this meeting, engine start procedures will be implemented as follows:

The electrical power and air start unit should both be connected to the aircraft well in advance of engine start. The air start unit/units will not be engaged until the engine start sequence begins.

(1) The signalman will ensure that all aircraft doors and panels are closed and secured and that the area behind the engines is clear of people and property.

(2) The signalman will give “Brakes Set,” either orally via headset or using the hand signal, and receive confirmation from the Captain.

(3) Giving the “Engine Start” signal (visual or oral via headset) indicates to the crew which engine is to be started.

(4) The Captain will orally request or give the hand sign “Apply Air.”

NOTE

During air starts pressure should be approx 35 to 40 psi prior to engaging the starter. Successful starts have been achieved with lower pressures. Once demand has been put on the system, the air pressure can drop below 30 psi causing a START AIR PRES LO alert.

Air pressure should stay above approx 26 psi. The determining factor for normal engine start is N2. If N2 is at least 20 percent, than a normal start should be possible. With N2 this low, you will not have an N1 indication prior to ignition (and TGT). If sufficient pressure is not available for starting, the EEC will abort the start.

If an Engine Start - 10 Knot Tailwind Procedure is required, N1 rotation will have to be verified by ground personnel prior to moving the fuel switch to ON.

(5) The “Engine Start” procedure will be repeated by the signalman to indicate the second engine is clear to start.

NOTE

The preferred method is to start both engines with the air cart(s). Starting one engine and cross-bleed starting the other one is also acceptable, if necessary.

(6) After engines are running, the Captain will give “Disconnect Power” and “Remove Air” either orally or via hand signals.

NOTE

Allow the engine generators to come on line and position the EXT power switch to OFF prior to pulling the external power. This will eliminate the possibility of a break power transfer which could cause various nuisance faults to be displayed on the EAD. If faults occur that cannot be cleared, it may be necessary to shut down and restart the engines. Checking the ELEC Page to ensure that the generators are up to speed and all busses are powered is a good technique.

(7) The signalman will direct the appropriate movement of the aircraft.

If a cross bleed start is necessary, refer to Crossbleed Starts in this Section.

* * * * *

ENGINE START - MANUAL PROCEDURE

CAUTION

During a manual start, it is the responsibility of the crew to monitor engine parameters for start exceedances. In the event of start exceedance, start must be aborted.

IGNITION Switch . . . . ON

ENG START Switch . . . . PULL

Engine must be motored for 30 seconds at 19% N2 or greater.

TGT . . . . VERIFY LESS THAN 150°C

NOTE

If the tailwind component is 10 knots or greater, delay moving the FUEL switch to ON until there is an indication of N1 reotation.

FUEL Switch . . . . ON

NOTE

TGT ground start limit is 700°C.

N2 . . . . APPROXIMATELY 39%

Observe ENG START switch pops in and switch light extinguishes.

N1 and N2 indications . . . . . . STABILIZED AT GROUND IDLE RPM

TGT and ENG OIL Quantity:

Pressure Indications . . . . NORMAL RANGE

IGNITION switch . . . . AUTO

*****

ENGINE START - 10 KNOTS TAILWIND PROCEDURE

With a 10 knot tailwind at the gate, the engine start will be performed in the following manner.

Engine Start Switch ON

Pull ENG START switch and observe switch light illuminates. Call “OIL PRESSURE RISING” and “N1” rotation.

CONTINUED

NOTE

Normal start sequence is left engine followed by right engine. Start one engine at a time.

FUEL switch . . . . ON

At N1 indication, move FUEL switch to ON.

TGT rises

If necessary, discontinue start to prevent exceeding TGT limits.

NOTE

The engine should not start with static TGT greater than 150°C. However, if it does start, it may result in start TGT limit exceedance.

Approximately 40% N2

Observe ENG START switch pops in, switch light extinguishes, and START VLV L/R OPEN (ENG) does not illuminate.

Ground Idle RPM

N2 and N1 indications stabilize at ground idle RPM. TGT and ENG OIL quantity/pressure indicate normal range.

*****

ENGINE START - STARTER VALVE MANUAL OPERATION

If unable to electrically open start valve,

BEFORE START Checklist. . . . . .COMPLETE

MAINT INTPH Switch . . . . ON

Request ground crew to go on maintenance interphone at engine.

ENG START Switch. . . . . PULL

Command ground crew to open start valve.

When N2 RPM reaches 20% or maximum motoring,

FUEL Switch. . . . . ON

After TGT rise and N2 RPM 41%,

Command ground crew to close start valve.

[END]

FIRE WARNING TEST

MASTER WARNING and MASTER CAUTION Lights . . . . OFF

ENG and APU LOOPS Switches . . . . .BOTH

FIRE TEST Switch . . . . TEST

Hold FIRE TEST switch down. A successful test is indicated by:

- Fire bell.
- Voice fire warning from each engine and APU.
- Illumination of both MASTER WARNING lights and both ENG FIRE handles.

The following alerts will be displayed on the EAD:

- “ENG L FIRE”
- “ENG R FIRE”
- “APU FIRE”
- “PODS TEST PASS”

Push MASTER WARNING light and observe voice warning and fire bell are silenced. Release FIRE TEST switch and observe all alerts and warnings are extinguished.

OXYGEN REQUIREMENTS FOR CREW

Crew oxygen requirements for dispatch is 1350 PSI for 2 pilots and an observer. If there is no observer, crew oxygen requirements are 950 psi.

ADVERSE WEATHER PROCEDURES

Airplane operation in adverse weather conditions may require additional considerations due to the effects of extreme temperatures. The following additional instructions are intended to supplement the normal operating procedures and should be observed when applicable.

Hot Weather Operation

During extended ground operations, prior to flight deck preparation, consideration should be given to reducing the heat being generated on the flight deck. Window heat, radar, and other electronic components which contribute to a high temperature level on the flight deck may be turned off. All the flight deck air outlets should be open.

When possible, both packs should be used for maximum cooling. To maximize the cooling capacity of the air conditioning system, the flight deck side windows and all doors, including cargo doors, should be kept closed as much as possible. All gasper outlets should be open and window shades on the hot (sun-exposed) side of the passenger cabin should be closed.

Cold Weather Operation - General

Cold weather operations, particularly those associated with icing conditions, freezing rain, and slush or snow covered runways, present flight crews with potentially hazardous conditions. The following information is intended to supplement or amplify the normal operating procedures and should be applied appropriately. Since weather conditions will vary, the following procedures may not fit all situations. For that reason, it remains the responsibility of the operator to evaluate existing conditions and take necessary action to ensure safe operation. Refer to AirTran Flight Operations Manual (FOM) and Winter Operations Manual for operational performance guidelines and methods and material for de-icing and servicing airplanes in cold weather.

Winter weather is often characterized with rapidly changing and widespread adverse conditions. It is the responsibility of those operating in winter weather areas to have a thorough knowledge of existing and forecast weather conditions, exercise extreme caution, and adhere to standard operating procedures. Due to the basic nature of winter flight operations, flight crews should allow additional time to accomplish what would normally be routine tasks to ensure proper planning, briefing, and airplane preparation.

Icing conditions can exist when: TAT is 8°C (46°F) or below, and either visible moisture (clouds, fog with visibility less than 1 mile, rain, snow, sleet, ice crystals, etc.) is present; or when the temperature and dew point are within 3°C (5°F), or when standing water, ice, or snow is present on the ramps, taxiways, or runways.

Cold Weather Operations - Preflight Check

A careful check of fuselage, wings, tail, control surfaces, surface actuators, engine nacelle inlets, landing gear, and gear doors must be made, and all ice, frost, or snow must be removed from these areas prior to takeoff.

A light coating of powdery snow that is determined not to be adhering to critical surfaces, and can be expected to blow off during the early stages of takeoff roll, may be acceptable at the determination of the Captain. In this case, consideration should be given to the potential of melting and refreezing, or the possibility of ice or frost beneath such a layer. If in doubt, de-ice.

The area around pitot tubes, static ports, vanes, etc., should be carefully checked and verified to be clean, even though these items are electrically heated. Any ice or snow formations on inlets, cabin outflow valves, cabin pressure relief valves, and windshields should be completely removed. Be alert for any signs of water leakage in water and lavatory service panel areas to preclude subsequent accumulation and freezing which could result in foreign object damage.

Ensure the area on and around the APU inlet door (located above the left engine pylon) is clear of snow and ice. If the area on or around the inlet door is not clear, have debris removed prior to starting the APU. If temperature is less than 35°F with visible moisture, minimize use of the APU when not required for operations.

Check tires and struts for proper inflation and ensure that tires are not frozen to ground or to chocks.

Pay particular attention to underside of flaps and open areas of flaps and slats as a previous descent through icing conditions with flaps and slats extended may have caused considerable ice to accumulate in these areas. Similarly, landing and taxiing through slush or snow may also have caused accumulation on struts, gear doors and flaps.

The removal of snow from the fuselage should be accomplished before prolonged heating of the interior of the airplane to preclude melting and subsequent refreezing of water on the fuselage.

Frosting on underside of wings below fuel tanks will occur when fuel temperature is low, outside air temperature is above freezing and humidity is high. This type of frost may re-form after removal on the ground. Takeoff with frost on fuel tank underwing surfaces is permitted, provided it is not excessive. A coating of frost thicker than 1/8 inch should be removed before departure. Operation with frost adhering on areas of the wing other than the lower surface fuel tank region is not permitted.

CAUTION

Ice shedding from wing upper surface during takeoff can cause severe damage to one or both engines, leading to surge, vibration, and complete thrust loss.

Ice can form on wing surfaces during exposure of airplane to normal icing conditions. Clear ice can also form on wing upper surface when cold-soaked fuel is in main wing fuel tanks and airplane is exposed to conditions of high humidity, rain, drizzle, or fog at ambient temperatures well above freezing. Even though the bottom surface of wing is free of frost and ice, upper wing surface clear ice can form if suitable conditions exist. An accumulation of clear ice is difficult to detect visually.

The wing upper surface must be physically checked for ice when airplane has been exposed to conditions conducive to ice formation. Takeoff may not be initiated unless flight crew verifies that a visual check and a physical (hands-on) check of wing upper surface has been accomplished and wing is clear of ice accumulation.

De-icing fluid, if allowed to enter engine or APU inlet ducts, will cause white acrid smoke to enter airplane via the air conditioning system if these pneumatic sources are operating. When de-icing around engines and APU inlet and exhaust areas, use de-icing fluid sparingly to avoid subsequent ingestion. During de-icing, operational and safety considerations may require leaving APU running. In this case, air conditioning packs should be shut down and care should be exercised to avoid fluid spray in vicinity of APU inlet and exhaust.

CAUTION

De-icing fluid, if allowed to enter the APU inlet (located above the left engine pylon), could damage the APU.

Cold Weather Operations - Engine Start

When parked on a slippery area, make sure that chocks are applied both in front and behind nose and main wheels prior to starting engines. Chocks may not hold on slippery areas unless they are sanded. If chocks are not available for start, use sand or similar material and clear airplane for potential movement.

Before starting engines, ensure engine cowl inlet and exhaust areas are clear of any excess de-icing fluid and/or ice accumulations. Use of de-icing solutions for removal of engine inlet ice should be kept to minimum required.

Apply normal procedures for engine start. Preheating is normally not necessary; however, if engine will not start, or a hung start is experienced, ground heating may be necessary to warm engine components.

A cold engine may exhibit abnormal oil pressure and temperature indications during start. Observe appropriate engine limitations in accordance with the LIMITATIONS section and do not increase thrust above idle until all engine parameters are in the normal range.

CAUTION

Do not operate engine or wing anti-ice when TAT is above 10°C (50°F).

Engine anti-ice must be ON during all ground operations and in flight when icing conditions exist or are anticipated, except when the OAT is -40°C (-40°F). When icing conditions exist in immediate vicinity of the departure airport, air foil anti-ice may also be turned on at this time. When icing conditions exist in the immediate vicinity of the departure airport, airfoil anti-ice may also be turned on at this time. When using airfoil anti-ice for takeoff, refer to engine and airframe ice protection weight correction table.

When engine anti-ice is required:

L and R ENG Anti-Ice Switches (one at a time) . . . . ON

Move one ENG anti-ice switch to ON. Allow engine to stabilize, then move other ENG anti-ice switch to ON.

When engine anti-ice is no longer required,

L and R ENG Anti-Ice Switches (Both). . . . . OFF

Aircraft Deicing/Anti-icing

Preferred aircraft configuration for deicing/anti-icing procedure at the gate:

- Engines shut down
- Aircraft packs off
- APU OFF
- All doors/windows closed

Preferred aircraft configuration for deicing/anti-icing at remote location or when no external power is available:

- Engine(s) running at Idle (Bleeds Closed)
- Air-conditioning packs of
- APU Off
- All doors/windows closed

NOTE

The intent of the above procedure is to ensure that the APU cannot have deicing fluid and runoff forced into it’s inlet. Shutdown APU early enough to allow the inlet door to close (approx 90 seconds). After deicing, you may restart the APU as needed.

Engine deicing:

- Any frozen deposits that may have bonded to the intake or fan blades may be removed by hot air utilizing a ground heat source. Ensure the first stage fan rotates freely.

CAUTION

Do not spray deice/anti-ice solutions in engine inlet/exhaust, ram air inlet, outflow valve opening, or onto brakes.

At the conclusion of the deicing/anti-icing process, the Captain will confirm with the deicing crew that all ice, snow, or frost is removed from the aircraft exterior. Confirmation may be accomplished via the aircraft interphone, VHF radio, or by written means.

An operational check of the fight controls should be accomplished at this time to confirm all control surfaces are free and clear.

If a holdover time is established, a Pre-Takeoff Check is required. This inspection shall be conducted from the overwing cabin windows by a flight crewmember.

During taxi-out, if the holdover time is exceeded, a Pre-Takeoff Contamination Check is required. This inspection shall be conducted from the overwing cabin windows by a flight crewmember. This check must be completed within 5 minutes prior to beginning takeoff.

If contamination is evident prior to takeoff roll, the airplane will be returned and deiced again prior to takeoff.

Complete normal checklists as required.

Cold Weather Operations - Taxi

WARNING

Reverse taxi (powerback) is not authorized when ice, snow, or slush is on the ramp, or during periods of heavy rain.

Single engine taxi is not recommended on ice, snow, or slush-covered surfaces. When on slippery surfaces, make sure parking brakes are released prior to commencing taxi. When power is applied, airplane may slide forward even though brakes are set.

Exercise caution when commencing taxi as ramp areas may be especially slippery due to airplane servicing, de-icing, etc. Avoid high thrust settings when taxiing, especially when leaving ramp area. If airplane response to throttle movement is slow while on snow or slush, allow a few seconds for airplane to respond before applying more throttle. Advance power only as necessary to start airplane moving, then retard throttles smoothly to idle or to minimum thrust necessary to maintain appropriate taxi speed.

Extend flaps/slats to full down, and then to takeoff setting when commencing taxi. Spray and debris deflectors combined with prudent taxi speeds on contaminated taxi areas provide sufficient protection from contamination of exposed flap/slat surface areas.

WARNING

If the flaps are left up during taxi to avoid slush and ice, complete the TAXI Checklist after flaps are in takeoff configuration.

Taxi speed should be as slow as practical on slippery surfaces and should be especially slow when approaching turns or stopping areas. Lead turns by as much as possible considering taxiway width. Nosewheel steering and braking action may both be affected by lack of traction on slick and frozen surfaces; the slower the speed, the better the traction. Avoid excessive nose gear steering deflection. Surface conditions may vary between taxiways and parking areas due to sanding and de-icing. Expect taxiways on bridges or other elevated areas to be more susceptible to ice formation than adjacent areas. An icy surface may be covered by a layer of snow. Melting ice or snow may cause rapid changes in traction. Taxi speed should be kept low enough that airplane can be stopped in space available. Reverse thrust may be used if necessary to assist in stopping.

Taxi slowly on contaminated taxiways to prevent snow and slush from impinging on wheel wells, flaps, and engines. Do not taxi through areas of deep snow or deep slush. A crowned, slippery taxiway or a slick crosswind taxiway may cause sideways slipping or weathervaning into the wind. Taxi as close as possible on centerline and avoid large nose steering inputs. Be aware of snowbanks as extended flaps are particularly susceptible to damage from such hazards. Be alert for obscured runway, taxiway, or ramp markings and lights.

In the event of extended ground idle operations during taxi or a delay in takeoff in severe icing conditions, periodic engine runups with engine anti-ice system on, to a thrust setting of at least 50% N1 is desired every 10 minutes, to minimize the possibility of ice buildup. Be aware that blasted snow or ice can cause damage at considerable distances. Maintain increased separation behind other airplanes. Expect they may also require an engine runup to counteract ice formation.

Prior to takeoff, recheck flight controls and trim for freedom of movement. Use caution when taxiing onto runway for takeoff. The approach end of the runway may be more slippery than other areas due to melting and refreezing of snow or ice following previous takeoffs. In addition, painted surfaces and normal accumulation of fuel, oil, and rubber are made more slippery when coated with moisture (i.e. water or slush).

Cold Weather Operations - Takeoff

Oil temperature must be at least 20°C prior to takeoff.

Check latest field conditions prior to takeoff. Slush and snow conditions change rapidly. A reduced thrust takeoff is not permitted when the runway is wet or contaminated with water, ice, slush or snow. Maximum depth of wet snow/slush/water is 1/2 inch and maximum depth of dry snow is 4 inches. Refer to Runway Analysis Manual for contaminated runway corrections.

Dry snow is snow with limited water content. It normally forms a cloud when disturbed and dissipates rapidly. Outside temperature is generally below 2°C (28°F). Dry snow can become wet if exposed to bright sunlight.

Wet snow has sufficient moisture content so that it packs easily and will compact when pushed. It packs down when compressed but has no tendency to splash. If there is a tendency to splash, it must be considered slush. Wet snow quickly becomes slush under certain conditions. If in doubt, consider it as slush.

Slush is partially melted snow with high water content. It will splash when a vehicle is run through it or when it is otherwise compressed.

If takeoff is being made on a contaminated runway, keep the APU running for electrical backup (if available).

Align the airplane with runway centerline and ensure that the nosewheel is straight before applying power for takeoff. Takeoff should be preceded by a static runup to 50% N1. Stable engine operation must be verified prior to the start of takeoff roll. If airplane starts to move due to poor braking conditions, release brakes and proceed with a rolling takeoff. Check all engine instruments for stable operation early in the takeoff roll.

Asymmetrical thrust can adversely affect directional control on slippery runways. Throttle alignment at partial power may not assure alignment at takeoff power as engine pairs may have different spool-up rates.

On slippery runways, apply some nose down elevator to improve nosewheel traction and directional control until rudder control becomes effective for steering the airplane. Excessive forward control column pressure should be avoided and, as speed increases, the forward pressure on control column should be reduced to lessen the possibility of nosewheel spray being ingested into engines when operating on wet, or slush and snow-covered runways.

To maintain heading during takeoff roll, recognize initial heading deflections early and correct by small rudder pedal steering inputs. With increased stopping distances encountered under contaminated runway conditions, consideration should be given to limiting decision to abort at speeds between V1-20 and V1 to engine failure, or conditions where airplane is considered not flyable.

Difficulty with directional control may be encountered after a takeoff rejection, especially under crosswind conditions. When rejecting, ensure spoiler deployment, apply moderate forward pressure on the control column and maintain directional control with rudder pedal steering, simultaneously applying maximum braking. Both nosewheel steering and differential braking effectiveness are reduced during wet/slippery runway operation. Do not apply excessive forward control column pressure as this will reduce the weight on the main wheels resulting in reduced braking friction. The use of reverse thrust on wet runways is recommended to reduce the stopping distance. Reverse thrust should be applied gradually and symmetrically (both engines operating) commensurate with the ability to maintain directional control under the existing conditions. Should directional control become a problem while in reverse thrust, reduce reverse thrust to reverse idle (or forward idle thrust, if required), regain directional control and reapply reverse thrust as necessary. Do not attempt to maintain directional control by using asymmetric reverse thrust.

If uncommanded pitch or roll is encountered after lift-off, use aileron, rudder, and elevator as required to maintain the desired flight path. Do not allow further increases in pitch attitude until full lateral control has been regained. Use smooth continuous control inputs to avoid over-controlling. If during flap or slat retraction, uncommanded pitch or roll or buffeting is encountered (due to undetected ice, frost, or snow accumulations), reselect the flaps/slats to the original configuration. Activate the airfoil ice protection prior to any further configuration changes. Wing anti-ice system may be used to provide anti-ice protection or to de-ice in flight only.

CAUTION

Do not operate wing anti-ice when the TAT is above 10°C (50°F) unless ice is visible.

When wing anti-ice is required.

AIR FOIL Anti-Ice Switches . . . . ON

NOTES

Engine anti-ice should be turned on prior to wing anti-ice use.

"BLD AIR TEMP LO" alerts may be displayed with engines at low power. Increasing power enough that alerts are no longer displayed will provide adequate ice protection.

Cold Weather Operations - In-Flight

The flight crew and operational personnel must be aware at all times of the adverse and rapidly changing nature of winter weather and be alert for potential requirements for flight plan changes and possible diversions. Icing, strong winds, turbulence, and windshear are common occurrences in the wintertime.

Engine and airfoil anti-ice should be ON whenever icing conditions exist or are expected. Engine anti-ice should be used, and airfoil icing conditions can exist, when the TAT air temperature is less than 8°C (46°F) and there is visible moisture in the air (temp/dewpoint spread 3°C (5°F). Also, be alert for ice buildup on windshield wipers or edges of the windshields as indications of airfoil icing conditions.

The higher the temperature, the higher the cloud liquid water content. This will result in more severe icing conditions. At temperatures below -20°C (-4°F), icing conditions should be less severe. However, heavy icing has, on occasion, been reported at temperatures as low as -60°C (-76°F).

One of the first indications of engine ice formation can be an erratic EPR. Ice formation can produce a thrust loss as indicated by a drop of all engine thrust parameters, or induce surging or flameout if allowed to become sufficiently severe. If icing conditions become severe, consideration should be given to altering flight plan to avoid the area of icing conditions. The flight crew should be familiar with SEVERE TURBULENCE AND/OR HEAVY RAIN INGESTION procedure in the ABNORMAL NON-ALERTS section.

When encountering engine inlet icing conditions, move engine anti-ice switches to ON one at a time. Wait until engine is stabilized before turning on the opposite engine anti-ice.

When engine anti-ice is no longer required, move engine anti-ice switches to off one at a time, allowing each engine to stabilize.

When air foil anti-ice is required, airfoil anti-ice switches should be turned on subsequent to application of engine anti-ice and, when no longer required, should be selected off prior to termination of engine anti-icing to maintain normal bleed configuration.

When extended periods of using engine and airfoil anti-ice systems are anticipated or encountered, consideration should be given to the increased fuel burned criteria as indicated on Cruise Control Table in CRUISE section of the AOM PERFORMANCE section.

When icing is anticipated during descent, commence use of the engine and airfoil anti-ice systems well before reaching expected icing level.

NOTE:

If “BLD AIR TEMP LO” alerts may be displayed with engine at low power. Increasing power enough that alerts are no longer displayed will provide adequate ice protection.

Increased drag, such as use of speed brakes, may be necessary to maintain an adequate rate of descent. Vertical speeds should be kept as high as practical to reduce exposure and ice accretion time.

Holding is normally flown in minimum fuel consumption cruise configuration with slats and flaps retracted. Engine bleed air adequate to maintain anti-icing may require a higher drag configuration, much the same as descent, consequently causing a higher fuel consumption. When forced to hold in icing conditions, there is a concern for ice buildup on underside of the flaps and flap/ slat extension mechanisms. If necessary, landing gear may be extended to increase drag as effects of ice accumulation on landing gear would be less than on flaps, slats, and speed brakes.

If a landing is to be made on a runway contaminated with slush, standing water, or during heavy rain, the APU should be started prior to final approach (if available). This will serve as a backup electrical power source in case engine driven generators are lost due to slush or water ingestion by engines and subsequent loss of engine RPM.

Cold Weather Operations - Landing

The flight crew must be aware of the condition of the runway with respect to snow, ice, slush, or precipitation. The most favorable runway in relation to surface condition, wind, and weather should be used. A landing on, or dispatch to, a runway with a braking action of poor is undesirable and should not be planned unless other factors make this imperative. In very general terms, landing on a wet runway increases stopping distance approximately 1000 feet over a dry runway, and landing on an icy runway increases the stopping distance by more than 3000 feet. Appropriate landing distance should be obtained from the applicable charts and tables in the PERFORMANCE chapter, to include Estimated Effect Of Runway Surface Conditions and Reverse Thrust On Landing Distance and the Estimated Ice Covered Runway Landing Distance tables. As winter weather is often characterized by strong winds and crosswinds, guidelines for VREF additives should be observed.

If a landing is planned on a runway contaminated with snow, slush, standing water, or during heavy rain, the following factors must be considered: available runway length; visibility of runway markers and lights; snowbanks and drifts along the runway; wind direction and velocity; crosswind effect on directional control; braking action; possibility of effect on the airplane from slush and water spray (engine ingestion, damage to flaps, gear doors, etc.); and probability of hydroplaning and its effect on stopping distances.

A common form of hydroplaning is dynamic hydroplaning. It occurs when there is standing water on the runway surface. Water with a depth of about 1/10 of an inch acts to lift tire off runway surface. This condition can progress to where tires no longer contribute to directional control and braking.

Minimum dynamic hydroplaning speed of a tire has been determined to be 8.6 times the square root of tire pressure in pounds per square inch. With a main wheel tire pressure of 225 PSI, calculated hydroplaning speed is approximately 130 knots. Nosewheel tire hydroplaning might be encountered while executing a high speed turnoff. Calculated hydroplaning speed referred to is for start of dynamic hydroplaning. Once hydroplaning has started, it may persist to a significantly slower speed.

Braking action can become inhibited following application of chemical de-icers on an icy runway. When first applied, chemicals provide a watery film over snow and ice that results in an extremely low coefficient of friction. When in doubt about type of runway de-icing, ask tower specifically if chemical de-icers were used.

Blowing or drifting snow can create optical illusions of depth perception problems during landing or taxi-in. In crosswind conditions, they may create a false impression of airplane movement over the ground. It is possible to have an impression of no drift when in fact a considerable drift may exist. When landing under these conditions, runway markers or runway lights can help supply the necessary visual references.

When it has been established that a safe landing can be made, the airplane must be flown with the objective of minimizing the landing distance. The approach must be stabilized early. Precise control over drift and approach speeds is mandatory. Execute a missed approach if zero-drift condition cannot be established prior to touchdown. When making the transition to visual reference for landing, continue to utilize the glideslope and VASI information to control the glidepath as wet windshields and snow covered surfaces may distort depth perception. The airplane should be flown firmly onto the runway at the aim point. Avoid holding off. Be prepared to manually deploy the spoilers if automatic deployment does not occur as wheel spinup may be delayed.

On touchdown, take positive action to lower the nose gear to the runway and maintain moderate forward pressure on the control column to assist in directional control. Avoid excessive forward control column pressure in order to retain maximum braking effectiveness and to reduce the possibility of nosewheel spray. Maintain centerline tracking, ensure spoiler deployment, and simultaneously apply brakes smoothly and symmetrically, as appropriate to the braking action and runway length available to ensure a safe stop. On contaminated surfaces, full braking should be used to realize optimum anti-skid operation. The normal braking technique on slippery runways is that immediately after nose gear touchdown, apply brake pressure smoothly and symmetrically with maximum pedal pressure and hold until a safe stop is assured.

Apply reverse thrust initially to the idle reverse detent, then, after reverse thrust is verified, to full reverse. Full reverse should be used as soon as possible since the reverse thrust effectiveness is greatest at higher speeds. If difficulty in maintaining directional control is experienced during reverse thrust operation, reduce thrust as required. Do not attempt to maintain directional control by using asymmetric reverse thrust as this will further aggravate the effects of weathervaning. Under emergency conditions, maximum reverse thrust may be used to a complete stop. The use of reverse thrust may cause a visibility problem from blowing snow forward as ground speed decreases and can melt dry snow which can impinge and freeze on cold surfaces. Take action as appropriate for the braking effectiveness and runway length available. Avoid rapid return to forward thrust when engine RPM is high. The resultant forward thrust may be high enough to cause the airplane to accelerate.

Maintain directional control primarily with rudder pedals. Use differential braking as needed. Be alert for drift toward downwind side of the runway. The rudder required in strong crosswinds may cause the nose gear to turn to an angle which could induce skidding. Therefore, it may be necessary to hold the nose gear steering wheel centered while controlling steering with rudder and brakes to maintain tracking.

If a skid develops, especially in crosswind conditions, reverse thrust will increase the sideward movement of the airplane. In this case, release brake pressure and reduce reverse thrust to reverse idle, and if necessary, forward idle. Apply rudder as necessary to realign the airplane with the runway and reapply braking and reversing to complete the landing roll. Use as much runway as necessary to slow the airplane. Do not attempt to turn off a slippery runway until speed is reduced sufficiently to turn without skidding. Consider that braking effectiveness in the last 2000 feet of the runway may be further reduced by painted surfaces and accumulation of fuel, oil, and rubber.

Cold Weather Operations - Taxi-In

If the approach was made in icing conditions or if the runway was covered by slush or snow, retract the flaps and slats to 18/T.O. EXT. Damage to the flaps and slats could occur if residual ice is present and the flaps and slats are fully retracted. Slush in puddles or runway low spots may be deeper than the maximum allowed for operation and cause damage to flaps or other parts. A check after parking should be made for any damage or the necessity to de-ice the flaps and slats area. After a satisfactory check, flaps and slats should be moved to UP/RET.

Use caution when entering ramp areas. Be alert for obscured taxi and parking lines and surface conditions that may not be conducive to good steering and stopping. Other airplanes may not be parked in proper positions and may not afford sufficient clearance due to contaminated parking areas. If in doubt, request assistance for proper parking and clearance from other airplanes and obstacles.

Cold Weather Operations - Parking

The area in which an airplane is to be parked should be clear of snow and slush. If this is impractical, the area around the main and nose gear wheel should be cleared to reduce the possibility of tires freezing to the ground.

Avoid a parking position during or immediately after completion of a turn. It is best to allow nosewheels to be centered and the airplane to roll forward a few feet to eliminate all side loads on main and nose gear struts.

Parking brakes should be released to eliminate possibility of brakes freezing. If concerned about chocks holding on an icy ramp, parking brakes may be left on.

In blowing snow, engine covers may be required, depending on length of stop. After engine shutdown, check engines air inlets for presence of water and/or ice. Remove any accumulations before installing engine inlet plugs and covers. If remaining overnight, ensure all cabin doors, cargo compartment doors, access doors, sliding windows, APU inlet door, and outflow valves are closed. If the airplane is to remain inactive and the temperature is expected to go below freezing, drain all water and water waste systems and service the airplane in accordance with the Winter Operations Manual.

Windshield Wipers

CAUTION

Windshield scratching will occur if the windshield wipers are operated on a dry windshield.

WINDSHEAR PROCEDURES

The most important policy for the flight crew in coping with a windshear is to avoid areas of known windshear.

Windshear - Definition

Severe windshear may be defined as a rapid change in wind direction and/or velocity that results in airspeed changes greater than 15 knots or vertical speed changes greater than 500 FPM.

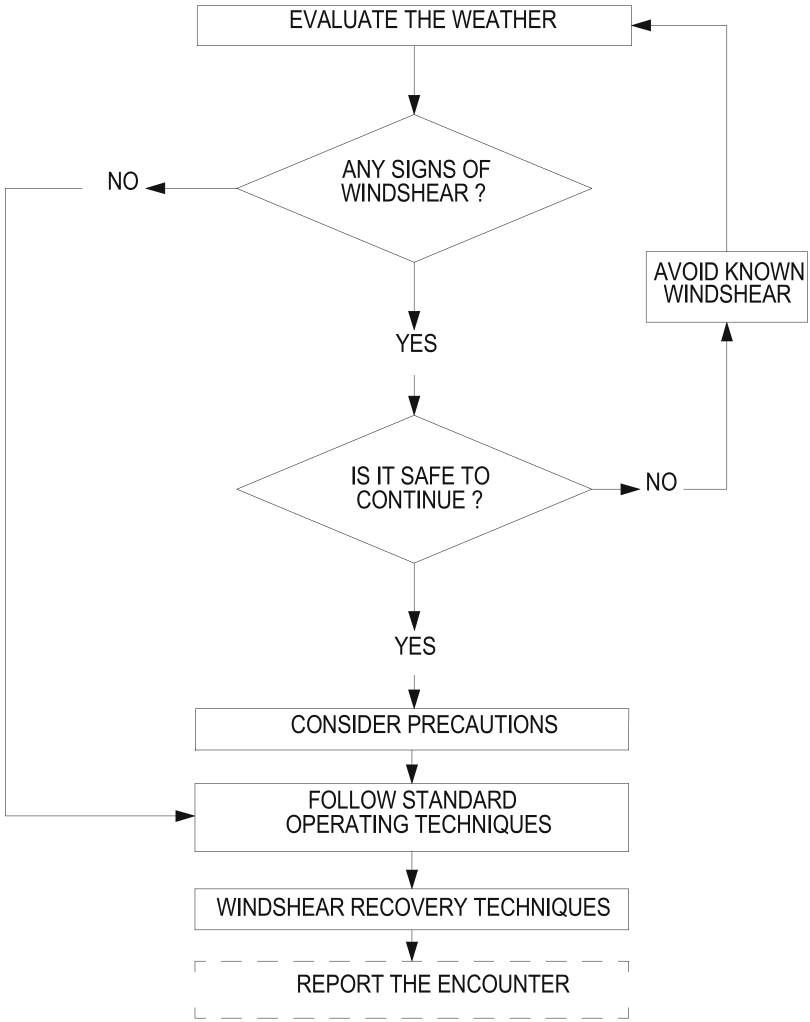
Windshear - Flight Crew Actions

Flight crew actions preparatory to encountering possible windshear events are divided into five areas. They are:

1. Evaluate the weather.
2. Avoid known windshear.
3. Consider precautions.
4. Follow standard operating techniques.
5. Windshear recovery technique.

The figure on the following page summarizes how flight crew actions may be incorporated into everyday operations. Use of this model will simplify operational windshear decisions.

Model Of Flight Crew Actions



KB1-2-0002

Windshear - Evaluate The Weather

Detection of windshear is difficult with today's technology. Develop an awareness of the causes and danger signals of windshear to successfully avoid windshear.

The most dangerous form of windshear is a convective weather microburst of either dry or wet type. As shown in the table below, convective weather conditions have produced the majority of known windshear accidents.

CAUSE OF WINDSHEAR	APPROX % OF WINDSHEAR ACCIDENTS
Convective conditions (thunderstorms, rain, and snow showers)	65
Frontal systems	15
Low altitude jet streams	5
Strong or gusty surface winds	5
All other causes (temperature inversions, mountain waves, sea breeze circulations, unknown causes).	10

DANGER SIGNALS OF DRY MICROBURSTS

PIREP	**CAUTION** Due to rapid intensification of microbursts, actual windshear may be up to twice as severe as PIREP.
LLWAS	**CAUTION** LLWAS in its present state of development is not completely accurate in detecting microbursts and is prone to false alarms.
Virga	Rain falling from high based convective clouds evaporating before it reaches the ground.
Temperature/ dewpoint	Watch for a spread of 30 to 50°F (17 to 28°C).

DANGER SIGNALS OF DRY MICROBURSTS

Localized strong winds	Blowing dust, rings of dust, dust devils, other tornado-like features and other evidence of strong local outflow near the surface.
Turbulence	Moderate or greater turbulence may be associated with the outflow from a microburst.
Airborne weather radar	Indications of weak (green) cells with bases from 5000 to 15,000 feet AGL which indicate weak precipitation, usually virga. In addition, in doppler mode, areas of red (doppler turbulence) surrounding weak precipitation may indicate microburst windshear conditions in their formative stages aloft.
Weather forecast	The potential for a microburst is indicated by mid-level moisture, very dry surface conditions and a 30 to 50°F (17 to 28°C) temperature/dewpoint spread.

DANGER SIGNALS OF WET THUNDERSTORM MICROBURSTS

PIREP	**CAUTION** Due to rapid intensification of microbursts, actual windshear may be up to twice as severe as PIREP.
LLWAS	**CAUTION** LLWAS in its present state of development is not completely accurate in detecting microbursts and is prone to false alarms.
Thunderstorms	In addition to the well known hazards of thunderstorms, an estimated 5% of thunderstorms accompanied by heavy rain and/or lightning contain embedded microbursts.

DANGER SIGNALS OF WET THUNDERSTORM MICROBURSTS

Localized strong winds	Blowing dust, rings of dust, dust devils, other tornado-like features and other evidence of strong local outflow near the surface. Visual clues may be obscured by low visibilities in wet thunderstorm microburst situations.
Turbulence	Moderate or greater turbulence may be associated with outflow from a microburst.
Airborne weather radar	Search area above and along takeoff and approach paths for heavy precipitation.
Weather forecast	Although no techniques currently exist to forecast wet microbursts, crews should consider the thunderstorm forecasts contained in terminal forecasts and severe weather advisories as a possible indication of presence of wet microbursts.

The following table provides a subjective evaluation of various observational clues to aid in making appropriate real time avoidance decisions. Although encountering weather conditions described in the table above 1000 feet AGL may be less critical in terms of flight path, such encounters may present other significant weather related risks. Windshear clues should be considered cumulative. The probability of each single observation is given. However, if more than one windshear clue is observed, the probability rating may be increased to reflect the total set of observations. Use of the table should not replace sound judgment in making avoidance decisions. Crewmembers are urged to exercise caution when determining a course of action.

MICROBURST WINDSHEAR PROBABILITY GUIDELINES

OBSERVATION	PROBABILITY OF WINDSHEAR
PRESENCE OF CONVECTIVE WEATHER NEAR INTENDED FLIGHT PATH:	HIGH
With localized strong winds (tower reports or observed blowing dust, rings of dust, tornado-like features, etc.)	HIGH
With heavy precipitation (observed or radar indications of contour, red or attenuation shadow)	HIGH
With rain shower	MEDIUM
With lightning	MEDIUM
With virga	MEDIUM
With moderate or greater turbulence (reported or radar indications)	MEDIUM
With temperature/dew point spread of 30° to 50°F (–1° to 10°C)	MEDIUM
ONBOARD WINDSHEAR DETECTION SYSTEM ALERT:	
Reported or observed	HIGH
PIREP OR AIRSPEED LOSS OR GAIN:	
20 KIAS or greater	HIGH
Less than 20 KIAS	MEDIUM
FORECAST OF CONVECTIVE WEATHER:	LOW

HIGH - Critical attention needs to be given to this classification. A decision to avoid (e.g., divert or delay) is appropriate.

MEDIUM - Consideration should be given to avoiding. Precautions are appropriate.

LOW - Consideration should be given but a decision to avoid is not generally indicated.

NOTE

These guidelines apply to operations in the airport vicinity (within 3 miles of the point of takeoff or landing along intended flight path and below 1000 feet AGL). Hazard increases with proximity to convective weather. Weather assessment should be continuous.

CAUTION

Currently no quantitative means exist for determining presence or intensity of microburst windshear. Crewmembers are urged to exercise caution in determining course of action.

Avoid Known Windshear

The policy is to avoid areas of known windshear. Consider one or more of the following actions as appropriate:

- Delay takeoff until conditions improve.
- In flight, divert around area of known windshear.
- If windshear is indicated during approach, initiate a go-around or hold until conditions improve.

Consider Takeoff and Approach Precautions

These precautions are recommended when probability of windshear exists but avoidance action is not considered necessary.

<u>Takeoff Precautions</u>

- Use maximum takeoff thrust instead of reduced thrust.
- Use the longest suitable runway away from potential windshear (winds and obstacle clearance permitting).
- Consider using the lowest practical flap setting (5° or 13° until such time that Dial-A-Flap is availabe allowing a range between 5° and 13°) unless limited by obstacle clearance and/or climb gradient.
- Consider increasing VR speed to the performance limited gross weight rotation speed not to exceed actual gross weight VR speed + 20. Set speed bugs for the actual gross weight takeoff speeds, but remember to rotate at the performance limited gross weight rotate speed.

Approach Precautions

- Achieve a stabilized approach no later than 1000 feet AGL.
- Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases.
- Use the longest suitable runway away from potential windshear.
- Consider using FLAPS 25 for landing.
- Consider using increased approach speed (correction applied in the same manner as gusts) up to a maximum of 20 knots.
- Use the autopilot and autothrottles for the approach to provide more monitoring and recognition time. If using autothrottles, manually back-up throttles to prevent excessive power reduction during an increasing performance shear.

Windshear - Follow Standard Operating Techniques

NOTE

This will become the standard operating technique when the WAGS system becomes operational. Until that time the Standard Operating/Recovery Technique for windshear is on page 44 under Windshear Recovery Technique (WAGS Inoperative).

Certain procedures and techniques can prevent a dangerous flight path situation from developing if windshear is inadvertently encountered. These procedures and techniques are of such importance that they should be incorporated into each crewmember's personal standard operating techniques and practiced on every takeoff and landing whether or not windshear is anticipated. Also of great importance is a cockpit atmosphere which encourages awareness and effective crew coordination (CRM).

Takeoff Standard Operating Techniques

- Be alert for any airspeed fluctuations during takeoff and initial climb.
- Use normal rotation rate when rotating to an all-engine initial climb pitch attitude (2.5 seconds from lift-off to takeoff attitude in one smooth continuous pitch change and follow flight director commands).
- As much as possible, maintain initial climb pitch attitude until terrain and obstacle clearance is assured.
- Be aware of what should be normal values for airspeed, attitude, vertical speed, and airspeed acceleration.
- PNF closely monitors vertical flight path instruments such as vertical speed and altimeters. PNF must call out any deviations from normal.

Approach Standard Operating Techniques

- Be aware of what should be normal values for vertical speed, thrust, and pitch.
- Know go-around decision criteria and be prepared to execute an immediate go-around if parameters are exceeded. IF IT DOES NOT LOOK OR FEEL RIGHT, DO NOT HESITATE TO GO AROUND.
- PNF closely monitors vertical flight path instruments such as vertical speed, altimeters and glideslope displacement. PNF must call out deviations from normal.

Reactive Windshear System (To be added when avaiable)

Predictive Windshear System

Takeoff –

If a predictive windshear warning “WINDSHEAR AHEAD, WINDSHEAR AHEAD” is generated and/or a red “WINDSHEAR AHEAD” message is displayed on the PFD,

- Abort takeoff or
- Do not start takeoff roll.

NOTE

All predictive windshear alerts are inhibited after 100 KIAS and until airplane has reached 50 feet radio altitude.

If a predictive windshear caution “MONITOR RADAR DISPLAY” aural alert and/or an amber “WINDSHEAR AHEAD” message is displayed on the PFD,

- Consider location of windshear relative to the flight path and plan to deviate, avoid, or
- Delay takeoff until conditions improve.

If a predictive windshear warning occurs after takeoff, follow the same procedures if a warning occurs during approach.

Approach –

If a predictive windshear “GO AROUND WINDSHEAR AHEAD” warning is generated, perform an immediate go-around.

If a predictive windshear caution “MONITOR RADAR DISPLAY” and advisory ICON are generated, consider location of the windshear relative to the flight path and deviate to avoid windshear, continue landing, or go around and divert to alternate. Continue to monitor the windshear icon.

In all cases, report the windshear location to ATC.

Reactive and Predictive Windshear System Interaction –

If a predictive windshear warning is generated and a subsequent reactive windshear event occurs, the reactive system will issue a red warning. If the reactive system first detects a windshear caution without a predictive system alert, the reactive system will issue "HEADWIND SHEAR" or "TAILWIND SHEAR" alerts as appropriate.

Windshear Recovery Techniques (WAGS Inoperative)

The following actions are recommended whenever flight path control becomes marginal at low altitude on takeoff or approach. As guidelines, marginal flight path control may be indicated by deviations from target conditions in excess of:

- $\pm$15 KIAS
- $\pm$500 FPM vertical speed
- $\pm$5° pitch attitude.
- $\pm$1 dot displacement for glideslope.
- Unusual throttle position for a significant period of time.

Initiate the following recommended windshear recovery techniques without delay.

NOTE

Accomplish the first three steps simultaneously.

Thrust –

Disengage autothrottles and aggressively apply maximum thrust to ensure adequate airplane performance. If ground contact is imminent, advance throttles through the N1 mode gate to obtain maximum available thrust. When windshear is no longer present and airplane safety has been ensured, adjust throttles to maintain engine parameters within limits and reset FADEC to EPR mode.

NOTE

Engine parameters which exceeded limits will require a log entry including duration of exceedance.

Autopilot –

Disengage autopilot.

Pitch –

For a windshear encounter after liftoff, or on approach, increase or decrease pitch attitude as necessary (at a normal pitch rate) toward an initial target attitude of 15°. On takeoff, where a normal all engine pitch attitude has been established before a windshear is encountered, it is not necessary to decrease pitch to 15°. All engine pitch attitude may be maintained until either the shear has been exited or stick shaker is encountered. The stick shaker may be expected to activate when pitch attitude reaches the PLI. Use intermittent stick shaker as upper limit for pitch. Rapidly changing vertical winds can also cause momentary stick shaker at any attitude. If attitude has been limited to less than 15° to stop stick shaker, increase attitude toward 15° as soon as stick shaker stops.

If vertical flight path or altitude loss is still unacceptable after reaching 15°, further increase pitch attitude smoothly in small increments not to exceed stick shaker angle of attack.

Rapidly changing winds may cause rapid excursions in pitch and roll with little or no pilot input. Control pitch in a smooth, steady manner (in approximately 2° increments) to avoid excessive overshoot/ undershoot of desired attitude. Once airplane is climbing and ground contact is no longer an immediate concern, airspeed should be increased by cautious reductions in pitch attitude.

Flight Director –

Turn flight director off or disregard commands.

WARNING

With an inoperative windshear detection system, the flight director/autoflight system may command a pitch attitude change to follow target airspeeds or a fixed pitch attitude regardless of flight degradation. This guidance may be in conflict with the proper procedures for windshear recovery.

If windshear is encountered on the runway during takeoff and an abort is not practical, rotate toward 15° at normal rate of rotation, but no later than with 2,000 feet of usable runway remaining. After becoming airborne, follow after liftoff/on approach recovery technique.

Configuration –

Do not change flap, gear or trim position until terrain contact is no longer a factor.

NOTE

It is recognized that a change in flap position may improve windshear recovery. However, this procedure is not recommended since the risk of moving flaps in the wrong direction or amount is considered to be greater than the risk of encountering a shear so great that a flap change is needed for recovery.

NOTE

The normal tire limiting speed for the B-717 is normally 225 mph.

Report The Encounter

Report airspeed change, shear encounter location, altitude and airplane type to ATC as quickly as possible. Use the term PIREP in making the report in order to encourage rebroadcast to other airplanes.

TABLE OF CONTENTS

ABNORMAL NON-ALERTS

LEVEL 1 AND LEVEL 0 ALERTS

NO TAKEOFF LEVEL 1 ALERTS

EMERGENCY PROCEDURES

GENERAL INFORMATION

Non-normal procedures are used by the trained flight crew to cope with system faults and other situations adversely affecting flight. Non-normal procedures focus on execution rather than what the procedure is called.

Procedures, when appropriate, contain information a crew may need, such as the amount of time one may safely operate in a certain configuration. The intent of such information is to aid the crew in making decisions concerning continuation or termination of the flight. While such judgment decisions can only be made by the Captain after consideration of relevant factors such as, airplane condition, weather, suitable landing airports, etc., there are some situations which always require a landing at the nearest suitable airport, in point of time, where a safe landing can be accomplished. These situations include, but are not limited to:

- engine failure or fire;
- cargo smoke;
- two engine flameout;
- fuselage fire;
- cabin smoke or fire which cannot be immediately and positively determined to be eliminated or extinguished;
- one AC power source remaining (i.e. engine or APU generator);
- or any other situation determined by the Captain to present significant adverse effect on safety if flight is continued.

In some cases, such as engine failure, regulations requiring an early landing may also apply. In each case, it is the responsibility of the Captain to assess the situation and execute sound judgment to determine the safest course of action. The crewmember observing a non-normal indication will call out the condition (example: "engine fire") and silences the aural warning.

All actions are accomplished by direction or under the supervision of the Captain and performed in a deliberate, systematic manner. Under no circumstances should control of the airplane be compromised.

Procedures that prescribe an engine shutdown must be evaluated by the Captain to ascertain if actual shutdown or operation at reduced thrust is the safest course of action. Consideration in this case must be given to the probable effects if the engine is left running at minimum required thrust.

Non-normal procedures fall into two categories: Emergency Alert procedures and Emergency Non-Alert procedures.

Emergency alert procedures are provided alphabetically in the Emergency Alert section, and are annunciated by the display of a red LEVEL 3 alert and an aural warning. All alert procedure titles use the exact wording of the EAD alert message.

Emergency Non-Alert procedures are provided alphabetically in the Emergency Non-Alert section. These emergencies are not annunciated by the alerting system.

Procedures include the following elements, as appropriate to the situation.

- Action steps to contain or correct the situation, these may be recall or reference. Recall action steps are boxed to distinguish them from reference items.
- Information relevant to the situation and useful for planning the subsequent course of action.
- A landing preparation section, if required, that identifies action or considerations for the approach and landing phase. The required actions are accomplished in a logical sequence during the approach and landing phase. Some exceptions to this are checklists which include unique approach and landing checklists.
- A IN RANGE checklist is commenced during descent and should be completed prior to arriving at the initial approach fix.
- The LANDING checklist should be called for by the Captain when appropriate, depending on the non-normal condition.
- At the completion of all line item tasks a statement of "__________ CHECKLIST COMPLETE" will be made.
- The completion of checklists are marked by END.

Flight patterns associated with certain non-normal situations indicate the sequence of airplane configuration changes and are contained in the Flight Training section of this manual.

Non-normal procedures also assume:

- System Controls are in the normal configuration for the phase of fight prior to the initiation of the non-normal procedures.
- Aural warnings are silenced by the flight crew as soon as the cause of such warning is recognized.
- Oxygen masks and goggles are donned and communications are established when their use is required. This includes, but is not limited to: loss of cabin pressure, use of fire extinguishing agents, contamination (such as smoke), or concentration of fumes or odors, either present or anticipated on the flight deck or in the passenger cabin.
- Testing lights may be accomplished at the discretion of the crew to verify suspected indication faults.
- Circuit breakers will be checked. Resetting tripped circuit breakers by the crew is not recommended. If a system is essential for the flight's safe completon, the Captain may elect to reset a tripped circuit breaker one time, following a two minute delay.

CAUTION

Do not reset any tripped fuel pump circuit breakers.

Most emergency procedures are written considering single failures only. If more than one failure exists within a system, the engine and alert display (EAD) will normally display only the most serious problem. In certain cases the alert will indicate a procedure for multiple failures. If failures occur simultaneously in more than one system, it is the Captain's responsibility to establish the priority of actions

NON-NORMAL CHECKLIST PHILOSOPHY

As soon as an emergency condition is detected, the detecting crew member will announce the condition and, when applicable, reset the alerting system.

The primary method of resetting the alerting system is to push the associated cue switch on the systems display control panel (SDCP). This action will reset the MASTER WARNING light and display the appropriate synoptic on the system display. In the event of an engine fire warning, the red MASTER WARNING light must be pushed or the associated fire handle must be pulled to silence the aural warning.

For all emergency alerts, if conditions do not permit (i.e., short final approach), the MASTER WARNING light may be reset by pushing either MASTER WARNING light. In this case, the associated cue light will remain illuminated and can be pushed to select the system display when time permits.

The Pilot Flying (PF) will dedicate his attention to airplane control. Time permitting, the Pilot In Command (PIC) will then call for appropriate memory items and the Volume I checklist. The Pilot Not Flying (PNF) will accomplish the memory items with PF confirmation. The PNF will then verify the appropriate checklist and refer to the Volume I procedure. The checklist should be accomplished by the "Challenge-Do-Verify" method. The PNF will accomplish each item in the procedure if it is in his area of responsibility or coordinate the action with the PF if the action is in the PF's area of responsibility. The PNF will announce procedural and advisory items given in the checklist. He will also read the consequences and assure verbal confirmation by the PF.

APU FIRE

Consequences

NONE

NOTE

The APU will automatically shut down when an APU fire is detected.

APU FIRE CONT Switch....................................OFF & AGENT ARM

"APU FIRE" ALERT REMAINS DISPLAYED

NO

APU FIRE AGENT Switch NO 1 or NO 2 . . . DISCH/CHECK

After 30 seconds,

"APU FIRE" ALERT REMAINS DISPLAYED

NO

Remaining APU FIRE AGENT Switch . . . . DISCH/CHECK

APU MASTER Switch . . . . OFF

[END]

APU MASTER Switch .... OFF

[END]

CABIN ALTITUDE

Consequences NONE

Oxygen Masks	ON/100%

***NOTE**: Use emergency as required to remove smoke or fumes from the mask.*

Outflow VALVE.. VERIFY CLOSED

CABIN ALTITUDE CONTROLLABLE

NO

Operate cabin pressure system as required.

[END]

Initiate descent to 14,000 feet or minimum safe altitude, whichever is higher. *(Pilots must keep masks on until below 10,000 feet)*

CAUTION: Descent not to exceed 10° pitch or 30° bank.

NO SMOKE/SEAT BELTS Switches ....ON

ATC ....NOTIFY

Altitude Select Knob ....REDUCE/PULL

Commence IAS/MACH SEL descent.

Speed Brakes .... EXTEND

Descent Speed ....ESTABLISHED (.80 M/320 KIAS)

CAUTION: If structual damage suspected use .75 M/270 KIAS.

Transponder (If necessary for descent)...................................... 7700

BELOW 10,000':

To reactivate boom mike when O2 mask is no longer required,

O2 Mask Doors...CLOSE

PRESS-TO-TEST AND RESET Lever .... PUSH

Brief crew and passengers.

[END]

CARGO SMOKE___

Consequences:

LAND AT NEAREST SUITABLE AIRPORT

NOTE

In addition to the "CARGO SMOKE___" alert displayed, an aural warning will sound.

CARGO SMOKE AGENT 1 DISCH Switch..............................PUSH

Push flashing CARGO SMOKE AGENT DISCH PUSH switch and observe LOW light illuminates.

NOTES

CARGO SMOKE AGENT DISCH PUSH switch will stop flashing when DISCH "PUSH" light switch is pushed.

If CARGO SMOKE AGENT 2 DISCH PUSH switch is pushed inadvertently, AGENT 2 cylinder will discharge and associated CARGO SMOKE AGENT 1 DISCH PUSH switch will continue flashing.

After approximately 1 minute elapsed time,

CARGO SMOKE AGENT DISCH
LOW LIGHT ILLUMINATED

NO

Approximately 6 minutes after AGENT 1 has been discharged, "DISCH CARGO AGENT" alert will be displayed on EAD and CARGO SMOKE AGENT 2 DISCH PUSH switch will flash.
Push the flashing CARGO SMOKE AGENT 2 DISCH PUSH switch.

(CONTINUED)

CARGO SMOKE AGENT DISCH LOW
LIGHT ILLUMINATED

NO

(CONTINUED)

NOTES

Cargo Smoke Agent DISCH PUSH switch will stop flashing when DISCH “PUSH” light switch is pushed.

Approximately 2 hours after the Cargo Smoke Agent 2 DISCH PUSH switch is pushed, the low light will illuminate.

Land at nearest suitable airport.

[END]

Associated CARGO SMOKE AGENT 2 DISCH PUSH Switch.. PUSH

Land at nearest suitable airport.
[END]

ENGINE __ FIRE
OR
SEVERE DAMAGE

Consequences:

Land at nearest suitable airport

NOTES

A fire warning may not appear with severe engine damage.

Indications of severe damage may include airplane vibration and, on the affected side, erratic or no indications in engine displays, rapid loss of hydraulic pressure, and sudden loss of generator power.

Severe airframe/engine vibration may be caused by unbalanced engine rotating components following an engine failure. These vibrations often are most severe only at specific engine rotor windmilling RPM's. A change in airspeed, either decrease or increase, may change the engine windmilling RPM and reduce the severity of the resultant airframe/engine vibration

Throttle (Affected Engine)	IDLE

When engine is idle,

(CONTINUED)

ENGINE FIRE OR SEVERE DAMAGE (CONTINUED)

"ENGINE___FIRE" ALERT REMAINS DISPLAYED OR SEVERE DAMAGE SUSPECTED

NO

FUEL Switch (Affected Engine) . . . . OFF

ENG FIRE Handle/
AGENT Low Light . . . . PULL, DISCH/CHECK

After 30 seconds,

"ENGINE___FIRE" ALERT REMAINS DISPLAYED

NO

Remaining Agent . . . . DISCH/CHECK

Hydraulic AUX or
TRANS Pump Switches. . . . . AS REQUIRED

HYDRAULIC PUMP Switch (Affected Engine) . . . . OFF

Fuel Boost Pump Switches/
FUEL XFEED Lever . . . . AS REQUIRED
Throttles can be used together.

BLEED Switch (Affected Engine) . . . . OFF

PACK Switch (Affected Engine). . . . . OFF

PACK SHUTDOWN Switch . . . . AS REQUIRED

APU (If Available) . . . . START

Transponder . . . . TA

Land at nearest suitable airport. **[END]**

(CONTINUED)

"ENGINE___FIRE" ALERT REMAINS DISPLAYED OR SEVERE DAMAGE SUSPECTED

NO

(CONTINUED)

BLEED Switch (Affected Engine) .... OFF
PACK Switch (Affected Engine) .... OFF
PACK SHUTDOWN Switch .... AS REQUIRED
Transponder .... TA
Continue engine operation at Captain's discretion.
Land at nearest suitable airport.

CLIMB (Silent)

Gear .... Up
Flaps/Slats .... Up
Spoilers .... Disarmed

IN RANGE

FMS .... Set
DH/MDA .... Set
Landing Data and Briefing .... Complete
Hyd Pumps .... Set
Ice Protection .... Set
Seat Belt Sign .... On
Shoulder Harness .... On
Altimeters .... Set & X-Ckd

LANDING

F/A Signal .... Given
Landing Gear .... Down-3 Green
Spoilers .... Armed
Flaps .... 25°
EAD .... Checked

[END]

APPROACH SPEED FOR FLAPS 25°/EXT **[VREF + 5].**

LANDING WGT	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
FLAP/SLAT 25/EXT	116	117	120	123	126	129	132	135	138	141	143	146	149	151	154

NO MASKS

Consequences:

NONE

PASS OXY MASK Switch. .... EJECT & HOLD 3–5 SECONDS

CAUTION

Holding PASS OXY MASK switch in EJECT position in excess of 5 seconds may cause damage to the oxygen compartment latches.

[END]

TAIL MANF FAIL

Consequences

USE FLAPS 25° FOR LANDING

R BLEED Switch...OFF

ISOL Switch.. CLSD

R PACK Switch...OFF

TAIL AIR FOIL Anti-ICE Switch ....OFF

Depart icing conditions.
Prior to final approach add 5 knots to all minimum maneuvering and approach speeds. Do not extend flaps beyond 25°/EXT as a decrease in airplane controllability may result.
[END]

NOTE

See page EMER-11 for 25° flaps approach [Vref + 5] speed chart.

TAIL TEMP___HI

Consequences

NONE

WING/TAIL Anti-ice Switches .... OFF

ISOL Switch .... CLSD

BLEED Switch (Affected Engine) .... OFF

PACK Switch (Affected Engine) .... OFF

Depart icing conditions.

If unable to depart icing conditions or if tail icing is suspected, prior to final approach add 5 knots to all minimum maneuvering and approach speeds. Do not extend flaps beyond 25°/EXT as a decrease in airplane controllability may result.

After 2 minutes,

"TAIL TEMP___ HI" ALERT DISPLAYED

NO

BLEED Switches (Both) . . . . OFF

NOTE

Cabin will depressurize.

Land as soon as practical.

[END]

No further crew action required.

[END]

NOTE

See page EMER-11 for 25° flaps approach [Vref + 5] speed chart

WING MANF FAIL

Consequences

NONE

L BLEED Switch .... OFF

ISOL Switch... CLSD

L PACK Switch .... OFF

WING AIR FOIL Anti-Ice Switch .... OFF

Avoid icing conditions.
[END]

AIR CONDITIONING SMOKE/FUMES

Oxygen Masks	ON/100%

NOTE: Use emergency as required to remove smoke or fumes from the mask.

SMOKE/FUMES IN COCKPIT

NO

L PACK Switch . . . . OFF
Gasper Fan . . . . OFF

SMOKE/FUMES STOP

NO

Continue flight with L PACK switch OFF
[END]

L PACK Switch . . . . AUTO
R PACK Switch . . . . OFF
[END]

R PACK Switch . . . . OFF

[END]

AIRSPEED: LOST, SUSPECT OR ERRATIC

Unreliable airspeed/Mach, vertical speed and altitude information can be caused by pitot static system or Air Data Inertial Reference Unit (ADIRU) malfunctions. This may or may not be accompanied by Level 1 and Level 2 alerts, autopilot/autothrottle disconnects and/or instrument failure indications. These malfunctions can have several causes, including pitot-static blockage, volcanic ash, system damage, loss or damage to the radome, ice accumulation, and improper maintenance. Cases where all pitot-static-sources malfunctioned have occurred. When all systems are in error, comparisons are not available and the flight crews are unable to identify the errors.

During takeoff roll, pitot-static or ADIRU malfunctions may be recognized by abnormal indications at standard airspeed callouts such as "80 KNOTS". In flight recognition occurs by normal monitoring of basic flight instruments and crew familiarity with pitch, power and airspeed relationships.

It is important that the flight crews recognize an unreliable airspeed condition in a timely fashion, and imperative that their initial action is to maintain aircraft control.

Air Data and pitot system malfunctions can result in different EIS alerting system displays or erroneous indications depending on the nature of the cause of the malfunction. Not all malfunctions will be readily obvious or result in specific alerts.

The following are some of the indications the flight crew might see if a malfunction occurs in the pitot-static system or in the ADIRU:

- Indicated airspeed not consistent with normal pitch attitude for phase of flight.
- Indicated altitude different from expected actual altitude.
- PITOT HEAT alert, indicating associated pitot heater is OFF.
- Amber IAS, ATT, and/or ALT displayed on PFD.
- Level 1 and Level 2 alerts.

(CONTINUED)

AIRSPEED: LOST, SUSPECT OR ERRATIC
(CONTINUED)

- Engine FADEC and EPR messages.
- Pressurization system problems.

AFS OVRD Switches . . . . OFF

Airplane Pitch/Thrust . . . . .STABILIZE

Establish a normal thrust/pitch relation.

Disregard IAS/flight director pitch bar and high speed warnings. Use pitch attitude or FPA as the primary flight reference.

NOTE

With autopilot disconnected at altitude, control wheel may seem sensitive in pitch.

Flight Director. . . . . OFF

Disregard all alerts and warnings, except stick shaker, until after airplane is stabilized and safe operations achieved. Alerts and aural warnings can produce conflicting and disorienting cues.

NOTE

Initial concern is establishing control of the airplane through pitch/thrust relation. Attention should not be directed toward responding to malfunction alerts until safe flight is assured.

CAUTION

Under certain failures FPA and PLI may be unreliable. Check against primary flight references before using PLI or FPA.

(CONTINUED)

AIRSPEED: LOST, SUSPECT OR ERRATIC (CONTINUED)

If practical fly to VMC at earliest possible opportunity.

After the airplane is safely stabilized in flight, ensure terrain avoidance.

NOTE

Approximately 10° pitch attitude and MCT thrust will provide a safe initial climb condition if a climb is required.

Compare pilot and standby flight instruments.

ABLE TO IDENTIFY UNRELIABLE AIR DATA SOURCE

NO

AIR DATA Switch (Unreliable Side) . . SELECT OTHER SIDE

Continue to monitor pitch, thrust, and airspeed to insure accuracy of selected instruments. If air data returns to normal, select AFS OVRD OFF switches , autopilot and autothrottles as desired.

[END]

Attitude and Thrust . . . . ADJUST

Maintain normal pitch attitude and thrust for the phase of flight.

NOTE

The following information and displays can be considered reliable: PFD attitude, ground speed readout, engine N1 and stickshaker

(CONTINUED)

AIRSPEED: LOST, SUSPECT OR ERRATIC (CONTINUED)

NOTES

The following may or may not be reliable depending on the cause of lost or suspect airspeed (radio NAV may be required when referring to these instruments): FPA, PLI, low speed pitch protection, IVSI, altimeter, FMS NAV and altitude reporting including TCAS.

The following will not be reliable: Autothrottle speed protection, high speed pitch protection, overspeed warning

Use the following AIRSPEED: LOST, SUSPECT OR ERRATIC tables to determine thrust/pitch relation for remainder of flight.

(CONTINUED)

AIRSPEED: LOST, SUSPECT OR ERRATIC (CONTINUED)

FLIGHT PHASE	CONFIG	PRESSURE ALTITUDE	REF	WEIGHT (1000 LB) 130	110	90	70
CLIMB Use max thrust (throttles to overboost bar)	UP/RET	5000	PITCH *IAS*	9.8 *275*	10.2 *275*	11.1 *275*	13.1 *275*
		FL 100	PITCH *IAS*	9.2 *275*	9.4 *275*	10.2 *275*	11.9 275
		FL150	PITCH *IAS*	6.4 275	6.6 *275*	7.2 *275*	8.4 *275*
		FL 200	PITCH *IAS*	5.3 275	5.4 *275*	5.7 *275*	6.6 *275*
CRUISE Use N_1 for thrust setting	UP/RET	FL 100	PITCH N_1 *IAS*	3.5 67.80 275	2.6 *65.10* *275*	1.8 *62.80* *275*	1.0 *61.00* *275*
		FL 200	PITCH N_1 *IAS*	3.1 *76.60* *275*	2.3 *73.70* *275*	1.5 *71.30* *275*	0.7 *69.4* *275*
		FL 300	PITCH N_1 *IAS*	2.7 *84.60* *275*	2.0 *81.30* *275*	1.3 *78.80* *275*	0.5 *77.00* *275*
		FL 350	PITCH N_1 *IAS*		2.7 *84.20* *253*	1.9 *80.30* *253*	1.0 *77.40* *253*
DESCENT Use Idle thrust	UP/RET	FL 350	PITCH *IAS* VS		0.1 250 -2100	-0.7 250 -2000	-1.8 250 -2200
		FL 300	PITCH *IAS* VS	1.0 250 -2100	0.2 250 -2000	-0.8 250 -2000	-2.0 250 -2200
		FL 200	PITCH *IAS* VS	1.6 250 -1800	0.6 250 -1700	-0.5 250 -1800	-1.8 250 -1900
		FL 100	PITCH *IAS* VS	1.6 *250* -1600	0.5 *250* -1600	-0.7 *250* -1700	-2.1 *250* -1900

(CONTINUED)

AIRSPEED: LOST, SUSPECT OR ERRATIC (CONTINUED)

FLIGHT PHASE	CONFIG	PRESSURE ALTITUDE	REF	WEIGHT (1000 LB) 130	110	90	70
ARRIVAL LVL FLT	UP/RET	5000	PITCH N_1 *IAS*	4.8 62.40 249	4.9 58.20 229	4.9 54.10 207	5.0 49.10 182
	0/EXT	3000	PITCH N_1 *IAS*	9.7 64.17 195	9.7 59.76 179	9.7 54.6 162	9.7 49.5 143
	0/EXT	1500	PITCH N1 IAS	9.7 63.19 195	9.7 58.55 179	9.7 53.64 162	9.7 48.52 143
Use N1 for thrust setting	13/EXT	1500	PITCH N_1 *IAS*	9.5 65.56 173	9.5 61.22 159	9.5 56.04 144	9.5 50.43 127
	18/EXT	1500	PITCH N_1 *IAS*	8.9 66.64 170	8.9 62.08 156	8.9 57.02 141	8.9 51.17 125
	25/EXT	1500	PITCH N_1 *IAS*	8.2 72.02 167	8.2 67.13 153	8.2 61.60 139	8.2 55.39 122
	40/EXT	1500	PITCH N_1 *IAS*	6.6 76.71 163	6.6 72.29 150	6.6 66.43 136	6.6 59.83 120
APPROACH IAS APPROX VREF + 15	25/EXT GEAR DOWN	DESCENT	PITCH N_1 *IAS*	4.7 60.42 169	4.5 56.18 157	4.2 51.96 143	3.8 47.16 128
Use N1 for thrust setting	40/EXT GEAR DOWN	DESCENT	PITCH N_1 *IAS*	3.0 67.04 166	2.8 62.67 154	2.5 58.06 140	2.1 52.37 126
	Maintain pitch and adjust power to maintain glide path.						
GO AROUND	13/EXT	SEA LVL	PITCH *IAS*	18.0 166	20.2 154	23.3 140	28.1 126
	13/EXT	5000	PITCH *IAS*	16.8 166	18.7 154	21.6 140	26.0 126
VREF 40 + 15	18/EXT	SEA LVL	PITCH *IAS*	16.8 166	18.9 154	22.1 140	26.9 126
	18/EXT	5000	PITCH *IAS*	15.5 166	17.5 154	20.4 140	24.8 126

When ready for approach and landing:

Maintain VMC.

Establish landing configuration.

Use IRS ground speed and reported winds to verify airspeed.

Use radar altimeter.

Use a runway with electronic or visual glideslope.

[END]

ALL ENGINE FLAMEOUT

START PUMP Switch. . . . . .ON

Windmill start envelope is VMO to 250 KIAS. A minimum N2 of 8% is required for air start. Higher airspeeds increase N2 RPM and improve air start capability.

Throttles . . . . IDLE

FUEL Switch. . . . . OFF then ON

IGNITION Switch. . . . . .ON

ONE OR BOTH ENGINES START

NO

FUEL Boost Pump Switches (All) . . . . VERIFY ON
START PUMP Switch . . . . OFF
FUEL X-FEED Lever . . . . AS REQUIRED
EMER PWR Selector. . . . . OFF THEN ARM

[END]

Continue start attempts.

NOTES

If N2 displays an amber "X", descend below FL200, decrease airspeed below 220 KIAS and verify N1 is less than 20%. Cycle the FUEL switch to ON, then OFF to clear the amber "X". If the N2 amber "X" is no longer displayed, restarts may be attempted after airspeed is increased above 250 KIAS.

A minimum N2 of 8% is required for air start. Higher airspeeds increase N2 RPM and improve air start capability.

If repeated start attempts are unsuccessful, refer to Abnormal Non-alerts - DITCHING OR CRASH LANDING.

[END]

ELECTRICAL SMOKE/FUMES OF UNKNOWN ORIGIN

Oxygen Masks ON/100%

NOTE: Use emergency as required to remove smoke or fumes from the mask.

Crew Communications . . . . ESTABLISH

EMER PWR Selector . . . . ON

AVIONICS COOLING Switch. . . . . OVRD

CABIN PRESS SYSTEM Switch . . . . MANUAL

L GEN Switch. . . . . OFF

R GEN Switch . . . . OFF

APU GEN Switch . . . . OFF

Land at nearest suitable airport with affected equipment inoperative.

NOTES: Above 17,000 feet, maintain a minimum fuel flow (greater than 1700 pph to ensure that the engines sustain fuel suction feed.

Use emergency power as required. Battery power cannot be relied upon for more than 60 minutes.

Cabin pressure must be manually controlled to maintain desired cabin altitude.

With all generators off, the following systems and indications will be inoperative:

- *Stall warning system.*
- *Slat and gear position indications.*
- *Stabilizer trim and position indications.*
- *Automatic cockpit/cabin temperature control.*
- *Flight director/autopilot/autothrottle.*
- *Ground proximity warning system.*

(CONTINUED)

ELECTRICAL SMOKE/FUMES OF UNKNOWN ORIGIN (CONTINUED)

- *Speed brakes and ground spoilers.*
- *Thrust reversers.*
- *On the ground, engine idle speed will be in flight idle.*
- *Cabin pressurization control (manual available).*

SMOKE IN COCKPIT

NO

Airspeed .REDUCE TO 165 KIAS

Either Clearview Window. . . . . 1/2 to 2/3 OPEN

CAUTION: Noise level with a window open may prevent crew from hearing CAWS alerts.

Prior to landing,

AIRPLANE IN TRIM WITH
LANDING FLAPS SET

NO

Land at nearest suitable airport with selected flaps.

[END]

Use FLAPS 40 for landing and increase V_{REF} by 20 knots.

Refer to ESTIMATED LANDING DISTANCE table.

Do not reduce thrust until landing flare has been initiated and sink rate has been reduced.

(CONTINUED)

ELECTRICAL SMOKE/FUMES OF UNKNOWN ORIGIN

Make positive main gear touchdown to minimize float and take positive action to lower nose to runway.

Disconnect auto throttles prior to 50 ft

ESTIMATED LANDING DISTANCE (FEET)
40 FLAPS, SLATS EXT
Standard day, no wind, zero slope, Vref (Flaps 40) + 20 knots.
Add 10% to chart value for temperatures greater than Standard.

WEIGHT(1000 LB)		70	80	90	100	110	120
S.L. STD=15 C	DRY	5520	5640	5680	6180	6520	6860
	WET	7850	8260	8790	9420	10120	10840
2000 FT STD=11 C	DRY	5710	5880	6170	6510	6870	7230
	WET	8180	8670	9300	10020	10790	11580
4000 FT STD=7 C	DRY	5930	6170	6500	6860	7240	7630
	WET	8560	9170	9890	10690	11530	>12000
6000 FT STD=3 C	DRY	6190	6490	6850	7240	7640	8050
	WET	9010	9730	10550	11420	>12000	>12000
8000 FT STD= -1 C	DRY	6510	6850	7230	7640	8050	8490
	WET	9560	10380	11290	>12000	>12000	>12000
10000 FT STD= -5 C	DRY	6860	7220	7630	8050	8490	8970
	WET	10160	11080	>12000	>12000	>12000	>12000

NOTE: Actual (unfactored) distances are shown. Includes air run distance from 50 ft above threshold. Assumes max available braking, no ground spoilers, and all engines forward flight idle.

[END]

EMERGENCY DESCENT

Initiate descent to 14,000 feet or minimum safe altitude, whichever is higher. *(Pilots must keep masks on until below 10,000 feet)*

CAUTION: Descent not to exceed 10° pitch or 30° bank.

NO SMOKE/SEAT BELTS Switches . . . . .ON

ATC . . . . .NOTIFY

Altitude Select Knob . . . . .REDUCE/PULL

Commence IAS/MACH SEL descent.

Speed Brakes . . . . EXTEND

Descent Speed . . . . .ESTABLISHED (.80 M/320 KIAS)

CAUTION

If structual damage suspected use .75 M/270 KIAS. Known failures affecting structural integrity and/or turbulence may dictate more conservative speed profiles or entry maneuvers.

Transponder (If necessary for descent) 7700

BELOW 10,000’:

To reactivate boom mike when O2 mask is no longer required,

O2 Mask Doors. . . . . CLOSE

PRESS-TO-TEST AND RESET Lever . . . . PUSH

Brief crew and passengers.

[END]

(CONTINUED)

ENGINE FAILURE / IN FLIGHT SHUTDOWN

Throttle (Affected Engine) . . . . .IDLE

FUEL Switch (Affected Engine) . . . . OFF

NOTE

After FUEL switch is off, throttles may be used together.

FUEL X-FEED Lever . . . . ON

BLEED Switch (Affected Engine). . . . . OFF

PACK Switch (Affected Engine). . . . . OFF

PACK SHUTDOWN Switch . . . . AS REQUIRED

APU (If Available). . . . . .START

Transponder. . . . . TA

AUX and TRANS HYD PUMP Switches . . . . AS REQUIRED

Land at nearest suitable airport.

[If needed refer to NON-ALERTS PROCEDURE-ENGINE RESTART IN FLIGHT]

CLIMB (Silent)

Gear . . . . Up
Flaps/Slats . . . . Up
Spoilers . . . . DISARMED

IN RANGE

FMS . . . . SET
DH/MDA. . . . . SET
Landing Data and Briefing . . . . .COMPLETE
Hyd Pumps . . . . ON
Ice Protection . . . . SET
Seat Belt Sign . . . . ON
Shoulder Harness . . . . ON
Altimeters . . . . SET & X-CHECKED

(continued)

ENGINE FAILURE / IN FLIGHT SHUTDOWN CONTINUED

LANDING

F/A Signal . . . . GIVEN

Landing Gear . . . . DOWN-3 GREEN

Spoilers. . . . . ARMED

Flaps. . . . . .25°

EAD . . . . CHECKED

[END]

APPROACH SPEED **[VREF + 5]** FOR FLAPS 25°/EXT.

LANDING WGT	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
FLAP/SLAT 25/EXT [Vref + 5]	116	117	120	123	126	129	132	135	138	141	143	146	149	151	154

SMOKE/FUMES REMOVAL - COCKPIT UNPRESSURIZED

Oxygen Masks. ON/100%

NOTE: Use emergency as required to remove smoke or fumes from the mask.

Airspeed . . . . .REDUCE TO 165 KIAS

Either Clearview Window . . . . 1/2 TO 2/3 OPEN

CAUTION

Noise level with a window open may prevent crew from hearing CAWS alerts.

[END]

SPOILER FLOAT

NOTE

Spoiler float is indicated when a rapid roll occurs during extension of flaps beyond 25°.

FLAP/SLAT Handle. .RETRACT TO 25°/EXT

Land with flaps/slats in 25°/EXT.

[END]

STABILIZER RUNAWAY

CAUTION: Avoid manual pitch inputs until the autopilot is disconnected.

NOTE: Extended trim operation may result in trim motor thermal shutdown. Trim motor operation may return after a sufficient cooling period.

Autopilot . . . . .DISCONNECT

Control Wheel
Trim Switches . . . . . .TRIM OPPOSITE DIRECTION OF RUNAWAY

STABILIZER MOVES IN OPPOSITE DIRECTION OF RUNAWAY

NO

AUTOPILOT & ALTERNATE LONGITUDINAL TRIM C/Bs D-9, D-10, D-11 (Upper EPC). . . OPEN (PULL).

Continue flight using primary trim system.

Do not exceed 0.78M.

Autopilot is available, but autotrim and mach trim functions are inoperative. After trimming, the autopilot may be engaged, but should be disconnected/retrimmed periodically as needed.

[END]

STABILIZER TRIM (Guarded) SWITCH. . . . . OFF (PUSH)

ALT LONG TRIM Switch. . . . . RETRIM

Continue flight using alternate trim system.

Autopilot is available.

[END]

ACTIVATION OF EGPWS WARNING

Do not ignore short duration warnings. Take immediate and aggressive action. This is particularly important during IMC conditions, night over unlighted terrain, or with unreliable glidepath information.

Flight crews should react immediately and aggressively upon activation of an aural or visual EGPWS warning.

THRUST	MAX
PITCH	20°
SPEED BRAKES	RETRACT (IF EXTENDED)

- Disengage the autothrottles and autopilot.
- Aggressively apply necessary thrust to ensure adequate airplane performance. Use emergency over-rated-thrust (maximum N1) to avoid imminent ground contact.
- Immediately rotate the airplane at a rate of 3° per second to 20° pitch attitude.
- Flight Director should be turned off or disregarded.
- Level wings to assure maximum airplane performance.
- Do not change gear or flap configuration until terrain separation is assured. Monitor radio altimeter for sustained or increasing terrain separation.
- After EGPWS warning ceases, continue climb to published minimum safe altitude.

NOTE

If an alert occures when flying under day/night VFR conditions, and positive visual verification is made that no hazards exists, the alert may be regarded as cautionary and the approach flight segment may be continued.

AIR SYS___PRES LO

Consequences:

NONE

BLEED Switch (Affected Engine) . . . . OFF

PACK Switch (Affected Engine) . . . . OFF

NOTE

If operating in icing conditions, refer to ANTI-ICE OPERATION WITH SINGLE PNEUMATIC SOURCE.

[END]

AVNCS AIR FLO OFF

AIRPLANE ON GROUND

NO

Call maintenance.

[END]

AVIONICS COOLING Switch . . . . .OVRD

After landing, shut down all unnecessary radio and electronic equipment as soon as possible.

CAUTION

Prolonged use of electronic equipment on the ground with the avionics fan inoperative will cause overheating and could damage equipment.

[END]

BLD AIR___TEMP HI

Consequences:

NONE

BLEED Switch (Affected Engine) . . . . OFF

PACK Switch (Affected Engine) . . . . OFF

NOTE

If operating in icing conditions, refer to ANTI-ICE OPERATION WITH SINGLE PNEUMATIC SOURCE.

[END]

BLD AIR___TEMP LO

Consequences:

NONE

Throttles . . . . ADVANCE

"BLD AIR___TEMP LO" ALERT DISPLAYED

NO

BLEED Switch (Affected Engine) . . . . OFF

PACK Switch (Affected Engine). . . . . OFF

NOTE

If operating in icing conditions, refer to ANTI-ICE OPERATION WITH SINGLE PNEUMATIC SOURCE. **[END]**

[END]

BLEED AIR ___FAIL

Consequences:

NONE

BLEED Switch (Affected Engine) . . . . OFF

PACK Switch (Affected Engine) . . . . OFF

NOTE

If operating in icing conditions, refer to ANTI-ICE OPERATION WITH SINGLE PNEUMATIC SOURCE.

[END]

CABIN DUCT OVHT

Consequences:

NONE

CABIN TEMP Selector . . . . MAN COLD

[END]

CABIN INFLO LO

Consequences:

NONE

FLOW Switch . . . . HIGH

Throttles (If Required). . . . . ADVANCE

If throttles are at low power (conditions permitting) advance throttles until air conditioning pack supply is normal.

"CABIN INFLO LO" ALERT DISPLAYED/CABIN CONTINUES TO DEPRESSURIZE

NO

Descend to an altitude where adequate pressurization can be maintained.

[END]

No further crew action required.

[END]

CABIN PRES HI

Consequences:

NONE

CABIN PRESS SYSTEM Switch . . . . MANUAL

CABIN PRESS MANUAL Rate Selector. . . . . .ADJUST

Move selector to momentary climb sufficient to decrease differential pressure.

(CONTINUED)

CABIN OUTFLOW VALVE MOVES TOWARD OPEN

NO

Adjust cabin altitude to normal schedule.

[END]

Terrain & conditions permitting.

DESCEND (TO 10,000) . . . . .INITIATE

L or R PACK Sw. . . . . OFF

Turn either the L or R PACK switch OFF and maintain a comfortable cabin rate of descent by varying throttle position on the side of operating air conditioning system.

When below 10,000 ft,

PACK Sws (Both). . . . . OFF

NOTE

Cabin altitude may be below sea level. when cabin altitude indicates 2000 ft above destination altitude, continue descent, approach and landing.

RAM AIR Sw . . . . ON

Clearview Window(s) . . . . .OPEN

NOTES

Air conditioning may be resumed for passenger comfort

Do not close clearview window(s) after restarting air conditioning system(s).

[END]

CABIN PRESSURIZED

Consequences:

CABIN DOORS MAY NOT OPEN

CABIN PRESS SYSTEM Switch . . . . MANUAL

CABIN PRESS MANUAL Rate Selector. . . . . CLIMB

CABIN OUTFLOW VALVE INDICATES OPEN

NO

Open cabin doors when differential pressure indcates zero.
[END]

L/R PACK Switches (If Necessary). . . . . OFF

[END]

CKPT DUCT OVHT

Consequences:

NONE

CKPT TEMP Selector. . . . . MAN COLD

[END]

PACK___OVERHEAT

Consequences:

NONE

PACK Switch (Affected engine) . . . . OFF

[END]

TAIL A-ICE DISAG

Consequences:

NONE

CAUTION

Leading edge of horizontal stabilizer may be damaged if tail anti-ice is operated on the ground.

AIRPLANE ON GROUND

NO

TAIL AIR FOIL Anti-Ice Switch . . . . OFF

APU AIR Switch . . . . OFF

R BLEED Switch . . . . OFF

ISOL Switch . . . . CLSD

[END]

(CONTINUED)

AIRPLANE ON GROUND

NO

(CONTINUED)

TAIL AIR FOIL ANTI-ICE SWITCH ON

NO

Depart icing area.

TAIL AIR FOIL Anti-Ice Switch . . . . OFF

Use 25°/EXT flaps for landing.

Prior to final approach, add 5 knots to all minimum maneuvering and approach speeds. Do not extend flaps beyond 25°/EXT as a decrease in airplane controllability may result.

[END]

Assume tail anti-ice is on.

After landing,

R BLEED Switch. . . . . OFF

ISOL Switch . . . . .CLSD

Do not pressurize right pneumatic system.

Do not move APU AIR Switch to ON.

[END]

TAIL A-ICE OFF

Consequences:

NONE

Depart icing conditions.

After departing icing conditions,

TAIL AIR FOIL Anti-Ice Switch . . . . OFF

Use 25° flaps for landing.

[END]

WING A-ICE DISAG

Consequences:

NONE

CAUTION

Slats may be damaged if wing anti-ice is operated on the ground.

AIRPLANE ON GROUND

NO

L BLEED Switch . . . . OFF

ISOL Switch . . . . CLSD

WING AIR FOIL Anti-Ice Switch . . . . OFF

[END]

AIRPLANE ON GROUND

NO

(CONTINUED)

WING AIR FOIL ANTI-ICE SWITCH ON

NO

Depart icing area.

WING AIR FOIL Anti-Ice Switch . . . . OFF

[END]

After landing,

L BLEED Switch . . . . OFF

ISOL Switch . . . . CLSD

Assume wing anti-ice is on.
Do not pressurize left pneumatic system.

[END]

WING A-ICE OFF

Consequences:

NONE

WING AIR FOIL Anti-Ice Switch . . . . OFF

Avoid icing conditions.

[END]

"WING OR TAIL A-ICE ON" ALERT EXTINGISHED WITH WING/TAIL AIR FOIL ANTI-ICE SWITCHES ON

AIR SYNOPTIC INDICATING NORMAL OPERATION OF AIR FOIL ANTI-ICE

NO

No futher crew action required

[END]

Depart icing conditions.

If unable to depart icing conditions, use 25° flaps for landing if tail anti-ice is inoperative.

[END]

INTENTIONAL BLANK

ANTI-SKID___FAIL

Use maximum landing flaps. Consider reducing airplane weight. Do not turn off anti-skid. Use longest runway available and full length of runway for deceleration. Use full reverse thrust while applying brakes smoothly and gradually. Compute landing distance from applicable table (add (TBD) feet per 1°C above standard temperature).

ANTI-SKID FAIL ESTIMATED LANDING DISTANCES (FEET)

40°/50° EXT

GWT (1000 LB)		60	70	80	90	100	110	115
S.L.	DRY	3250	3530	3825	4125	4425	4710	4860
	WET	3735	4060	4400	4745	5090	5420	5590
2000 FT	DRY	3375	3705	4010	4335	4640	4950	5115
	WET	3885	4265	4610	4985	5335	5695	5880
4000 FT	DRY	3555	3885	4225	4550	4890	5210	5385
	WET	4090	4465	4860	5230	5625	5990	6195
6000 FT	DRY	3735	4095	4440	4790	5140	5505	5680
	WET	4295	4710	5110	5510	5910	6335	6530
8000 FT	DRY	3925	4305	4680	5055	5440	5810	5990
	WET	4515	4955	5385	5810	6255	6680	6890
10000 FT	DRY	4125	4530	4935	5325	5715	6135	6315
	WET	4745	5210	5675	6125	6575	7055	7265

NOTES: Includes air run distances.

Table assumes anti-skid fail braking, full reverse thrust, standard day, no wind, zero slope.

[END]

BRAKE OVERHEAT

Consequences:

NONE

NOTE

"BRAKE OVERHEAT" alert displays when any one brake temperature exceeds 308°C and extinguishes when brakes cool to 260°C.

AIRPLANE ON GROUND

NO

Stop airplane as soon as practical. Do not set parking brake.

WARNING: ***Ground crew must remain clear of main gear. Fuse plugs may melt.***

[END]

Flight conditions permitting, extend gear until "BRAKE OVERHEAT" alert extinguishes.

[END]

ELEVATOR SPLIT

Consequences:

NONE

Airspeed . . . . REDUCE

CAUTION

Avoid abrupt elevator inputs.

"ELEVATOR SPLIT" ALERT
DISPLAYED BELOW 240 KIAS

NO

Do not exceed 240 KIAS.

[END]

Do not exceed speed at which alert extinguished.

[END]

FLAP DISAG

Consequences:

FLAPS <25° , AUTOBRAKES NOT AVAILABLE FOR LANDING

Return FLAP/SLAT handle to position where alert was not displayed or, if alert remains displayed, select the most symmetrical configuration and land.

FINAL FLAP SETTING LESS THAN 25°

NO

GND PROX WARN Switch . . . . FLAP OVRD

Prior to 50 feet AGL,

Autothrottles . . . . .DISCONNECT

NOTE

Autothrottle retard mode is not available when flaps are less than 25°.

[END]

Perform normal landing.

[END]

GEAR DOOR OPEN

Consequences:

NONE

NOTE

This procedure assumes hydraulic pressure is normal and gear handle is down.

Emergency Gear Extension Lever . . . . RAISE/LATCH

CAUTION

Do not stow emergency gear extension lever until malfunction has been corrected.

Stop airplane on runway. **Do not taxi.**

[END]

RUDDER LIM FAIL

Consequences:

NONE

Avoid abrupt rudder inputs.

[END]

SLAT DISAG

Consequences:

NONE

NOTE

If slat asymmetry is indicated any time by a lateral trim change, return FLAP/SLAT handle to the last position where slats were symmetrical.

ALERT DISPLAYED DURING ATTEMPTED EXTENSION

NO

FLAP/SLAT Handle . . . . UP/RET

Refer to NO FLAP/NO SLAT landing.

[END]

FLAP/SLAT Handle . . . . 0°/EXT

Plan normal flap/slat landing.

[END]

BUS DC XFER OFF

Consequences:

DU 2 and the ISIS would not be available.

STANDBY INSTRUMENTS OPERATING

NO

No further crew action required.

[END]

Fire detection/protection is not available.

CAUTION: Left thrust reverser is not available with the loss of DC transfer bus.

NOTES: APU cannot be started.

Fire handles must be used for engine shutdown.

Land at nearest suitable airport.

[END]

BUS ___ EMER OFF

Consequences:

DUs 1 and 3 would not be available.

EMER PWR Selector . . . . OFF

EMER LT Switch. . . . . OFF

AFFECTED BUS POWERED

NO

No further crew action required.

[END]

Continue flight with affected circuits inoperative.

CAUTION: Right thrust reverser is not available with the loss of DC emergency bus.

Land at nearest suitable airport.

NOTE

Use emergency power as required within 30 minutes of landing.

[END]

GEN___OFF

Consequences:

NONE

GEN Switch (Affected Side). . . . . .RESET/ON

NOTE

One reset allowed

"GEN___OFF" ALERT REMAINS DISPLAYED

NO

GEN Switch (Affected Side) . . . . OFF

APU (If Available) . . . . START

Continue flight with generator inoperative.

[END]

No further crew action required.

[END]

GEN ALL OFF

Consequences:

NONE

EMER PWR Selector . . . . ON

GEN Switches (All). . . . . RESET/ON

GENERATOR BUS(ES) RESTORED

NO

EMER PWR Selector. OFF then ARM

[END]

CABIN PRESS SYSTEM Switch . . . . MANUAL

AVIONICS COOLING Switch . . . . OVRD

NOTES

Consider starting APU for electrical power.

Above 17,000 feet, maintain a minimum fuel flow (greater than 1700 pph) to ensure that the engines sustain fuel suction feed.

Use emergency power as required. Battery power cannot be relied upon for more than 60 minutes.

Cabin pressure must be manually controlled to maintain desired cabin altitude.

With all generators off, the following systems and indications will be inoperative:

- Stall warning system.
- Slat and gear position indications.

(CONTINUED)

GEN ALL OFF (CONTINUED)

- Stabilizer, trim and position indications
- Automatic cockpit/cabin temperature control.
- Flight director/autopilot/autothrottle.
- Ground proximity warning system
- Speed brakes and ground spoilers
- Thrust reversers.
- On the ground, engine idle speed will be flight idle.
- Auto cabin pressurization control (manual available).

Prior to landing,

AIRPLANE IN TRIM WITH LANDING FLAPS SET

NO

Land at nearest suitable airport with selected flaps.

[END]

Use FLAPS 40° for landing and increase V_{REF} by 20 knots.

WARNING

Landing distance will be significantly greater than the normal landing field length.

Disconnect auto throttles prior to 50 feet.

Do not reduce thrust until landing flare has been initiated and sink rate has been reduced.

Make positive main gear touchdown to minimize float and take positive action to lower nose to runway.

(CONTINUED)

INTENTIONALLY LEFT BLANK

GEN APU OFF

Consequences:

ONE RESET ATTEMPT ALLOWED

APU Generator Switch . . . . .RESET/ON

"GEN APU OFF" ALERT REMAINS DISPLAYED

NO

APU Generator Switch . . . . OFF

APU MASTER Switch . . . . OFF

[END]

No further crew action required.

[END]

INTENTIONAL BLANK

APU EGT HI

Consequences:

NONE

APU DESIRED FOR FLIGHT

NO

Continue APU operation. Monitor RPM and EGT.

NOTE

APU will automatically shut down 10 minutes after landing.

[END]

APU MASTER Switch . . . . OFF

[END]

APU FAULT

Consequences:

NONE

APU DESIRED FOR FLIGHT

NO

Continue APU operation. Monitor RPM and EGT.

NOTE

APU will automatically shut down 10 minutes after landing.

[END]

APU MASTER Switch . . . . OFF

[END]

ENG___OIL PRES LO

Consequences:

NONE

Throttle (Affected Engine). . . . . .IDLE

FUEL Switch (Affected Engine) . . . . OFF

Refer to EMERGENCY NON-ALERTS - ENGINE SHUTDOWN IN FLIGHT.

[END]

ENG___OIL TEMP HI

Consequences:

NONE

Throttle (Affected Engine). . . . . .ADJUST

If at high thrust, retard throttles. If at idle, increase thrust to provide higher fuel flow for improved cooling.

NOTE
Oil temperature stabilization may take several minutes following thrust changes.

"ENG___OIL TEMP HI" ALERT
REMAINS DISPLAYED

NO

Throttle (Affected Engine) . . . . .IDLE

FUEL Switch (Affected Engine) . . . . OFF

Refer to EMERGENCY NON-ALERTS – ENGINE SHUTDOWN IN FLIGHT.

[END]

(CONTINUED)

ENG___OIL TEMP HI (CONTINUED)

Continue engine operation. Monitor oil temperature.

[END]

ENG___RPM HI

Consequences:

NONE

Throttle (Affected Engine) . . . . IDLE

RPM REMAINS ABOVE REDLINE

NO

FUEL Switch (Affected Engine). OFF

Refer to EMERGENCY NON-ALERTS – ENGINE SHUT-DOWN IN FLIGHT.

[END]

Operate engine at a throttle setting necessary to maintain RPM below redline.

[END]

ENG___RPM LO

Consequences:

NONE

Throttle (Affected Engine). . . . . .IDLE

FUEL Switch (Affected Engine) . . . . OFF

RESTART DESIRED

NO

Refer to ABNORMAL NON-ALERTS – ENGINE RESTART IN FLIGHT.

[END]

Refer to EMERGENCY NON-ALERTS – ENGINE SHUTDOWN IN FLIGHT.

[END]

ENG___TGT HI

Consequences:

NONE

Throttle (Affected Engine) . . . . IDLE

TGT REMAINS ABOVE REDLINE

NO

FUEL Switch (Affected Engine). . . . . OFF

Refer to EMERGENCY NON-ALERTS – ENGINE SHUTDOWN IN FLIGHT.

[END]

Operate engine at a throttle setting necessary to maintain an acceptable TGT.

[END]

ENG___BRG OVHT

Consequences:

NONE

Throttle (Affected Engine). . . . . .IDLE

When engine at idle,

"ENGINE___BRG OVHT" ALERT
REMAINS DISPLAYED

NO

FUEL Switch (Affected Engine) . . . . OFF

Refer to EMERGENCY NON-ALERTS – ENGINE SHUT-DOWN IN FLIGHT.

[END]

Continue operation at idle power setting.

[END]

SELECT FADEC ALTN

Consequences:

NONE

FADEC MODE Switch (Affected Engine) . . . . PUSH

Observe "ENG___FADEC ALTN" alert is displayed.

Observe FADEC MODE ALTN light is illuminated.

Observe FADEC MODE SELECT light is extinguished.

FADEC MODE Switch (Affected Engine) . . . . PUSH

“SELECT FADEC ALTN” ALERT DISPLAYED

NO

FADEC MODE Switch (Affected Engine) . . . . PUSH

Observe "ENG___FADEC ALTN" alert is displayed.

Autothrottles . . . . DISENGAGE

NOTE

Autothrottle will be inoperative when either engine is in N1 mode.

Opposite FADEC MODE SwitchPUSH

Observe "ENG___FADEC ALTN" alert is displayed.

[END]

Continue normal engine operation.

[END]

START VLV___OPEN

Consequences:

NONE

AIRPLANE ON GROUND

NO

APU AIR Switch/External Air Source . . . . OFF

ISOL Switch . . . . CLSD

FUEL Switch (Affected Engine). . . . . OFF

Call maintenance.

[END]

ISOL Switch . . . . CLSD

BLEED Switch (Affected Engine) . . . . OFF

PACK Switch (Affected Engine) . . . . OFF

Avoid icing conditions.

Do not repressurize affected pneumatic system unless necessary.

[END]

BALST FUEL DISAG

Consequences:

NONE

AIRPLANE ON GROUND

NO

Ballast Fuel . . . . VERIFY

Verify correct quantity of ballast fuel is loaded or revise FMS ballast fuel entry, if required.

[END]

CTR PUMPS Switches . . . . OFF

[END]

CTR___PUMP LO

Consequences:

NONE

Failed CTR Pump Switch . . . . OFF

Main Tank Pumps Switches (Both Tanks) . . . . OFF

CENTER TANK FUEL DECREASING

NO

When center tank fuel quantity indicates 500 pounds.

Main Tank Pumps Switches (Both Tanks) . . . . ON

CTR Pump Switch . . . . OFF

[END]

Main Tank Pumps Switches (Both Tanks) . . . . ON

CTR Pumps Switches. . . . . OFF

NOTE
Center and/or aux tank fuel will not be available.

[END]

FUEL OFF SCHEDULE

Consequences:

NONE

CTR FWD/AFT PUMP Switches . . . . ON

CENTER TANK FUEL FEED
NORMAL

NO

Continue operation. Monitor fuel system.

[END]

Plan remainder of flight using 5000 pounds or less total fuel.

Land at nearest suitable airport.

[END]

FUEL QTY ALERTS

Consequences:

SYSTEM DISPLAY INCOMPLETE

QTY A/B Switch . . . . .PUSH

"FUEL QTY ALERTS" REMAINS DISPLAYED

NO

EIS SOURCE Selector . . . . BOTH ON 1

"FUEL QTY ALERTS" REMAINS DISPLAYED

NO

EIS SOURCE Selector . . . . NORM

Monitor fuel quantity readouts.

NOTE

On the system display, an "X" will cover the area of removed or invalid data. Subsequent alerts for removed or invalid data will not be displayed.

[END]

NOTE

Fuel quantity alerts and system display data will be normal.

[END]

FUEL QTY FAULT

Consequences:

NONE

QTY A/B Switch . . . . PUSH

"FUEL QTY FAULT" ALERT
REMAINS DISPLAYED

NO

NOTE
FMS FUEL and GROSS WEIGHT on INIT page 2 will now be calculated using fuel flow only.

[END]

NOTE
Fuel quantity alerts and system display data will be normal.

[END]

FUEL QTY SYS FAIL

Consequences:

NONE

QTY A/B Switch . . . . .PUSH

"FUEL QTY SYS FAIL" ALERT
REMAINS DISPLAYED

NO

NOTE
FMS FUEL and GROSS WEIGHT on INIT page 2 will now be calculated using fuel flow only.

[END]

NOTE
Fuel quantity alerts and system display data will be normal.

[END]

HYD L & R FAIL

Consequences:

ALTERNATE GEAR EXTENSION REQUIRED
FLAP/SLAT EXT/RET INOPERATIVE
SPOILERS INOPERATIVE
CROSSWIND LIMIT (10 KNOTS)
MIN APPR SPEED 144 KNOTS
LEAVE GEAR DOWN FOR GO-AROUND
BRAKES ON ACCUMULATORS ONLY
NOSEWHEEL STEERING RESTRICTED

NOTES

If flaps and/or slats are extended, they will remain in their last selected position.

Speed brakes/ground spoilers will not be available.

Rudder will revert to manual

Use longest available runway for existing conditions.

Plan a wide pattern and longer than normal final approach for speed stabilization on final.

The crosswind capability of the aircraft is greatly reduced.

Reduce landing weight to minimum practical.

Hydraulic PUMPS Switches (Both) . . . . OFF

Hydraulic TRANS Switch . . . . OFF

Hydraulic AUX Switch . . . . OFF

Refer to ESTIMAED LANDING DISTANCE table.

When ready to begin approach,

GND PROX WARN Switch . . . . .FLAP OVRD

(CONTINUED)

HYD L & R FAIL (CONTINUED)

NOTE

In FLAP OVRD, ground proximity warning will be disabled as result of flaps not in landing range. All other functions of ground proximity warning system will remain operative.

Gear Handle . . . . DOWN

Emergency Gear Extension Lever . . . . RAISE/LATCHED

Gear Lights . . . . .3 GREEN

NOTE

"GEAR DOOR OPEN" alert will be displayed.

Airspeed . . . . V_{REF} +5

WARNING

Rudder reverts to manual. Minimum approach speed is 144 KIAS until landing is assured.

Fly approach at V_{REF}+5 for existing FLAP/SLAT configuration.

Disconnect autothrottles prior to 50 feet AGL.

NOTE

Throttles will not automatically retard at 30 feet AGL with flaps less than landing range. Autothrottles must be disconnected prior to 50 feet AGL.

Make positive main gear touchdown to minimize float.

Lower nose immediately (Thrust reversers will not deploy until NLG is compressed.

Braking . . . . MAXIMUM AVAILABLE TO COMPLETE STOP

CAUTION

Do not apply brakes until NLG is on ground

(CONTINUED)

HYD L & R FAIL (CONTINUED)

NOTE

Apply steady symmetrical brake pedal force all the way to mechanical stops to minimize accumulator pressure loss. Use differential braking to maintain directional control as rudder control deteriorates at lower speeds.

Reverse Thrust. . . . . MAXIMUM REVERSE

WARNING

Do not use asymmetrical reverse thrust to maintain directional control.

NOTES

Immediately apply symmetrical reverse thrust. Reduce to idle reverse if directional control problems occur. At 110 KIAS, reduce to idle reverse.

Maintain idle reverse until airplane is stopped and parking brake is set.

Thrust reversers will not stow.

Stop airplane on runway.

Do not attempt to taxi.

Before airplane is towed, shut down engines, ensure gear safety pins are installed and main gear doors are closed.

(CONTINUED)

HYD L & R FAIL (CONTINUED)

Reduce gross weight to lowest practical value.

ESTIMATED LANDING DISTANCES (FEET)

No Flap, No Slat, Standard Day, No Wind, Zero Slope
Add 10% to table value for temperatures greater than standard.

WEIGHT (1000 LB)		70	80	90	100	110	120
S.L. (STD=15°C)	DRY	4780	5230	5680	6190	7150	9000
	WET	6200	6980	7790	***	***	***
2000 FT (STD=11°C)	DRY	4990	5470	5950	6550	7760	10360
	WET	6590	7430	8310	***	***	***
4000 FT (STD=7°C)	DRY	5230	5730	6230	6980	8550	***
	WET	7010	7910	8870	***	***	***
6000 FT (STD=3°C)	DRY	5470	6000	6540	7500	9640	***
	WET	7470	8430	***	***	***	***
8000 FT (STD=–1°C)	DRY	5730	6290	6890	8150	11170	***
	WET	7960	9000	***	***	***	***
10000 FT (STD=–5°C)	DRY	6030	6620	7340	9050	***	***
	WET	8520	9640	***	***	***	***

**** MAXIMUM BRAKE ENERGY LIMIT.*

NOTE: Actual (unfactored) distances are shown. Includes air run distance from 50 ft above threshold. Assumes max available braking, no ground spoilers, and includes the following reverse thrust procedure: Max reverse to 110 knots, then idle reverse to stop.

(CONTINUED)

NO FLAP/NO SLAT OR NO FLAPS/ SLATS EXTENDED LANDING (CONTINUED)

UP/RET APPROACH SPEEDS - NO FLAP/NO SLAT LANDING

GWT (1000 LB)	64	68	72	76	80	84	88
VAPP (V_{REF}+5)	157	162	167	172	177	179	183

GWT (1000 LB)	92	96	100	104	108	112	116	120
VAPP (V_{REF}+5)	187	191	195	198	202	206	209	213

IN RANGE

FMS .... Set
DH/MDA .... Set
Landing Data and Briefing .... Complete
Hyd Pumps .... As Required
Ice Protection .... Set
Seat Belt Sign .... On
Shoulder Harness .... On
Altimeters .... Set & X-Ckd

LANDING

F/A Signal .... Given
Landing Gear .... Down-3 Green
Flaps .... Verify Position
EAD .... Checked

[END]

HYD___PRES LO

Consequences:

NOSEWHEEL STEERING RESTRICTED LEFT (L)
NOSEWHEEL STEERING RESTRICTED RIGHT (R)

Hydraulic TRANS Switch . . . . ON

Hydraulic AUX Switch. . . . . ON

"HYD___PRES LO" ALERT EXTINGUISHED

NO

No further crew action required.

[END]

"HYD R PRES LO" ALERT DISPLAYED

NO

Hydraulic TRANS Switch. . . . . OFF

Hydraulic AUX Switch . . . . OFF

WARNING

Outboard spoilers will be inoperative. If rudder reverts to manual, minimum approach speed is 144 KIAS until landing is assured.

When ready to begin approach,

Gear Handle . . . . DOWN

3 GREEN GEAR LIGHTS DISPLAYED

NO

[END]

(CONTINUED)

HYD___PRES LO (CONTINUED)

"HYD R PRES LO" ALERT DISPLAYED

NO

(CONTINUED)

3 GREEN GEAR LIGHTS DISPLAYED

NO

(CONTINUED)

Emergency Gear Extension Lever . . . . . . .RAISE/LATCHED

Gear Lights . . . . 3 GREEN

NOTE

"GEAR DOOR OPEN" alert will be displayed.
Nosewheel steering is restricted to the left.
Right thrust reverser may remain fully deployed

After landing,

Stop airplane on runway. **Do not taxi.**

[END]

HYD TRANS Switch. . . . . OFF

NOTES

Inboard spoilers will be inoperative.
Nosewheel steering is resticted to the right.
Left thrust reverser may remain fully deployed.

[END]

HYD___QTY LO

Consequences:

ALTERNATE GEAR EXTENSION REQUIRED (R)

AFFECTED REVERSER MAY NOT STOW

NOTE

Loss of hydraulic fluid may result in an increasing quantity indication on affected side due to foaming.

Hydraulic TRANS Pump Switch . . . . OFF

"HYD R QTY LO" ALERT DISPLAYED

NO

Hydraulic AUX Pump Switch . . . . OFF

Hydraulic R PUMP Switch . . . . OFF

NOTE

Right hydraulic system may be repressurized for landing if any hydraulic fluid remains.

WARNING

Rudder will revert to manual. Minimum Approach Speed is 144 Kts.

When ready to begin approach,

Gear Handle . . . . DOWN

Emergency Gear Extension Lever. . . . . . . RAISE/LATCHED

Gear Lights . . . . .3 GREEN

NOTE

"GEAR DOOR OPEN" alert will be displayed. Nosewheel steering is restricted to the left.

(CONTINUED)

“HYD R QTY LO” ALERT DISPLAYED

NO

(CONTINUED)

NOTE

If 3 green Gear Lights are displayed and any hydraulic quantity remains, the Emergency Extension Lever may be re-stowed and the Right Hydraulic Pump turned back ON in an attempt to retract and latch the main gear doors before landing.

Stop airplane on runway.

Do not attempt to taxi.

[END]

Hydraulic L PUMP Switch . . . . OFF

NOTE

Left hydraulic system may be repressurized for landing if any hydraulic fluid remains.
Nosewheel steering is restricted to the right.

[END]

HYD___TEMP HI

Hydraulic TRANS Switch . . . . OFF

Hydraulic PUMP Switch (Affected Engine). . . . . OFF

"HYD R TEMP HI" ALERT DISPLAYED

NO

Hydraulic AUX Pump Switch . . . . OFF

Repressurize hydraulic system for approach and landing.

[END]

AIR DATA___FAIL

Consequences:

NONE

AIR DATA 1 FAIL

NO

AIR DATA Switch (Captain's SISP Panel) . . . . . . CAPT ON 2

Push AIR DATA switch on the Captain's Source Input Select Panel (SISP) and observe CAPT ON 2 light illuminates.

AIR DATA 2 FAIL

NO

AIR DATA Switch (F/O's SISP Panel) . . . . F/O ON 1

Push AIR DATA switch on the F/O's Source Input Select Panel (SISP) and observe F/O ON 1 light illuminates

[END]

DCU FAIL

TO BE ADDED WHEN AVAILABLE.

[END]

IRS___FAIL

Consequences:

NONE

Associated IRS Mode Selector. . . . . OFF

Rotate associated IRS mode selector on the IRS panel to OFF and observe the NAV/OFF light illuminates.

IRS 1 OFF

NO

IRS Switch (Captain's SISP Panel) . . . . CAPT ON AUX

Push IRS switch on the Captain's Source Input Select Panel (SISP) and observe CAPT ON AUX light illuminates.

IRS 2 OFF

NO

IRS Switch (F/O's SISP Panel) . . . . F/O ON AUX

Push IRS switch on the F/O's Source Input Select Panel (SISP) and observe F/O ON AUX light illuminates.

[END]

TAILCONE UNLOCK

Consequences:

TAILCONE MAY HAVE DEPLOYED

AIRPLANE ON GROUND

NO

Ground Control . . . . NOTIFY

Advise ground control that tailcone may have deployed on taxiway or runway.

Call maintenance.

[END]

Tower or ATC . . . . NOTIFY

Advise tower or ATC that tailcone may drop on runway during landing rollout.

[END]

WSHLD HEAT FAIL

Consequences:

NONE

WINDSHLD ANTI-ICE Switch . . . . OFF

Do not exceed 315 KIAS below 10,000 feet when windshield heat is inoperative.

[END]

INTENTIONAL BLANK

AILERON CONTROLS JAMMED OR RESTRICTED

If airplane control is adequate, continue to normal descent point.

NOTE: If freezing water is the cause, control may be regained by descending into warmer air.

If controls remain jammed or restricted,

Autopilot . . . . DISCONNECT

Maximum Airspeed 270 KIAS/.76M

Autothrottles . . . . DISCONNECT

Control Wheels . . . . DISCONNECT

Use force as required, to disconnect the two halves of the control system.

Autothrottles will be available. Autopilot may be available.

Select a runway with minimum crosswind.

If roll authority is reduced, fly a wider pattern than normal to allow a stabilized approach.

[END]

(CONTINUED)

ANTI-ICE OPERATION WITH SINGLE PNEUMATIC SOURCE

BLEED Switch (Affected engine) . . . . OFF
PACK Switch (Affected engine) . . . . OFF
ISOL Switch . . . . AUTO

FLIGHT INTO ICING CONDITIONS IS REQUIRED:

NO

WING and TAIL AIR FOIL ANTI-ICE Switches . . . . ON

On Final Approach:

Within one minute prior to selecting 25° landing flaps (normally just prior to landing gear extension),
TAIL AIR FOIL ANTI-ICE Switch . . . . OFF then ON

Flaps/Slats . . . . 25°/EXT

NOTE: Do not extend flaps beyond 25°/EXT.

GO AROUND REQUIRED

NO

Flaps/slats retract to 18°/EXT and use appropriate maneuvering speeds.

When clear of icing conditions:

WING AIR FOIL ANTI-ICE Switch . . . . OFF
After 3 minutes,
TAIL AIR FOIL ANTI-ICE Switch . . . . OFF

[END]

[END]

APPROACH WITH LESS THAN 1000 LB FUEL IN EITHER MAIN TANK

NOTE: If a go-around is required, avoid sustained nose-up attitudes in excess of 10°.

Fuel Boost Pump Switches (All). . . . . ON
FUEL X-FEED Lever. . . . . ON
IGNITION Switch. . . . . ON

NOTE: A go-around is not recommended with less than 500 pounds fuel in each main tank or if both main tank aft pumps are inoperative.

[END]

DITCHING OR CRASH LANDING

Crew & Cabin Attendants. . . . . ALERT/STOW LOOSE EQUIPMENT

As time and other duties permit, stow all loose equipment.

Transponder. . . . . .AS REQUIRED
ATC. . . . . ADVISE

Advise ATC of identification, ground speed, position, altitude and true course. Describe nature of emergency, state intentions and request assistance.

APU. . . . . OFF
NO SMOKE/SEAT BELTS Switches. . . . . ON
When below 10,000 feet,
CABIN PRESS SYSTEM SELECT Switch. . . . . MANUAL
CABIN PRESS MANUAL
Rate Selector . . . . MANUALLY DEPRESSURIZE
L/R PACK Switches. . . . . OFF
Cabin Attendants' Preparation. . . . . .COMPLETED
Crew Vests (If Required), Belts, Harness. . . . . ON / FASTENED
Crew/Passenger Briefing. . . . . .COMPLETED

When beginning final approach, advise crew and passengers to brace for impact (30 seconds prior to touchdown) and not to release seatbelts until airplane has come to a complete stop.

EMER LT Switch. . . . . ON

(continued)

DITCHING

NO

CABIN PRESS MANUAL Rate Selector . . . VALVE CLOSED
AVIONICS COOLING Switch. . . . . FAN
FLAP/SLAT Handle . . . . 25°/EXT
Gear Handle. . . . . UP

NOTE: After ditching, airplane will assume a slight tail down attitude.

When airplane has stopped, and if time permits,

ENG FIRE Handle/
AGENT LOW Light. . . . . .PULL, DISCH/CHECK

NOTE: BATT switch must be ON to discharge fire extinguishing agent.

[END]

FLAP/SLAT Handle . . . . 25°/EXT

Gear Handle/Lights. . . . . .DOWN / 3 GREEN

When airplane has stopped, and if time permits,

ENG FIRE Handle/AGENT LOW Light . . . . . PULL, DISCH/CHECK

NOTE: BATT switch must be ON to discharge fire extinguishing agent.

[END]

ELEVATOR CONTROLS JAMMED OR RESTRICTED

If airplane control is adequate, continue to normal descent point.

NOTE: If freezing water is the cause, control may be regained by descending into warmer air.

If controls remain jammed or restricted,

Autopilot . . . . DISCONNECT

Maximum Airspeed 270 KIAS/.76M

Autothrottles. . . . . DISCONNECT

Control Columns . . . . DISCONNECT

Use force, as required, to disconnect the two halves of the control system.

Autothrottles will be available. Autopilot may be available.

Elevator authority may be reduced. The pilot with the operative elevator control system should fly the airplane to a normal approach and touchdown.

[END]

ENGINE ABNORMAL START

FUEL Switch (Affected Engine) . . . . OFF

STARTER ENGAGED

NO

Continue rotation for 30 seconds to clear engine of fuel.

NOTES: Advise maintenance if any limitations were exceeded. If no limitations were exceeded during first start attempt, another start may be attempted at Captain's discretion.

For subsequent start attempt motor engine for 30 seconds before moving FUEL switch to ON.

[END]

N2. . . . . "20"%

Reengage starter for 30 seconds to clear engine of fuel.

NOTES: Advise maintenance if any limitations were exceeded. If no limitations were exceeded during first start attempt, another start may be attempted at Captain's discretion.

For subsequent start attempt, motor engine for 30 seconds before moving FUEL switch to ON.

[END]

ENGINE(S) COMPRESSOR STALL (SURGE)

Autothrottle. . . . . .OFF

Throttle (Affected Engine(s)) . . . . RETARD (SLOWLY)

NOTE: Slowly retard throttle on affected engine(s) (minimum for safe flight) until engine stabilizes or throttle reaches idle, whichever occurs first.

AFFECTED ENGINE TGT, N1, N2 NORMAL

NO

Continue normal engine operation.

NOTE: *"ENG_SURGE" alert may be displayed and remain illuminated for 2 minutes.*

Monitor engine parameters. **[END]**

FUEL Switch (Affected Engine) . . . . .OFF

Refer to EMERGENCY NON-ALERTS Procedure - ENGINE FAILURE/IN FLIGHT SHUTDOWN.
Land at nearest suitable airport. **[END]**

ENGINE RESTART IN FLIGHT

NOTE: Airstarts may be attempted at any altitude and airspeed. Airstarts have been demonstrated below FL250.

FUEL Switch. . . . . OFF
Autothrottle . . . . OFF
Throttle (Affected Engine). . . . . IDLE
L/R FWD/AFT FUEL PUMP Switches . . . . ON
HYDRAULIC PUMP Switch (Affected Engine). . . . . OFF
ENG Anti-Ice Switch (Affected Engine) . . . . OFF
AIR FOIL Anti-Ice Switches . . . . OFF
ISOL Switch . . . . OPEN
PACK Switch (At Least One) . . . . OFF
ENG START Switch . . . . PULL
When N2 RPM is above 14%
FUEL Switch. . . . . ON

NOTE: *If TGT and RPM rise do not occur within 30 seconds, or if TGT exceeds 850 degrees C after FUEL Switch was moved to ON, move FUEL switch to OFF.*

ENGINE RESTARTS

NO

NOTE: If conditions permit, operate engine at idle for 5 minutes after start.

HYDRAULICS PUMP Switch. . . . . ON
ISOL Switch. . . . . AUTO
BLEED Switches . . . . .AS REQUIRED
PACK Switches . . . . .AS REQUIRED
ENG/AIR FOIL Anti-Ice Switches . . . . .AS REQUIRED
FUEL CROSSFEED . . . . .AS REQUIRED
[END]

ENG START Switch . . . . .PUSH
FUEL Switch. . . . . OFF
ISOL Switch . . . . .AUTO
ENG/AIR FOIL Anti-Ice Switches . . . . AS REQUIRED

(continued)

ENGINE RESTART IN FLIGHT (CONT)

***NOTE**: If N2 displays an amber "X" , descend below FL200, decrease airspeed below 220 KIAS and verify N1 is less than 20%. Cycle the FUEL switch to ON, then OFF to clear the amber "X". If the N2 amber "X" is no longer displayed and engine severe damage is not suspected, additional engine restarts may be attempted.*

If restart attempts are successful, complete Emergency Non-Alert Procedure - ENGINE FAILURE/IN FLIGHT SHUTDOWN.

[END]

FMS_FAIL

(With INDEPENDANT OPERATION shown on both MCDUs)

NOTE: If the aircraft has departed the gate the aircrew may attempt this procedure. If at the gate, call maintenance.

AIRPLANE IN FLIGHT

NO

Continue with INDEPENDENT FMS OPERATION.

NOTE*: Select “MENU”,* verify MCDU #1 continues to display “FMC-1 <ACT>” and MCDU #2 continues to display “FMC-2<ACT>”. *This will verify independent FMS operation. The FMS_FAIL alert may be disregarded after independent FMS operation is verified.* ***DO NOT*** *use SISP switching in conjunction with this condition. Both FMSs remain fully operational.*

Flight Guidance information will be independent. It is imperative that identical data is entered into each MCDU separately whenever a modification of the flight plan or data is necessary.

Radio NAV AID tuning, both auto and manual, will be independent. Each MCDU will only allow tuning of the navigation radio associated with its FMS.

Verify autopilot engagement is to the desired side, 1 or 2. The autopilot will use data, including navigation radios, only from the selected side.

Verify FMS independent operation by observing the “FMC-1<ACT>” prompt on the MCDU #1 MENU page and the “FMC-2<ACT>” prompt on the MCDU #2 MENU page.

Pull and reset VIA 1 circuit breaker. (OVHD, A-16)

NOTE*: Allow a 10 second pause before resetting the VIA circuit breaker. The VIA will require approximately 2 1/2 minutes to re-power.*

Only one attempt at cycling the circuit breaker is allowed.

Verify FMS_FAIL alert is extinguished. FMS 1 and 2 will be in dual operation.

(continued)

If normal FMS operation is not restored, pull and reset VIA 2 circuit breaker. (UPPER EPC, E-2)

> ***NOTE:*** *Allow a 10 second pause before resetting the VIA circuit breaker. The VIAs will require approximately 2 1/2 minutes to re-power.*
>
> *Only one attempt at cycling the circuit breaker is allowed.*

If this procedure fails to restore normal FMS operation, contact maintenance.

Ensure that any occurrence is documented in maintenance logbook.

[END].

FUEL LEAK

NOTE: *Fuel leaks may be indicated by significant differences between planned and actual fuel usage and/or unexplained increase or decrease in tank quantity (main tank imbalance, "ENG___FUEL PRES" alert displayed).*

Main Tank FWD/AFT PUMP Switches
(For Tank With Greater Quantity). . . . . ON

Main Tank FWD/AFT PUMP Switches
(For Tank With Lesser Quantity). . . . . OFF

UNCOMMANDED FILLING OF A TANK (TANK QUANTITY INCREASING/DECREASING AT OTHER THAN NORMAL RATE)

NO

FUEL X FEED Lever . . . . .AS REQUIRED

Move FUEL X FEED lever to ON (as required) and move fuel boost pump switches for supplying tank(s) to ON intermittently as required to make fuel available and to maintain balance.

NOTE: Maintaining 2500 pounds in right main tank will minimize chance of left engine drawing air (if it is on suction feed).

Land at nearest suitable airport.

[END]

FUEL X FEED Lever . . . . OFF

Engine Operation . . . . CHECK

(continued)

FUEL LEAK (CONT)

FAILURE OF ENGINE USING
SUCTION FEED

NO

Throttle (Affected Engine). . . . . IDLE
FUEL Switch (Affected Engine). .OFF
ENG FIRE Handle
(Affected Engine). . . . . PULL (DO NOT ROTATE)
FUEL X FEED Lever. . . . . .AS REQUIRED

Move FUEL X FEED lever to ON (as required) and move fuel pump switches for supplying tank(s) to ON intermittently as required to make fuel available and to maintain balance.

Land at nearest suitable airport. **[END]**

GEAR HANDLE WILL NOT MOVE TO DOWN POSITION

Airspeed. . . . . 230 KIAS MAX
Emergency Gear Extension Lever . . . . RAISE/LATCH
It may be necessary to decrease airspeed to allow the nose gear to lock down.
Gear Lights. . . . . 3 GREEN
Gear Handle. . . . . DOWN

GEAR HANDLE MOVES DOWN

NO

Emergency Gear Extension Lever . . . . .STOW
[END]

CAUTION: Do not stow emergency gear extension lever until malfunction has been corrected.

Stop airplane on runway. Do not taxi.
[END]

GEAR HANDLE WILL NOT MOVE TO UP POSITION

Airspeed . . . . 230 KIAS MAX

NOSE STEERING WHEEL LOCKED AND INDEX CENTERED

NO

NOTE: Indicates failure of gear anti-retract mechanism.

GEAR HDL REL Button. . . . . PUSH/HOLD

Gear Handle . . . . UP

[END]

Do not retract gear.

CAUTION: Nosewheel may not be centered and damage may occur if gear is retracted. Do not exceed 300 KIAS/.70 Mach.

GROUND SENSING CIRCUIT IN GROUND MODE

NO

Refer to GROUND SENSOR FAILURE in this section.

NOTE: The following are indications of ground sensing circuit in ground mode while in flight:

- *Autopilot will not engage.*
- *Cabin fails to pressurize.*
- *T/O warning may sound.*

[END]

If continuing flight to destination, consider fuel and ATC requirements.

[END]

GEAR UNSAFE LIGHT(S) ILLUMINATE WITH GEAR HANDLE DOWN

NOTE: If any gear indicator indicates unsafe, gear aural warning will sound until 100 feet AGL prior to touchdown. It may be necessary to decrease airspeed to allow nose gear to lock kown.

Emergency Gear Extension Lever. . . . . RAISE/LATCH

ALL 3 GEAR LIGHTS INDICATE SAFE

NO

Emergency Gear Extension Lever . . . . .STOW

ALL GEAR INDICATIONS REMAIN SAFE

NO

No further crew action required.

[END]

Emergency Gear Extension Lever . . . . RAISE/LATCH

Stop airplane on runway. Do not Taxi.

[END]

Emergency Gear Extension Lever . . . . .STOW

NOTE: Stowing emergency gear extension lever will restore hydraulic pressure to extend side of gear actuator.

Stop airplane on runway. Do not taxi

CAUTION: Maintain right hydraulic system pressure after landing.

Refer to LANDING WITH ABNORMAL LANDING GEAR CONFIGURATION in this section.

[END]

GEAR UNSAFE LIGHT(S) ILLUMINATE WITH GEAR HANDLE UP

Airspeed. . . . . MAX 230 KIAS
Gear Handle. . . . . DOWN

ALL 3 GEAR INDICATES GREEN

NO

LANDING GEAR/TIRE DAMAGE SUSPECTED

NO

Do not retract gear.
Land at nearest suitable airport.

[END]

Gear Handle . . . . UP

ALL GEAR LIGHTS EXTINGUISHED

NO

No further crew action required.

[END]

Airspeed . . . . .MAX 300 KIAS/.70MACH

[END]

Refer to LANDING WITH ABNORMAL LANDING GEAR CONFIGURATION in this Section.

[END]

GROUND SENSOR FAILURE

NOTES: When ground shift mechanism does not shift to flight mode, some systems will not be in normal mode:

- *Autopilot cannot be engaged.*
- *Takeoff warning sounds when flaps or slats are retracted.*
- *Cabin fails to pressurize.*

GROUND CONTROL RELAY C/B's
K-32 and L-32 (Upper EPC). . . . . .PULL

During approach and just prior to final approach fix,

CABIN PRESS SYSTEM Switch. . . . . .MANUAL

CABIN PRESS MANUAL Rate Selector. . . . . .CLIMB

Observe outflow VALVE indicator moves to full OP.

Do not arm auto spoilers.

Upon touchdown, manually deploy ground spoilers.

After landing,

GROUND CONTROL RELAY C/B's
K-32 and L-32 (Upper EPC). . . . . RESET

AIR FOIL Anti-Ice Switches (Both). . . . . .OFF

[END]

(CONTINUED)

LANDING WITH ABNORMAL LANDING GEAR CONFIGURATION

NOTE: Review normal descent/approach/landing checklists, PASSENGER EVACUATION checklist, and DITCHING OR CRASH LANDING checklist prior to landing.

Landing Gross Weight . . . . REDUCE

GPWS C/B F-20 (Upper EPC) . . . . PULL

NOSE GEAR UNSAFE WITH BOTH MAIN GEAR SAFE

NO

Perform normal approach for landing.

Ensure gear handle is down and spoilers are armed for deployment.

At touchdown,

PF begin actuating trim control to nose up to assist in holding nose off runway.

PNF monitor spoiler deployment and manually deploy spoilers if necessary.

After touchdown,

While elevator control is still effective, lower nosewheel gently to runway.

Upon nose contact, use maximum braking (within limits of directional control) to stop airplane.

[END]

(CONTINUED)

ONE MAIN GEAR UNSAFE WITH NOSE GEAR SAFE

NO

NOTE: Consideration should be given to selecting the widest runway available for landing due to the possibility of severe directional control difficulties. Consider touching down on the side of the runway corresponding to extended main gear.

Perform normal approach for landing.

Ensure that gear handle is down and that spoilers are disarmed and not used during landing.

Touch down on extended main gear. While elevator control is still effective lower nose gear gently to runway and hold wings level with ailerons as long as possible.

Maintain directional control with nosewheel steering and braking.

[END]

ANY OTHER COMBINATION OF EXTENDED/RETRACTED GEAR

NO

Any gear which can be extended should be extended for landing whether on a prepared or unprepared surface.

Nosewheel will provide some additional directional control if extended. Main gear is designed to shear as required and will provide protection for fuselage.

Perform normal approach for landing.

Ensure gear handle is down and spoilers are disarmed and not used for landing.

Touch down on main gear, if extended.

While elevator control is still effective, lower nose gently to runway and hold wings level with ailerons as long as possible.

Maintain directional control with nosewheel steering (if available).

[END]

[END]

NO FLAP/NO SLAT OR NO FLAPS/ SLATS EXTENDED LANDING

Refer to NO FLAP/NO SLAT OR NO FLAPS/SLATS EXTENDED LAND DISTANCE chart on the following page.

Reduce gross weight to lowest practical value.

Plan a wide pattern for speed stabilization on final approach.

GND PROX WARN Switch. . . . . .FLAP OVRD

> *NOTE: In FLAP OVRD, ground proximity warning will be disabled as a result of flaps not in landing range. All other functions of ground proximity warning system will remain operative.*

Perform appropriate normal checklists.
Disconnect autothrottles prior to 50 feet AGL.

> *NOTE: Throttles will not automatically retard at 50 feet AGL with flaps less than landing range. Autothrottles must be disconnected prior to 50 feet AGL.*

AIRSPEED . . . . V_{REF} +5
Fly a normal glideslope.

On touchdown, lower nose gear to runway and immediately apply full reverse thrust and brakes as required.

Do not attempt to achieve a smooth touchdown.

Full reverse thrust may be used to a complete stop.

(CONTINUED)

NO FLAP/NO SLAT OR NO FLAPS/ SLATS EXTENDED LANDING (CONTINUED)

ESTIMATED LANDING DISTANCE

No Flap, No Slat

Standard day, no wind, zero slope

Add 10% to table value for temperatures greater than Standard.

WEIGHT (1000 LB)		70	80	90	100	110	120
S. L. (STD=15°C)	DRY	3740	4130	4510	4880	5280	**
	WET	4950	5610	6290	7000	7710	**
2000 FT (STD=11°C)	DRY	3920	4320	4730	5120	5540	**
	WET	5260	5960	6700	7450	8220	**
4000 FT (STD=7°C)	DRY	4110	4530	4960	5380	**	**
	WET	5590	6350	7140	7950	**	**
6000 FT (STD=3°C)	DRY	4310	4760	5200	5640	**	**
	WET	5950	6770	7610	8480	**	**
8000 FT (STD= –1°C)	DRY	4520	4990	5470	5930	**	**
	WET	6340	7220	8130	9080	**	**
8000 FT (STD= –5°C)	DRY	4750	5250	5750	6280	**	**
	WET	6780	7730	8710	**	**	**

**** Maximum brake energy limit.**

NOTES: Actual (unfactored) distances are shown. Includes distance from 50 ft above threshold. Assumes max available braking and includes the following reverse thrust procedure: Max reverse to 80 kts; Idle reverse by 60kts; and Idle forward by 40 kts.

UP/RET VAPP SPEEDS - NO FLAP/NO SLAT LANDING

GWT (1000 LB)	64	68	72	76	80	84	88
VAPP (V_{REF}+5)	157	161	166	170	175	179	183

GWT (1000 LB)	92	96	100	104	108	112	116	120
VAPP (V_{REF}+5)	187	191	195	198	202	206	209	213

PASSENGER EVACUATION

If time permits, alert ATC, ground crew, and brief cabin attendants.
Emergency light switch should be moved to ON just prior to landing.
After stopping.

Parking Brakes. . . . . SET

SPD BRK Lever. . . . . RET

FLAP/SLAT Handle. . . . . 25°/EXT

NOTE: Flap position is for unobstructed egress from airplane. If airplane is at gate and ramp is congested with service vehicles, use good judgment to ensure maximum safety of passengers.

EMER LT Switch. . . . . ON

FUEL Switches . . . . OFF

ENG FIRE Handles . . . . PULL

NOTE: If required, discharge fire agent.

Cabin Attendants. . . . . ALERT

NOTE: Command evacuation at this time.

APU FIRE CONT Switch . . . . OFF & AGENT ARM

BATT Switch. . . . . OFF

[END]

Crew Duties

	Pre-Landing	Post-Landing
Captain	Advises crew to prepare for landing. Advises flight attendant of: **T** - type of emergency expected **E** - evacuation, will it be necessary **S** - signals for brace and evacuation **T** - time available for preparation	Orders evacuation Directs and assists in the evacuation. Checks that all persons have been evacuated. Exits through any convenient exit.
First Officer	Assists in cockpit emergency preparations as directed by the captain. Secures cockpit door and stows loose equipment.	Takes fire extinguisher and exits through forward exit. Assists in the evacuation from outside the airplane.

[END]

PFD ALT DATA MISSING/INTERMITTENT

ISIS Altimeter Data. . . . . CHECK

NOTES: Standby Instrument (ISIS) is isolated and provides accurate altimeter data.

The following are some of the indications that the flight crew might see.

- *Flashing Captain or F/O PFD baro setting*
- *Autopilot and autothrottles disconnect*
- *FCP windows are blanked and all GCP functions are unavailable*
- *FMC RANGE DISAGREE on NAV displays*
- *Loss of NAV data, airspeed, and altitude bugs.*

SCP ELEC Page . . . . SELECT

L and R TR Voltage . . . . .CHECK

L TR VOLTAGE LESS THAN 25V

NO

GCP A MAIN POWER C/B A-13 (OVHD Panel) . . . . .PULL

GCP BACKUP POWER C/B T-41 (Lower EPC Panel) PULL

NOTE: Autopilot single operation.

[END]

R TR VOLTAGE LESS THAN 25V

NO

GCP B MAIN POWER C/B G-12 (Upper ECP Panel). .PULL

GCP BACKUP POWER C/B T-41 (Lower ECP Panel) .PULL

NOTE: Autopilot single operation.

Emergency PWR Selector . . . . OFF THEN ARM

[END]

Land at nearest suitable airport.

[END]

REVERSER DEPLOYED OR “U/L” OR “REV” DISPLAYED IN FLIGHT

NOTE: Engine thrust will be reduced to idle whenever respective EEC detects 10% or more uncommanded reverser deployment.

Throttle (Affected Engine). . . . . .RETARD

Reverser Levers . . . . FULL DOWN

AIRPLANE BUFFETING OR YAWING

NO

FUEL Switch (Affected Engine) . . . . OFF

Refer to EMERGENCY NON-ALERT Procedure - ENGINE FAILURE/IN FLIGHT SHUTDOWN.

Land at nearest suitable airport.

[END]

Operate engine at idle.

Land at nearest suitable airport

[END]

RUDDER JAMMED OR RESTRICTED

"RUDDER RESTRICTED" ALERT DISPLAYED

NO

Level 1 alert indicates that either the primary or secondary rudder limiter is over-restricteing the rudder. In this case, the rudder cannot be overpowered. Limited rudder control is available.

Select a runway with minimum croswind.

[END]

Use rudder trim (if available) and aileron for directional control.

NOTES: If freezing water is the suspected cause, and if conditions permit, descend to warmer air and attemt to regain rudder control.

If rudder input is not possible, use operative flight controls, trim, and thrust as required for airplane control.

Select a runway with minimum crosswind.

Rudder pedal steering is inoperative.

If directional control is a concern, use differential braking at high speed.

Tiller nose wheel steering can be used as speed decreases.

[END]

SEVERE TURBULENCE/HEAVY RAIN/ICE INGESTION

Turbulence, Penetration Speed . . . . .270 KIAS OR .75 M, WHICHEVER RANGE IS LOWER

NOTE: Below 10,000 feet, the greater of 250 KIAS or minimum maneuvering speed may be used.

IGNITION Switch . . . . ON

Autothrottles . . . . OFF

NOTES: Use speed brakes to slow airplane. Adjust throttles only if necessary to avoid excessive airspeed variations. Use smooth power changes and maintain thrust as high as practicable. Do not chase airspeed.

If throttles are at idle when extreme precipitation is encountered, N2 should be monitored for spool-down below idle RPM. Delay throttle advance as long as possible and, when necessary, very slowly advance one throttle at a time while monitoring N2 for response. If no response is noted, return throttle to idle and wait for indications of spool-up to idle RPM.

Autopilot . . . . MONITOR

Use autopilot in turbulence. Closely monitor autopilot operation and be prepared to disconnect autopilot only if airplane does not maintain an acceptable attitude. If autopilot disconnects, pilot should smoothly take control and stabilize pitch attitude. Fly attitude as the primary pitch reference. Sacrifice altitude to maintain attitude. Disregard flight director pitch bar. Do not trim manually. After recovery, autopilot should be reengaged if available.

WARNING: ***Do not attempt to overpower the autopilot with control forces. This can cause the autopilot to disengage with too much control input, which could result in over-control during recovery. Every attempt should be made not to over-control.***

Longitudinal control forces at high altitude will be lighter than those which the pilot experiences at low altitude due to altitude effects.

When the autopilot is off, use minimum control inputs to fly attitude.

(continued)

SEVERE TURBULENCE/HEAVY RAIN/ ICE INGESTION (CONT)

ENG and AIR FOIL Anti-Ice Switches . . . . AS REQUIRED

NOTES: Engine and air foil anti-ice systems should be OFF if TAT is above 10°C (50°F) or no icing is encountered or anticipated. Reduced engine bleeds will increase engine flameout margin during periods of heavy water ingestion.

Increased engine vibraqtion during low thrust operation in severe icing conditions, with or without engine anti-ice, may be due to fan blade icing. This is especially suspect if more than one engine experiences higher than normal vibration levels. If fan blade icing is suspected, verify IGNITION is on. If engine anti-ice is off, reduce thrust (one engine at a time) to idle and turn on engine anti-ice. Accelerate affected engine to 90% N1 while closely monitoring engine instruments (especially TGT) for any abnormalities. If vibration decreases (indicating ice removal), resume normal operation for existing conditions. If vibration does not decrease after 1 minute, consider engine shutdown.

When conditions no longer exist,

ENG and AIR FOIL Anti-Ice Switches . . . . AS REQUIRED

Autothrottles . . . . ON

Ignition Switch . . . . AUTO

[END]

SPOILER STUCK IN EXTENDED POSITION

Aileron Trim . . . . AS REQUIRED

Land at nearest suitable airport.

During landing,

- Use FLAPS 25°.
- Minimum approach speed V_{REF} + 10.

  NOTE: Spoilers may be armed for landing.

[END]

STABILIZER INOPERATIVE

WARNING: *Do Not attempt additional actions beyond those contained in the checklist(s). Priority should be given to landing at the nearest suitable airport.*

NOTE: Extended trim operation may result in trim motor thermal shutdown. Trim motor operation may return after sufficient cooling period.

AIRPLANE IN TRIM WITH LANDING FLAPS SET

NO

Land with selected flaps.
[END]

Use FLAPS 40° for landing and increase V_{REF} speed by 20 knots or, if time permits, by the speed increment from the chart below.
Disconnect autothrottles prior to 50 feet.
Do not reduce thrust until landing flare has been initiated and sink rate has been reduced.
Make positive main gear touchdown to minimize float and take positive action to lower nose to runway.

STABILIZER INOPERATIVE - SPEED INCREMENT CHART

NOTE: Use takeoff C.G. (%MAC) if landing C.G. is unknown.

	Center of Gravity - % MAC					
STAB ANGLE	6	10	15	20	25	30 to 34
	SPEED ADDITIVE (KIAS)					
2.5° AND	35	31	26	20	14	9
2° AND	33	28	23	18	12	7
0°	25	21	18	12	6	1
2°ANU	20	17	13	7	1	0
4° ANU	15	12	8	1	0	0
6° ANU	11	7	3	0	0	0
8° ANU	6	2	0	0	0	0
10° ANU	1	0	0	0	0	0

(CONTINUED)

STABILIZER INOPERATIVE (CONT)

ESTIMATED LANDING DIST (ft) 40 FLAPS, SLATS EXT

Standard day, no wind, zero slope, Vref (Flaps 40) + 20 knots. ADD 10% TO TABLE VALUE FOR TEMPERATURES GREATER THAN STANDARD. Add 20% to table value for Vref speed additives greater than 20 kts.

Weight (1000 LB)		70	80	90	100	110	120
S.L (STD = 15°C)	Dry	3180	3460	3750	4030	4310	4580
	Wet	3870	4280	4700	5140	5580	6040
2000 FT (STD = 11°C)	Dry	3300	3600	3900	4200	4490	4790
	Wet	4050	4490	4950	5420	5900	6400
4000 FT (STD = 7°C)	Dry	3430	3750	4070	4380	4700	5010
	Wet	4250	4730	5220	5730	6260	6800
6000 FT (STD = 3°C)	Dry	3570	3910	4250	4580	4920	5250
	Wet	4470	4980	5520	6070	6650	7230
8000 FT (STD = -1°C)	Dry	3720	4080	4440	4800	5160	5520
	Wet	4710	5270	5850	6450	7080	7710
10000 FT (STD = -5°C)	Dry	3880	4270	4650	5030	5420	5800
	Wet	4980	5590	6220	6880	7550	8240

[END]

STARTER VALVE MANUAL OPERATION

If unable to electrically open start valve,

BEFORE START Checklist. . . . . COMPLETE

MAINT INTPH Switch. . . . . ON

Request ground crew to go on maintenance interphone at engine.

ENG START Switch. . . . . PULL

Command ground crew to open start valve.

When N2 RPM reaches 20% or maximum motoring,

FUEL Switch. . . . . ON

After TGT rise and N2 RPM 41%,

Command ground crew to close start valve.

[END]

TAILPIPE FIRE

FUEL Switch (Affected Engine) . . . . OFF

STARTER DISENGAGED

NO

Allow N2 to decrease to 40% or less; then,

ENG START Switch . . . . PULL

CAUTION

Tailpipe fires are not annunciated in the cockpit. The first notification of a tailpipe fire may be from an external source. Discharging the engine fire extinguishing agent will not extinguish the fire. If the fire cannot be extinguished by motoring, or if motoring is not possible, the use of ground fire fighting equipment may be required.

After fire is extinguished,

ENG START Switch . . . . .PUSH

Call maintenance.

[END]

(CONTINUED)

VIA FAIL OR MAP FAIL OR FLIGHT DIRECTOR MISSING

NOTES: VIA FAIL and/or MAP FAIL and some of the following indications might be the result of a faulty TR output:
- *Flashing Captain or F/O PFD baro setting*
- *Autopilot and autothrottles disconnect*
- *FCP windows are blanked and all GCP functions are unavailable*
- *FMC RANGE DISAGREE and/or MAP FAIL on NAV displays*
- *Loss of NAV data*
- *Loss of airspeed and altitude bugs.*

SCP ELEC Page . . . . SELECT
L and R TR Voltage . . . . .CHECK

L TR VOLTAGE LESS THAN 25V

NO

GCP A MAIN POWER C/B A-13 (OVHD Panel) . . . . PULL
GCP BACKUP POWER C/B T-41 (Lower EPC Panel) PULL

NOTE: Autopilot single operation, and reconfigure displays with SISP.

[END]

R TR VOLTAGE LESS THAN 25V

NO

GCP B MAIN POWER C/B G-12 (Upper ECP Panel) . PULL
GCP BACKUP POWER C/B T-41 (Lower ECP Panel) PULL

NOTE: Autopilot single operation, and reconfigure displays with SISP.

[END]

Reconfigure displays with SISP.
Land at nearest suitable airport.
[END]

VOLCANIC ASH

If a volcanic ash cloud is inadvertently entered during flight, depart the area by the shortest route possible. Consider executing a descending 180° turn.

Do not use windshield wipers.

> *NOTE: Use of windshield wipers for ash or dust removal will result in minute scratches on the windshield. These will create a blossoming effect at night and could make landing approach difficult.*

> ***CAUTION: If airspeed indications are abnormal, refer to AIRSPEED: LOST, SUSPECT OR ERRATIC Emergency Non-Alert procedure for pitch guidance information.***

> *NOTES: Airspeed indications may be erratic and unreliable or a complete loss of airspeed indication may occur.*
> *Avoid rapid throtle movements if possible.*
> *If compressor and/or turbine blades have been eroded, an increase in fuel flow and TGT may be noticed.*

Perform the following actions as rapidly as possible:

Auto throttles. . . . . DISENGAGE
Throttles (All). . . . . IDLE
IGNITION Switch. . . . . ON
ENG Anti-Ice Switches. . . . . ON
WING and TAIL AIR FOIL Anti-Ice Switches. . . . . ON

> *NOTE: Decreasing TGT will reduce debris buildup on the turbine blades and hot section, and significantly reduce damage to the compressor section and blade tips due to erosion.*

ENGINE(S) FLAMED OUT OR STALLED, OR TGT BEYOND LIMITS, OR INCREASING RAPIDLY TOWARD LIMITS

NO

FUEL Switch (Affected Engine(s)). . . . . .OFF THEN ON

N2 RPM LESS THAN 15%

NO

ENGINE START Switch . . . . PULL

Monitor start.

NOTES: Engines accelerate to idle very slowly at high altitudes. This may be incorrectly interpreted as a hung start or an engine malfunction not caused by volcanic ash.

If an engine fails to start, repeated attempts should be made immediately. A successful start may not be possible until clear of volcanic ash cloud and airspeed and altitude are within normal range.

Consider starting the APU, if available. The APU can be used to power the electrical system in the event of multiple engine loss.

Land at Nearest Suitable Airport.

NOTES: A precautionary landing should be made if damage has occurred to the airplane or abnormal engine operation was observed while operating in the ash cloud.

The abrasive effects of volcanic ash on windshields and landing lights may significantly decrease visibility for approach and landing.

[END]

LEVEL 1 AND LEVEL 0 ALERTS

This chapter lists and describes all Level 1 and Level 0 alerts. The Level 1 alerts are listed alphabetically, along with their consequences, action/awareness code, and a description of the alert.

Flight crew response to a Level 1 alert may differ based on how the alert is presented. There are no written QRH procedures for Level 1 alerts except for the NO TAKEOFF list. If a Level 1 alert displays on the ground prior to takeoff, this list should be consulted. Level 1 alerts can be displayed in the following ways:

1. Level 1 alerts displayed on EAD: Level 1 alerts that appear on the EAD with or without accompanying MASTER CAUTION lights are caused by a condition requiring crew response. The nature of the response is contained in the title of the alert, in the associated consequence statements, or is intuitive by the nature of the alert. When an alert appears on the EAD, the PNF should announce the alert condition and push the illuminated cue switch to reset the MASTER CAUTION lights and display the synoptic. Generally, the alert will be removed from the EAD and replaced by a reminder message in the lower right-hand corner of the EAD.
2. Level 1 alerts displayed on the synoptic with flashing reminder message on EAD: Alerts that appear only on the synoptic are annunciated by a flashing reminder message in the lower right-hand corner of the EAD and illumination of the associated systems display control panel cue switch. There is no accompanying MASTER CAUTION light. These alerts indicate a condition that requires crew awareness and system degradation not requiring a flight crew procedure. When a flashing reminder message appears on the EAD, the PNF should push the illuminated systems display cue switch when time and conditions permit. This will display the synoptic and reset the flashing reminder message to a steady reminder message.
3. Level 1 alerts displayed on synoptic only, with no flashing reminder message on EAD: These alerts indicate system conditions that may be a result of a deliberate flight crew action or

an abnormal switch position. There are no MASTER CAUTION lights or flashing reminder messages associated with these alerts. Some of these Level 1 alerts may be accomplished by a steady reminder message on the EAD. These alerts are advisory only and require no flight crew response.

Level 0 alerts are listed alphabetically following the Level 1 alerts. Since Level 0 alerts generally display system status information and are not caused by abnormal conditions, there are no action codes or consequences associated with these alerts. There are no QRH procedures associated with Level 0 alerts.

The following sections list all the Level 1 and 0 alerts alphabetically by level.

Level 1 alerts are accompanied by one of the following action codes:

NO T/O	Do not take off. Call maintenance for corrective action. In flight, continue to destination and make appropriate log book entry.
MAINT	Consult maintenance prior to takeoff for appropriate disposition. MEL procedures and limitations may apply. In flight, continue to destination and make appropriate log book entry.
N/A	No flight crew action is required. These alerts generally display to inform the crew of an automatic system controller normal action, a result of a maintenance action taken to comply with the MEL, or alerts that appear only in flight as a result of an associated problem, or that have no flight crew action.
SW	This alert is the result of a deliberate flight crew action and reflects an abnormal switch or control position. The flight crew should confirm the desired configuration.

[END]

LEVEL 1 ALERTS

Some Level 1 alerts have associated consequence statements on the system synoptic display. These consequences are listed when they apply.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
ACARS NO COMM	MAINT	Consequences: NONE ACARS communication has been lost.
ACCESS COMPT DOOR	NO T/O	Consequences: NONE Indicates accessory compartment door is not closed and locked.
ADIRU___FAULT	MAINT	Consequences: NONE Respective inertial navigation portion of the ADIRU has lost the navigation function or there is a failure of the baro set input bus from either VIA.
AFT BULKHEAD DOOR	NO T/O	Consequences: NONE Indicates aft bulkhead door is not closed and locked.
AGS FAIL	MAINT	Consequences: NONE The Auto Ground Spoiler (AGS) system has detected a failure which may cause the AGS to not deploy.
AILERON DISC	NO T/O	Consequences: NONE Captain's and First Officer's control wheels are disconnected. Could indicate a jam on one side.
AIL TRIM FAIL	MAINT	Consequences: NONE Aileron trim system has failed.
AIR DATA HEAT OFF	SW	Consequences: NONE Indicates air data probe heater switch is OFF.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
AIR ISOL DISAG	NO T/O	Consequences: DEPART ICING AREA Pneumatic system isolation valve not in the commanded position.
AIR SYS___NOT OFF	MAINT	Consequences: NONE Bleed air system has been commanded off, but is still pressurized.
AIR SYS___OFF	SW	Consequences: NONE Bleed air system is off and the ISOL valve is closed.
ANTISKID OFF	SW	Consequences: NONE ANTISKID switch is selected OFF.
ANTISKID FAULT	MAINT	Consequences: NONE Antiskid system has detected a fault that could result in a reduction or loss of system redundancy.
AOA HEAT___FAIL	NO T/O	Consequences: DEPART ICING AREA Indicates angle of attack probe heat has failed.
A/P NOT AVAIL	MAINT	Consequences: NONE Indicates autopilot is not available.
APU AUTO SHUTDOWN	MAINT	Consequences: NONE Indicates APU has detected a fault and has executed automatic shutdown.
APU DOOR OPEN	MAINT	Consequences: NONE Indicates APU door is open with APU commanded OFF.
APU FIRE LOOP___	MAINT	Consequences: NONE Indicates one of the two APU fire detection loops is inoperative.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
APU SQB___FAIL	MAINT	Consequences: NONE Indicates firex squib caused failure of firex test.
APU VALVE DISAG	MAINT	Consequences: NONE The APU switch, air valve and load bleed valve command disagree.
ATC XPDR___ FAIL	MAINT	Consequences: NONE Indicates ATC transponder has failed. Select other transponder.
AUTO SPOILER FAIL	MAINT	Consequences: USE MANUAL SPOILERS Auto ground spoiler system has detected a failure which may cause the AGS to not deploy.
AUTO TRIM FAIL	MAINT	Consequences: MACH TRIM FAILED POSSIBLE PITCH CHANGES IF A/P DISC DO NOT EXCEED 0.78 MACH AUTOPILOT TRIM INOPERATIVE The FCC is unable to trim the stabilizer.
AUTOPILOT SINGLE	MAINT	Consequences: NONE Indicates only one autopilot available.
AVNCS COOL OVRD	SW	Consequences: NONE AVIONICS COOLING switch is in OVRD position.
BATT CHARGER FAIL	NO T/O	Consequences: NO TAKEOFF Indicates battery charger is inoperative.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
BATT CHARGING	NO T/O	Consequences: NONE Indicates battery charging at 10 amp or higher rate for more than 10 seconds. Alert is normal after extended use of battery such as during APU start. Alert displayed for an extended period may indicate a malfunction.
BATT DISCHARGING	NO T/O	Consequences: APU AND EMER PWR MAY NOT BE AVAIL Battery is being discharged without emergency power on.
BATT SWITCH OFF	SW	Consequences: NONE Indicates BATT switch is OFF.
BLEED AIR ___OFF	SW	Consequences: NONE Indicates bleed air valve is closed.
BRAKE PRESS LO	NO T/O	Consequences: NONE One or both brake accumulator pressures are low.
BUS AC GS OFF	NO T/O	Consequences: NONE Indicates AC ground service bus (AC tie bus) is OFF.
BUS AC___OFF	NO T/O	Consequences: DO NOT USE APU GENERATOR DO NOT CONNECT EXTERNAL POWER Indicates main generator AC bus is not powered.
BUS DC___OFF	NO T/O	Consequences: NONE Indicates main DC bus is not powered.
BUS TIE ___ LOCKOUT	NO T/O	Consequences: NONE Indicates AC bus tie is locked open due to a failure.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
BUS TIE___OPEN	SW	Consequences: NONE Indicates bus tie switch is in OPEN position.
CAB PRES MAN FAIL	NO T/O	Consequences: NO TAKEOFF Indicates CPC panel or manual control of outflow valve has failed.
CAB PRES SYS MAN	SW	Consequences: NONE Indicates cabin pressurization control system has been selected to MANUAL.
CABIN DOOR	NO T/O	Consequences: NONE Indicates forward cabin door is not closed and locked.
CABIN RATE		Consequences: NONE Cabin rate of climb or descent exceeds comfortable limits.
CABIN TEMP MANUAL	SW	Consequences: NONE CABIN TEMP control is selected to manual.
CARGO AGENT___LO	NO T/O	Consequences: NONE One or more of the cargo compartment fire agent bottles has been discharged.
CARGO DOOR___	NO T/O	Consequences: NONE Indicates respective cargo compartment door is not closed and locked.
CARGO SMOKE___ FAIL	NO T/O	Consequences: NONE A single or pair of smoke detectors in the forward or aft cargo compartment has failed.
CRG SMK___SGL	SW	Consequences: NONE Respective cargo smoke detection system is set in the single mode of operation.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
CAWS FAIL	NO T/O	Consequences: NONE Indicates the central aural warning system has failed.
CKPT TEMP MANUAL	SW	Consequences: NONE CKPT TEMP control is selected to manual.
CPC___FAIL	MAINT	Consequences: NONE Cabin pressure controller has failed.
CTR___ PUMP OFF	SW	Consequences: NONE Indicates respective tank pump is selected OFF with usable fuel in center tank.
DC TIE SW OPEN	SW	Consequences: NONE Indicates the DC BUS TIE switch is in the OPEN position.
DISARM SPOILERS	MAINT	Consequences: USE MANUAL SPOILERS The Auto Ground Spoilers (AGS) system has detected a failure which may cause the AGS to not deploy.
DCU FAULT	MAINT	Consequences: SYNOPTICE DISPLAYS INCOMPLETE LOSS OF SOME ALERTS The Data Concentrator Unit (DCU) has lost data redundancy.
DCU CHANNNEL FAIL	MAINT	Consequences: NONE One Data Concentrator Unit (DCU) channel has failed.
DISCH CARGO AGENT		Consequences: NONE 30 minutes have elapsed since discharge of first bottle and second bottle should be discharged.
DME___FAIL	MAINT	Consequences: NONE Indicates respective DME receiver has failed.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
DOOR OPEN	MAINT	Consequences: NONE Indicates one or more airplane doors or access hatches are not closed.
DRAIN MAST HEAT	MAINT	Consequences: FWD GALLEY/LAV SINK MAY NOT DRAIN COORDINATE WITH CABIN CREW indicates drain mast heater has failed.
EIS SINGLE SOURCE	NO T/O	Consequences: NO CROSS COCKPIT COMPARE POSSIBLE A single VIA Channel is driving all six displays. Cross comparison is not available.
ELEC COMPT DOOR	NO T/O	Consequences: NONE Indicates the electrical/electronics bay door is not closed and locked.
ELEC FAULT	NO T/O	Consequences: NONE Indicates the electrical system has detected a fault.
ELEVATOR PWR ON		Consequences: NONE Elevator Power Augmentation System (EPAS) has actuated. Verify alert displays during flight control rollout.
EMER LTS DISARM	SW	Consequences: NONE Indicates EMER LT switch is in the OFF or ON position.
EMER POWER ON	NO T/O	Consequences: NONE Indicates emergency power is on and the battery is powering the DC transfer bus and AC/DC emergency busses.
EMER PWR SW OFF	SW	Consequences: NONE Indicates EMER PWR switch is OFF.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
EMER PWR TST FAIL	NO T/O	Consequences: NONE Indicates the emergency electrical power preflight test has failed due to battery voltage less than 25 volts and/or emergency power not on within first 3 seconds of test and/or emergency power remaining on 3 seconds after initiation of test.
ENG___A-ICE DISAG	NO T/O	Consequences: DEPART ICING AREA Engine anti-ice valve is open when commanded off, or closed when commanded on.
ENG___FADEC ALTN	SW	Consequences: NONE Indicates FADEC MODE ALTN mode has been selected. Autothrottle will disconnect with FADEC in ALTN mode.
ENG___FUEL FILTER	MAINT	Consequences: NONE Indicates engine fuel filter is partially clogged and bypass is imminent. Engine fuel system is automatically heated. Fuel contamination from other than ice most likely cause.
ENG___ FUEL PRES	NO T/O	Consequences: NONE Indicates engine inlet fuel pressure is low. Possible engine flameout.
ENG___OIL FILTER	NO T/O	Consequences: NONE Indicates engine oil filter is partially clogged and bypass is imminent.
ENG__SQB___ FAIL	MAINT	Consequences: NONE Indicated engine firex squib caused failure of firex test.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
ENG___ START ABORT	MAINT	Consequences: NONE EEC has detected an abnormal condition (hung start, hot start, no start, locked rotor, engine surge) and automatically aborted start. Start auto abort not available during battery start or inflight starts.
ENG___SURGE	MAINT	Consequences: INCREASE ENGINE BLEED AIR Indicates engine is experiencing an (unrecoverable) surge.
ENG___SYS FAIL	NO T/O	Consequences: NO TAKEOFF Indicates engine is in a “no dispatch” condition.
ENG___SYS FAULT	MAINT	Consequences: NONE Indicates engine is in a “time limited dispatch” condition.
ENGINE VIB HI	MAINT	Consequences: NONE Indicates engine vibration parameters exceed 4.0 units.
FCC___FAIL	MAINT	Consequences: NONE Respective Flight Control Computer (FCC) channel A and B has failed.
FCC___FAULT	MAINT	Consequences: NONE One Flight Control Computer channel has failed. Loss of Dual Land.
F/D G/A ONLY	MAINT	Consequences: NONE Indicates autopilot go-around is not available. If go-around is required, disconnect autopilot.
FIRE AGENT___LO	NO T/O	Consequences: NONE Indicates firex bottle agent (1 or 2) has been discharged.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
FIRE DET APU FAIL	MAINT	Consequences: APU NOT AVAILABLE Indicates both APU fire detection loops are inoperative.
FIRE DET___FAIL	NO T/O	Consequences: NO TAKEOFF Indicates both engine fire detection loops are inoperative.
FIRE L-___ FAULT	MAINT	Consequences: NONE Indicates respective left engine fire detection loop is failed.
FIRE R-___FAULT	MAINT	Consequences: NONE Indicates respective right engine fire detection loop is failed.
FIRE APU___FAULT	MAINT	Consequences: NONE Respective fire detection loop has detected a fault.
FIREX TEST FAIL	NO T/O	Consequences: NONE Indicates one or more discharge cartridges have failed manual test.
FLT REC FAIL	MAINT	Consequences: NONE Indicates Digital Flight Data Recorder or Flight Data Acquisition Unit has failed. Flight recorder is inoperative.
FMS___FAIL	MAINT	Consequences: NONE Indicates the respective flight management function of the VIA has failed. Select off-side FMS function.
FUEL LEVEL LO	NO T/O	Consequences: LAND AT NEAREST SUITABLE AIRPORT Indicates center and left or right main tank has low fuel. Center tank quantity minus latched ballast fuel is equal to or less than 1000 lb/450 kg and either main tank has less than 2500 lb/1150 kg.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
FWD (AFT) AUX PRESS LO (Some Operators)	SW	Consequences: FUEL MAY BE TRAPPED IN AUX TANK Indicates aux tank transfer is commanded, but not occurring.
GALLEY DOOR	MAINT	Consequences: NONE Indicates the forward galley service door is not closed and locked.
GEN APU OFF	SW	Consequences: NONE Indicates APU generator switch is in the OFF position.
GEN___OFF	SW	Consequences: NONE Indicates GEN switch is in the OFF position. Alert also displayed when associated engine fire control handle is pulled.
GPS 1 FAIL GPS 2 FAIL	MAINT	Consequences: NONE GPS function of the MMR #1 has failed. GPS function of the MMR #2 has failed.
GPWS FAIL	MAINT	Consequences: SELECT ANY ND TO WXR Indicates the ground proximity warning system has failed.
GPWS FAULT	MAINT	Consequences: NONE The Ground Proximity Warning System (GPWS) has detected a fault.
GPWS TERR OFF	SW	Consequences: NONE Indicates the enhanced ground proximity system terrain mode is selected OFF.
HYD AUX PUMP FAIL	MAINT	Consequences: NONE Indicates low pressure output from aux hydraulic pump with pump commanded ON.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
HYD AUX PUMP OFF	SW	Consequences: NONE Indicates aux hydraulic pump is not ON with the slats extended and at least one engine on.
HYD___OFF	SW	Consequences: NONE Indicates all hydraulic pumps in system are commanded OFF.
HYD PUMP___FAIL	MAINT	Consequences: NONE Indicates low pressure output from engine hydraulic pump with pump commanded ON.
HYD PUMP___OFF	SW	Consequences: NONE Indicates hydraulic pump is commanded OFF.
HYD TRANS DISAG	MAINT	Consequences: NONE Indicates hydraulic transfer pump is not in commanded position.
HYD TRANS OFF	SW	Consequences: NONE Indicates hydraulic transfer pump is not ON with the slats extended and at least one engine.
ILS___FAIL	MAINT	Consequences: NONE Indicates respective ILS function of the MRR has failed.
IRS BATT FAIL	NO T/O	Consequences: NONE Indicates backup battery for IRS 2 has failed.
IRS BATT LO	NO T/O	Consequences: NONE IRS 2 or IRS Aux battery voltage is below 21 volts.
IRS 2 ON BATT	NO T/O	Consequences: NONE IRS 2 powered by IRS battery. IRS 2 operation beyond 20 minutes cannot be relied on.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
IRS___NO ALIGN	NO T/O	Consequences: NONE Indicates the IRS has failed to complete an alignment.
IRS OFF	SW	Consequences: NONE One or more ADIRU's have been selected OFF in flight.
IRS___NAV FAIL	NO T/O	Consequences: NONE Indicates the respective inertial reference portion of the ADIRU has lost position sense. Select off-side FMS.
LAT FUEL UNBAL	SW	Consequences: BALANCE FUEL AS REQUIRED Indicates left and right main tank fuel quantity differs by at least 1400 lb. Transfer fuel as required.
LAVATORY SMOKE		Consequences: COORDINATE WITH CABIN CREW Smoke has been detected in a lavatory.
LDG ALTITUDE MAN		Consequences: NONE Landing field elevation has been set manually.
MACH TRIM FAIL	MAINT	Consequences: MAINTAIN SPEED BELOW .80 MACH FCC has detected a failure in the mach trim system and deselected the function.
MANUAL G/A ONLY	MAINT	Consequences: NONE Autopilot and flight director guidance for go-around is not available. If go-around is required, disconnect autopilot and fly go-around with raw data.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
NO AUTOLAND	MAINT	Consequences: NONE Autoland function is not available.
OVERWING DOOR	NO T/O	Consequences: NONE Indicates one or more overwing emergency exit doors is not closed and locked.
PACK__FLO DISAG	MAINT	Consequences: NONE Pack has been selected ON, but no flow condition detected after 20 seconds or selected to OFF, but there is still flow and pressure after 10 seconds.
PACK___OFF	SW	Consequences: NONE Pack has been commanded OFF; or alert displays (with MASTER CAUTION) if both packs are off above 4500 feet AGL.
PACK OVRD	SW	Consequences: NONE PACK SHUTDOWN switch is in the OVRD position.
PITOT___FAIL	NO T/O	Consequences: AIRSPEED MAY BE UNRELIABLE Indicates respective pitot probe heater has failed.
PODS A-ICE FAULT	MAINT	Consequences: NONE PODS system has a fault in the wing or tail ice protection system and cannot detect a manifold failure.
PODS FAIL	NO T/O	Consequences: NO TAKEOFF PODS system has failed, and is unable to detect a manifold failure.
PODS FAULT	MAINT	Consequences: NONE One loop or controller channel in the PODS system has failed. Manifold failure detection is still operative.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
PODS TEST FAIL	NO T/O	Consequences: NONE The PODS system test has failed.
PRED WSHEAR FAULT	MAINT	Consequences: SELECT ANY ND TO WXR. The Enhanced Ground Proximity Warning System (EGPWS) has deted a fault in the Predictive windshear mode.
PRED WSHEAR OFF	SW	Consequences: NONE Indicates the predictive windshear function of weather radar is not functioning.
PSC FAULT	MAINT	Consequences: NONE Pneumatic system has detected a fault.
PSEU FAIL	NO T/O	Consequences: NONE Proximity sensor system has failed resulting in the loss of data on gear, door and slat position.
PSEU FAULT	MAINT	Consequences: NONE PSEU has logged an internal fault or detected a failure of a redundant sensor.
RAT PROBE FAIL	NO T/O	Consequences: NONE Indicates ram air temperature probe heat has failed.
REV___DEPLOYED	MAINT	Consequences: NONE Indicates thrust reverser has deployed in flight.
REV___FAULT	MAINT	Consequences: THRUST REVERSER MAY NOT DEPLOY Indicates EEC has detected a thrust reverser abnormal condition that may inhibit its operation.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
RUD PITOT FAIL	NO/TO	Consequences: NONE Indicates rudder limiter pitot probe heater has failed. Possible over/or under restricted rudder.
RUDDER LIM FAULT	MAINT	Consequences: NONE There is a fault in either the primary or secondary rudder limiter system.
RUDDER PWR OFF	SW MAINT	Consequences: NONE Rudder is in the manual mode either due to hydraulic failure, or HYD CONT RUDDER switch selected OFF.
RUDDER RESTRICTED	NO T/O	Consequences: NONE Rudder is restricted more than it should be for the flight conditions.
SECU FAULT	MAINT	Consequences: NONE Spoiler system has detected a fault.
SEL AUX XFER AUTO	SW	Consequences: NONE Center tank is capable of receiving aux tank fuel, but aux tank transfer is not commanded.
SEL CAB PRES MAN	MAINT	Consequences: NONE Both auto cabin pressure controllers have failed and the system must be selected to MANUAL.
SEL CTR PUMPS OFF	SW	Consequences: NONE Indicates center fuel tank is empty of usable fuel.
SEL CTR PUMPS ON	SW	Consequences: NONE Indicates center fuel tank pumps are off with usable fuel in the tank.
SEL___XFER OFF	SW	Consequences: NONE Indicates the aux fuel tank is empty of usable fuel.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
SET LDG ALTITUDE		Consequences: NONE Cabin pressurization system has lost landing field elevation data from the FMS and must be set manually.
SINGLE LAND	MAINT	Consequences: NONE Dual land is not available.
SPEEDBRAKE DISAG	SW	Consequences: RETRACT SPEED BRAKES Speedbrakes are extended and throttles are advanced to a high power setting. The SECU has retracted the speedbrakes. Retract the speedbrake handle.
SPEEDBRAKE/ FLAP	SW	Consequences: RETRACT SPEED BRAKES Speedbrakes are extended with flaps in landing range.
SPOILER FAIL	NO T/O	Consequences: NONE The spoiler system has detected a non-dispatchable fault.
SPOILER FAULT	NO T/O	Consequences: NO TAKEOFF The spoiler system has detected a fault.
SPOILER___FAIL	NO T/O	Consequences: REDUCED ROLL RATE AVAILABLE A pair of spoilers has shut down due to a SECU or actuator failure.
STAB OUT OF TRIM	MAINT	Consequences: POSSIBLE PITCH CHANGE IF A/P DISC Stabilizer is not responding to autopilot trim commands. Possible transient on A/P disconnect.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
STAB TRIM OFF	SW	Consequences: USE ALTERNATE STABILIZER TRIM STABILIZER TRIM switch is selected OFF.
STAIRWAY DOOR FWD	NO T/O	Consequences: NONE Indicates FWD stairway door is not closed and locked.
STALL WARN FAIL	NO T/O	Consequences: NONE Indicates stall warning (stick shaker, SSRS and stick pusher) will not function.
STALL WARN FAULT	NO T/O	Consequences: NONE The stall warning system has lost two channels of stall warnings, and/or one channel of stick pusher.
START AIR PRES LO		Consequences: NONE Pressure in the manifold is insufficient for engine start. Select alternate pneumatic source or increase power for crossbleed start.
STATIC___HEAT	MAINT	Consequences: NONE Indicates static plate heater has failed.
STICK PUSHER FAIL	MAINT	Consequences: NONE Stick pusher has failed in a passive mode.
TERRAIN FAIL	MAINT	Consequences: NONE The Terrain mode has failed in the Enhanced Ground Proximity Warning System (EPGWS).
TERRAIN NOT AVAIL	MAINT	Consequences: NONE The Terrain mode is not available in the Enhanced Ground Proximity Warning System (EGPWS).

ALERT	CODE	CONSEQUENCES/DESCRIPTION
TNK___ __PMP OFF	SW	Consequences: NONE Indicates associated main tank pump switches OFF with respective engine FUEL switch ON.
TNK___ __PUMP LO	MAINT	Consequences: NONE Indicates associated main tank pump is commanded ON, but indicates low pressure.
TNK___PUMPS LO	NO T/O	Consequences: NONE Indicates low fuel pressure output from affected main tank with all respective main tank pumps commanded ON.
TNK___PUMPS OFF	SW	Consequences: NONE Indicates both pumps in tank are commanded OFF.
TR___FAIL	MAINT	Consequences: NONE Indicates transformer-rectifier unit has failed (voltage low).
UNABLE RNP	MAINT	Consequences: NONE FMS required navigational performance not within limits for particular phase of flight.
VIA CONFIG DISAG	NO T/O	Consequences: NO TAKEOFF Configuration of VIA -1 and VIA-2 do not agree.
VIA FAIL	NO T/O	Consequences: FUEL QUANTITY TEST MISCOMPARE Indicates respective VIA computer has failed.
VIA FAULT	MAINT	Consequences: ENG COMPARISON MONITOR INOPERATIVE A VIA has a limited dispatch condition or the engine comparison monitor has failed.

ALERT	CODE	CONSEQUENCES/DESCRIPTION
VIA___ FAULT	MAINT	Consequences: NONE Indicates respective VIA computer has detected an internal fault.
VOR___FAIL	MAINT	Consequences: NONE Indicates respective VOR receiver has failed.
WING ICE DETECTED	NO T/O	Consequences: OVERWING DE-ICING REQUIRED Indicates detection of ice buildup on left or right wing surface.
WING ICE___FAIL	MAINT	Consequences: VISUAL INSPECTION FOR ICE REQUIRED One overwing ice detection system has failed. Visual wing ice inspection required prior to departure.
WSHEAR DET FAIL	MAINT	Consequences: NONE Indicates the reactive windshear detection system has failed.
WSHLD A-ICE OFF	SW	Consequences: NONE Indicates windshield heat has been selected OFF.
YAW DAMP FAIL	MAINT	Consequences: NONE Yaw damp function has failed.

LEVEL 0 ALERTS

ALERT	DESCRIPTION
ACARS MESSAGE	Indicates an incoming ACARS message is being received.
A-ICE ALL ON	Indicates all air foil and engine anti-ice ON.
AIR ISOL OPEN	Indicates pneumatic isolation valve is open.
AIRFOIL A-ICE ON	Indicates air foil anti-ice is selected ON and engine anti-ice is selected OFF.
APU AIR ON	Indicates APU is supplying pneumatic power.
APU AIR/ELEC ON	Indicates APU is supplying pneumatic and electrical power.
APU ELEC ON	Indicates APU is supplying electrical power.
APU ON	Indicates APU is commanded ON and available, but not providing pneumatic or electrical power.
CARGO SMOKE TEST	Indicates cargo smoke detection system test is in progress.
CDU___MENU REQ	Indicates MCDU is selected to a function other than flight management.
CRG SMK TEST PASS	Indicates cargo smoke test passed.
EMER POWER TEST	Indicates emergency power test is in progress.
ENG A-ICE ON	Indicates both engine anti-ice switches are ON, and air foil anti-ice is OFF.
ENG___A-ICE ON	Indicates one engine anti-ice switch is ON, and air foil anti-ice switches are OFF.
ENG IGN OVRD ON	Indicates ignition has been selected to the ON position.

ALERT	DESCRIPTION
ENG START PUMP ON	Indicates the engine start fuel pump is commanded ON.
ENGINE COOL	Indicates engine has cooled sufficiently after landing to be shut down.
EXT POWER AVAIL	Indicates external power is plugged in and available.
EXT POWER ON	Indicates external power is on and powering the tie bus.
FIREX TEST PASS	Indicates manual firex discharge test has passed.
FUEL SYS TEST	Indicates fuel system display is in test mode.
FUEL TEST PASS	Indicates the FUEL SYS TEST button has been pushed and fuel system is in test mode.
FUEL XFEED ON	Indicates fuel crossfeed lever is selected open.
GPWS FLAP OVRD	Indicates GPWS switch is in the FLAP OVRD position.
ICE DETECT TEST	Indicates the primary ice detection system test is in progress.
IRS IN ALIGN	Indicates one or more of the inertial reference units are in align mode.
NO SMOKING	Indicates the NO SMOKING lights have been commanded ON.
PACKS ALL OFF	Indicates a packs off takeoff has been selected and the packs have automatically switched off; or packs have been switched off due to engine failure on takeoff.
PACKS HIGH FLOW	Indicates the pack FLOW switch has been selected to the HIGH flow position.
PARK BRAKE ON	On ground, indicates the parking brake is set.

ALERT	DESCRIPTION
PODS TEST PASS	Indicates the PODS preflight test is successful (accomplished with FIRE TEST switch).
PRED WSHEAR OFF	Indicates the predictive windshear function of weather radar is not functioning.
SEAT BELTS	Indicates the FASTEN SEAT BELTS signs have been turned on.
SPEEDBRAKE	Indicates the speed brakes are extended.
SPOILER SYS TEST	Indicates spoiler system test is in progress.
TAIL A-ICE ON	Indicates tail anti-ice is selected ON and wing and engine anti-ice is OFF; or wing and tail are selected ON and system is in alternating mode.
TERRAIN OVRD	Terrain mode is off in the Enhanced Ground Proximity Warning System (EGPWS).
VHF-3 VOICE	Indicates VHF-3 receiver is in the voice rather than the data mode.
WING A-ICE ON	Indicates wing anti-ice is selected ON and tail and engine anti-ice is OFF; or wing and tail are selected ON and system is in alternating.
WING ICE DET PASS	Indicates upper surface ice detection system test has passed successfully.
WSHLD ANTI-FOG ON	Indicates windshield ANTI-FOG has been selected ON.

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NO TAKEOFF LEVEL 1 ALERTS

Do not take off with any of the following Level 1 alerts displayed. Call maintenance for corrective action. If in flight and not restricted by the Consequence message, continue to destination and make appropriate log book entry.

ACCESS COMPT DOOR
AFT BULKHEAD DOOR
AILERON DISC
AIR ISOL DISAG
AOA HEAT___FAIL
BATT CHARGER FAIL
BATT CHARGING
BATT DISCHARGING
BRAKE PRESS LO
BUS AC GS OFF
BUS AC___OFF
BUS DC___OFF
BUS TIE___LOCKOUT
CAB PRES MAN FAIL
CABIN DOOR
CARGO AGENT___LO
CARGO DOOR AFT
CARGO DOOR FWD
CARGO SMOKE___ FAIL
CAWS FAIL
EIS SINGLE SOURCE
ELEC COMPT DOOR
ELEC FAULT
EMER POWER ON
EMER PWR TST FAIL
ENG___A-ICE DISAG
ENG___FUEL PRESS

ENG___OIL FILTER
ENG___SYS FAIL
FIRE AGENT___LO
FIRE DET___FAIL
FIREX TEST FAIL
FUEL LEVEL LO
IRS BATT LO
IRS BATT FAIL
IRS 2 ON BAT
IRS___NAV FAIL
IRS___NO ALIGN
OVERWING DOOR
PITOT___FAIL
PODS FAIL
PODS TEST FAIL
PSEU FAIL
RAT PROBE FAIL
RUD PITOT FAIL
RUDDER RESTRICTED
SPOILER FAIL
SPOILER___FAIL
SPOILER FAULT
STAIRWAY DOOR FWD
STALL WARN FAIL
STALL WARN FAULT
TANK___PUMPS LO
VIA CONFIG DISAG
VIA FAIL
WING ICE DETECTED

[END]

TABLE OF CONTENTS

AIRCRAFT SYSTEMS

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ABBREVIATIONS GLOSSARY

A

ABS	Auto Brake System
AC	Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACP	Audio Control Panel
ADF	Automatic Direction Finder
ADIRU	Air Data Inertial Reference Unit
ADL	Airborne Data Loader
ADM	Air Data Module
ADS	Automatic Dependent Surveillance
AFS	Auto Flight System
A-ICE	Anti-Ice
AIL	Aileronl
ALN	Align
ALT	Altitude; Alternate
ALTN	Alternate
AND	Airplane Nose Down
ANNUN	Annunciator
ANP	Actual Navigation Performance
ANT	Antenna
ANU	Airplane Nose Up
AOC	Aeronautical Operational Communications
AOM	Aircraft Operations Manual
AP	Autopilot
APCDU	APU Power Conversion and Distribution Units
APU	Auxiliary Power Unit
AREU	Audio Remote Electronics Unit
ARPT	Airport
ARR	Arrival
A/S	Airspeed
AT or A/T	Autothrottle
ATC	Air Traffic Control
ATR	Automatic Thrust Restoration
ATS	Autothrottle System
ATT	Attitude, Attendant
ATTND	Attendant
AUTO	Automatic
AUX	Auxiliary
AVAIL	Available

B

BARO	Barometric
BATT	Battery
BLS	Bezel Light Sensor
BRT	Bright; Brightness

C

C	Celsius, Center
CAP	Capture
CAPT	Captain
CAWS	Central Aural Warning System
CG	Center of Gravity
CH, CHAN	Channel
CHR	Chronograph
CKPT	Cockpit
CL	Closed
CLB	Climb
CLMP	Clamp
CLR	Clear
CMD	Command
CMP, CMPTR	Computer
COMM	Communication
CONFIG	Configuration
CONT	Control; Continuous
CONSEQ	Consequence
CPA	Closest Point of Approach
C/PDLC	Controller/Pilot Datalink Communications
CRS	Course
CRZ	Cruise
CTR	Center; Crosstie Relay
CVR	Cockpit Voice Recorder

D

DC	Direct Current
D/D	Driftdown
DECR	Decrease
DEG	Degree
DEP	Departure
DES, DESC	Descent
DEST	Destination
DET	Detector; Detection, Detect
DFDAU	Digital Flight Data Acquisition Unit
DFDR	Digital Flight Data Recorder
DH	Decision Height

DIR INTC	Direct Intercept
DISAG	Disagree
DME	Distance Measuring Equipment
DTG	Distance To Go
DTW	Distance To Waypoint
DU	Display Unit

E

EAD	Engine and Alert Display
ECON	Economy
ECP	Electronic Control Panel
ECU	Electronic Control Unit
E/D	End Of Descent
E/E	Electrical/Electronic
EEC	Electronic Engine Control
EGT	Exhaust Gas Temperature
EIS	Electronic Instrument System
ELEC	Electric; Electrical
EMER	Emergency
ENG	Engine
ENG OUT D/D	Engine Out Driftdown
E/O	Engine Out
EPCU	Electrical Power Control Unit
EPR	Engine Pressure Ratio
ET	Elapsed Time
ETA	Estimated Time Of Arrival
ETD	Estimated Time Of Departure
ETE	Estimated Time En Route
EXEC	Execute
EXT	External; Extend

F

F	Fahrenheit
FADEC	Full-authority Digital Electronic Control
FANS	Future Air Navigation System
FCC	Flight Control Computer
FCOM	Flight Crew Operating Manual
FCP	Flight Control Panel
FD	Flight Director
FF	Final Approach Fix
F-F	Fuel Flow
FGS	Flight Guidance System
FL	Flight Level
FLAR	Flare
FLEX TO	Flex Takeoff

FLO	Flow
FLR	Flare
FLT	Flight
FLT DIR	Flight Director
FLT RCDR	Flight Recorder
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMS	Flight Management System
FMU	Fuel Metering Unit
F/O	First Officer
FOM	Flight Operations Manual
FPA	Flight Path Angle
FPM	Feet/Minute
FQS	Fuel Quantity System
FREQ	Frequency
FT	Feet
FWD	Forward

G

G	Acceleration Of Gravity, Generator
GA, G/A	Go-Around
GEN	Generator
GMT	Greenwich Mean Time
GNSSU	Global Navigation System Sensor Units
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GS	Ground Speed; Ground Service
GS or G/S	Glideslope
GW	Gross Weight

H

HDG	Heading
HF	High Frequency
HI	High
HLD	Hold
HP	High Pressure
HYD	Hydraulic

I

I/O	Input/Output
IAS	Indicated Airspeed
IDENT	Identifier; Identification
IDG	Integrated Drive Generator
ILS	Instrument Landing System
INCR	Increase

IN HG	Inches of Mercury
INIT	Initialization
INOP	Inoperative
INSTR	Instrument
INT	Intercom; Intermittent
INTC	Intercept
INTPH	Interphone
IRS	Internal Reference System
IRU	Internal Reference Unit
ISA	International Standard Atmosphere
ISOL	Isolation

K

KIAS	Knots Indicated Airspeed

L

L	Left
LAND	Landing
LAT	Lateral; Latitude
LBS	Pounds
LCDU	Liquid-Crystal Display Units
LDG	Landing
LED	Light Emitting Diode
LIM	Limit
LNAV	Lateral Navigation
LND	Land
LO	Low
LOC	Localizer
LONG	Longitude
LP	Low Pressure
LRC	Long Range Cruise
LSK	Line Select Key
LT(S)	Light(s)
LWD	Left Wing Down

M

M	Mach, Meters
MAG	Magnetic
MAINT	Maintenance
MAN	Manual, Maneuvering
MAX	Maximum
MAX ALT	Maximum Engine Out Altitude
MAX CLB	Maximum Climb
MAX DES	Maximum Descent
MAX END	Maximum Endurance

MB	Millibars
MCDU	Multipurpose Control and Display Unit
MCL	Maximum Climb (Engine Rating)
MCT	Max Continuous Thrust (Engine Rating)
MECH	Mechanic
MED	Medium
MIC	Microphone
MIN	Minimum; Minute
MISC	Miscellaneous
MKR	Marker
MLG	Main Landing Gear
MLW	Maximum Landing Weight
MMEL	Master Minimum Equipment List
MMO	Maximum Operating Mach
MOM	Momentary
MSG	Message
MSP	Mode Select Panel
MTES	Maintenance Test Enable Switch
MTOGW	Maximum Takeoff Gross Weight
MU	Management Unit

N

N/A	Not Available
NACL	Nacelle
N1	Engine Low Pressure Rotor (RPM)
N2	Engine High Pressure Rotor RPM
NAV	Navigation
ND	Navigation Display
NDB	Non-Directional Beacon
NL	Nose Left
NLG	Nose Landing Gear
NR	Nose Right
NORM	Normal

O

OFST	Offset
OP	Open
OVHD	Overhead
OVRD	Override
OXY	Oxygen

P

PA	Passenger Address
PBD	Place/ Bearing/ Distance
PBE	Protective Breathing Equipment

PED	Pedestal
PERF PEN	Performance Penalty
PFD	Primary Flight Display
PLAN	Plan Mode
PLI	Pitch Limit Indicator
PMP	Pump
PNEU	Pneumatic
PNL	Panel
POS	Position
PPH	Pounds Per Hour
PRAM	Prerecorded Announcement Machine
PRES, PRESS	Pressure
PROF	Profile
PROG	Progress
PROX	Proximity
PSEU	Proximity Switch Electronics Unit
PSI	Pounds Per Square Inch
PSU	Passenger Service Utilities
PTT	Push To Talk
PTU	Power Transfer Unit
PWR	Power
PWS	Predictive Windshear

Q

QFE	Field Elevation Pressure
QNH	Sea Level Pressure
QTY	Quantity

R

R	Right
RA	Radio Altitude, Resolution Advisory
RAT	Ram Air Temperature
RDR	Rudder
REF	Reference
RET	Retract
RETD	Retard
REV	Reverser
RHM	Rudder Hook Monitor
RLS	Remote Light Sensor
RNAV	Area Navigation
RNP	Required Navigation Performance
RPM	Revolutions Per Minute
RSL	Rudder Stop Limiter
RTE	Route
RTO	Rejected Takeoff

RUD	Rudder
RWD	Right Wing Down
RWY	Runway

S

SAT	Static Air Temperature
SATCOM	Satellite Communication System
SCP	System Control Panel
S/C	Step Climb
S/D	Step Descent
SD	System Display
SDP	System Display Panel
SEL	Select; Selector; Selected
SELCAL	Selective Calling
SENS	Sensitivity
SID	Standard Instrument Departure
SMOK	Smoking
SPD BRK	Speed Brake
SPD	Speed
STAB	Stabilizer; Stabilization
STAR	Standard Terminal Arrival Route
STBY	Standby
STD	Standard
SW	Switch
SYNC	Synchronizer
SYS	System

T

TA	Traffic Advisory
TAKOFF	Takeoff
TAS	True Air Speed
TAT	Total Air Temperature
TBD	To Be Determined
TCAS	Traffic Alert Collision Avoidance System
TD	Traffic Display
TEMP	Temperature
TFR	Transfer
TGT	Turbine Gas Temperature
THNDSTRM	Thunderstorm
THROT	Throttle
TO, T/O	Takeoff
TOC	Top Of Climb
TOD	Top Of Descent
TO FLEX	Takeoff Flexible Derate

TOGA	Takeoff and Go-Around
TOGW	Takeoff Gross Weight
TR	Transformer Rectifier
TRANS	Transition; Transfer
TRFC	Traffic
TRK	Track
TRU	True
TURB	Turbulence

U

U/L	Unlocked
UNBAL	Unbalanced

V

Vapp	Approach Speed
VDC	Volts Direct Current
VERT	Vertical
Vfe	Flap Extend Speed
Vfr	Flap Retract Speed
Vge	Gear Entend Speed
Vgr	Gear Retract Speed
VHF	Very High Frequency
VIA	Versatile Integrated Avionics
VIB	Vibration
VLV	Valve
Vmax	FMC Calculated Max Operating Speed
Vmin	FMC Calculated Min Operating Speed
Vmo	Maximum Operating Speed
VNAV	Vertical Navigation
VOL	Volume
VOR	VHF Omnidirectional Range
Vref	Reference Approach Speed
Vs	Stall Speed
Vse	Slat Extend Speed
Vso	Clean Stall Speed
Vsr	Slat Retract Speed
Vss	Stickshaker Speed
V/S	Vertical Speed
VSI	Vertical Speed Indicator
V1	Critical Engine Failure Speed; Decision Speed
V2	Takeoff Safety Speed; Climbout Speed
V3	Final Segment Climb Speed

W

WAGS	Windshear Alert Guidance System
WARN	Warning
WINDSHLD	Windshield
WINDSHR, WND-SHR	Windshear
WOW	Weight On Wheel
WPT	Waypoint
W/S	Windshear
WSC	Windshear Computer
WT	Weight
WX, WXR	Weather Radar
WXBRT	Weather Radar Brightness
WX+T	Weather and Turbulence

X

X FEED	Crossfeed
XFER, XFR	Transfer
XPDR	Transponder

Z

ZFW	Zero Fuel Weight
ZFWCG	Zero Fuel Weight Center of Gravity

TABLE OF CONTENTS

AIRCRAFT GENERAL

INTRODUCTION

This chapter describes general airplane information and specific information for the following:

- Cockpit.
- Cabin.
- Passenger forward entrance and service doors.
- Passenger aft exit door.
- Lighting systems.
- Alerting system.

The 717 airplane is powered by two aft-mounted turbofan engines. Minimum crew required is two pilots. Separate seating is provided for a cockpit observer and up to four cabin attendants.

The fuselage consists of nose, center, and tail sections. In addition to the cockpit and the cabin, the fuselage contains main/nose gear wheel wells, forward and aft cargo compartments, and compartments for accessories/electronics.

The tail consists of a vertical stabilizer, a horizontal stabilizer, two elevators, and a rudder.

The detachable tail cone may be jettisoned on the ground for emergency exit. A door, mounted in the lower forward portion of the tail cone, provides external access to the aft accessory compartment.

COCKPIT

The pilot seats are fully adjustable in fore-and-aft, up-and-down directions, and reclines with positive locking in any position. A non-adjustable seat is provided for a flight observer.

To aid each pilot in attaining a precise seat adjustment, an alignment device is provided under the glareshield on each side of the instrument panel. To properly adjust the seat, each pilot must look across the cockpit to the alignment target. When the seat is properly adjusted, the pilot should see a white dot centered in the right eye target locator.

The cockpit contains four different types of windows: a center and two side windshields; a clearview and an aft window on either side; and two upper (eyebrow) windows immediately above the clearview windows.

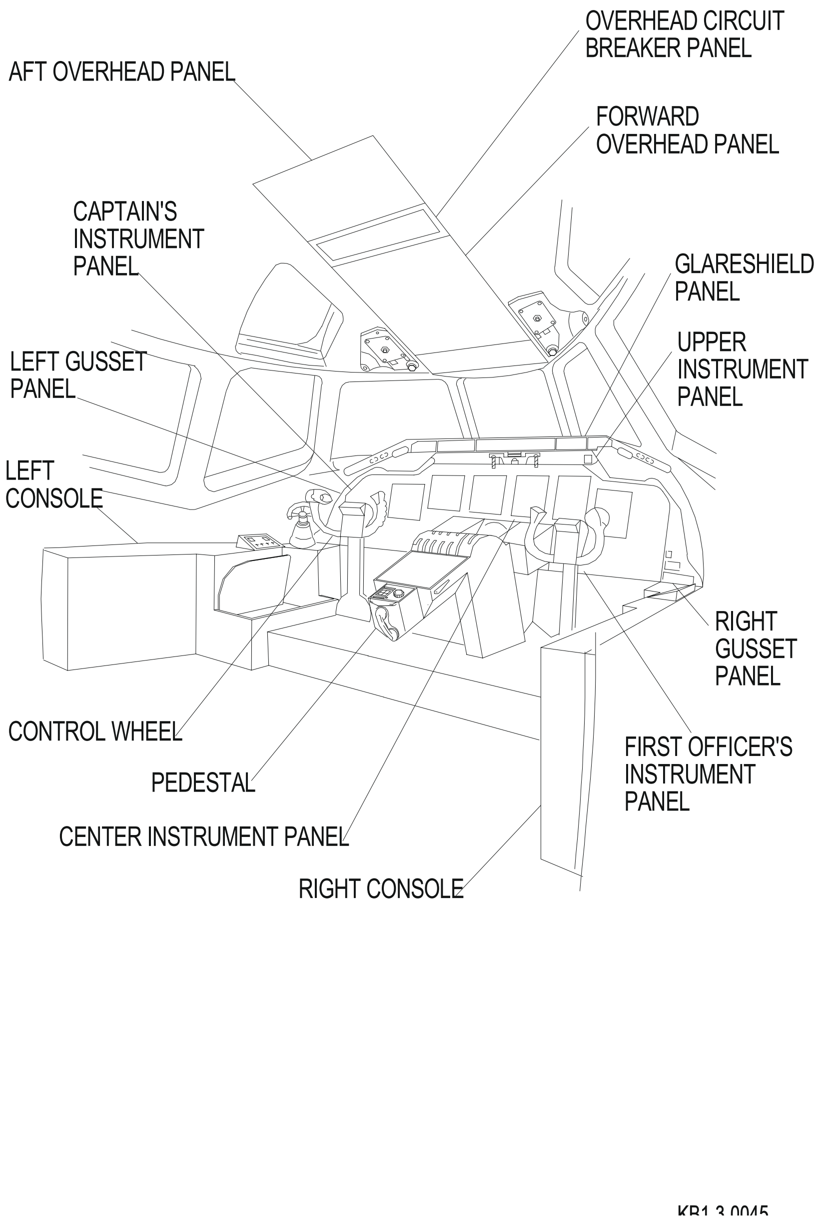
The windshields are electrically heated for anti-icing, anti-fogging and bird impact resistance.

The clearview windows can be opened when the cockpit is not pressurized. They also provide an emergency exit using the escape lines stowed directly above them. These windows are electrically heated for anti-fogging, but not for anti-icing. The eyebrow windows are electrically heated for anti-fogging. The aft windows are not heated.

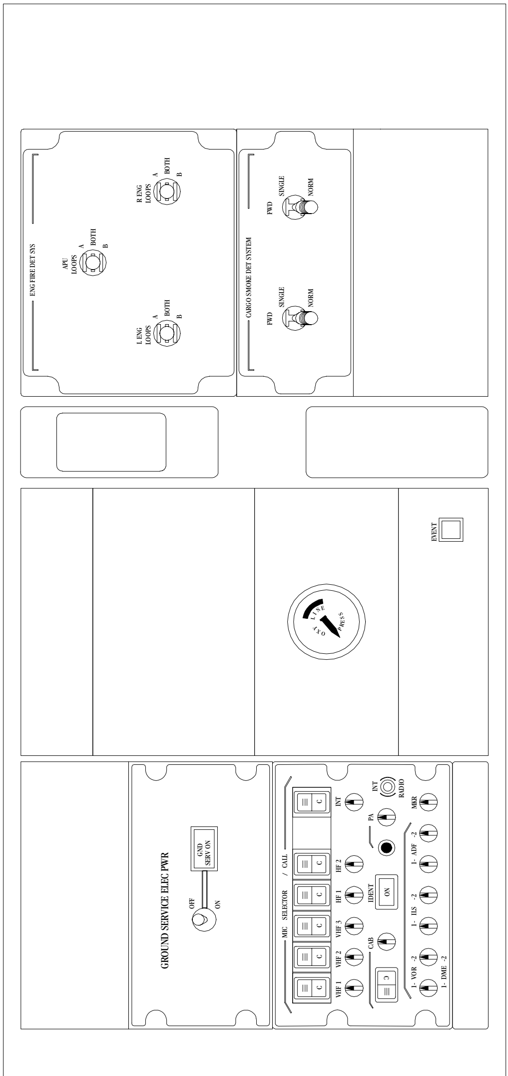
The cockpit door can be electrically locked/unlocked with the CKPT DOOR button on the forward overhead panel. In the event of lock malfunction or power loss, the door may be opened mechanically from the cockpit/ cabin.

A fire extinguisher and fire axe are provided in the cockpit.

COCKPIT ARRANGEMENT



AFT OVERHEAD PANEL



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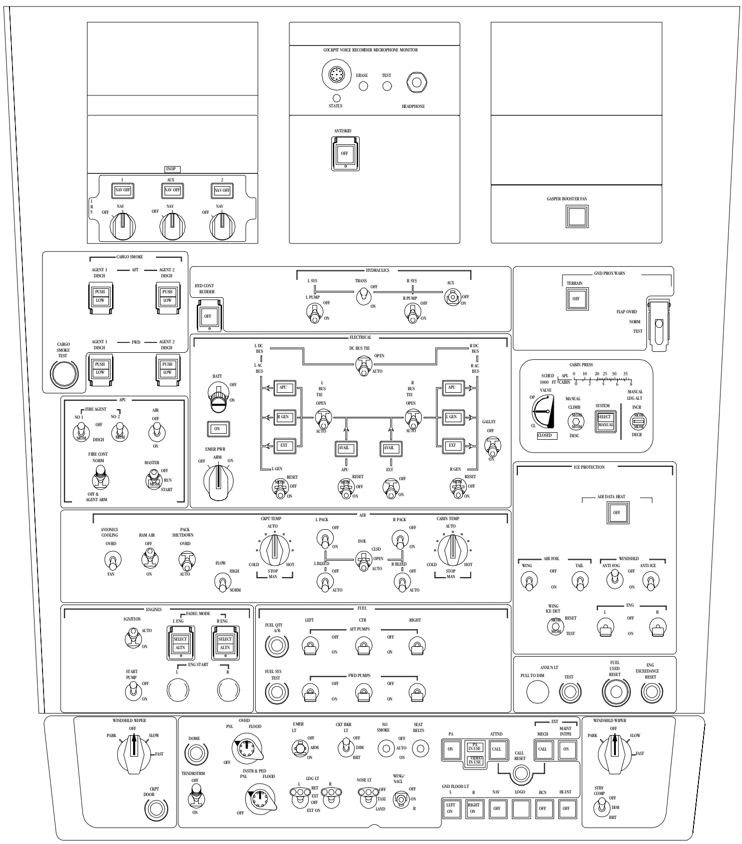
FORWARD OVERHEAD PANEL



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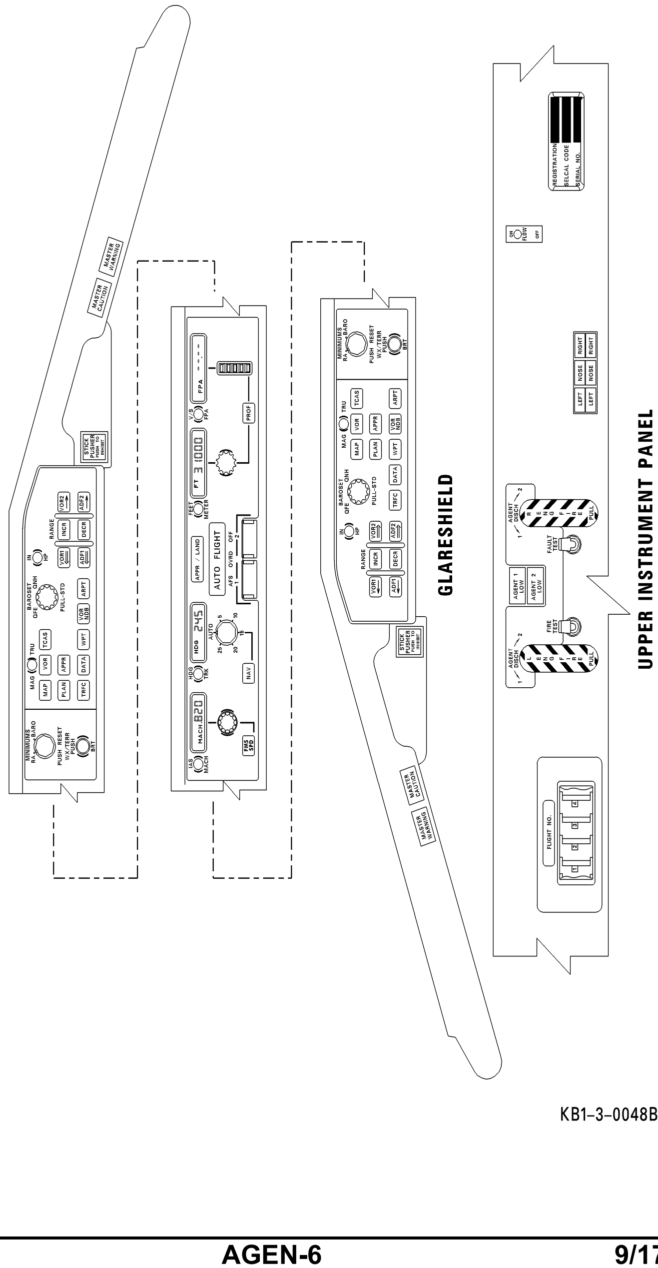
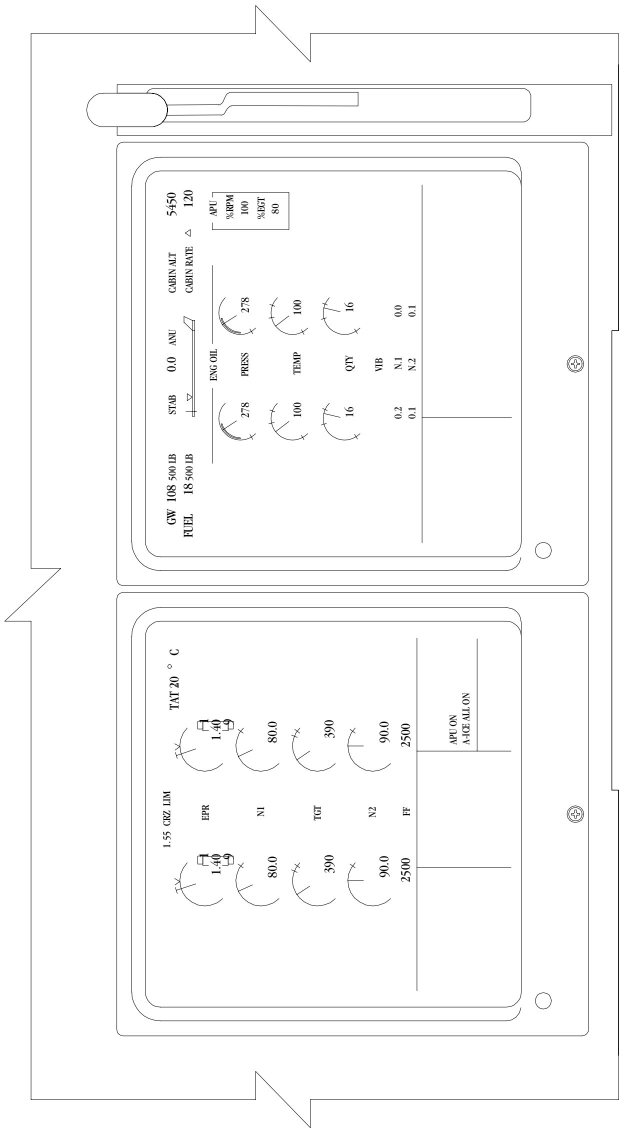
GLARESHIELD & UPPER INSTRUMENT PANEL



CENTER INSTRUMENT PANEL



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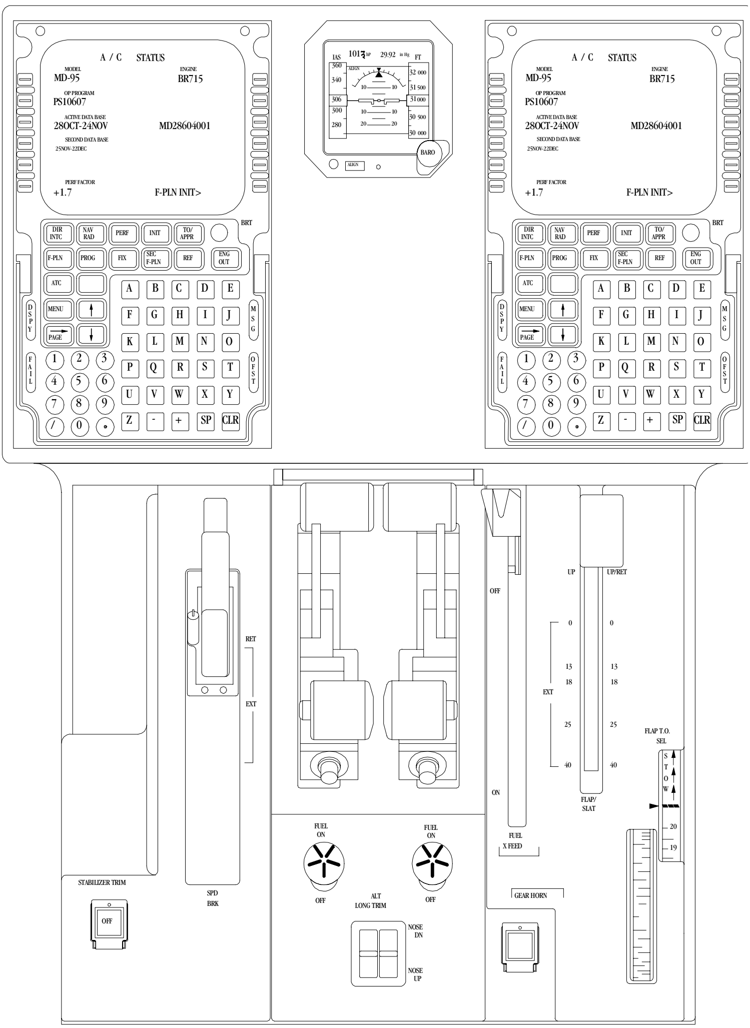
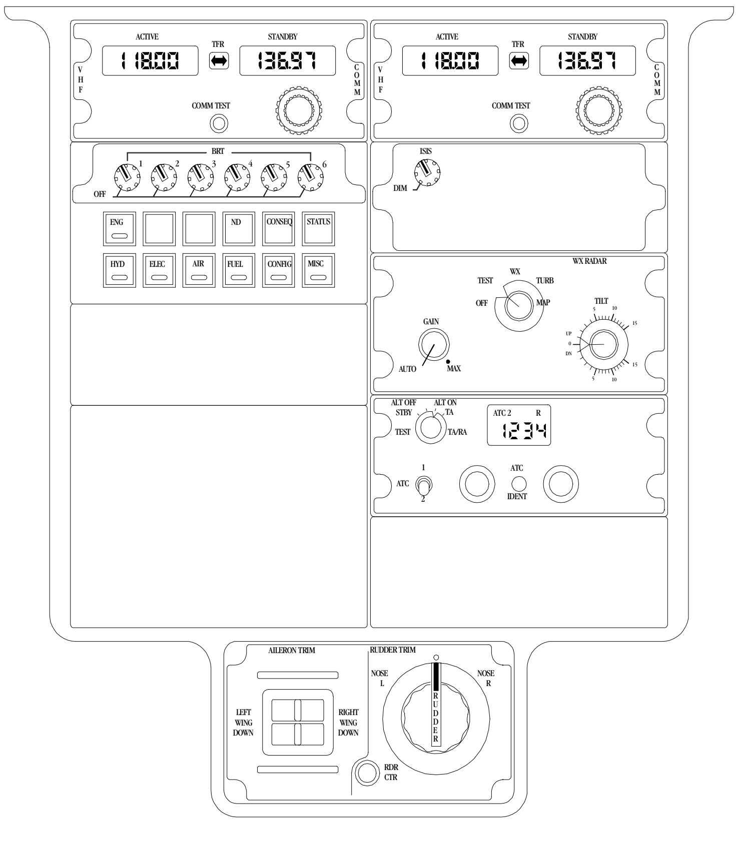
FORWARD PEDESTAL



AFT PEDESTAL



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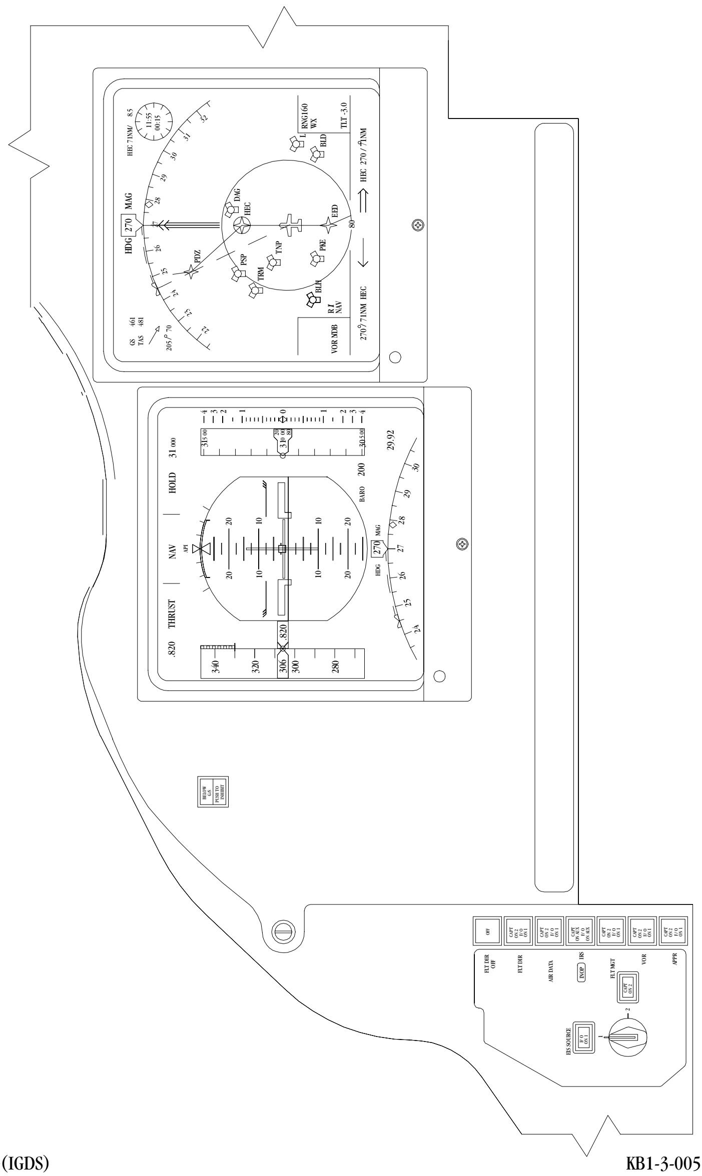
CAPTAIN'S INSTRUMENT PANEL



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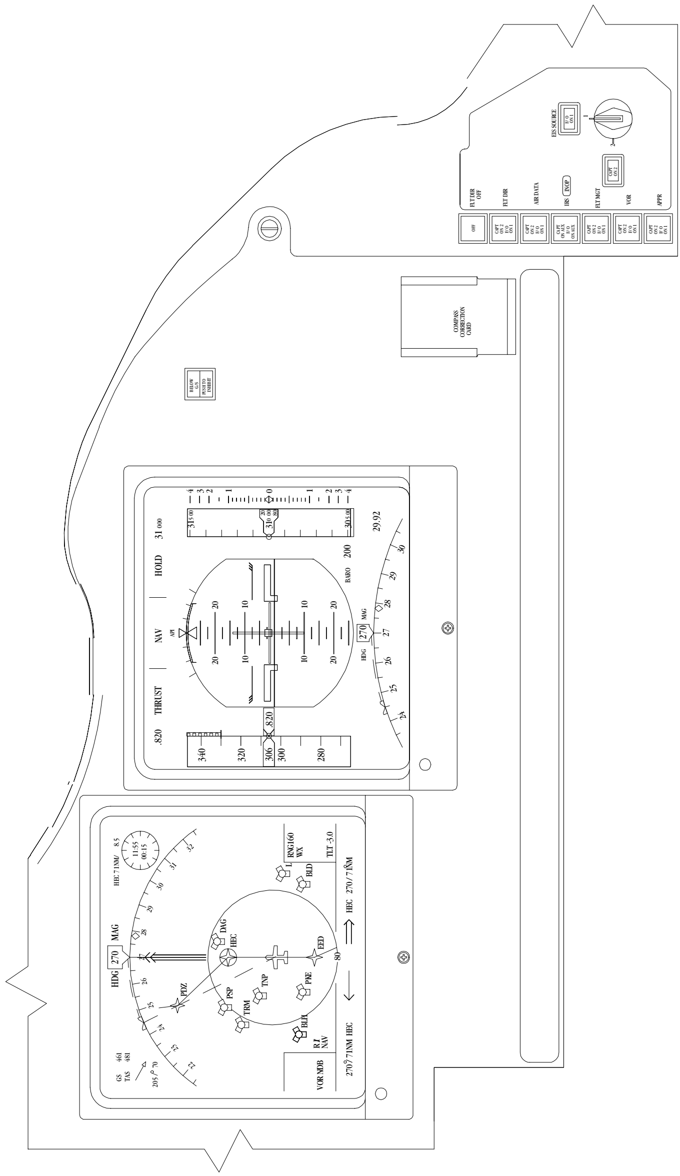
FIRST OFFICER'S INSTRUMENT PANEL



CABIN

Two cabin attendant's stations with control panel and oxygen masks are provided for four cabin attendants. Two cabin attendant's seats are located forward, at the left of the cockpit door, and two are located aft at the aft exit door.

Passenger Service Utilities (PSU), consisting of reading lights, cold air outlets, attendant call buttons, and oxygen compartments, are grouped on panels mounted on the overhead stowage rack lower surface.

All passenger seat backs, except on the outboard seats forward of each overwing exit, are adjustable in the recline position and can be forced to fold down flush with the seat cushions.

All armrests, except the ones mounted next to the overwing exit doors, may be folded up flush with the seat back. The seat bottom cushions can be used as flotation gear.

Three galley units are installed in the cabin. Galleys G1 and G2 are located forward on the right side of the cabin adjacent to the forward service door. Galley G3 is located forward on the left side of the cabin.

The vacuum waste status panel has a SYSTEM INOP switch/light. The vacuum waste status panel is located on the attendant panel at the forward attendant station. The light comes on when the tank is full, the two ultrasonic level sensors fail, or a complete logic control module failure occurs. The SYSTEM INOP switch can start a built-in-test.

PASSENGER FORWARD ENTRANCE AND SERVICE DOORS

The passenger forward entrance door is located on the left side of the fuselage, and the service door is located on the right side. Either door can be opened from either inside or outside of the airplane. A viewing window and evacuation slide are installed on each door.

AFT EXIT DOOR

The passenger aft exit door provides access to the aft accessory compartment and tailcone emergency exit. The door is mounted on the aft pressure bulkhead and hinged on the right side. A viewing window located in the door handle recess allows inspection of the exit way on the aft side of the door. The aft cabin attendant's seat is attached to the door and automatically folds into a recess in the door when not in use.

POTABLE WATER SYSTEM

The aircraft has a pressurized potable water system. The system supplies water to galley 1 and the lavatories. The aircraft pneumatic system pressurizes the water system for distribution. The system can be pressurized for ground maintenance at the water service panel. The water system has a quantity pre-select function with automatic shutoff for servicing.

The potable water system has a 47 gallon water supply tank with a preset fill capacity of 30 gallons for usual operation. The tank is in the fuselage right tunnel, aft of the forward cargo door.

The water service panel is on the lower left side of the fuselage, opposite the water supply tank. The service panel has the controls and indications necessary for servicing. During servicing operations, lights on the service panel show valve position and the water level in the water supply tank.

A two-channel logic control module (LCM) monitors the vacuum waste toilet system. Indicator lights, on the front of the module, show system status. The LCM has built-in-test capability to record failed system components. The LCM stops toilet operation and makes the SYSTEM INOP light come on if any of the following conditions occur:

A full waste tank assembly

Two ultrasonic level sensors fail

A failure of the two channels of the LCM.

LAVATORIES

A toilet assembly is in each lavatory. The toilet assembly is installed behind a removable shroud. It is a self-contained line replaceable unit with electrical and plumbing connections.

The vacuum blower supplies system differential pressure when the airplane is on the ground or the airplane altitude is less than 16,000 ft The blower control relay energizes with the following conditions:

- Altitude switch senses as altitude less than 16,000 ft.
- Service panel door switch senses the door is in a closed position
- Thermostats, in the vacuum blower, do not sense a blower motor overtemperature.

A manual override handle is on the bottom and front of the toilet assembly. The manual override handle lets you close the flush valve manually if the motor does not close the valve electrically.

The rinse water valve is behind the toilet assembly. The rinse water valve is the interface with the potable water system. The FCU supplies signals to operate a solenoid in the rinse water valve, When the solenoid energizes, the rinse valve opens for 0.7 seconds. When the valve is open, 6 to 8 ounces of water flow from the rinse water valve to the rinse ring.

COCKPIT LIGHTING

Cockpit dome lights provide area lighting and are controlled by the DOME switch on the overhead panel.

Floodlights illuminate the overhead, glareshield, pedestal, and instrument panels. The light intensity can be adjusted using the INSTR & PED PNL-FLOOD and OVHD PNL-FLOOD knobs on the overhead panel.

A THUNDRSTRM switch overrides the individual lighting controls and illuminates all floodlights to maximum intensity.

In the event of complete loss of normal electrical power, emergency lighting is automatically provided.

Additional cockpit lighting consists of floor lights, map lights, briefcase lights, circuit breaker lights, standby compass light, and chart holder lights.

CABIN LIGHTING

Cabin lighting consists of ceiling and sidewall lights, aisle drop ceiling lights, door and entrance lights, aft passenger stairway lights (optional), and other miscellaneous lights.

The ceiling and sidewall fluorescent lights provide indirect lighting for the ceiling and sidewall respectively. A four-position rotary switch controls illumination levels of sidewall lights. A five-position rotary switch controls illumination levels of ceiling lights and handrail electroluminescent lighting. These switches are located on the forward attendant's panel.

The ceiling and sidewall fluorescent lights will illuminate full bright automatically if the cabin altitude exceeds 14,150 feet regardless of the cabin attendant's control panel switch position.

Aisle drop ceiling lights are located in the forward and aft cabin. The fluorescent lights are controlled by switches on the forward cabin attendant's control panels.

Forward passenger entry door incandescent light, located at the entrance area, is controlled by a switch on the forward cabin attendant's control panel.

Cabin emergency lights, located in the ceiling, will illuminate automatically if an interruption/loss of normal power occurs.

PASSENGER INFORMATION SIGNS

Illuminated signs located throughout the cabin provide instructions and/or information for the passengers and cabin attendants.

The NO SMOKING and FASTEN SEAT BELTS signs are controlled by the NO SMOKE and SEAT BELTS switches located on the forward overhead panel. Both signs will illuminate if cabin altitude exceeds 10,000 feet regardless of control switch position.

The RETURN TO CABIN signs in the lavatories will illuminate or extinguish when the FASTEN SEAT BELTS signs are turned ON or OFF.

The words FORWARD LAVATORY and AFT LAVATORIES of the FORWARD LAVATORY OCCUPIED and AFT LAVATORIES OCCUPIED signs are illuminated at all times. The word OCCUPIED illuminates when the forward lavatory or both aft lavatory doors associated with the applicable sign are locked.

EXTERIOR LIGHTING

Exterior lights consist of wing and nacelle floodlights, forward and aft position and strobe lights, ground floodlights, anti-collision lights, logo light, and landing and taxi lights.

The wing and nacelle floodlights are located in each side of the fuselage to assist in visually checking the engine nacelle and wing leading edge for icing conditions. The lights can be used for ground servicing, fueling, and taxiing.

The wingtip position and strobe lights include forward navigation lights consisting of a red light on the left wingtip and a green light on the right wingtip. A white strobe light is also installed in each wingtip adjacent to the forward position lights. A clear wingtip lens fairing covers each forward position/strobe light. A combination aft white position light and white strobe light is installed in the trailing edge of each wingtip. Strobe lights will only illuminate in flight.

The ground floodlights provide lighting for ground service. They also aid side and forward visibility while taxiing.

Anti-collision lights are located on the upper and lower fuselage surfaces.

The landing and taxi lights consist of the nose gear landing and taxi lights and the wing landing lights. Two sealed-beam, fixed-position, combination landing and taxi lights are located on the nose gear assembly. The lights will illuminate only when the landing gear control handle is in the down position. One sealed-beam retractable landing light is installed on the lower surface of each wingtip. Each light assembly is enclosed in a housing and contains a motor to retract and extend the light.

CARGO AND SERVICE COMPARTMENT LIGHTING

The cargo and service compartment lights are installed in various compartments and accessory areas to facilitate passenger and cargo loading, area inspection, and servicing. Control switches are installed in the compartments adjacent to the access door. Compartment light extinguishes when the forward or aft cargo door is closed.

The gear wheel well and forward accessory compartment lights are controlled by a switch on the external power receptacle panel. Electrical/electronics compartment lights are controlled by a switch near the access door.

Tail section area and aft accessory compartment service lights are operated by switch located adjacent to the aft accessory compartment access door.

ALERTING SYSTEM

The alerting system provides aural, visual, and/or tactile indications to warn of potentially unsafe operating conditions or airplane configurations and system malfunctions. Indications are generated by a Central Aural Warning System (CAWS), EIS alerting system, stick shakers, or a Enhanced Ground Proximity Warning System (EGPWS). Refer to Flight Controls for description of stick shakers and Instrumentation and Navigation chapter for EGPWS.

CENTRAL AURAL WARNING SYSTEM (CAWS)

The aural warnings consist of tones such as horns, chimes, and bells accompanied with voice messages (vocal warnings) for selected warnings. Each voice message is preceded by its associated tone warning.

WARNINGS - AURAL/VISUAL/CONDITION

Engine Fire

AURAL WARNINGS - Bell followed by voice “FIRE LEFT ENGINE” or “FIRE RIGHT ENGINE”.

VISUAL - L/R ENG FIRE handle(s); MASTER WARNING lights, and associated FUEL switch light.

CONDITION - Fire or overheat in engine nacelle.

APU Fire

AURAL WARNINGS - Horn followed by voice “APU FIRE”. Automatically cancelled after 3 cycles.

VISUAL - MASTER WARNING lights and APU FIRE light on external APU ground control panel.

CONDITION - Fire or overheat in APU.

Stall Warning

AURAL WARNINGS - Klaxon followed by voice “STALL”.

VISUAL - STALL indications on PFD.

CONDITION - Angle of attack approaching stall condition for flap/slat configuration.

Landing Gear

AURAL WARNINGS - Horn followed by voice “LANDING GEAR”.

VISUAL - Red light for any gear not down and locked.

CONDITION - Gear not down and locked and the following:

Flaps extended in the landing range, or

Throttles retarded with airspeed less than 210 knots, altitude below 1,200 feet and flaps not in landing range.

Altitude Alert

AURAL WARNINGS - C-chord followed by voice “ALTITUDE”.

VISUAL - PFD altitude box turns amber or flashes.

CONDITION - Deviating or approaching selected altitude.

Spoilers/Flaps Extended

AURAL WARNINGS - Horn followed by voice “SPEED BRAKE”.

VISUAL - SPD BRK/FLAP alert on EAD.

CONDITION - Speedbrakes are extended with the flaps in the landing range.

Cabin Altitude

AURAL WARNINGS - Horn followed by voice: “CABIN ALTITUDE”.

VISUAL - MASTER WARNING lights and CABIN ALTITUDE alert on EAD.

CONDITION - Cabin altitude is greater than 10,000 feet.

Overspeed

AURAL WARNINGS - Clacker followed by voice: “OVERSPEED” or “SLAT OVERSPEED”.

VISUAL - Airspeed tape on PFD amber or red.

CONDITION -

Overspeed: VMO or MMO exceeded (red).

Slat Overspeed: Over 280 knots with slats extended (amber).

Autopilot

AURAL WARNINGS - Warbler followed by voice:”AUTOPILOT”.

VISUAL - Red flashing box on FMA.

CONDITION - Autopilot disconnected.

Horizontal Stabilizer In Motion

AURAL WARNINGS - Horn followed by voice: “STABILIZER MOTION”.

VISUAL - N/A.

CONDITION - Horizontal stabilizer in motion for more than 1 second.

Takeoff Warning

AURAL WARNINGS - Horn followed by one of the following voices: “BRAKES”, “FLAP”, “SLAT”, “SPOILERS”, or “STABILIZER”, or “RUDDER TRIM”.

VISUAL - Associated red boxed item on EAD Essential Items Checklist.

CONDITION - Airplane on the ground, both throttles advanced and any of the following:

Brakes: Parking brake on.

Flap: Flaps not in agreement with takeoff setting entered into FMS.

Slat: Slats not in takeoff.

Spoilers: Spoilers not stowed.

Stabilizer: Stabilizer not in green band.

Rudder Trim: Rudder trim not centered.

Reactive Windshear Warning

AURAL WARNINGS - Tone followed by voice: “HEADWIND SHEAR”, or “TAILWIND SHEAR” (“WINDSHEAR” optional).

AURAL WARNINGS - Tone followed by voice “WINDSHEAR”.

VISUAL - WINDSHEAR message on PFD as follows:

Amber - Headwind shear.

Red - Tailwind shear.

CONDITION - Increasing/decreasing performance windshear encountered.

Predictive Windshear Warning

AURAL WARNINGS -

Warning Alert - Tone followed by voice: “WINDSHEAR AHEAD, WINDSHEAR AHEAD” during takeoff; “GO AROUND WINDSHEAR AHEAD” during landing/go-around.

Caution Alert - Tone followed by voice: “MONITOR RADAR DISPLAY”.

VISUAL - Icon on ND and either a red (warning) or amber (caution) “WINDSHEAR AHEAD” on PFD.

CONDITION - Airplane below 1,200 feet AGL and a microburst detected.

ELECTRONIC INSTRUMENT SYSTEM (EIS) ALERTING

The EIS alerting system displays alerts and applicable consequences on the Display Units (DU).

The EIS alerting system consists of:

MASTER WARNING and MASTER CAUTION lights.

Engine and Alert Display (EAD).

System Display (SD).

System Display Control Panel (SDCP).

Alerts are categorized into four levels (3, 2, 1, and 0) and have unique display characteristics to allow immediate crew recognition of the alert level. The alerts are sorted by level with the most recent in each level listed first.

Alerts are presented in three columns in the lower 1/3 of the EAD. Each column allows alerts up to 17 characters long, including leading triangles for level 3 alerts. The first two columns may contain 6 alerts, but the third column is limited to only 4 because the two bottom lines are dedicated for reminder messages.

The EAD alerts are logically displayed to minimize the number of alerts requiring action. Additional alerts which occur as a result of the initial failure are displayed on the associated system pages.

Pushing the associated system cue switch on the SDCP, located on the pedestal, displays associated system synoptic page on the SD and resets the illuminated MASTER CAUTION or MASTER WARNING lights.

On any SD page, a PRESS (associated cue switch) AGAIN TO CONTINUE message indicates that alerts or consequences on subsequent SD pages can be accessed by pushing the associated cue switch. The associated cue switch part of the message flashes until all pages have been reviewed. The secondary engine page automatically appears on the SD for alerts associated with the secondary engine page parameters.

Alert - Level 3 Alerts - Boxed Red

Level 3 (red) alerts indicate emergency operational conditions that require immediate crew awareness and immediate corrective or compensatory action by the crew. Level 3 alerts are characterized as follows:

- Red MASTER WARNING lights illuminate.
- Boxed red alert on the EAD with a red triangle in the first position.
- Alert is positioned starting at top left corner of the alert list with latest alert at the top of the list.
- Associated cue switch illuminates on the SDCP.
- Alerts remain displayed on EAD until condition no longer exists.
- Cue switch lights are extinguished by pushing the cue switch.
- MASTER WARNING lights are resettable by pushing either the MASTER WARNING light or by pushing associated cue switch.

Alert - Level 2 Alerts - Boxed Amber

Level 2 (amber) alerts indicate abnormal operational system conditions that require immediate crew awareness and subsequent corrective or compensatory action by the crew. Level 2 alerts are characterized as follows:

- Amber MASTER CAUTION lights illuminate.
- Boxed amber alert on the EAD.
- Alert is positioned below any level 3 alert in the alert list. The latest level 2 alert is added to the top of the level 2 alerts.
- Associated cue switch illuminates on the SDCP.
- Alerts are acknowledged and possibly reset by pushing associated illuminated cue switch.
- A boxed amber reminder message will appear on the EAD when a level 2 alert has been reset.
- Cue switches are resettable by acknowledging associated alerts.
- MASTER CAUTION lights are resettable by pushing either MASTER CAUTION light or the associated cue switch.

Alert - Level 1 Alerts - Amber

- Level 1 alerts (amber) may require maintenance prior to takeoff, a logbook entry, a confirmation of desired system configuration, or a flight crew action but not a checklist procedure. Level 1 alerts are characterized as follows:
- Amber MASTER CAUTION lights may illuminate.
- Amber alert appears on the EAD, SD page, or STATUS page.
- Alert is positioned below any level 3 or 2 alerts in the alert list. The latest level 1 alert is added to the top of the level 1 alerts.
- Associated cue switch may illuminate on the SDCP.
- Alerts are acknowledged and possibly reset by pushing associated illuminated cue switch.
- An amber reminder message will appear on the EAD when a level 1 alert has been reset.
- MASTER CAUTION lights are resettable by pushing either the MASTER CAUTION light or the associated cue switch on the SDCP.

Some level 1 alerts appear on the SD synoptic or STATUS page only and will not illuminate the MASTER CAUTION lights. Some level 1 alerts are non-resettable and cannot be removed from EAD.

Alert - Level 0 Alerts - Cyan

Level 0 (cyan) alerts are generally operational, or airplane systems, status information. Level 0 alerts are characterized as follows:

- A cyan alert on the EAD.
- Alert is positioned above the space for reminder messages. The latest level 0 alert is added to the top of the level 0 alerts.

Alert Consequences

When some level 3, 2, or 1 alerts are displayed, statements called CONSEQUENCES appear (aligned with the associated alert) in the lower third of the associated SD synoptic. The SD consequences are the effects of the failure and/or the required crew action. Required checklist procedures should be integrated with the SD consequences.

Alert Reminder Messages

When level 2 or 1 alerts have been reset by pushing the associated cue switch on the SDCP, the alert is removed from the alert list on the EAD and a reminder message consisting of the associated system name (FUEL, HYD, etc.) is displayed in a dedicated location within the two bottom lines of the right column on the EAD. These reminder messages are amber and boxed for level 2 alerts and amber and unboxed for level 1 alerts. The EAD reminder message will flash when a new alert message appears on the associated SD page.

Alert Inhibits

<u>Takeoff Inhibits</u>:

Level 3 alerts and associated MASTER WARNING lights are inhibited from V1 to 400' RA, but no longer than 25 seconds in flight.

Level 2 or 1 alerts and associated MASTER CAUTION lights are also inhibited by varying amounts, with more critical alerts being inhibited for the same amount of time as level 3, to less critical inhibited from throttle advance for takeoff to 1000 feet baro (or 120 seconds inflight).

Level 0 alerts are not inhibited.

<u>Landing Inhibits</u>:

Some warnings and alerts are also inhibited during landing below 1000 feet, based on severity.

TAKEOFF ESSENTIAL ITEMS CHECKLIST

During taxi, takeoff items are checked sequentially. The EIS provides a dedicated space at the bottom of the center column on the EAD for display of the takeoff essential items checklist. When this checklist is displayed, any alerts are displaced.

The takeoff essential items checklist consists of the following ordered list of conditions and boxed messages.

CONDITION	MESSAGE	COLOR
1. STAB not in green	STAB TRIM	White
2. Rudder Trim not centered	RUDDER TRIM	White
3. Slats not in takeoff	SLAT	White
4. Flaps not in takeoff	FLAP	White
5. Auto ground spoilers not armed	SPOILER	White
6. Park brake on	BRAKES	White

The checklist is sequentially checked from the top. Only the highest condition not met is displayed. When a condition is met, the EIS continues down the list displaying the next condition not met. When all takeoff conditions have been satisfied, a green takeoff-checklist-complete box is displayed in the essential items checklist area.

Before takeoff, if takeoff flap setting does not match flap value on the FMS TAKEOFF page, the green takeoff-checklist-complete box will not appear and the flap takeoff warning will activate if throttles are advanced for takeoff.

With the exception of the spoilers not armed, takeoff essential items that have not been satisfied will cause the checklist display (message and box) to turn red when the airplane begins the takeoff roll. The essential items checklist is removed when the airplane becomes airborne.

LANDING ESSENTIAL ITEMS CHECKLIST

During the approach phase, the EIS initiates a check of essential landing items. This checklist is displayed in the same position and manner as the takeoff essential items checklist.

The landing essential items checklist consists of the following ordered list of conditions and messages.

CONDITION	MESSAGE	COLOR
1. Landing gear not down	LANDING GEAR	White
2. Flaps not in landing	FLAP	White
3. Spoilers not armed	SPOILERS	White

The checklist is sequentially checked from the top. Only the highest condition not met is displayed. When a condition is met, the EIS continues down the list displaying the next condition not met. When all landing conditions have been satisfied, a green landing-checklist-complete box is displayed in the essential items checklist area.

The essential items checklist is removed when the airplane is on the ground.

SD ALERTS AND CONSEQUENCES DISPLAY

Pushing a cue switch on the SDCP causes the associated system page to be displayed on the SD and resets the MASTER WARNING or MASTER CAUTION lights (if illuminated).

The secondary engine page is automatically called up when secondary engine parameter alerts appear or when a secondary engine page parameter changes to amber or red.

Each systems page (except MISC) contains a schematic for that system on the upper 2/3 of the SD. The bottom 1/3 is for alerts related to that system and the alert consequences. Only levels 3, 2, and 1 alerts are shown on the system pages.

Alerts are shown in the left column. The alerts are grouped by level and appear in the same order as they appeared on the EAD.

Consequences are shown in the right column. Consequences are aligned with the associated alerts. Consequences are shown in white and may have a maximum of 34 characters.

If not all alerts or consequences can be displayed within the space available on the first SD page (maximum 5 alerts and 5 consequences), additional pages of alerts and consequences are made available. These pages have the same format as the first page. When there are additional pages, the message PRESS XXXX AGAIN TO CONTINUE will be displayed at the bottom of the page (XXXX = associated cue switch).

SD Consequence Page

The consequence page is displayed on the SD by pushing the CONSEQ switch on the SDCP. The CONSEQ page shows a compilation of all consequences depicted on the individual synoptic pages.

The alerts are grouped by level and appear in the same order as they appear on the EAD. The consequences associated with an alert are displayed adjacent to that alert.

This page and all subsequent pages can display up to 17 alerts and 17 consequences. When additional pages are required, the message PRESS CONSEQ AGAIN TO CONTINUE will appear at the bottom of the page.

SD Status Page

The STATUS page displays a list of all alerts included on the systems pages and is selected by pushing the STATUS switch on the SDCP. The alerts are shown in three columns in the same format as on the EAD. The alerts are grouped per system in the same order as the cue switches on the SDCP and the reminder messages on the EAD (ENG, HYD, ELEC, AIR, FUEL, CONFIG, and MISC).

A separate section for maintenance alerts is after the MISC system alerts. This section is titled MAINT. MAINT alerts appear only on STATUS page one and can only be level 1. MAINT alerts may have impact and should be written up by the flight crew. Within each system group, the alerts are grouped by level and appear in the same order as they appeared on the EAD. Above each group of alerts appears the system label, preceded by a blank line if not at the top of the page. This system label will appear as a place holder even if no alerts are associated with that system. This page and all subsequent pages can display up to 51 alerts. When there are additional pages, the message PRESS STATUS AGAIN TO CONTINUE will appear at the bottom of the page.

SD Miscellaneous Page

The miscellaneous system page is displayed on the SD by pushing the MISC switch on the SDCP. The miscellaneous system page displays alerts and consequences for various uncategorized systems in text form only.

The consequences are grouped with the alerts in the same manner as the consequences page. The first miscellaneous systems page may have a maximum of 17 alerts and 17 consequences.

Additional pages may be made available for the display of consequences and may display up to 17 alerts and 17 consequences. When additional pages are required, the message PRESS MISC AGAIN TO CONTINUE will appear at the bottom of the page.

The miscellaneous page is for alerts (levels 3, 2, and 1 only) and consequences (levels 3 and 2).

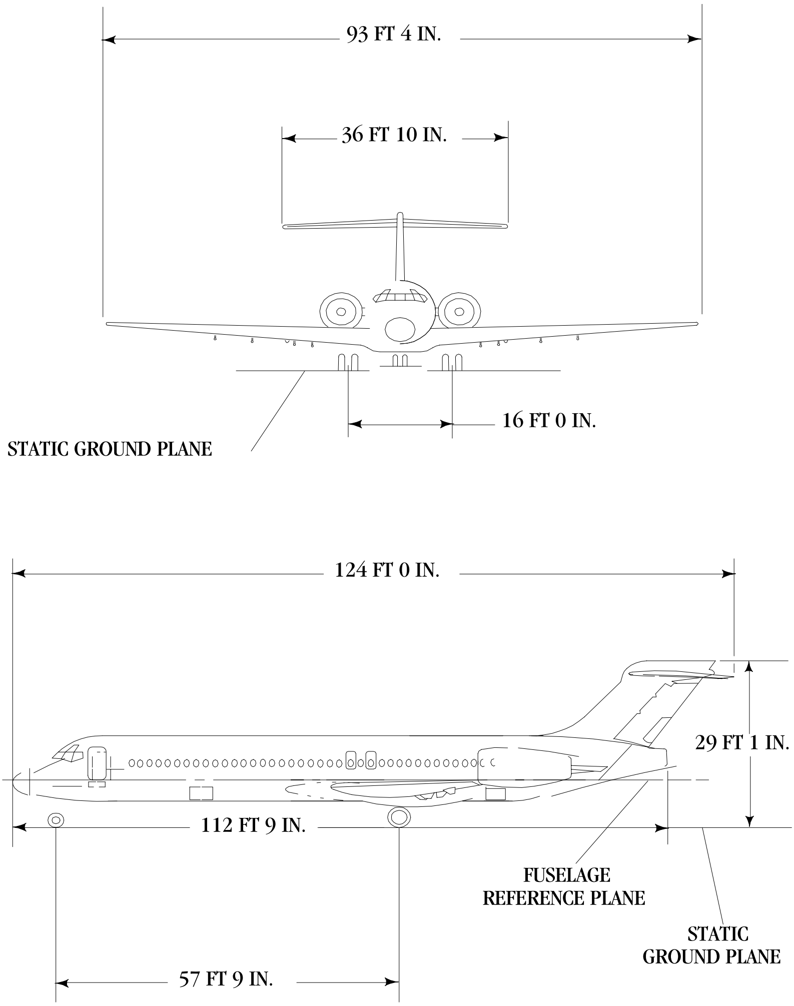
SELECTION OF PROGRAM OPTIONS (ZVQ)

1. Cockpit Displays in English.
2. Split-Cue Flight Director Command Bars.
3. Track-Up Presentation on ND.
4. Rising Runway Display on PFD.
5. Wind Direction and Speed Display on ND.
6. Magenta Weather Radar Turbulence Display on ND.
7. Deletion of QFE Mode From Displays
8. Decision Height (DH) Display.
9. Airspeed Trend Vector Display.
10. Standard MAP Symbology on ND.
11. Engine Parameter Order: EPR, N1, TGT, N2 and FF.

12. No Radio Altitude “2500” Foot Voice Warning.
13. No Radio Altitude “1000” Foot Voice Warning.
14. Barometric Altitude “1000” Foot Voice Warning.
15. No Radio Altitude “500” Foot Voice Warning.
16. No Barometric Altitude “500” Foot Voice Warning.
17. No Radio Altitude “400” Foot Voice Warning.
18. No Radio Altitude “300” Foot Voice Warning.
19. No Radio Altitude “200” Foot Voice Warning.
20. Radio Altitude “100” Foot Voice Warning.
21. Voice Warning “50, 40, 30, 20, 10" When Descending Through Respective Altitudes.
22. Voice Warning “Approaching Minimums” When Airplane is 100 Feet Above Minimum Altitude Selected on EIS Control Panel.
23. No “Plus Hundred” Voice Warning When Airplane is 100 Feet Above Minimum Altitude Selected on EIS Control Panel.
24. Voice Warning “Minimums” When Descending Through Minimums Altitude Selected on EIS Control Panel.
25. Selection of Voice Warning: “Fire Left/Right Engine, Landing Gear, Altitude, Speed Brake, Cabin Altitude, Overspeed, Slat Overspeed, Autopilot, Stabilizer Motion, and APU Fire”.
26. Selection of Takeoff Voice Warning: “Flaps, Slats, Spoilers, Stabilizer, Rudder Trim, and Brakes”
27. “Windshear” Voice Warning.
28. Deactivation of Flight Management Auto-String Feature.
29. Flight Management VOR Tracking Beam Mode.
30. Selection of Localizer Mode Only on MCDU.
31. Flight Management PROF To Be Armed While on Ground.
32. Selection of One or Two Fixed Derates For Takeoff and Climb.
33. Deletion of Altitude Advisory Tone at Acquisition.
34. Altitude Advisory Inhibit with Landing Flap Selection.
35. Windshear Inhibit During Takeoff Roll
36. Head Windshear Aural Warning.
37. Mach Display in lieu hectopascals baro pressure on ISIS.

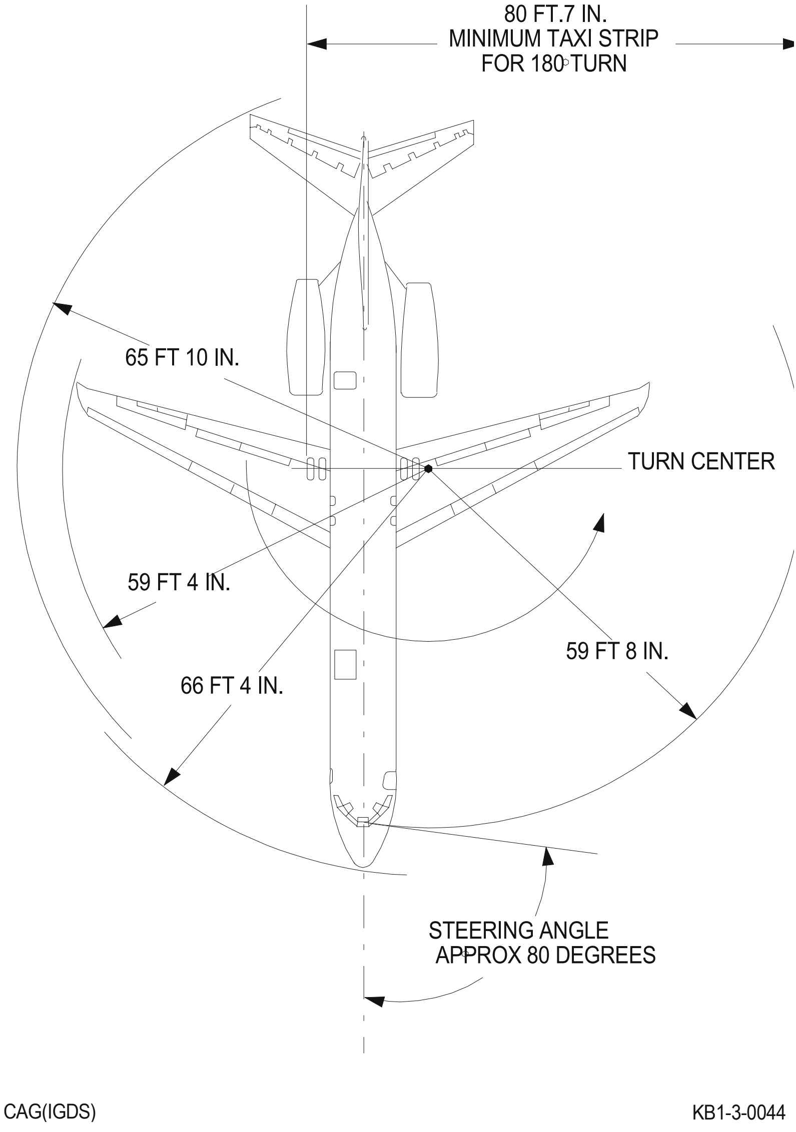
COMPONENTS

Airplane Dimensions (Typical)



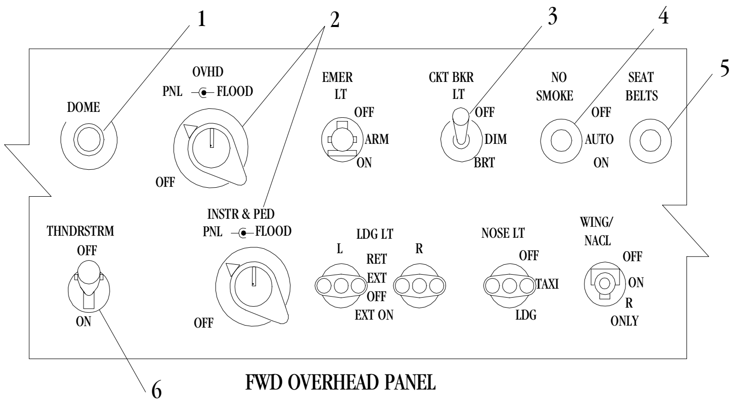
CAG(IGDS) KB1-3-0043

Turn Radius


80 FT.7 IN.
MINIMUM TAXI STRIP
FOR 180° TURN
65 FT 10 IN.
TURN CENTER
59 FT 4 IN.
59 FT 8 IN.
66 FT 4 IN.
STEERING ANGLE
APPROX 80 DEGREES
CAG(IGDS)
KB1-3-0044

CONTROLS AND DISPLAYS

Cockpit Lighting Controls



1. **DOME Switch**

   Push - Illuminates/extinguishes overhead dome lights.

2. **OVHD and INST & PED Rheostats**

   Rotate - Outer rheostats control respective switchplate lights. Inner rheostats control respective floodlights.

3. **CKT BKR LT Switch**

   OFF - Extinguishes circuit breaker panel floodlights.

   DIM/BRT - Sets illuminated circuit breaker panel floodlights to low or full brightness.

4. **NO SMOKE Switch**

   OFF - Extinguishes NO SMOKING signs (chime).

   AUTO - NO SMOKING signs illuminate when landing gear is extended (chime).

   ON - Illuminate NO SMOKING signs (chime).

NOTE

NO SMOKING signs automatically illuminate if cabin pressure exceeds 10,000 feet regardless of switch position.

5. SEAT BELTS

OFF - Extinguishes FASTEN SEAT BELT and RETURN TO CABIN signs (chime).

AUTO - FASTEN SEAT BELT and RETURN TO CABIN signs illuminate when leading edge slats are extended (chime).

ON - Illuminate FASTEN SEAT BELT and RETURN TO CABIN signs (chime).

NOTE

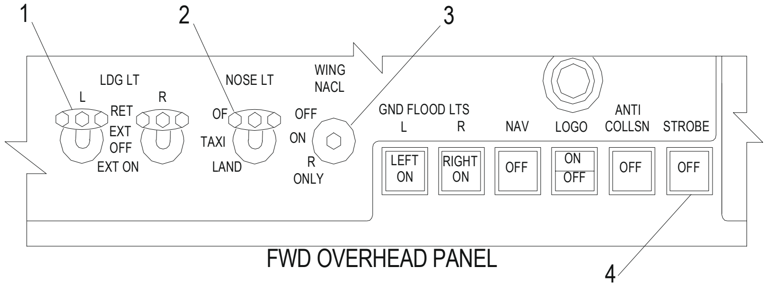
FASTEN SEAT BELT and RETURN TO CABIN signs automatically illuminate if cabin pressure exceeds 10,000 feet regardless of switch position.

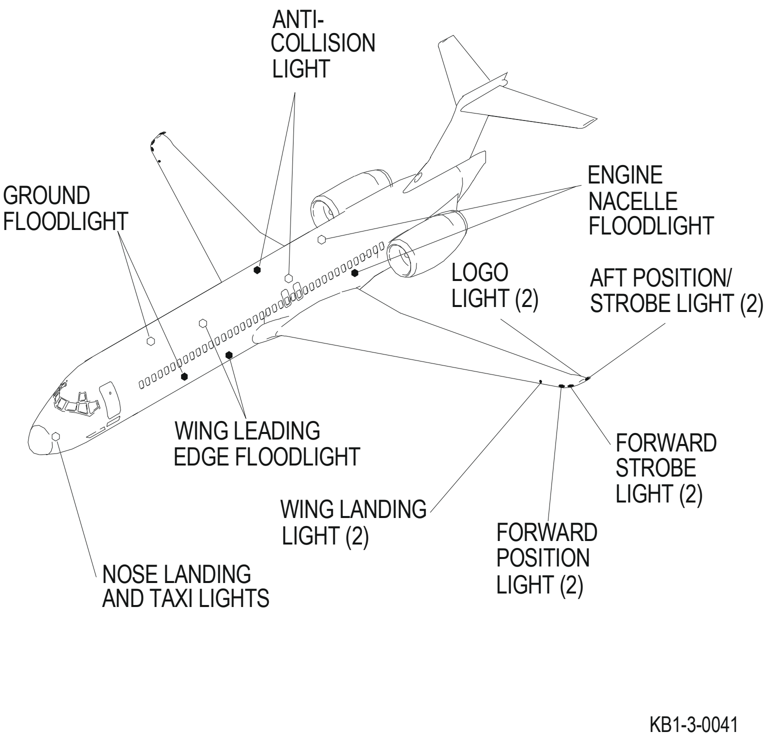
6. THNDRSTRM Switch

OFF - Normal position.

ON - Overrides individual lighting controls to illuminate instrument and control panel floodlights full bright.

Exterior Lighting Controls





1. **LDG LT Switches (L/R)**

   RET - Retracts landing light(s) flush with fuselage.

   EXT OFF/ON - Extends landing light(s) with lamps off or on.

2. **NOSE LT Switch**

   OFF - Extinguishes nose gear landing taxi light.

   TAXI - Illuminates light for taxi.

   LAND - Illuminates light for landing.

3. **WING NACL Switch**

   OFF - Extinguishes wing leading edge and engine nacelle floodlights.

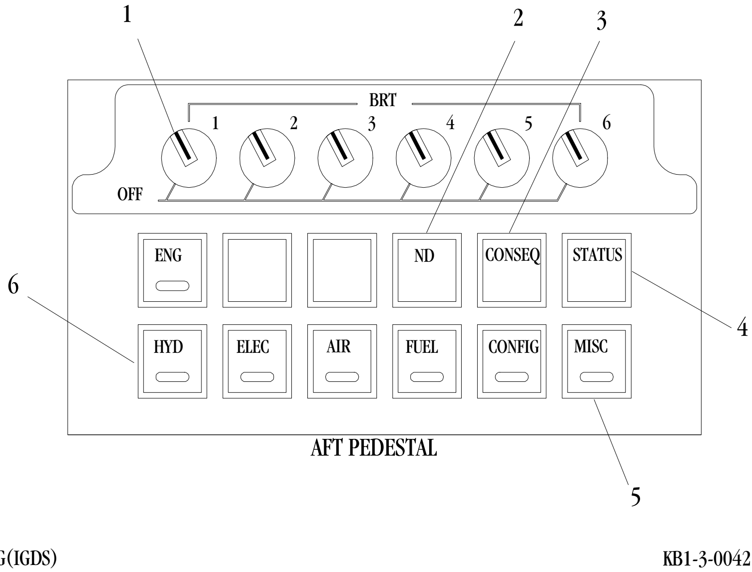
   ON - Illuminates wing leading edge and engine nacelle floodlights.

   R ONLY - Illuminates right wing leading edge and right engine nacelle floodlights.

4. **Switches-Lights (6)**

   Push - Illuminates/extinguishes respective left, right ground floodlights, navigation, logo, anti-collision or strobe lights.

EIS System Display Control Panel



1. **BRT Knob**

   Rotate - Controls respective DU brightness. Turning fully counter-clockwise through a detent will turn off respective DU.

2. **ND Switch**

   Push - With 1 or more DUs inoperative, causes the existing SD to become an ND. If all DUs are operative, THIRD NAV DISPLAY NOT AVAILABLE will appear on DU 4.

3. **CONSEQ Switch**

   Push - Displays CONSEQUENCE page on SD. Consequences displayed are associated with level 3 and 2 alerts.

4. **STATUS Switch**

   Push - Displays STATUS page on SD.

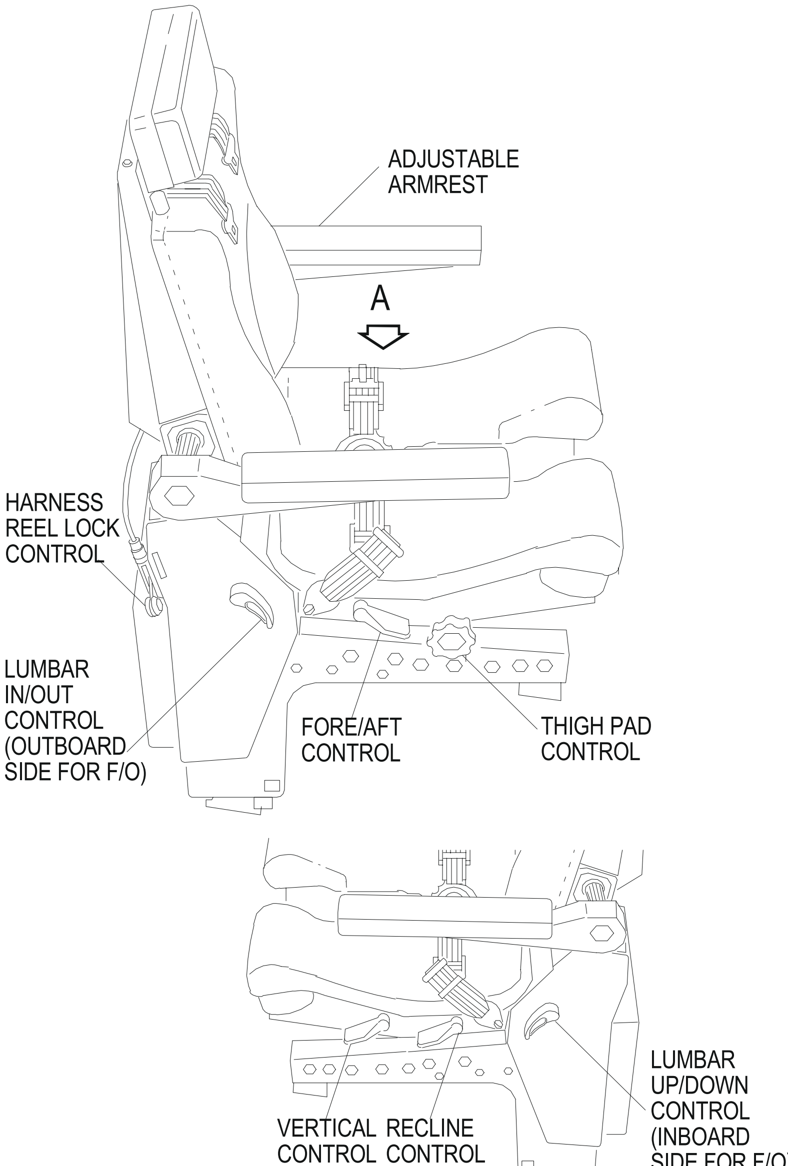
5. **MISC Switch**

   Push - Displays MISCELLANEOUS page on SD.

6. **System Cue Switch (6)**

   Appropriate (ENG, HYD, ELEC, AIR, FUEL, or CONFIG) cue switch will illuminate when an alert related to the system appears on the EAD. Pushing cue switch displays applicable synoptic page on SD and resets illuminated MASTER WARNING or MASTER CAUTION lights.

Captain's Seat



VIEW A

KB1-3-0144

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

TAILCONE UNLOCK (MISC) - Tailcone is not locked.

Amber Alerts (Level 1)

ACCESS COMPT DOOR (MISC) - Accessory compartment door is not closed and locked.

AFT BULKHEAD DOOR (MISC) - Aft exit door is not closed and locked.

CABIN DOOR (MISC) - Forward cabin door is not closed and locked.

CARGO DOOR FWD/AFT (MISC) - Respective cargo door is not closed and locked.

CAWS FAIL (MISC) - Central aural warning function in both VIAs has failed.

DRAIN MAST HEAT (MISC) - Drain mast heater has failed.

DOOR OPEN (MISC) - One or more doors are not closed and locked.

ELEC COMPT DOOR (MISC) - Electrical/electronics compartment door is not closed and locked.

GALLEY DOOR (MISC) - Galley door is not closed and locked.

STAIRWAY DOOR FWD/AFT (MISC) - (Optional) Respective stairway door is not stowed and locked.

Cyan Alerts (Level 0)

NO SMOKING - NO SMOKING signs have been turned on, or NO SMOKE switch is in AUTO with slats extended.

SEAT BELTS - FASTEN SEAT BELTS signs have been turned on, or SEAT BELTS switch is in AUTO with the airplane below 10,000 feet.

TABLE OF CONTENTS

AIR

DESCRIPTION AND OPERATION

INTRODUCTION

Air for pressurization, air conditioning, anti-ice, engine start, and the potable water system can be supplied by the engines, the APU (ground only), or an external source (ground only).

Controls for pressurization, air conditioning, and anti-ice are on the forward overhead panel. Air system flow, temperatures, valve positions, and pressurization status are shown on the Systems Display (SD). Associated alerts are shown on the Engine and Alert Display (EAD).

Air system functions include the airplane pneumatic system, the air conditioning system, and the pressurization system.

The pneumatic system consists of two identical sub-systems, each with the capability of operating independently. Each pneumatic sub-system is normally supplied by its respective engine. During ground operation, air from the APU or from a ground pneumatic source may be supplied to the sub-systems through the crossfeed manifold.

There are two independent air conditioning systems. Bleed air entering the air conditioning systems is processed and cooled to provide conditioned air to the cabin and cockpit and for airplane pressurization.

PNEUMATIC SYSTEM COMPONENT LOCATION

The pneumatic system components are located within the engine nacelles and the tail compartment. The nacelle components consist of low stage check valves, high stage valves, pressure regulator and shutoff valves, pre-coolers and fan air valves.

Components located in the tail compartment include the air conditioning system flow control valves, the pneumatic system isolation valve, the wing and tail ice protection pressure regulator and shutoff valves, and the necessary ducting for APU and ground pneumatic air.

PNEUMATIC SYSTEM - HIGH & LOW STAGE AIR

Low fifth stage air is normally sufficient for air conditioning and pressurization. The high stage valve regulates eighth stage air to satisfy pneumatic pressure and temperature requirements when low stage pressure or temperature is insufficient.

PNEUMATIC SYSTEM - PRESSURE REGULATOR AND SHUTOFF VALVES

The pressure regulator and shutoff valve (PRSOV) opens and closes to ensure the correct bleed-air pressure in the manifold. When the BLEED switch is in the OFF position the PRSOV closes.

PNEUMATIC SYSTEM - PRECOOLER

Each pneumatic system uses a pre-cooler to reduce the temperature of the air supplied by the engines. Fan-air from the engine goes across the precooler. By a heat exchange process, the fan-air decreases the temperature of the bleed-air coming from the PRSOV. After flowing across the pre-cooler, the fan air is exhausted overboard.

PNEUMATIC SYSTEM CONTROLLER

The Pneumatic System Controller (PSC) monitors and controls the engine bleed air pressure and temperature requirements for the air conditioning system and the airfoil ice protection system. The PSC controls the positions of both the PRSOV, high stage valve, and how much engine fan air is being used to cool the bleed air.

PNEUMATIC SYSTEM ISOLATION VALVE

The pneumatic system isolation valve, normally closed, isolates the left and right pneumatic sub-systems from each other. On the ground, the isolation valve may be opened to connect both pneumatic systems when using the APU or ground pneumatic air for air conditioning or for engine start.

In flight, when only one sub-system is supplying bleed air, the isolation valve automatically opens to supply bleed air for airfoil ice protection. It may also be manually opened to supply pneumatics for both air conditioning systems.

When the isolation valve is open, the AIR ISOL OPEN alert is displayed on the EAD.

PNEUMATIC SYSTEM FLOW CONTROL VALVES

Conditioned air is supplied to the cockpit and cabin. The flow control valves schedule the flow of air into the air conditioning systems. The FLOW switch on the overhead panel allows the selection of a normal (NORM) or a high (HIGH) flow rate. When the APU is supplying the air, the flow is always high.

The flow control valves also serve as shutoff valves and may be manually selected closed through the PACK (OFF and AUTO) switches. The valves close automatically when an air conditioning system malfunction occurs. Automatic shutdown of an air conditioning system occurs if one of the system's over-temperature sensors detects an overheat condition.

In the event of an engine failure below 3000 feet AGL, both air conditioning systems shut down (through the flow control valves). This enables the remaining engine to operate without the bleed penalty and reduction in thrust associated with an operating air conditioning pack. This can be overridden by the PACK SHUTDOWN switch (see additional information under AUTO PACK SHUTDOWN later in this Section).

PNEUMATIC OVERHEAT DETECTION SYSTEM

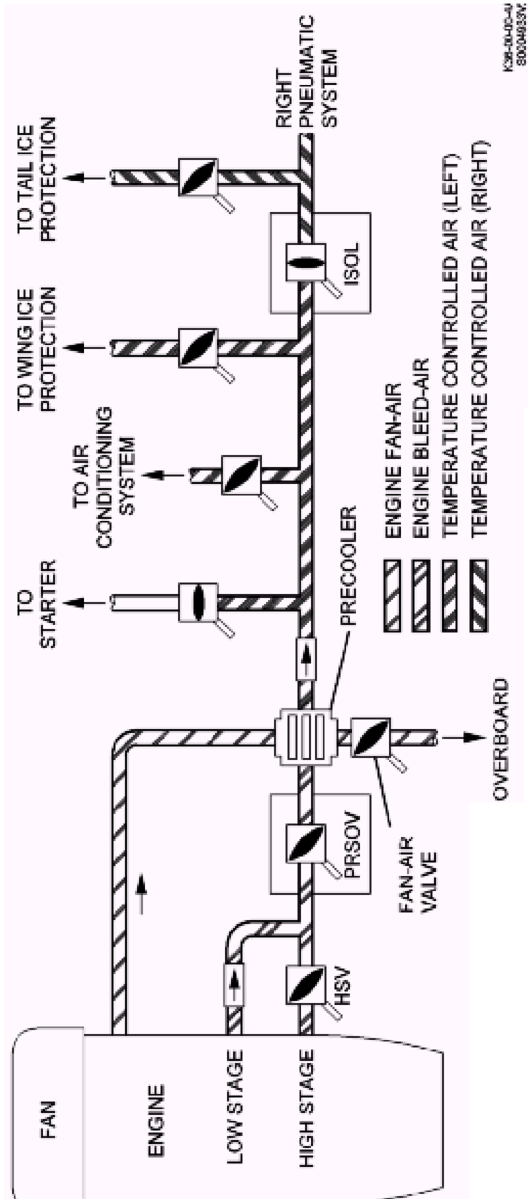
A pneumatic overheat detection system (PODS) detects overheat conditions in the tail compartment and along the wing and tail ice protection manifolds. System components include dual loop sensors in the tail compartment and single loop sensors along the ice protection manifolds.

The pneumatic overheat detection controller is located in the electrical/electronic (E/E) compartment. When an overheat condition occurs in the tail compartment, the associated TAIL TEMP L/R HI alert is displayed on the EAD. If a failure is detected in the anti-ice manifolds, PODS automatically closes the respective anti-ice valve and the WING A-ICE OFF/TAIL A-ICE OFF alert is displayed.

If PODS fails to shut off the affected manifold, the respective WING MANF FAIL/TAIL MANF FAIL alert is displayed.

A test of PODS is automatically activated when the engine fire protection test is performed. The PODs test needs AC electrical power. When the PODS test is successful, the PODS TEST PASS alert is displayed on the EAD.

PNEUMATIC SYSTEM DIAGRAM



AIR CONDITIONING AND VENTILATION

Two air conditioning systems, located in the tail compartment, each associated with an engine, provide conditioned air and pressurization to the cabin and the cockpit. The right air conditioning system, in general, ventilates the cabin and the left system, in general, ventilates the cockpit. Either system is capable of ventilating both the cabin and the cockpit.

Conditioned air can also be supplied to the cabin and cockpit using a ground pre-conditioned air supply. Ground air supply is connected into and uses the same ducting as the ram air system, however, the ram air valve must be closed for this operation.

A separate gasper booster fan, when selected ON, supplies additional ventilation (see Gasper Fan for additional information).

AIR CONDITIONING - REFRIGERATION UNITS AND WATER SEPARATORS

Each refrigeration unit contains a primary and a secondary heat exchanger, an air cycle machine, and an air cycle machine-driven fan.

In flight, cooling airflow across the heat exchangers is provided by ram air and by the air cycle machine-driven fans. The fans assist ram air cooling by drawing air across the heat exchangers when ram airflow is insufficient.

A water separator removes most of the moisture from the cold air before it goes to the distribution system. Condensed water collected from the water separator is sprayed onto the secondary heat exchanger to improve cooling.

AIR CONDITIONING - TEMPERATURE CONTROL VALVE

The CKPT/CABIN TEMP selectors on the AIR control panel, in either AUTO or MAN mode, control cockpit/cabin temperatures by modulating the temperature control valves. This valve allows hot air from the pneumatic system to mix with the cold air from the refrigeration units.

AIR CONDITIONING - MIXING CHAMBER

The conditioned air from the refrigeration units goes to the mixing chamber. The mixing chamber delivers the correct amount of air to the flight and passenger compartments. There are different ducts for the flight and passenger compartments.

The large distribution duct from the mixing chamber contains conditioned air and sends it forward into the passenger cabin. The airflow out of the cabin is through the cusp holes near the floor.

The small distribution duct from the mixing chamber sends conditioned air forward into the cockpit. A dropper duct, in the forward cabin area, gets some of the conditioned air and sends it forward for compartment and instrument ventilation. The air from the cockpit goes out through exhaust ducts and holes in the cockpit floor. This air gives ventilation and cooling for the compartments below the cockpit.

AIR CONDITIONING - GASPER FAN

The gasper fan is in the cold air duct of the left air conditioning system. The fan moves air through the individual air distribution system (eyeball outlets). An ON/OFF pushbutton in the overhead panel provides control of the fan operation.

When the left air conditioning system operates, the fan increases the airflow in the left and right cold air ducts. The air comes from the left air conditioning package, downstream from the water separator, and upstream from the temperature control valve’s hot air input. When the air conditioning system does not operate, the fan supplies ventilation through the cold air ducts from outside air. Open the ram air valve or the door to the ground conditioned air connection for outside air access. With the Gasper Fan in the ON position on the ground, a noticeable increase in air flow will result with the RAM AIR switch ON.

AIR CONDITIONING - RAM AIR

When air conditioning is not available, ram air can provide ventilation for the cabin and cockpit. When the ram air valve is open, ambient airflow from the right heat exchanger ram air duct enters the right air conditioning system. Only the right system has a ram air valve. The RAM AIR switch on the AIR control panel is used to select ram air ventilation ON or OFF. Packs are not required to be running for ram air ventilation.

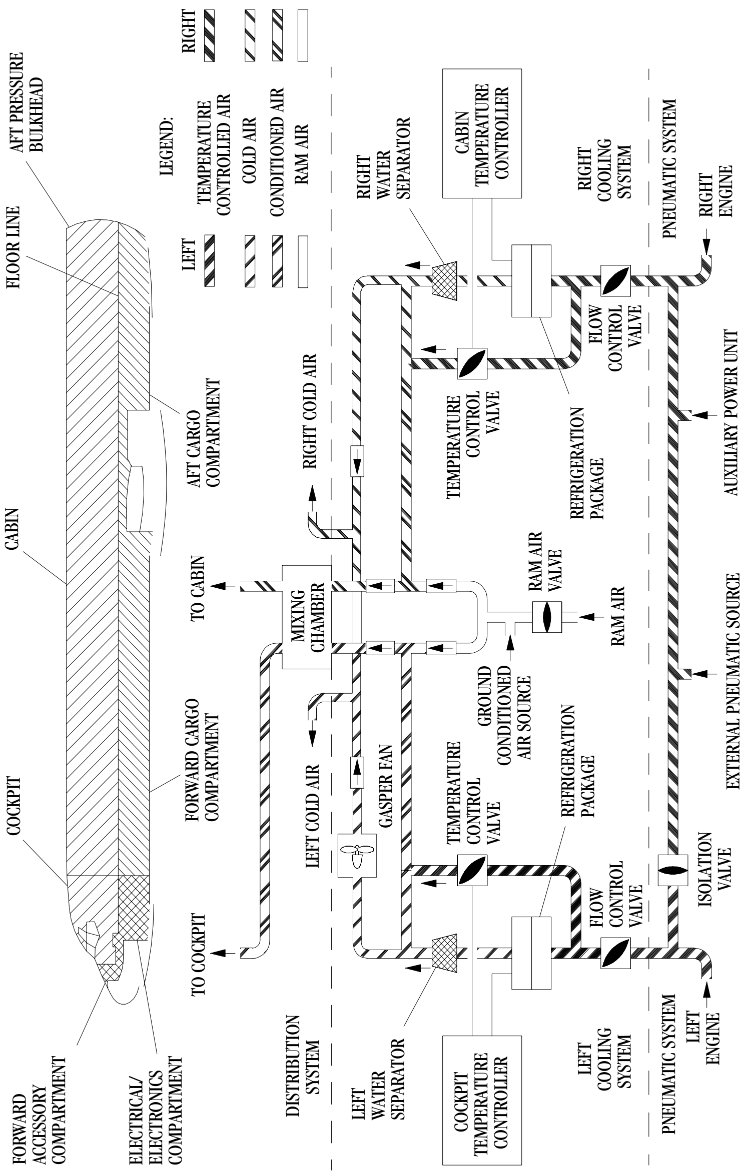
When the air conditioning system is operating, a check valve will not allow conditioned air to escape through the RAM AIR VALVE when airborne. However, there is no check valve that prevents air supplied from an external start unit from being dumped overboard. For this reason, the RAM AIR VALVE should be closed prior to attempting an external air engine start.

AUTO PACK SHUTDOWN

Both packs automatically shut down if either engine fails during takeoff, or if packs are selected off through the FMS. Auto shutdown of the packs due to engine failure is overridden, however, when the PACK SHUTDOWN switch is in OVRD and when the airplane is above 3,000’ AGL.

Auto pack shutdowns due to high supply duct temperatures cannot be overridden.

AIR SCHEMATIC



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PRESSURIZATION - CABIN PRESSURE CONTROLLERS AND OUTFLOW VALVES

Cabin pressure is maintained by controlling the discharge of cabin air through the outflow valve.

The cabin pressure controllers control outflow valve position during automatic operation. Outflow valve position is displayed on the CABIN PRESS panel outflow VALVE position indicator and on the AIR page of the SD. The CLOSED light illuminates when the valve is fully closed.

If cabin altitude exceeds the maximum limit (10,000 feet), the CABIN ALTITUDE alert is displayed on the EAD, an aural warning sounds in the cockpit, and a chime sounds in the cabin.

Cabin altitude rate is displayed in feet per minute on the SD. Downward moving rates are indicated by a downward pointing arrowhead and upward moving rates are indicated by an upward pointing arrowhead. A CABIN RATE alert is displayed on the EAD when the desired cabin rate is exceeded, and the failure is displayed on the SD. Cabin altitude, cabin rate information, and failure indications are also displayed on the SD secondary engine page. If either the cabin altitude or the cabin rate limits are exceeded, a failure indication is displayed.

Normal maximum cabin differential pressure is 7.86 psi. Failure of the cabin air outflow valve may result in inside pressure exceeding limits. Excessive pressure is relieved by two cabin (positive) pressure relief valves. The dual cabin pressure relief valves begin limiting cabin differential pressure at 8.06 psi, and allow a maximum differential pressure of 8.27 psi. A CABIN PRES HI alert will be displayed on the EAD and a failure indication will be displayed on the SD synoptic. Negative pressure relief is provided through the entrance galley door seals and through a negative pressure relief valve in the aft pressure bulkhead.

The cabin pressure SYSTEM switch has two operating modes, automatic and manual. When the pressurization system is operating in the automatic mode, the switch is dark. Pushing the switch selects the alternate cabin pressure controller, illuminates the MANUAL light, and selects manual pressurization system control. The CABIN PRES SYS MAN alert is displayed on the EAD.

Airplane pressurization is normally controlled automatically. The automatic system controls outflow valve position through an electrical actuator and clutch mechanism. Two independent pressure controllers, AUTO 1 and AUTO 2, each powered from a separate AC bus, are each capable of automatic pressurization control from takeoff to landing. Normally, one system controls pressurization during all operating conditions.

Automatic cabin pressurization begins when the throttles are advanced for takeoff. During a rejected takeoff, depressurization begins when the throttles are retarded. If the airplane is not in flight mode within 60 seconds after the throttles are advanced, the outflow valves automatically open to depressurize the cabin. During a failure of the active controlling system, automatic transfer to the other controlling system occurs. Cabin pressure is not affected during the system transfer.

If both cabin pressure controllers fail, the SELECT light illuminates and the SEL CAB PRES MAN alert is displayed on the EAD. In manual mode, the flight crew manually adjusts outflow valve position with the two-position (CLIMB/DESC) cabin pressure MANUAL switch. When the switch is moved to CLIMB, the outflow valve moves in the open direction, and cabin altitude increases. When the switch is moved to DESC, the outflow valve moves in the closed direction, and cabin altitude decreases. The crew controls cabin pressure to the proper level by adjusting the valve position and monitoring cabin altitude rate changes on the secondary engine display.

THE MANUAL LDG ALT (INCR/DECR) switch allows manual selection of the landing field elevation when landing altitude information is not available from the FMS. Moving the switch to INCR increases the landing altitude, DECR decreases landing altitude. The LDG ALTITUDE MAN alert is displayed.

RADIO AND INSTRUMENT COOLING

The radios are cooled automatically on the ground by two fans (primary and backup) that stay on all the time. During flight, radio cooling is controlled with the AVIONICS COOLING switch. With the switch selected to FAN, the primary fan cools the radios. If the primary fan fails, the backup fan comes on automatically. With the switch selected to OVRD and in flight, the fans are off and venturi airflow cools the radios. The OVRD switch position is only effective in flight i.e. the AVIONCIS COOLING switch is only operative in flight

On the ground both the primary and the standby fans are operating and the venturi valve is closed regardless of AVIONICS COOLING switch position. The forward cargo compartment heater is also inoperative on the ground.

The AVNCS AIR FLO OFF alert is displayed on the ground if the primary fan fails, and in flight if both fans fail with fan cooling selected.

The main instrument panel is cooled automatically by pack airflow when the packs are on. During ground operation, when either pack switch is OFF, and in flight in the event both air conditioning packs fail, the instrument panel is cooled by a fan.

CAUTION

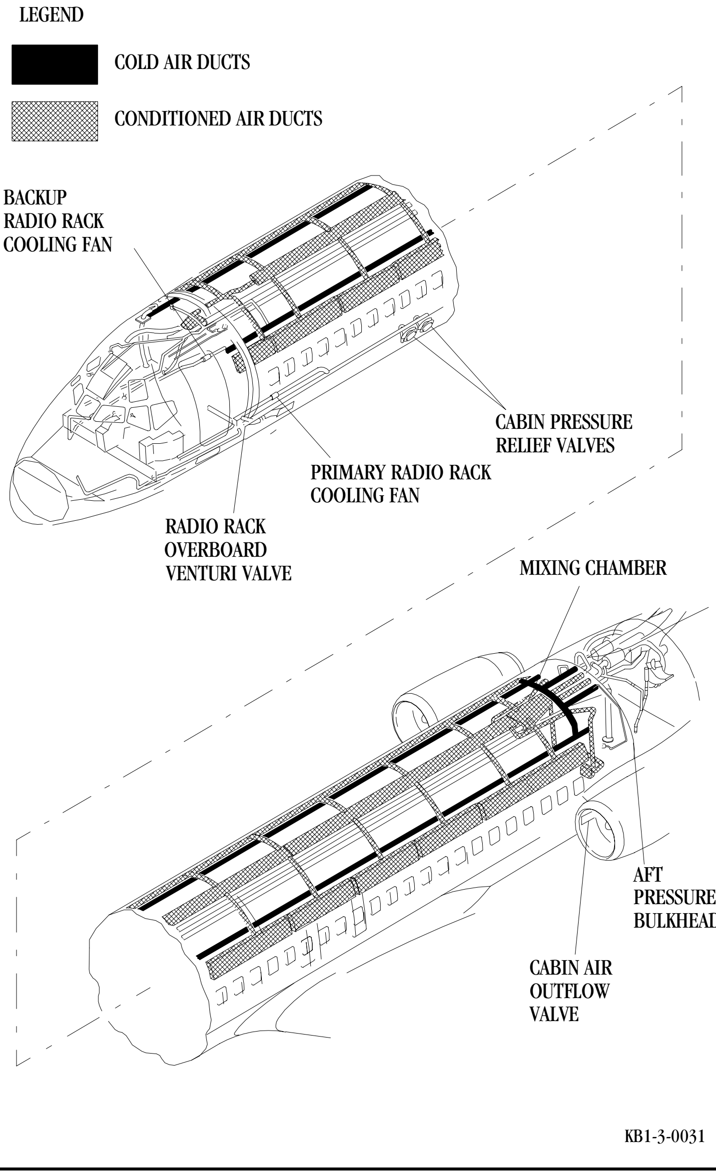
The fan will be turned off on the ground if the pack switches are in the AUTO position. If there is no pack flow, the instrument panel could be damaged

CARGO COMPARTMENT HEATING

The AVIONICS COOLING FANs discussed above draw hot air from the radio racks and discharge the hot air around the forward cargo compartment for heating. These fans are augmented with electrical heating so that the temperature in the forward cargo compartment stays between 60° and 75°F. The electrical heating will automatically shut off in flight if the AVIONICS COOLING FANS are shut off or fail. The electrical heating is not operational on the ground. Live animals can be carried in the section of the forward cargo compartment that is forward of the cargo door. The aft cargo compartment is heated with cabin exhaust air.

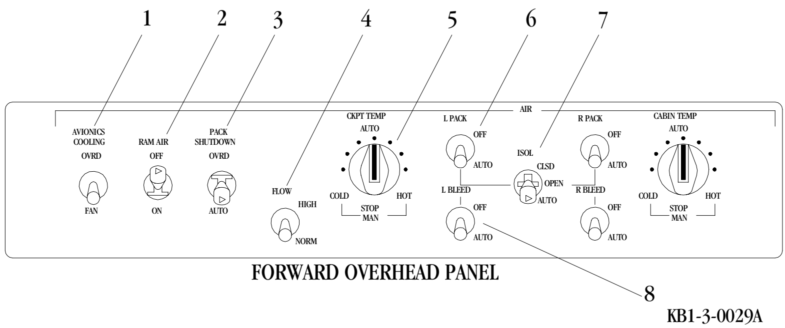
COMPONENTS

Major Component Location



CONTROLS AND DISPLAYS

Air Control Panel



1. **AVIONICS COOLING Switch (switch operates in flight only)**

   OVRD - The venturi valve is commanded open. The radio rack fans are off. Venturi airflow cools the radios.

   FAN - The venturi valve is commanded closed. The fans operate normally.

2. **RAM AIR Switch**

   OFF - Ram air valve is commanded closed.

   ON - Ram air valve is commanded open, allowing ram air to enter the right air conditioning ducts.

3. **PACK SHUTDOWN Switch**

   OVRD - Manually overrides automatic pack shutdown, except when supply temperatures exceed limits.

   AUTO - Allows automatic pack shutdown. (Inhibited above 3,000’ AGL when automatic shutdown is due to engine failure.)

4. **FLOW Switch**

   HIGH - Flow control valve solenoid is deenergized to provide a higher airflow rate.

   NORM - Flow control valve solenoid is energized to provide a lower airflow rate.

5. CKPT/CABIN TEMP Selector

NOTE

When operating in MAN mode, the full cold position should be selected initially. Manual temperature adjustments may be determined and selected thereafter, as desired.

AUTO - Automatically sets conditioned air temperature. The upper portion of selector rotation, from COLD to HOT, is the automatic range.

MAN - Manually sets conditioned air temperature.

NOTE

In MAN it is recommended to start in full cold and adjust as required.

COLD - Adjusts conditioned air temperature toward cool.

STOP - Spring loaded position when selector is released. The temperature control valve remains at the last selected position.

HOT - Adjusts conditioned air temperature toward warm.

6. L/R PACK Switch

OFF - Respective flow control valve commanded closed. Stops conditioned air flow.

AUTO - Respective flow control valve commanded open. Provides automatic conditioned air flow.

7. ISOL Switch

CLSD -I Isolates left and right pneumatic systems.

OPEN - Allows crossfeed of left and right pneumatic systems.

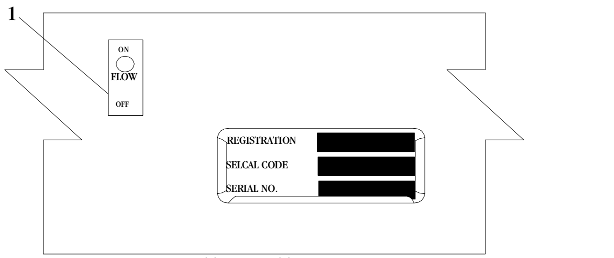
AUTO - Allows automatic crossfeed of left and right pneumatic systems during one bleed source operation with ice protection selected on.

8. L/R BLEED Switch

OFF - Turns off associated bleed air system. PRSOV commanded closed.

AUTO - Turns on associated bleed air system. PRSOV controlled by pneumatic system controller.

Instrument Panel Airflow Indicator



UPPER INSTRUMENT PANEL

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1.AIRFLOW INDICATOR

ON - On the ground, with air conditioning off, indicates instrument panel cooling fan airflow.

OFF - ON the ground, with air conditioning off, indicates the absence of airflow and cooling fan failure.

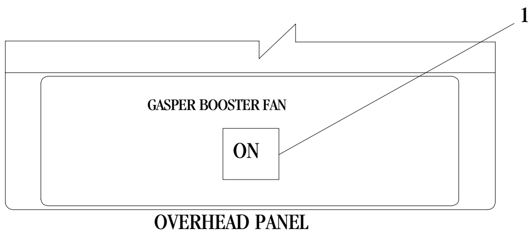
NOTE

Air flow indications apply only during the following:

On Gnd: When either pack is not operating.

In Flight: When both packs are not operating.

Gasper Booster Fan Switch



OVERHEAD PANEL

1.Gasper Booster Fan Switch - (blue)

ON - Provides supplemental airplane ventilation with or without air conditioning packs operating. Word ON illuminates.

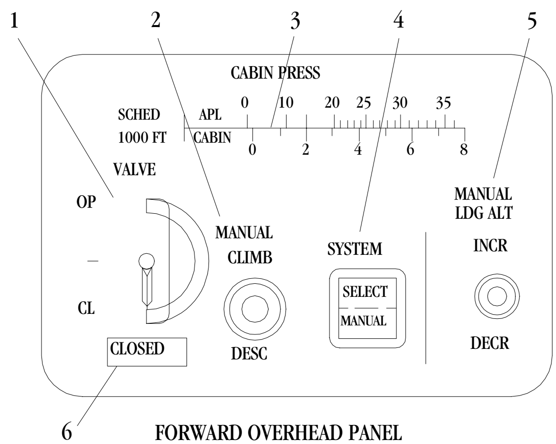
(continued)

NOTE

With packs off during gasper fan operation, the ram air valve should be manually selected to ON (open). The valve does not open automatically.

Off - Booster fan is not on. Switch is not illuminated.

Cabin Pressure Control Panel



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1.Outflow Valve Position Gage

OP - Valve position towards open indicates decreased cabin pressure.

CL - Valve position towards closed indicates increased cabin pressure.

2.MANUAL Switch

CLIMB - When held momentarily towards CLIMB, the outflow valve moves in the open direction, and cabin altitude increases.

DESC - When held momentarily towards DESC, the outflow valve moves in the closed position, and cabin altitude decreases.

3.CABIN PRESS Schedule

APL - Depicts a scale in thousands of feet to represent an airplane altitude.

CABIN - Depicts a scale in thousands of feet to represent a cabin altitude.

The normal relationship between airplane altitude (APL) and cabin pressurization (CABIN) is depicted on this scale.

4.SYSTEM SELECT/MANUAL Switchlight

MANUAL - When switchlight is pushed, MANUAL illuminates and the cabin pressurization system operates in manual mode. Also used to alternate control between cabin pressure controllers (auto 1 and auto 2).

SELECT - Illuminates to indicate failure of both cabin pressure controllers.

SELECT/MANUAL - Extinguished when the pressurization system is operating in automatic mode.

5.MANUAL LDG ALT Switch

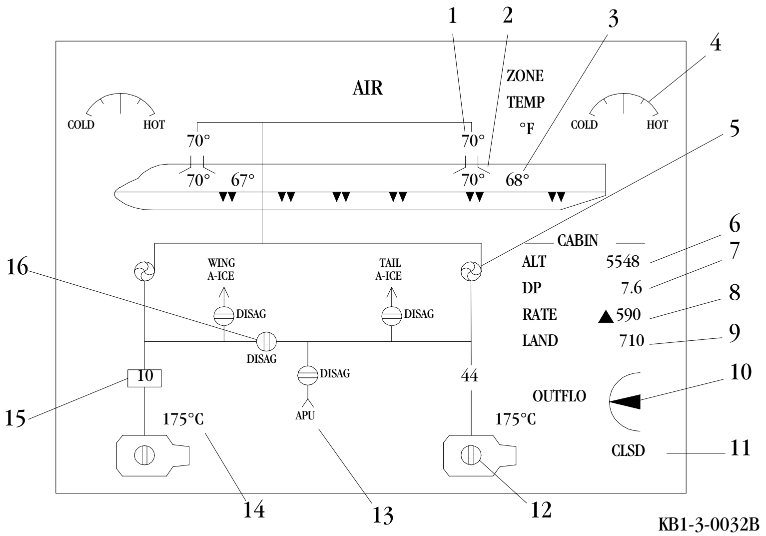
INCR - Increases landing altitude; displayed on the AIR page of the SD.

DECR - Decreases landing altitude; displayed on AIR page of the SD.

6. Outflow Valve CLOSED Light

Illuminated - Indicated the outflow valve is fully closed.

SD SYNOPTIC – AIR (TYPICAL)



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NOTE: A momentary EXT AIR indication may appear after engine start. The EXT AIR indication is an anomaly.

1.Cockpit/Cabin Supply Duct Temperature

White - Normal.

Amber (boxed) - Temperature exceeds limit.

2.Cockpit/Cabin Actual Temperature

White - Normal. Dashed for manual (cockpit).

3.Cockpit/Cabin Selected Temperature

Cyan - Normal. Dashed for manual.

4.Cockpit/Cabin Temperature Dial

Blank - Auto.

White (dial) - Manual.

5.Air Conditioning Pack

White - Commanded off and there is no air flow.

Green (vaned) - Commanded on and there is normal air flow.

Amber - Commanded off and there is normal air flow.

Amber (vaned) - Commanded on with no air flow.

6.Cabin Altitude

White - Normal.

Red (boxed) - Above 10,000 feet.

7.Differential Pressure

White - Normal.

Amber (boxed) - Above normal limit.

8.Cabin Rate of Climb

White - Within normal limits.

Amber - Exceeds normal limits.

9.Landing Altitude

White - Normal. (Dashed for invalid data from Cabin Pressure Control panel.)

10.OUTFLO Valve Position

White - Normal.

Blank - No data.

11.Outflow Valve CLSD

Amber - Fully closed.

White - Not fully closed.

12.Bleed Air Valve

White - Commanded off (horizontal lines), or, commanded on (vertical lines).

Green - Commanded on with engine running (vertical lines).

13.APU

Blanked - APU air not available.

White - APU air available, but not selected.

Green - APU air available, and selected.

14.Bleed Air Temperature

White - Normal (°C).

Amber (boxed) - Exceeds upper limit, or, temperature low with wing/tail anti-ice selected on.

15.Manifold Pressure

White - Normal.

Amber (boxed) - Exceeds high and low limits.

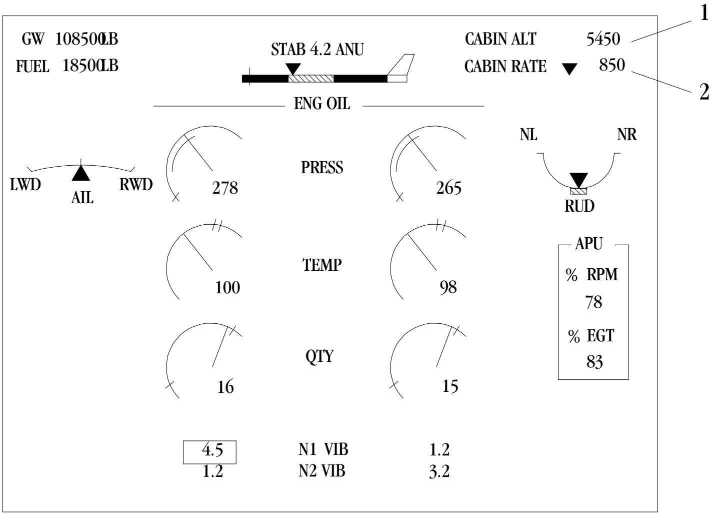
16. Isolation Valve

White - Commanded closed.

Green - Commanded open.

Amber - Valve position disagrees with commanded position.

SD SYNOPTIC – SECONDARY ENGINE (TYPICAL)



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1.CABIN ALT

Cabin altitude in feet.

2.CABIN RATE

Cabin rate of climb in feet per minute.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Red Boxed Alerts (Level 3)

CABIN ALTITUDE (AIR) - Cabin pressure altitude exceeds 10,000 feet.

TAIL TEMP L/R HI (AIR) - The PODs detects an overheat condition in the respective tail compartment.

WING/TAIL MANF FAIL (AIR) - PODs has failed to shut of the affected anti-ice manifold following a failure.

Amber Boxed Alerts (Level 2)

AIR SYS L/R PRES LO (AIR) - Respective system on with low pressure.

AVNCS AIR FLO OFF (AIR) - On the ground, indicates the primary fan has failed. In flight, indicates both fans have failed with fan cooling (AVIONICS COOLING switch in FAN) selected.

BLD AIR L/R TEMP HI (AIR) - Respective manifold temperature exceeds operating limits.

BLD AIR L/R TEMP LO (AIR) - Respective manifold temperature is below normal operating limits.

BLEED AIR L/R FAIL (AIR) - A failure has occurred in the respective bleed air system.

CABIN DUCT OVHT (AIR) - Cabin duct temperature exceeds limit. Pack shutdown could occur.

CABIN INFLO LO (AIR) - Cabin pressure is low. Pack air flow insufficient to maintain pressurization.

CABIN PRES HI (AIR) - Cabin pressure exceeds limits.

CABIN PRESSURIZED (AIR) - The cabin is pressurized while airplane is on the ground.

CKPT DUCT OVHT (AIR) - Cockpit duct temperature exceeds limit. Pack shutdown could occur.

PACK L/R OVERHEAT (AIR) - Respective air conditioning pack has shut down due to high temperature.

Amber Alerts (Level 1)

AIR ISOL DISAG (AIR) - The pneumatic system isolation valve is not in the commanded position

AIR SYS L/R NOT OFF (AIR) - The respective bleed air system is still pressurized when commanded OFF.

AIR SYS L/R OFF (AIR) - The respective bleed air system is off and the isolation valve is closed.

APU VALVE DISAG (AIR) - The APU valve position disagrees with the APU AIR switch position.

AVNCS COOL OVRD (AIR) - The AVIONICS COOLING switch is in the override (OVRD) position.

BLEED AIR L/R OFF (AIR) - The respective bleed air valve is closed.

CABIN PRES MAN FAIL (AIR) - The cabin pressure control panel or manual control of the outflow valve actuator has failed. Manual control is not available.

CABIN PRES SYS MAN (AIR) - The cabin pressurization control system is selected to manual.

CABIN RATE (AIR) - Cabin climb or descent rate exceeds comfortable limits.

CABIN TEMP MANUAL (AIR) - Cabin temperature control knob is selected to manual.

CKPT TEMP MANUAL (AIR) - Cockpit temperature control knob is selected to manual.

CPC 1/2 FAIL (STATUS) - The respective cabin pressure controller has failed.

LDG ALTITUDE MAN (AIR) - The landing field altitude is manually selected.

PACK L/R FLO DISAG (AIR) - Respective pack pneumatic flow disagrees with switch position.

PACK L/R OFF (AIR) - Respective pack is commanded off. MASTER CAUTION lights come on if both packs are off above 4000 feet AGL.

PACK OVRD (AIR) - The PACK SHUTDOWN switch is in the OVRD position.

PODS FAIL (AIR) - PODS has failed and cannot detect a manifold failure.

PODS FAULT (STATUS) - One loop or controller channel of PODS has failed. Manifold failure detection is inoperable.

PODS TEST FAIL (AIR) - The PODS test has failed.

PSC FAULT (STATUS) - The pneumatic system controller has recorded a fault requiring maintenance action.

SEL CAB PRES MAN (AIR) - Both cabin pressure controllers have failed and system only functions when set manually.

SET LDG ALTITUDE (AIR) - Cabin pressurization system landing field elevation data from the FMS is lost and must be set manually.

Cyan Alerts (Level 0)

AIR ISOL OPEN - The pneumatic isolation valve is commanded open.

PACKS ALL OFF - Packs are off for takeoff as selected through the FMS, or packs are switched off during engine failure on takeoff.

PACKS HIGH FLOW - HIGH pack flow is selected on the FLOW switch.

PODS TEST PASS - The PODS test is activated automatically when the engine fire protection test is performed, and the test is successful.

TABLE OF CONTENTS

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DESCRIPTION AND OPERATION

GENERAL

The Automatic Flight System (AFS) consists of 2 Flight Control Computers (FCC), a Flight Control Panel (FCP), a dual autothrottle servo, a stick pusher, a yaw damper actuator, seven position sensors, and three dual autopilot servos. The AFS is a dual, automatic, flight control system, which interfaces with the mechanical control system via dual electric servos. The AFS processes the inputs from airframe sensors, navigational sensors, air data, inertial reference units, and other sources to provide outputs for the control of pitch, roll, yaw, thrust, stall warning, and rudder limiting. The system also sends data to the VIAs where it is processed and used to generate displays and alerts on the LCDs in the cockpit.

Autoflight controls are on the Flight Control Panel (FCP). Annunciations are displayed on the Primary Flight Display (PFD). Related alerts are displayed on the Engine and Alert Display (EAD).

AUTOMATIC PILOT/FLIGHT DIRECTOR (AP/FD)

The FCP provides the means for the flight crew to preset/set speed, heading, vertical speed/flight path angle, and altitude references to be used by the AFS. Other inputs from configuration sensors, Air Data Computers Inertial Reference Units (ADIRU), and Flight Management Functions (FMF) are processed by the FCCs. The FCCs then send command signals to the ailerons, elevator, rudder, autothrottle, and yaw damper. The yaw damper actuator provides series inputs to the rudder control valve. The aileron, elevator, and rudder servos are activated by a cable control system.

In addition, the FCC provides the computations and outputs required to operate the stick shaker, stick pusher, rudder stop limiter, rudder hook monitor, and automatic ground spoiler.

PITCH CONTROL

Pitch modes are controlled from the FCP and are available as follows:

Vertical Speed - A vertical speed can be captured and maintained with the PITCH wheel.

Altitude Hold - Engages automatically after altitude capture or can be pilot engaged by pushing the altitude select knob.

Level Change - An altitude is preset with the altitude select knob and the level change is engaged by pulling the altitude select knob.

Airspeed/Mach Hold - Existing airspeed or Mach is held by pushing the IAS/Mach select knob.

Airspeed/Mach Select - An airspeed or Mach is preset by turning the IAS/Mach select knob. That speed is then captured and maintained by pulling the knob.

Profile - The airplane responds to FMS pitch commands. This mode is engaged by pushing the PROF button.

FMS Speed -The airplane responds to FMS speed targets. This mode is engaged by pushing the FMS SPD button.

Flight Path Angle (FPA) - A flight path angle can be captured and maintained with the V/S-FPA pitch wheel.

Automatic Approach/Landing - The airplane captures and tracks an ILS glideslope, flares for landing, and pitches down at runway contact. This mode is engaged by pushing the APPR/LAND button.

Takeoff - The airplane pitches up to maintain takeoff reference speeds.

Go-around - The airplane pitches up to maintain go-around reference speeds. This mode is engaged by pushing the go-around buttons on the aft part of the throttles.

ROLL CONTROL

Roll modes are controlled from the FCP and are available as follows:

Heading Hold - The airplane maintains a selected magnetic heading. This mode is engaged by pushing the HDG/TRK select knob.

Heading Select - The airplane will capture and hold a selected magnetic heading. This mode is engaged by turning the HDG/TRK knob to preselect a heading and then pulling the knob.

Lateral Navigation - The airplane captures and maintains an FMS lateral course. This mode is engaged by pushing the NAV button.

Automatic Approach/Landing - The airplane captures and tracks an ILS localizer, aligns with the runway, and rolls out on the airplane centerline. Rudder is used as well as aileron.

Takeoff - The airplane maintains wings level prior to liftoff and then maintains the heading tracked during takeoff roll.

Go-Around - The airplane maintains existing heading. This mode is engaged by pushing the go-around buttons on the aft side of the throttles.

AUTO THROTTLE SYSTEM (ATS)

ATS is engaged by pushing the AUTO FLIGHT button on the FCP and the following modes are available:

IAS/Mach - The throttles will adjust to capture and maintain a selected IAS/Mach.

Thrust Limit/Target - The throttles will acquire and maintain the thrust limit/target.

Retard - The throttles will cut back for landing at designated radio altitude.

Clamp - During takeoff (at about 80 knots) full manual throttle is available with ATS engaged.

Speed Protection - The ATS will always maintain airplane speed above stall speed and below maximum speed for any configuration. If The ATS is off, it will automatically engage to provide speed protection.

ATS Thrust Limit - The ATS will prevent the engines from exceeding thrust limits.

ATS disconnect switches are on the outboard side of each throttle. ATS annunciations are displayed on the Primary Flight Display (PFD).

MACH TRIM

The FCCs provide a Mach trim function that is operative when the AP is not engaged (auto pitch trim not on). When Mach trim is active, the stabilizer will automatically move to compensate for pitch forces caused by Mach number.

If Mach trim becomes inoperative, it will automatically stop driving the stabilizer and an alert will be displayed.

AUTOMATIC PITCH TRIM

When the autopilot is on, the stabilizer will automatically move as required to provide pitch trim.

REACTIVE WINDSHEAR ALERT AND GUIDANCE

During takeoff, approach, and go-around, the Windshear Alert and Guidance System (WAGS) provides visual/aural windshear warnings and AP/FD guidance through the windshear. Visual warnings are red for decreasing performance windshear and amber for increasing performance windshear.

On takeoff, when a windshear is detected, WINDSHEAR appears (after flashing) on the PFD and the FMA speed/altitude windows, and three cycles of TAILWIND SHEAR or HEADWIND SHEAR will sound. For decreasing performance windshear the FMA roll window will show HDG XXX. For increasing performance windshear, the FMA roll window will retain takeoff heading. The FD will command a pitch attitude for V2 + 30.

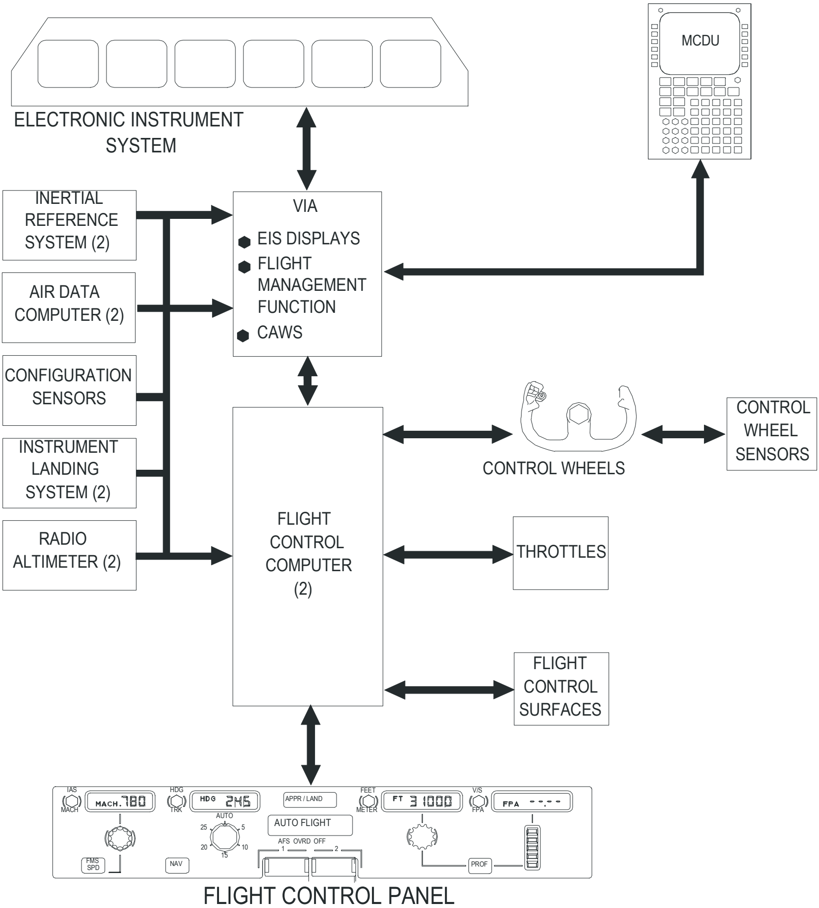
On approach and go-around, the same visual and aural annunciations will activate. The PFD speed bug will go to 1.3Vs+20 and the ATS, if on, will control to this speed. Guidance will not come on during approach unless a go-around is initiated by pushing the GA button or advancing the throttles past the 95% GA thrust limit after windshear is detected. Once the GA is initiated, the ATS, if off, will engage and advance to maximum GA thrust. The FD, if off, will pop up automatically. Guidance will continue until the windshear condition no longer exists.

If windshear is detected after a go-around has been initiated, guidance begins automatically.

For both takeoff and approach/go-around, the Pitch Limit Indicator (PLI) on the PFD shows the difference between airplane AOA and stickshaker AOA. The cyan PLI turns amber as the airplane approaches stickshaker AOA. At stickshaker AOA, the PLI turns red. The PLI is for indication only and is not to be used for guidance command.

The GPWS is inhibited during windshear guidance when the FD commands are being followed. The TCAS is also inhibited except for Traffic Advisories (TA) on the ND.

AFS COMPONENTS



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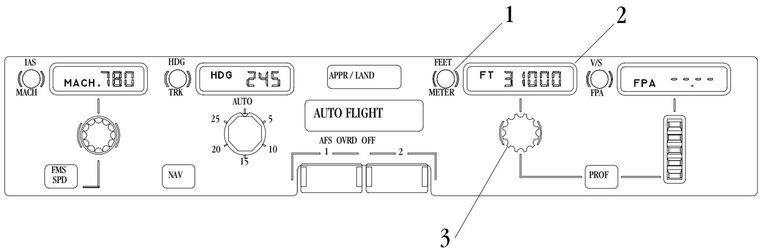
CONTROLS AND DISPLAYS

Altitude Control And Display



CENTER GLARESHIELD

1. **FEET/METER Changeover Button**

   Push - Selects feet or meters on FCP, FMA, and lower right of PFD.

2. **Altitude Display Window**

   Displays altitude dialed in with the altitude select knob. Window is blank if air data computers fail.

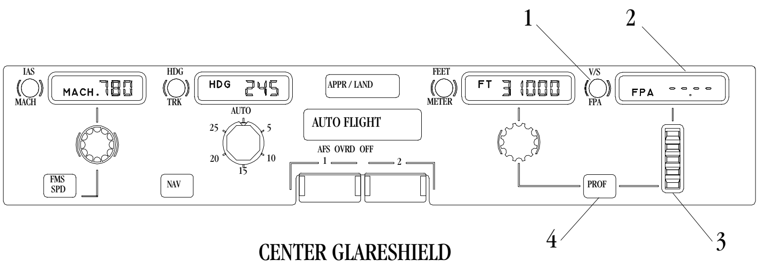
3. **Altitude Select Knob**

   Rotate - Sets preselected altitude in altitude display window. If PROF is engaged, sets FMS clearance ceiling (climb) or floor (descent).

   Pull - Airplane will climb or descend directly to selected altitude. ATS will go to climb thrust or idle descent as required. FCP altitude is displayed on FMA.

   Push - Airplane will hold current altitude. Altitude will display on FCP, FMA, and PFD.

Vertical Control And Display



CENTER GLARESHIELD

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1. **V/S-FPA Changeover Button**

   Push - Selects alternately either vertical speed in FPM or FPA in tenths of degrees.

2. **V/S-FPA Display Window**

   Displays vertical speed or FPA selected with the pitch wheel. Display is blank if V/S or FPA are not engaged. When FPA is selected, the value is in degrees and tenths. When V/S is selected, the value is in fpm.

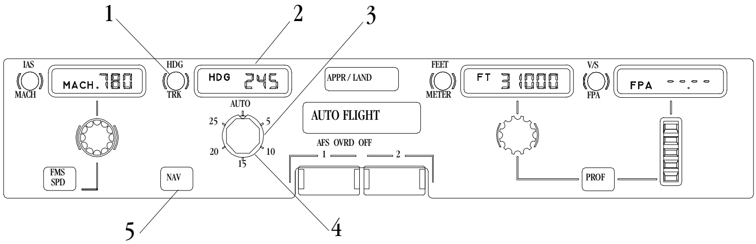
3. **Pitch Wheel**

   Rotate - Selects a vertical speed or FPA in the display window. The airplane then maintains that vertical speed or FPA. If the wheel is rotated again, the vertical speed or FPA will change again.

4. **PROF Switch**

   Push - Engages FMS vertical profile guidance.

Heading Control And Display



1. **HDG/TRK Changeover Button**

   Push - Selects alternately either heading or track in the display window and on the ND.

2. **HDG/TRK Display Window**

   Displays HDG or TRK dialed in with the HDG/TRK selector. Window is blank when the AFS is controlling to the FMS flight plan.

3. **HDG/TRK Selector (Inner Knob)**

   Turn - Preselects a heading or track in the display window.

   Pull - The airplane captures and follows the selected track or heading that is in the display window.

   Push - Airplane maintains current heading or track. The window will display this heading or track.

4. **Bank Angle Limit Selector (Outer Knob)**

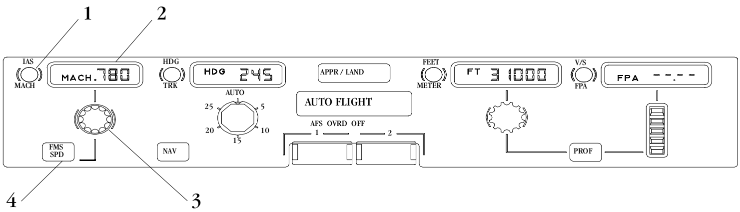
   Rotate - Selects max bank angle in 5 degree increments.

   AUTO - Bank angle limits vary with speed. This selector cannot override FMS bank angle limits. Limits are displayed on the top of the PFD attitude sphere.

5. **NAV Switch**

   Push - Arms the FMS NAV capture mode or resumes FMS lateral control. NAV ARM can be cancelled by selecting HDG/TRK hold, APPR/LAND arm, capturing the localizer, or capturing FMS NAV.

Speed Control And Display



CENTER GLARESHIELD

1. **IAS/MACH Changeover Button**

   Push - Selects alternately either IAS or Mach in the display window.

2. **IAS/MACH Display WIndow**

   Displays the IAS or Mach dialed in with the IAS/MACH select knob. The window shows dashes when the AFS is controlling to FMS flight plan speed.

3. **IAS/MACH Select Knob**

   Rotate - Preselects IAS or Mach in the display window.

   Pull - The airplane holds speed selected in the window.

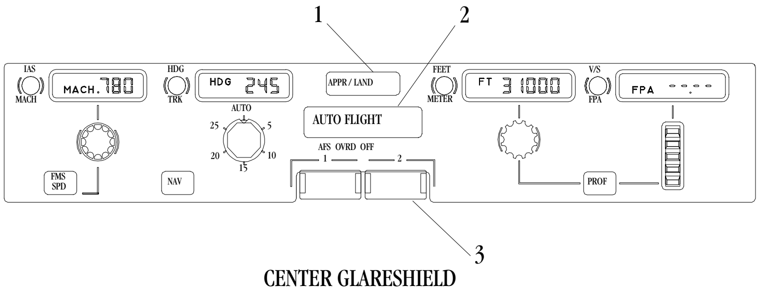
   Push - The airplane maintains current speed and the window will display the speed.

4. **FMS SPD Switch**

   Push - Selects the armed FMS speed. The display window will show dashes and the FMA speed changes from white to magenta. FMS speed can be edited by preselecting an FCP speed with the IAS/MACH select knob and immediately pushing this switch.

   FMS SPD is disengaged by pushing or pulling the IAS/MACH select knob or by engaging go-around.

Appr/Land, Autoflight And AFS Ovrd Off Switches



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1. **APPR/LAND Switch**

   Push - Arms the APPR and LAND modes. LAND ARMED appears in the FMA roll control window. A tuned ILS is required to arm APPR/LAND.

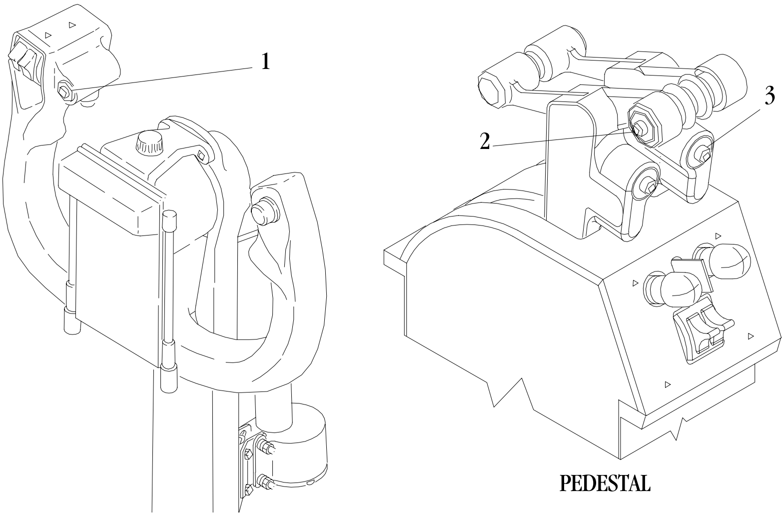
2. **AUTO FLIGHT Switch**

   Push - Engages ATS and one AP in the FD mode that has been selected. If no FD mode has been selected, the AP engages in HDG/TRK HOLD and either altitude hold (if level) or vertical speed hold (if climbing/descending). After AP engagement, each push alternates the AP between AP1 and AP2. This is displayed on the FMA.

3. **AFS OVRD OFF Switches (2)**

   Push down - Allows emergency disconnect of respective autopilot, autothrottle, and yaw damper. In OFF, an amber and gray bar comes into view.

AP Disconnect And Go-Around



1. AP Disconnect Switches

Push - Disconnects the autopilot system. AP OFF in red will flash in the PFD.

2. ATS Disconnect Switches

Push - Disconnects the autothrottle system. ATS OFF message is red will flash in the PFD.

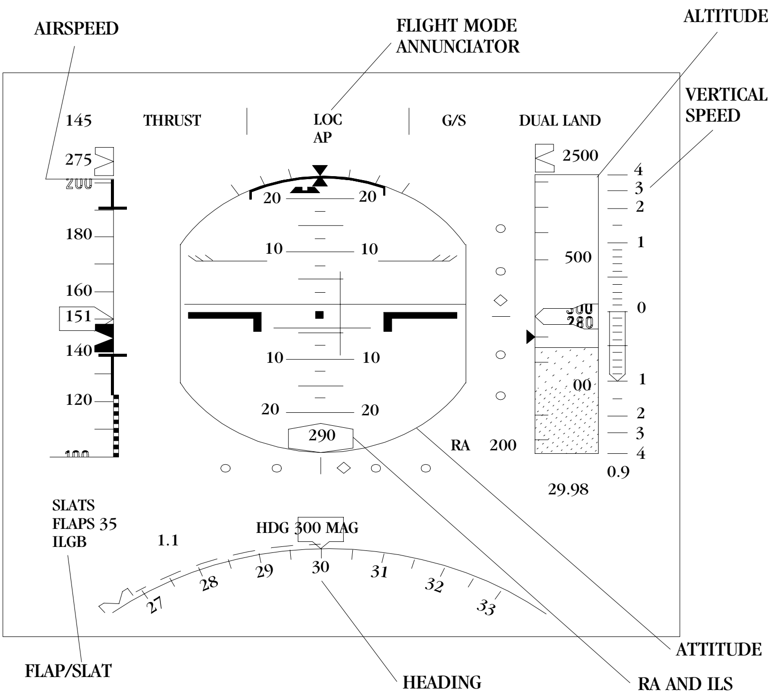
Pushing either switch when the ATS warning system is activated, the ATS OFF message stops flashing, changes color to white if re-engagement is possible, or amber if a condition is present which prevents further use of the system.

3. GA Button

Push - Airplane enters go-around mode as follows:

- FDs pop up to go-around (even if off).
- If AP is on, it will follow FD commands.
- ATS goes to go-around thrust limits.
- Parallel rudder is active and bank is limited to 10 degrees.
- Reference speed, PITCH, and GO-AROUND appear on FMA.
- Windshear pitch guidance comes on if windshear warning is active. WINDSHEAR appears in FMA speed & alt windows.

Primary Flight Display



NOTE: The flight mode annunciator (FMA) is the uppermost line of data on the PFD and is presented separately.

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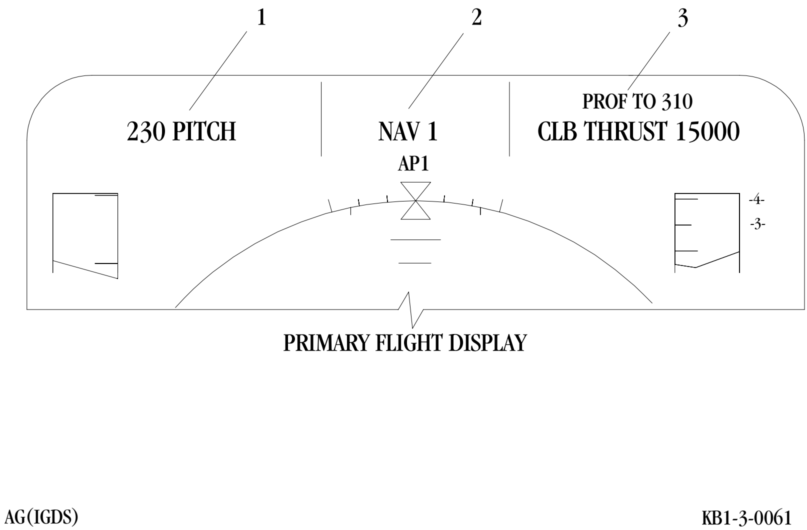
Flight Mode Annunciator



1. Speed Control Window

Shows FCP or FMS speed and mode. Mode is magenta when the FMS speed is engaged and the airplane is controlling to an FMS or pilot selected speed. The mode is white when an AFS speed mode is engaged and controlling to a pilot selected speed. When THRUST mode is on, ATS should be engaged. If it is not, the white ATS OFF box appears. If ATS is inop, the amber ATS OFF box appears. If a speed has been commanded that cannot be maintained due to vertical speed or FPA, the speed and mode will flash. Flashing continues until the airplane accelerates towards the target speed. If the mode changes due to an auto reversion, the new mode flashes 5 times. If speed protection engages, HI SPEED or LO SPEED PROTECTION will be displayed. Windshear warnings are displayed by a flashing white WINDSHEAR followed by a steady white WINDSHEAR.

2. Roll Control Window

Shows roll mode. Digits are displayed in HDG or TRK mode. Engaged AP (1 or 2) is shown. FMS modes are magenta, pilot and AFS modes are white, and DUAL LAND mode is green. If the mode changes due to an auto reversion, the new mode flashes 5 times. Armed modes are in small characters above the engaged mode.

3. **Altitude Control Window**

Shows FMS or FCP target altitude and profile mode. FMS altitudes and modes are magenta. Pilot selected altitudes and modes are white. If the mode changes due to an auto reversion, the new mode flashes 5 times. Armed modes are shown above the engaged mode. The GROUND PROX warning is in red and flashes with the engaged mode. The WINDSHEAR mode annunciation has priority over all modes including GPWS.

FMA Control Window Modes

SPEED MODES	ANNUNCIATION	COLOR
FMS Descent	IDLE THRUST	Magenta
Speed-on-Pitch (level change)	PITCH	Magenta/White
Speed-on-Throttle	THRUST	Magenta/White
Throttle Retard	RETARD	White
Windshear	WINDSHEAR	White
Lo Speed Protection	LO SPEED PROTECTION	White
Hi Speed Protection	HI SPEED PROTECTION	White

ROLL MODES	ANNUNCIATION	COLOR
Capture/Track LOC	LOC ONLY	White
FMS Nav	NAV1 or NAV2	Magenta
Heading Hold/Select	HEADING	White
Track Hold or Select	TRACK	White
Landing Rollout	ROLLOUT	Green/White
Localizer	LOC	Green/White
Runway Alignment	ALIGN	Green/White
Takeoff Roll	TAKEOFF	White
FMS Nav Armed	NAV ARMED	Magenta
LAND Armed	LAND ARMED	White
LOC Armed	LOC ARMED	White

ALTITUDE MODES	ANNUNCIATION	COLOR
Takeoff Thrust	T/O THRUST	White/Magenta
Takeoff Clamp	T/O CLAMP	White/Magenta
Climb w/Climb Thrust	CLB THRUST	White/Magenta
Altitude Hold	HOLD	White/Magenta
Climb w/MCT Thrust	MCT THRUST	White/Magenta
Vertical Speed	V/S	White/Magenta
Flight Path Angle	FPA	White
FMS Prof Descent	PROF	Magenta
GA Thrust	GO AROUND	White
Glideslope	G/S	White/Green
Dual Autoland	DUAL LAND	Green
Single Autoland	SINGLE LAND	White
No Land Mode	APPR ONLY	White
IIIA/B Autoland Flare	FLARE	White/Green
IIIA/B Autoland Roll	ROLLOUT	White/Green
Level Change Desc	IDLE CLAMP	White
FMS Speed-on-Elev	IDLE	Magenta
Next FMS Prof Alt	PROF TO	Magenta
PROF armed	PROF ARMED	Magenta
Prof altitude change	VERT ALERT	Magenta
G/S Capture Arm	LAND ARMED	White
Windshear (GA Thrust)	WINDSHEAR	White
Climb w/GA Thrust	GA THRUST	White/Magenta
Climb w/Cruise Thrust	CRZ THRUST	White/Magenta

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Alerts (Level 1)

AUTOPILOT SINGLE (MISC) - Only 1 autopilot is available.

FCC1/2 FAIL (CONFIG) - Respective FCC has failed.

FCC 1/2 FAULT (CONFIG) - Respective FCC has a fault.

FD G/A ONLY (MISC) - Autopilot go-around not available.

MANUAL G/A ONLY (MISC) - Autopilot and flight director go around modes are not available.

NO AUTOLAND (MISC) - Autoland mode is not available.

SINGLE LAND (MISC) - Autoland reduced from dual land to single land.

WSHEAR DET FAIL (MISC) - Windshear detection is inoperative.

TABLE OF CONTENTS

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DESCRIPTION AND OPERATION

GENERAL

The communication systems consist of a Digitally-Controlled Audio System (DCAS). This system provides all of the functions for the flight interphone system, the service interphone system, the Audio Control Panels (ACP), the Audio Remote Electronics Unit (AREU), the VHF communication systems, SELCAL, PA, and the Cockpit Voice Recorder (CVR).

FLIGHT INTERPHONE SYSTEM

The flight interphone system provides communications between the flight crew, as well as communications at the external power panel and the avionics compartment.

Microphone connections, headset jacks, and a handheld microphone are located at the Captain's console, the First Officer's console, and on the overhead panel for the Observer. A headset jack is also located on the external power panel.

NOTE

Headsets with boom microphones will be used below 18,000 feet.

Two speakers are located in the cockpit for the Captain and First Officer. Operation of the Captain's/First Officer's microphones or the PA mutes the speakers. Operation of the Observer's microphone does not mute the speakers.

SERVICE INTERPHONE SYSTEM

The service interphone system allows communication between the various service and maintenance locations around the airplane, the cockpit, and the cabin attendant stations. Telephone-type handsets in the cockpit and at the forward and aft attendant panels are used for both the service interphone and the PA system.

AUDIO CONTROL PANEL

Three digitally controlled Audio Control Panels (ACP) are used to control the radios, the PA system, and the audio for cockpit and cabin interphone and navigation receivers. The audio control panels for the Captain and First Officer are located on the respective consoles. The audio control panel for the Observer is on the aft overhead panel.

Pushing a MIC switch on the ACP selects the respective radio. The MIC switch on the outboard horn of either control wheel, the Push-To-Talk (PTT) switch on either hand microphone, or the radio/intercom PTT switch on each audio control panel may then be used to key the microphone for transmission.

Depressing (to pop out) and rotating the corresponding receiver's volume control knob adjusts the volume. Audio signals from two receivers may be simultaneously monitored by depressing the respective ACP volume control knob(s) to pop out and then rotating for desired volume.

OXYGEN MASK MICROPHONE AND JACKS

The oxygen mask microphone is contained within the EROS oxygen mask. Boom headset, boom microphone, and hand-held microphone jacks are provided. The Captain's and the First Officer's jacks are located in the respective console. The Observer's jacks are located adjacent to the observer's seat.

A boom microphone/mask microphone switch is located within each EROS oxygen mask stowage box and connects either the boom or the mask microphone.

The boom microphone automatically connects to the communication systems when the mask is stowed (and reset).

The mask microphone automatically connects to the communication systems when the mask is out of its stowage box and is in use.

VHF COMMUNICATION SYSTEMS

Two separate, identical VHF communication systems (VHF-1 and VHF-2) provide communication between the airplane and ground and/or another airplane. Both systems operate separately or simultaneously.

The VHF control panels are on the pedestal. Each VHF panel has a frequency selector, active and standby frequency windows, and a frequency transfer switch.

The Emergency DC bus supplies power to the VHF-1 radio.

The VHF communication systems interface with the following avionics systems:

4. SELCAL - The VHF system interfaces with SELCAL to receive selective calling signals.
5. Cockpit Audio System - The VHF system interfaces to the Remote Electronic Unit (REU) for cockpit voice.
6. Central Fault Display System (CFDIU) - The VHF system interfaces with the CFDIU for reporting system fault information.
7. Flight Data Recording System - The VHF system interfaces with the Versatile Integrated Avionics (VIA) via a Data Concentrator Unit (DCU) for recording the cockpit communication time.

SELECTIVE CALLING (SELCAL) SYSTEM

The SELCAL system provides visual and aural signals to the crew when the airplane is being called from the ground. The system operates in conjunction with the VHF system.

When a call is received, the respective MIC switch on the ACP illuminates and a chime from the central aural warning system (CAWS) sounds through the cockpit speakers and the headphones.

SELCAL interfaces with the following avionics:

- VHF communication system.
- Cockpit audio system.
- Audio control panel.
- Central Aural Warning System (CAWS).

PA SYSTEM

The PA system enables the pilots and cabin attendants to address passengers from the cockpit or the cabin through speakers located in the cabin, galleys and lavatories. PA announcements from the cockpit have priority over announcements made from any cabin station.

PA announcements from the cockpit can be made with the service interphone handset, the mask or boom microphones, or the handheld microphones.

When using the service interphone handset on the aft pedestal for PA announcements, the handset must be out of its hanger and the PA switch on the overhead panel must be selected to ON.

PA announcements from the cabin attendant panels are made through the service interphone handsets.

COCKPIT VOICE RECORDER

The Cockpit Voice Recorder (CVR), located in the aft tail compartment, continuously records and preserves the last 2 hours of cockpit sounds and communications, and all communications through the Captain's and First Officer's ACP and handsets. Controls for the CVR are on the overhead panel.

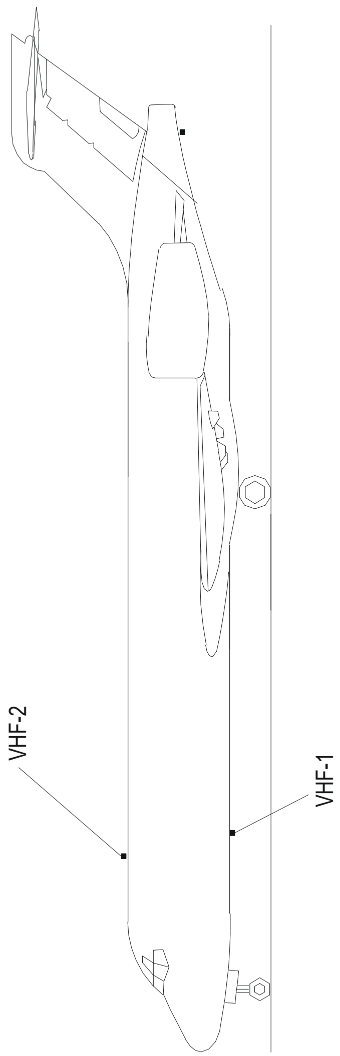
A water-activated Underwater Locator Beacon (ULB), attached to the CVR, provides an acoustic signal to aid in recovery of the submerged CVR.

The CVR operates automatically and continuously whenever power is available to the airplane. No crew action is required.

With the parking brake set, and the airplane ground sensing system automatically set in ground mode, pushing the ERASE pushbutton on the CVR MICROPHONE MONITOR control panel erases the recorder memory.

COMPONENTS

Antenna Locations



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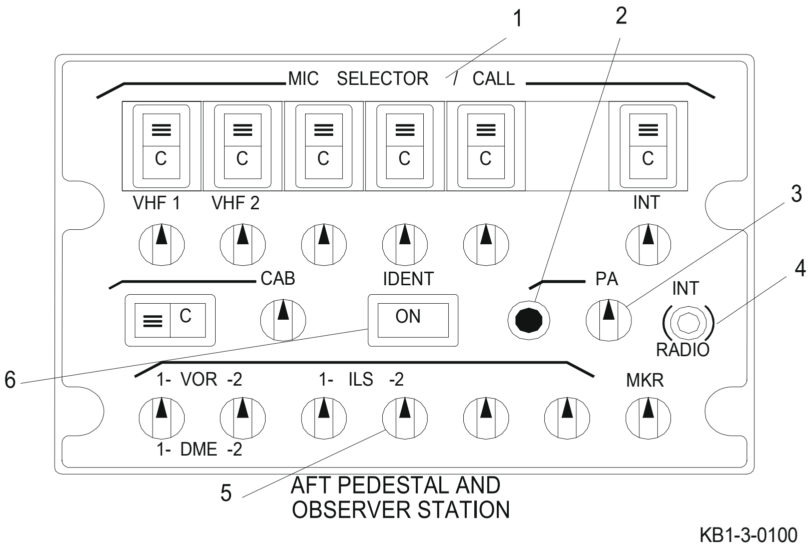
CONTROLS AND DISPLAYS

Audio Control Panel



1. **MIC SELECTOR/CALL Switch**

   Push - Selects desired transmitter. Integral (bars) light illuminates to indicate selection. Only one switch can be selected at a time.

   Integral (C) light illuminates in conjunction with chime from CAWS when applicable SELCAL channel is called by a ground station, or for an interphone call (on INT button). Switch and chime may be reset by keying the corresponding radio.

2. **PA Button**

   Push - When the PA button is held, PA transmissions can be made with either the boom or oxygen mask microphone.

3. **PA Volume Control Knob**

   Push - Pops out.

   Rotate - Adjusts the audio volume of the PA audio in the cockpit speakers and headsets.

4. **RADIO/INT Switch**

   Keys a radio transmitter or the flight interphone. Momentary in either position. Returns to center (off) when released.

   RADIO (Aft) - Keys radio transmitter selected by pushing microphone switch, for mask or boom microphone operation.

   INT (Fwd) - Keys flight interphone for mask or boom microphone operation, regardless of MIC selection.

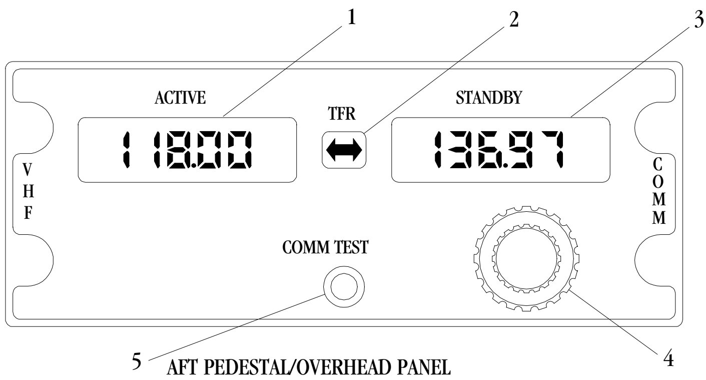
5. **On/Off/Volume Control Knob(s)**

   Push - When popped out, selects audio signal to monitor. Push again to stay in to discontinue monitoring. Rotate to adjust volume. All receivers can be monitored at the same time.

6. **IDENT Switch - white**

   Push - Selects voice and coded identification tones of the NAV1/2 or ADF 1/2 receivers. ON illuminates to indicate selection. Push again for reception without ID tones.

VHF Control Panel



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1. **ACTIVE Window**

   Displays the frequency in use.

2. **TFR Switch**

   Push - Transfers freqs between the STANDBY and ACTIVE windows.

   Frequencies are selected on the STANDBY window and transferred to the ACTIVE window. Frequencies in STANDBY cannot be used until transferred.

3. **STANDBY Window**

   Displays the standby frequency as selected. To transmit on this frequency, transfer to the ACTIVE window.

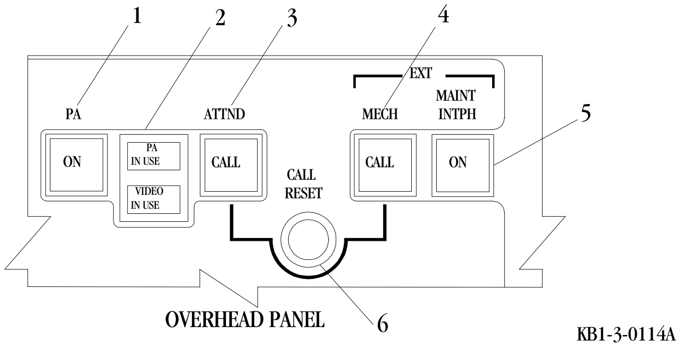
4. **Frequency Selector**

   Rotate - Selects the freq in the STANDBY window only.

5. **COMM TEST Switch**

   Push - Momentarily (5 seconds) disables the squelch.

PA, Call And Intph Switches



1. **PA ON Switch - blue**

   Push - Connects the handset on the aft pedestal to the PA system when the handset is removed from its hanger. ON illuminates.

   Replacing the handset disconnects the handset from the PA system, extinguishes the switch, and reverts the handset to the service interphone function.

2. **PA IN USE Light - blue**

   Light illuminates when a PA announcement is made from the cockpit microphone(s), the cabin handset(s), or when the Prerecorded Announcement Machine (PRAM)/Video is activated.

3. **ATTND CALL Switch - blue**

   Push - Initiates a cockpit-to-cabin attendant station call. Sounds a chime and illuminates the pink master call light at the cabin attendant stations.

   CALL - Illuminates when a flight attendant calls the cockpit from a cabin attendant station.

4. **MECH CALL Switch - blue**

   Push - Sounds the mechanic call horn.

   CALL - Illuminates when ground personnel push the pilot call switch at the ground power panel.

5. **MAINT INTPH Switch - amber**

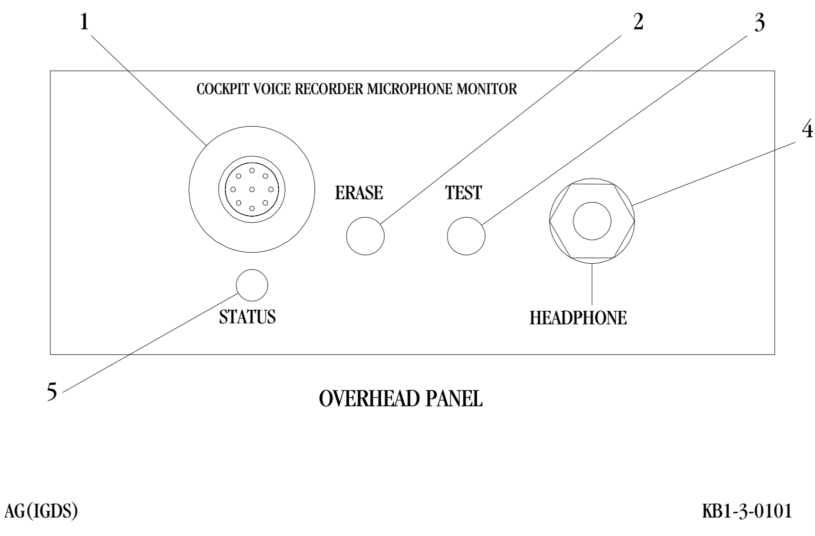
Push - Activates all service interphone jacks located throughout the airplane. ON illuminates.

When pushed again, extinguishes the switch and disconnects all stations from the service interphone (except cockpit, electrical/electronics compartment, ground power panel, and attendant stations.)

6. **CALL RESET Switch**

Push - Extinguishes the ATTND CALL and the MECH CALL lights.

Cockpit Voice Recorder



1. **Cockpit Monitor Microphone**

Records all audible sounds in the cockpit.

2. **ERASE Pushbutton**

Push - Erases the recorder memory when the airplane is on the ground and the parking brake is set.

3. **TEST Pushbutton**

   Push - Tests the CVR. An aural tone is heard through the monitor headphone and the STATUS light illuminates.

4. **HEADPHONE Jack**

   When the headset is plugged into the jack and the TEST pushbutton is pushed, audible tones indicate each function is operating properly.

5. **STATUS Light**

   Illuminates to indicate a successful self-test of all input channels. Does not illuminate if a system fault exists.

COMMUNICATIONS SCHEMATIC

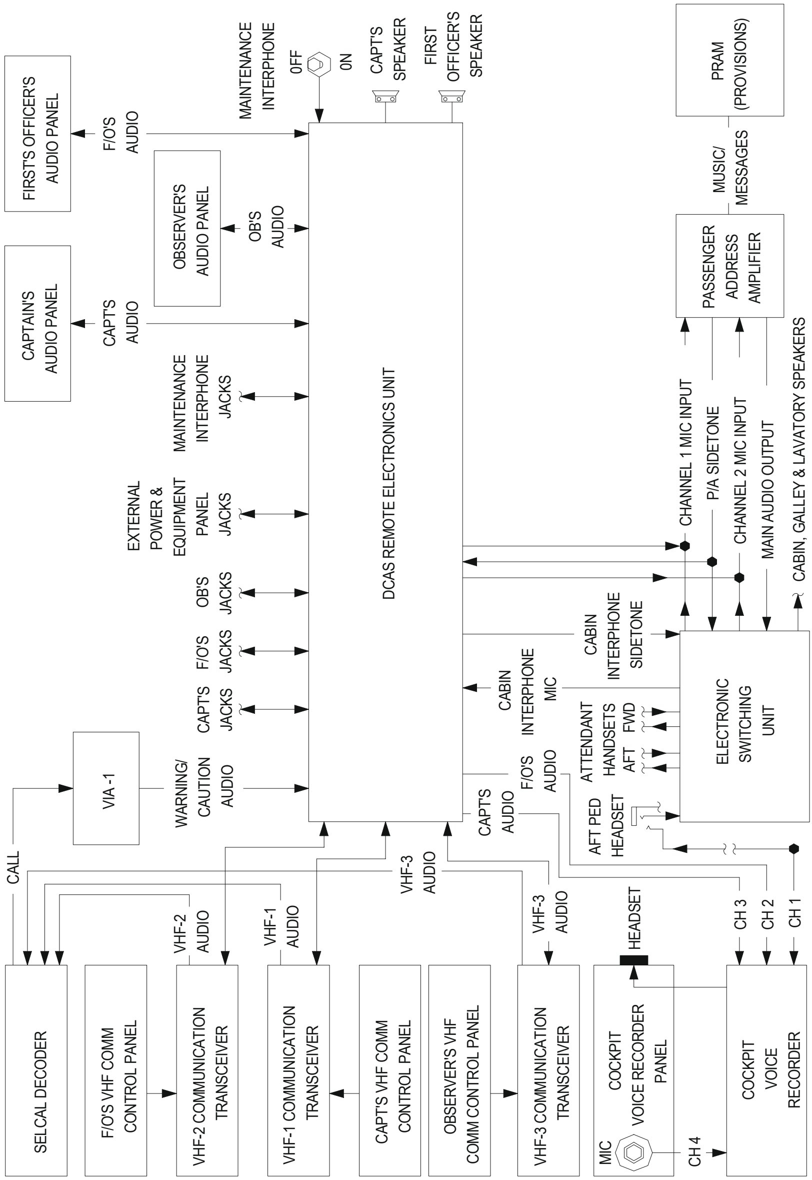


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TABLE OF CONTENTS

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ELECTRICAL

INTRODUCTION

The electrical power system generates and distributes AC and DC power to the airplane systems. The system consists of Integrated Drive Generator (IDG) power, auxiliary power, external power, DC power, emergency power, and ground service power. A no break power transfer system allows uninterrupted power switching under normal conditions.

Most system operation is controlled automatically by the Electrical Power Control Unit (EPCU), the Power Conversion and Distribution Units (PCDU) associated with each IDG, and the Auxiliary Power Conversion and Distribution Unit (APCDU) associated with the APU.

Manual controls for the electrical system are on the overhead panel. System alerts are displayed on the Engine and Alert Display (EAD). Relay positions, bus status, and system parameters are displayed on the System Display (SD) electrical synoptic.

INTEGRATED DRIVE GENERATOR (IDG)

Primary AC power is supplied by two (one IDG for each engine) 115-volt, 400Hz Integrated Drive Generators (IDG). Each IDG is normally connected to its associated main generator bus. No flight crew action is required for normal operating conditions. The function of the IDG is to convert the variable mechanical input speed, supplied by the engine gearbox, to a constant generator rotor speed. When the main generator rotor spins at this constant rpm, acceptable voltage and frequency is maintained. Each IDG is rated at 35/40 KVA and has a self contained oil system which is used for cooling and lubricating the unit. Each IDG is equipped with an internal oil temperature thermal disconnect function. The IDG input shaft is equipped with a shear section.

POWER CONVERSION AND DISTRIBUTION UNIT (PCDU)

Each power distribution system is controlled by their respective Power Conversion and Distribution Unit (PCDU). The three PCDUs receive power from the two IDGs or from the APU, and distribute the power to their respective main generator bus or to the tie bus. Each PCDU integrates the following components:

(continued)

- generator control unit (GCU)
- transformer rectifier (TR)
- generator relay (GR)
- bus tie relay or main external power relay
- DC tie relay
- various protective circuit breakers

PCDU power distribution is influenced by the position of the associated generator switch(es). When the associated generator switch is ON, the generator relay is commanded closed by the PCDU powering the associated generator bus. When the generator switch is OFF, the PCDU commands the associated generator relay to open, removing power from the generator bus. The generator switch RESET position allows a generator reset attempt when an IDG has tripped off line.

GENERATOR BUS POWER

Each IDG normally powers only their respective generator bus. When required, one IDG can power both generator buses through the two bus tie relays and the AC tie bus. This action is automatic when both BUS TIE Relay (BTR) switches are in AUTO position and commanded closed by the associated PCDU. When the BTR switches are in the OPEN position, the bus tie relays are locked open inhibiting cross-tie operations. Prior to any power transfer activity, the PCDU verifies the voltage and frequency are within acceptable limits.

ELECTRICAL POWER CONTROL UNIT (EPCU)

The Electrical Power Control Unit (EPCU), located in the E&E compartment, provides protective functions for the Main External Power Relay (MEPR) and the AC tie bus. The EPCU will remove all galley power when only one generator is providing electrical power for the aircraft, when airborne, regardless of the GALLEY switch position, and will command the Emergency Power Relay to close under specific conditions.

AC POWER

The AC system is divided into a left, right, and auxiliary generation and distribution system.

The primary sources of power for the AC systems (as stated earlier in this chapter) are the two engine driven IDG systems. Voltage and frequency output from the IDGs are regulated by the left or right generator control unit.

During normal operations, the generator buses remain isolated from each other and receive power from their respective IDG.

DC POWER

The DC system is divided into a left, right and auxiliary DC generation and distribution system.

The primary sources of power for the DC system are three Transformer Rectifiers. Each of the three PCDUs have an associated TR (left, right, and center) which convert 115-volt AC power to 28-volt DC power. The TRs then feed this DC power to the left, right, and ground service DC buses. The ships battery provides power to the Battery Direct Bus. When the BATT switch is in the ON position, the battery system also provides power to the DC Transfer Bus.

During normal power operation, the with the BATT switch ON, the battery will be sharing the DC load for the DC Transfer Bus with the center Transformer Rectifier.

Each DC bus may be connected to the DC tie bus with a tie relay.

The DC BUS TIE switch controls the three DC tie relays. When the switch is in OPEN, the DC tie relays are open and the left, right, and ground service DC buses are isolated from each other. When the switch is in AUTO, the DC tie relays are controlled automatically.

AUXILIARY POWER

An APU driven generator is installed to provide aircraft self-sufficiency on the ground and can be used in flight in place of an inoperative main IDG system. The APU driven generator operates at a constant speed and is rated at 40/60 KVA. When voltage and frequency are within limits, the blue APU power ON light illuminates above the APU generator switch. APU power distribution is controlled by the APCDU and influenced by the APU Generator switch. The generator RESET switch position allows a generator reset attempt when APU has tripped off line.

EXTERNAL POWER

External, 115-volt AC power can be connected to the airplane at the ground power receptacle in the left forward fuselage. The EPCU ensures that the external power is within voltage and frequency limits. When external power is connected, the AVAIL light illuminates green providing that voltage and frequency are within limits. External power is controlled with the EXT switch. With the switch in ON (and no engine or APU power source available), and external power connected, power is applied to the AC tie bus. With the switch in OFF, the AC tie bus remains unpowered.

EMERGENCY POWER SYSTEM/BATTERY

The function of the Emergency Power System is to provide electrical power to the emergency buses when a loss of normal power to those buses is sensed. This system is fully automatic when the battery switch in ON and the Emergency Power switch is in ARM. When the system senses a loss of normal power to either of the emergency buses, the emergency power relay is automatically commanded closed. Three ni-cad batteries (ships batteries), located in the E&E compartment, supply power directly to the Emergency DC bus and to the emergency inverter. The emergency inverter changes 28 volts DC to 115 volts AC and then supplies this inverted power to the Emergency AC bus. Other Emergency Power switch positions and their associated functions are described in the Controls and Displays Section. Emergency power should not be relied upon for more than 60 minutes.

NOTE

The first start of the APU is already calculated into the 60 minutes of Emergency Power so it is a “free” start attempt.

BATTERY CHARGER

The aircraft is equipped with a full time battery monitoring and charging system. The charger is functional whenever the Ground Service Bus is powered and the Emergency Power System is not ON. No pilot action is required to operate the charger unit. Specific battery charger operations and malfunctions will be displayed via the EIS Alerting and Warning System.

NO BREAK POWER TRANSFER (NBPT)

The aircraft incorporates a complete NBPT system. All electrical power source transfers, under normal conditions, will occur without power interruption. This function is accomplished by momentarily paralleling on coming and off going power sources on the same bus. NBPT will not be functional if the EPCU is inoperative.

A break power transfer may occur if the EPCU has insufficient time to accomplish power source paralleling prior to the complete loss of a power source. Examples of this would include unexpected loss of APU or IDG power, such as flame-out or uncommanded shutdown. Transfer of aircraft power from APU to an external power source may also cause a break power transfer.

GROUND SERVICE POWER

Ground service power is provided by the 115-volt AC, ground service bus. The bus normally receives power from the AC Tie Bus.

During all normal aircraft operations the ground service bus is powered. When the Ground Service Bus only is to be powered, for ground maintenance personnel, the GROUND SERVICE ELEC PWR Switch on the Aft Overhead Panel is used. When leaving the aircraft with only the Ground Service bus powered, confirm External Power is available and then move the switch GROUND SERVICE ELEC PWR switch to ON, and then move the EXT Power Switch to OFF. All Bus Tie Relays will automatically be commanded open leaving the Ground Service Bus only powered.

BUS SYSTEM PRIORITY

The engine generators have the highest priority for powering their respective generator bus. The APU generator has the second highest priority followed by external power. The opposite engine generator has lowest priority.

Power source priority for the tie bus is the APU generator, external power, right and then left generator.

KEY AIRCRAFT SYSTEMS OPERATIONAL WITH LOSS OF ALL GENERATORS

With loss of all generators, the Captain will be able to fly a raw data approach without autothrottles, autopilot or flight director.

When normal power is lost the system will provide emergency power to the following buses: Battery Direct Bus, DC Transfer Bus, Emergency AC bus (through emerg inverter), Emergency DC bus.

Additionally, below a list of key systems that remain operational (this is not an all inclusive list):

ADIRU - 1

Alerting system (EAD and aural) for powered systems

APU Start System

EIS Control Panel (Captain's only)

Comm Panel (Captain's only) (F/O can hear and transmit on VHF 1 and interphone)

DUs (three on the left - PFD, ND, and EAD - SDs available on DU-3)

Engine Ignition 2

FADEC, EEC-1 and EEC-2

Fire detection and protection system

FMC 1 (in standby)

Fuel start pump

ISIS

MCDU (Captain's only)

MultiMode Receiver 1 (MMR1) (provides guidance information to flight control and display systems - without DME)

Outer Marker

PA handset

Pressurization Control (manual only)

VHF Comm #1

VHF Nav #1 (no DME)

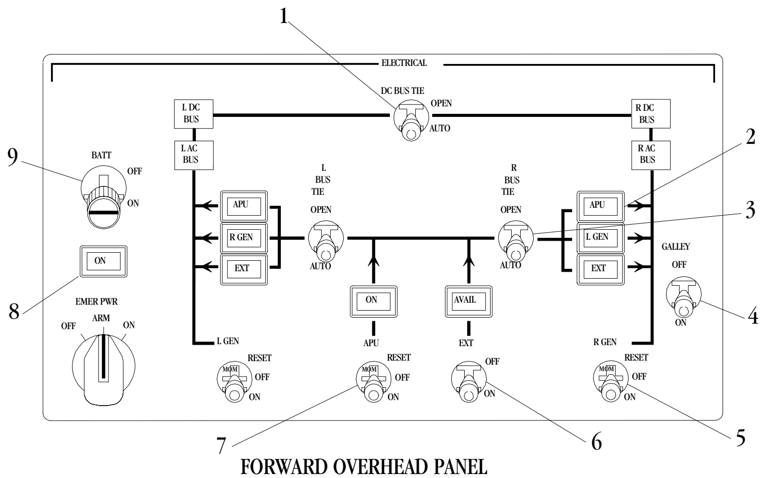
VIA - 1

Key items that are not available when emergency power is activated include:

Fuel pumps
Stab Trim
Spoilers
Flight Directors
Autoflight system
Radio altimeter
Gear position indicators
Automatic pressuization control
Transponder
FCP and F/O EIS control panel
Cabin/Cockpit temperature control.

CONTROLS AND DISPLAYS

Electrical Power Control Panel



1. DC BUS TIE Switch

OPEN - (Pull to unlock) Opens all three DC bus tie relays. Used during smoke procedures or testing.

AUTO - (Pull to unlock) The DC bus tie relays are controlled by the PCDUs and the EPCU as required to make sure all DC buses are powered.

2. APU, L/R GEN, and EXT Lights

Illuminate blue to indicate which power source (APU, generator, or external power) is supplying power to the associated bus.

3. L/R BUS TIE Switch

OPEN - Respective generator cannot power the tie bus. Can also be used to reset a bus tie lockout on the ground.

AUTO - Generator bus to tie bus connection is controlled automatically, as required.

4. GALLEY Switch

OFF - Galley power is off.

ON - Galley power is on. (In flight, if only one generator is providing power to both generator buses, then system sheds the galleys to conserve electrical power.) Can also be used to reset a galley loadshed.

5. L/R GEN Switch

RESET - (Momentary) Resets the generator.

OFF - (Pull to unlock) Disconnects the generator from the respective generator bus.

ON - (Pull to unlock) Generator supplies power to the respective generator bus, if generator is operating.

6. EXT Power Switch and AVAIL light.

OFF - Disconnects external power from the tie bus.

ON - Connects external power to the tie bus.

AVAIL light illuminates green when external power is connected and within limits.

7. APU Power Switch and ON Light

RESET - (Momentary) Resets the APU generator.

OFF - (Pull to unlock) Disconnects the APU generator from the tie bus.

ON - (Pull to unlock) APU generator supplies power to the tie bus if the generator is operating.

ON light illuminates blue when the APU generator is powering the tie bus.

8. EMER PWR Selector and ON Light

OFF - Emergency power is off. Resets the automatic emergency power system.

ARM - Emergency power automatically comes on when the EPCU detects a power loss to the emergency AC or DC bus enabling the battery and static inverter to power these buses.

When turning this switch to arm on the first flight of the day, a test of the electrical system will automatically take place. The test is completed successfully when the ON Light goes off, and the EMERGENCY POWER TEST alert is no longer shown on the EAD.

ON - Emergency power is on. The battery supplies power for AC emergency bus (through the static inverter) and DC emergency bus.

ON LIGHT: Illuminates amber when the emergency power system is on.

NOTE

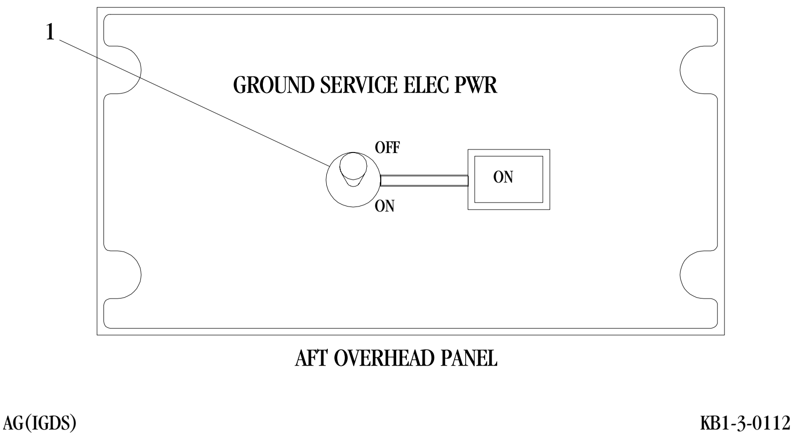
For EMER PWR Selector to automatically or manually power the emergency AC and DC buses, the Battery switch must be on.

9. BATT Switch

OFF - (Pull to unlock) Battery is disconnected from the DC Transfer Bus and connected to the Battery Direct Bus only. Battery charging is not affected.

ON - (Rotate switch knob counter clockwise and pull to unlock) Connects battery to the DC transfer bus and the battery direct bus.

Ground Service Panel



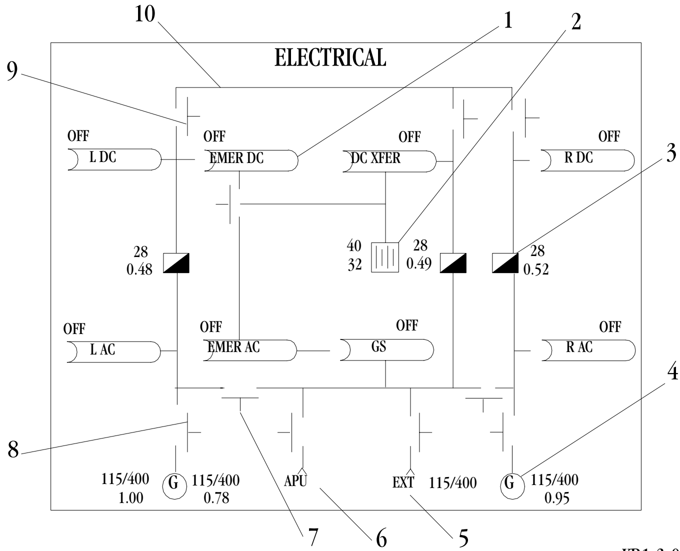
1. GROUND SERVICE ELEC PWR Switch and ON Light

OFF - Neutral position for ground service power.

ON - When EXT power switch is OFF, by turning this switch on, external power is connected to the AC and DC ground service buses. This insures that the AC and DC ground service buses can be powered with no other power on the aircraft.

ON light illuminates blue to indicate external power is powering the ground service bus.

SD SYNOPTIC - ELECTRICAL



KB1-3-0110

1. Power Buses

Green - Bus has normal power.

Amber OFF - Bus does not have power.

2. Battery

Green - Battery is discharging normally.

Amber - Battery voltage is less than normal or battery discharge is abnormal. Voltage digits will be boxed and amber.

White - There is no load on the battery. Load numerics are white in all conditions.

3. Transformer Rectifiers

White - Normal operation.

Amber - TR is failed.

4. Generators

Green - Generator is on with voltage and frequency within limits.

Amber - Generator is off due to relay protective trip. Voltage, freq, and load current digits are boxed and amber if not within limits.

White - Engine is not operating or generator is turned off. Volt and freq digits are white if within limits or engine is not operating. Load current digits are white if within limits.

5. External Power

White - External power available. EXT switch in OFF or main external power relay tripped.

Green - External power on and supplying power.

Blank - External power not connected.

6. APU

White - APU power available. APU generator off due to APU GEN switch in OFF or APU power relay tripped.

Green - APU on and supplying power.

Amber - APU available. APU gen relay off due to protective trip.

Blank - APU power not available.

7. Bus Tie Relay

Green - Relay is closed. Normal condition.

Amber - Relay is opened due to protective trip.

White - Relay is opened. Normal condition.

8. Power Relays

Green - Relay is closed. Normal condition.

Amber - Relay is opened, protective trip condition.

White - Relay is opened. Normal condition.

9. DC Tie Relay

Green - Relay is closed. Normal condition.

Amber - Relay is opened due to protective trip.

White - Relay is opened. Normal condition.

10. **Schematic Flow Lines**

White - Normal powered condition.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

BUS AC EMER OFF (ELEC) - AC emergency bus is off.

BUS DC EMER OFF (ELEC) - DC emergency bus is off.

BUS DC XFER OFF (ELEC) - DC transfer bus has failed.

GEN ALL OFF (ELEC) - Left, Right, and APU generators are off due to faults.

GEN L/R/APU OFF (ELEC) - Respective generator is off due to a fault.

Amber Alerts (Level 1)

BATT CHARGER FAIL (ELEC) - The battery charger is inoperative.

BATT CHARGING (ELEC) - The battery is being charged.

BATT DISCHARGING (ELEC) - The battery is discharging abnormally.

BATT SWITCH OFF (ELEC) - BATT switch is in OFF position.

BUS AC GS OFF (ELEC) - AC ground service bus is off.

BUS AC L/R OFF (ELEC) - Respective bus is off.

BUS DC L/R OFF (ELEC) - Respective DC bus is off.

BUS TIE L/R LOCKOUT (ELEC) - Respective bus tie is locked open due to a fault.

BUS TIE L/R OPEN (ELEC) - Respective BUS TIE switch is in OPEN position.

DC TIE SW OPEN (ELEC) - DC BUS TIE switch is in OPEN position.

ELEC FAULT (ELEC) - Electrical power system has detected an internal fault.

EMER PWR ON (ELEC) - Emergency power is on.

EMER PWR SW OFF (ELEC) - EMER PWR switch is in OFF position.

EMER PWR TST FAIL (ELEC) - The emergency power test has failed.

GEN L/R/APU OFF (ELEC) - Respective generator switch has been selected OFF or ENG/APU FIRE switches have been activated.

TR L/C/R FAIL (ELEC) - A fault exists in the respective TR.

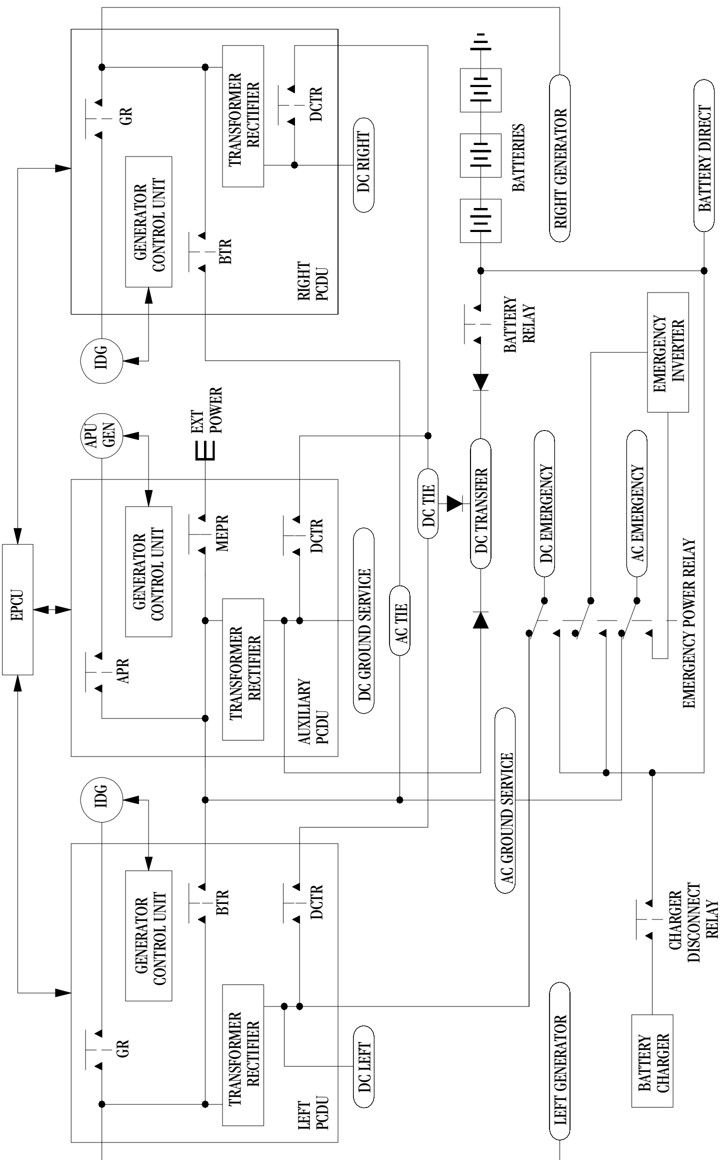
Cyan Alerts (Level 0)

EMER POWER TEST - Emergency power test is in progress.

EXT POWER AVAIL - External power is available.

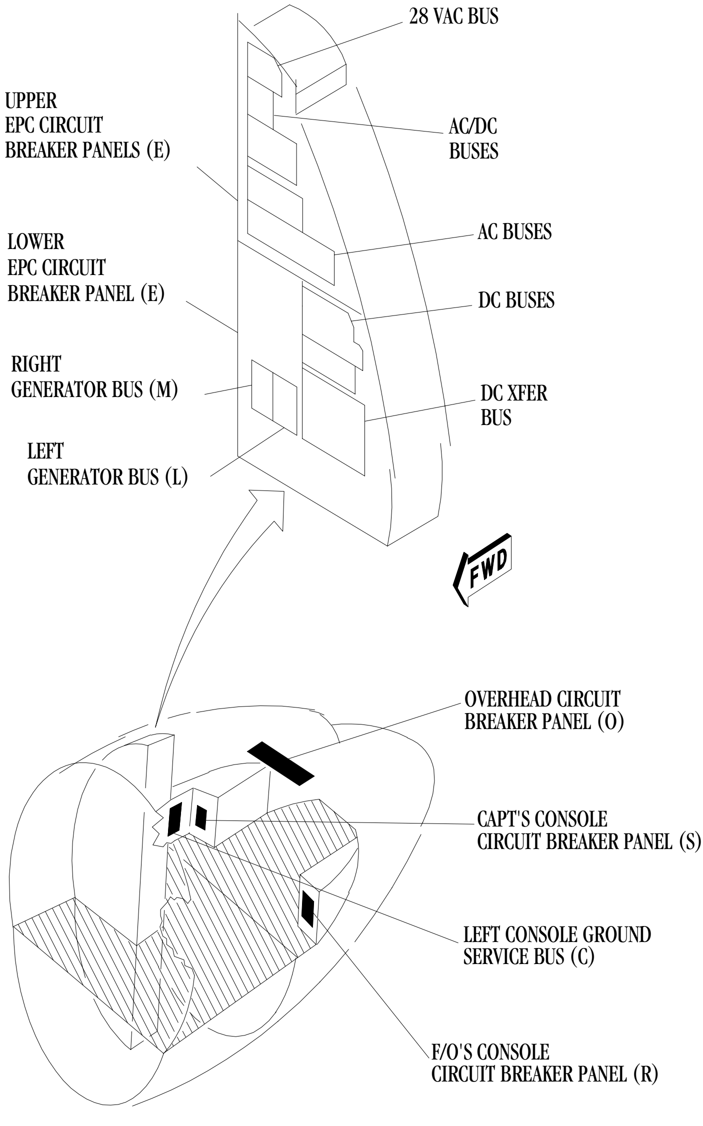
EXT POWER ON - External power is on.

SCHEMATICS



KB1-3-0341

CIRCUIT BREAKER PANEL LOCATION



KB1-3-0342

CIRCUIT BREAKER PANELS FOR ELECTRICAL SYSTEMS

Below and on the following pages are lists of the circuit breakers and their location on the aircraft.

Circuit Breaker Panel Code, Name and Location

CODE	NAME AND LOCATION
B	APU CBP (Sta 115, Left Side)
C	Ground Service Bus CBP (Left Console)
E	Electrical Power Center CBP (Behind Captain's Seat)
J	E/E Compartment (Sta 115)
L	Left Generator Bus (EPC CBP)
M	Right Generator Bus (EPC CBP)
O	Emergency Circuit Breaker Panel (Overhead)
P	External Power Panel (Sta 101 Left Side)
R	F/O's Instrument Panel CPB (Right Fwd Console)
S	Captain's Center Panel and Pedestal CPB (Left Fwd Console)
U	FCC Equip Panel
V	Freeze Protection CPB (Nose Wheel Well)
W	Fwd Cabin Lights CPB (Center Ceiling)
X1	E/E Compartment (Sta 154, Upper)
X2	E/E Compartment (Sta 154, Lower)
Y	Mid Cabin Lights CPB (Right Ceiling)

ALPHABETICAL LISTING OF CIRCUIT BREAKERS

PANEL	LOCATION	CIRCUIT BREAKER NAME
C		115 VAC 400 Cycle Utility Outlet
C		115 VAC Utility E/E Compt
X2		AC Tie Bus Volt Sense
E	F-18	ACARS
O	B-18	ACARS Memory Clock
E	F-24	ADF-1
E	F-12	ADF-2
E	E-13	ADIRU Battery
O	B-5	ADIRU-1
O	B-19	ADIRU-1 Backup Power
E	F-1	ADIRU-2
E	F-13	ADIRU-3
C		Aft Cargo, Tail, Serv Pnl & Wheel Well Lights
E	J-21	Aft Center Fuel Tank Boost Pump
E	Z-27	Aft Drain Mast Heater
C		Aft Left Flush Cont
E	H-23	Aft Left Fuel Tank Boost Pump
E	K-19	Aft Overhead Panel Light
C		Aft Right Flush Cont
E	J-19	Aft Right Fuel Tank Boost Pump
E	U-28	Air Cond Auto Off
E	U-32	Air Cond Flow
O	C-16	Air Condition Flow Control Valve Left
O	C-17	Air Condition Flow Control Valve Right
E	M-28	Air Data Heater Ind
E	L-33	Alternate Passenger Oxygen Release
E	N-37	Anti Collision Lt Cont Indicator
E	R-41	Anti-Skid Ann
E	G-15	Anti-Skid Brake Pressure
E	P-40	Anti-Skid Inboard Power

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	T-38	Anti-Skid Outboard Power
E	Z-34	APCDU DC Power
E	Z-39	APU Control
E	U-39	APU Door Control
E	Z-36	APU Emergency Shutdown Signal
E	X-33	APU Engine Start
E	W-41	APU Fire Warning Horn
X2		APU Gen Feeder Volt Sense
E	Z-35	APU Generator Switch Indication
E	W-31	APU Ready Relay
B		APU Starter
E	D-13	ATC Mode S-1
E	D-1	ATC Mode S-2
E	T-42	Auto Brake Ann
E	P-30	Auto Brake System
E	Z-42	Auto Emer Pwr Transfer Reset
E	L-4	Auto Ground Spoilers Motor
E	L-5	Auto Ground Spoilers Motor
E	L-6	Auto Ground Spoilers Motor
E	E-14	Auto Throttle-1
E	E-4	Auto Throttle-2
E	B-7	Autoflt Sys Ref Voltage-1A
E	A-7	Autoflt Sys Ref Voltage-1B
E	A-8	Autoflt Sys Ref Voltage-2A
E	B-8	Autoflight Sys Ref Voltage-2B
E	M-35	Autoland Light Retract
E	D-11	Autopilot & Alternate Longitudinal Trim
E	D-10	Autopilot & Alternate Longitudinal Trim
E	D-9	Autopilot & Alternate Longitudinal Trim
E	M-36	Autopilot Ldg Lt Retract-1
E	N-36	Autopilot Ldg Lt Retract-2
E	E-19	Autopilot-1

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	E-7	Autopilot-2
E	M-27	Aux Pitot Heater
E	G-26	Aux Fuel Xfer Control A
E	G-13	Aux Fuel Xfer Control B
E	L-20	Bagrack & Handrail Lighting
J		Batt Dir Bus Feed RCCB
O	D-17	Batt Dir Bus Feed
B		Battery Amp
C		Battery Charger
B		Battery Volt/Amp
O	D-11	Battery Xfer Bus Feed
E	T-39	Battery/DC Bus Tie Switch Indic
E	C-2	Cabin Ceiling Lighting Control
E	G-5	Cabin Interphone
W		Cabin Lights Ceiling
W		Cabin Lights Ceiling
W		Cabin Lights Fwd Music
W		Cabin Lights Fwd Music
W		Cabin Lights Handrail
W		Cabin Lights Handrail
W		Cabin Lights Mood Lts
W		Cabin Lights Passenger Reading
W		Cabin Lights Passenger Reading
W		Cabin Lights Passenger Reading
W		Cabin Lights Passenger Reading
W		Cabin Lights Passenger Reading
W		Cabin Lights Passenger Reading
W		Cabin Lights Passenger Reading
W		Cabin Lights Sidewall L
W		Cabin Lights Sidewall R
C		Cabin Lower Sidewall Lights Left
C		Cabin Lower Sidewall Lights Right

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	U-21	Cabin Pressure Control-1
E	U-22	Cabin Pressure Cont Pnl Auto-1
E	W-22	Cabin Pressure Cont Pnl Auto-2
O	A-14	Cabin Pressure Control Panel
E	W-21	Cabin Pressure Control-2
O	A-10	Cabin Standby Lights
E	J-1	Cabin Temp Control
C		Cabin Upper Sidewall Lights Left
C		Cabin Upper Sidewall Lights Right
E	P-25	Call System
E	K-14	Captain’s Inst & Pedestal Panel
E	E-20	Captain’s & First Officer’s Sis Panel
O	C-12	Captain’s Pitot Heater
E	P-33	Captain’s Stick Shaker
E	J-11	Cargo Compartment Heater
E	J-12	Cargo Compartment Heater
E	J-13	Cargo Compartment Heater
E	T-29	Cargo Fire Ext Bottle 1
E	T-30	Cargo Fire Ext Bottle 2
E	S-29	Cargo Smoke Det A
E	S-30	Cargo Smoke Det B
E	S-31	Cargo Smoke Test
O	C-1	Category IIIB Loads
E	X-25	Center Windshield Anti-Ice
E	F-3	CFDIU
E	F-6	Cockpit Voice Recorder
E	W-28	Cockpit Dome Lights
E	P-22	Cockpit Door Unlock
E	H-1	Cockpit Temperature Control
E	M-33	Cockpit Thunderstorm Flood Lts Contol
E	Z-26	Cockpit Window Anti-Fog Clearview & Eyebrow
E	Z-25	Cockpit Window Anti-Fog Control

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	N-38	DC Tie/DC Xfer Bus Feed
E	X-37	DC Transfer Bus Sensing
J		DC Transfer Bus Feed (Bat) RCCB
O	A-8	DCAS Captain
O	B-7	DCAS Serv/Maint Interphone
E	S-32	DCU Ch A
O	A-15	DCU Ch B
O	A-12	Display Unit-1
E	S-33	Display Unit-2
O	A-17	Display Unit-3
E	E-3	Display Unit-4
E	E-8	Display Unit-5
E	E-15	Display Unit-6
E	N-33	Display Warning Light & Test
E	D-14	DME-1
E	D-2	DME-2
E	R-22	Door Warning
E	M-26	Drain Mast Heater Annunciation
C		Drain Valve Power
E	W-32	EEC-1 Ch A
E	X-32	EEC-1 Ch B
O	B-16	EEC-2 Ch A
O	B-17	EEC-2 Ch B
C		Emer AC Bus Feed
O	D-15	Emer DC Bus Feed
O	D-13	Emer Inverter Bus Feed
J		Emer Inverter RCCB
E	Z-31	Emerg Power Load Shed
O	A-3	Emergency AC Bus Sensing
J		Emergency DC Bus Feed RCCB
O	C-7	Emergency DC Bus Sensing
O	A-11	Emergency Lights Arm & Charge

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	Z-37	Emergency Lights Charging
O	A-2	Emergency Nav Instr Xfmr
O	A-9	Emergency Power In Use Lights
E	U-40	Engine Start Pump
E	K-31	Engine Vibration Monitor
E	X-31	EPCU DC Power
E	X-38	Ext Power Light Test
P		External Power
P		External Power
P		External Power
E	X-34	External Power Avail Indication
P		External Power Cart
P		External Power Ind
P		External Power Relays
X2		External Power Volt Sensing
X2		External Power Volt Sensing
X2		External Power Volt Sensing
E	T-34	F/O DCAS
E	N-27	F/O Pitot Heater
E	R-33	F/O Stick Shaker
Y		Fasten Seat Belt
W		Fasten Seat Belt
E	S-40	FCC-1 Backup Power
E	G-24	FCC-1A Main Power
E	G-25	FCC-1B Main Power
E	S-41	FCC-2 Backup Power
E	G-10	FCC-2A Main Power
E	G-11	FCC-2B Main Power
E	D-19	FDAMS
E	Z-33	Fill Drain Valve Control
C		Fill/Vent Valve Power
E	W-35	Fire Detectors APU Loop A

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	W-36	Fire Detectors APU Loop B
E	W-39	Fire Detectors Left Engine Loop A
E	W-40	Fire Detectors Left Engine Loop B
E	W-37	Fire Detectors Right Engine Loop A
E	W-38	Fire Detectors Right Engine Loop B
E	X-41	Fire Extinguishing Control Bottle 1
E	X-42	Fire Extinguishing Control Bottle 2
E	U-33	Fire Handle Pulled Signal
E	W-42	Fire Warning Lights
E	R-26	Firex Agent Low Pressure Caution
E	B-12	Flap/Flap Handle Position-1
E	A-12	Flap/Flap Handle Position-2
E	F-21	Flight Recorder
X1		Floor & Circuit Breaker Panel Lights
E	U-31	Flt/Gnd Relay
E	J-17	Fuel Quantity Pwr Xfer Ch A
E	H-17	Fuel Quantity Pwr Xfer Ch B
E	M-31	Fwd Attd Control Switch Illumination
C		Fwd Cargo & Service Panel Lights
E	H-21	Fwd Center Fuel Tank Boost Pump
E	X-27	Fwd Drain Mast Heater
L		Fwd Galley-1 Power
L		Fwd Galley-1 Power
L		Fwd Galley-1 Power
M		Fwd Galley-2 Power
M		Fwd Galley-2 Power
M		Fwd Galley-2 Power
C		Fwd Left Flush Cont
E	J-23	Fwd Left Fuel Tank Boost Pump
O	A-20	Fwd Passenger Entrance Stair Carriage Motors-1
O	A-21	Fwd Passenger Entrance Stair Carriage Motors-2
O	A-19	Fwd Passenger Entrance Stair Control

PANEL	LOCATION	CIRCUIT BREAKER NAME
C		Fwd Passenger Entrance Stair Lights
E	H-19	Fwd Right Fuel Tank Boost Pump
C		Galley Area Work Lights
E	L-3	Galley Control
E	J-27	Gasper Booster Fan
E	C-3	Gasper Booster Fan Control
E	G-12	GCP B Main Power
E	T-41	GCP Backup Power
O	A-13	GCP A Main Power
E	U-36	Generator Control Indicator APU
E	U-38	Generator Control Indicator Left
E	U-37	Generator Control Indicator Right
R		Glareshield Lightplates
R		Glareshield Lightplates LCD
E	F-20	GPWS
E	C-6	Ground Flood Lights Control Left
E	C-5	Ground Flood Lights Control Right
C		Ground Flood Lights Left
C		Ground Flood Lights Right
E	G-20	Ground Proximity Warning Lights
E	Z-38	Ground Refuel
O	B-22	Ground Refueling
X1		Ground Refueling Indicator Input Power
C		Ground Service Bus Sensing Relay
E	M-37	Handrail Lighting Control
E	R-28	Hi-Int Control Indicator
E	B-2	Horiz Stab Position-1
E	A-2	Horiz Stab Position-2
E	R-27	Hyd Power Transfer Unit Control
E	P-37	Inboard Spoilers Actuators
E	Z-41	Inst & Pedestal Panel Flood Lts
E	H-8	Inst Cooling Fan

PANEL	LOCATION	CIRCUIT BREAKER NAME
S		Instrument Panel Lights Capt
S		Instrument Panel Lights Ctr
S		Instrument Panel Lights F/O
E	S-34	IRS Mode Select
O	C-14	Isolation Valve
O	C-15	Isolation Valve Control
O	C-13	Isolation Valve NFC Relay
E	S-36	L Engine Thrust Rvsr Ch A
E	S-37	L Engine Thrust Rvsr Ch B
E	R-40	Lav Smoke Detector
C		Lavatory Mirror Lights Aft Left
C		Lavatory Mirror Lights Aft Right
C		Lavatory Mirror Lights Fwd Left
L		Left AC Bus
L		Left AC Bus
L		Left AC Bus
L		Left AC Bus
L		Left AC Bus
L		Left AC Bus
E	X-22	Left Angle of Attack Vane Htr
E	P-21	Left DC Bus Sensing
E	Z-32	Left Engine Fuel Shutoff Solenoid
E	S-27	Left Engine Anti-Ice Caution
E	U-42	Left Engine Fuel Switch
E	S-39	Left Engine Ignitor-1
O	B-8	Left Engine Ignitor-2
E	T-36	Left Engine Lock Prox Sensor Ch A
E	T-37	Left Engine Lock Prox Sensor Ch B
E	K-25	Left Engine P2T2 Prob Heat
E	S-35	Left Engine Start Ch A
E	T-35	Left Engine Start Ch B
E	U-35	Left Engine Start Switch

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	S-38	Left Engine Thrust Reverser
E	U-41	Left FADEC Ch A & Ch B
O	D-1	Left Flap Position 28 VAC
E	U-34	Left Generator Switch Indication
E	K-32	Left Ground Control Relay
E	S-26	Left Hyd Pump Control
E	E-22	Left Hyd Brake Pressure
E	B-5	Left Hyd Oil Quantity
E	E-21	Left Hyd System Pressure
E	K-8	Left Inst Xfmr
E	X-29	Left Lavatory Water Heater Aft
E	X-30	Left Lavatory Water Heater Fwd
E	K-17	Left Logo Lights
E	K-13	Left Nose Gear Landing & Taxi Lt
E	M-21	Left Pneumatic Overheat Detection
E	P-39	Left Proximity Switch Control
E	X-21	Left Static Port Heater
E	S-28	Left Supply Air Flow
E	B-6	Left Temp Control Valve Position
E	X-24	Left Windshield Anti-Ice
E	M-23	Left Windshield Wiper
E	K-11	Left Wing Landing Light
E	K-12	Left Wing Landing Light Control
U		Lights Aft Cargo
U		Lights Aft Service Panel, Wheel Well & Tail Compt
U		Lights Fwd Cargo
U		Lights Fwd Service Panel
C		Logic Cont Module
C		Logo Lights Control Indicator
E	K-10	Lower Anti-Collision
E	X-36	LPCDU DC Power
O	B-3	Manual Temp Control Cabin

PANEL	LOCATION	CIRCUIT BREAKER NAME
O	B-2	Manual Temp Control Cockpit
O	A-5	MCDU-1
E	D-7	MCDU-2
C		Miscellaneous Cabin & Lavatory Occupied Lights Aft
C		Miscellaneous Cabin & Lavatory Occupied Lights Fwd
O	A-1	MMR-1
E	D-8	MMR-2
E	D-18	MMR-3
E	F-23	Multifunction Printer
E	C-4	Nav Control Indicator
W		No Smoking
Y		No Smoking
E	G-7	Observer’s DCAS
E	N-35	Observer’s Light
E	R-37	Outboard Spoilers Actuators
S		Overhead Panel Lights Aft
S		Overhead Panel Lights Fwd
S		Overhead Panel Lights Fwd
E	Z-40	Overhead Panel Flood Lights
E	S-42	Parking Brake Control
O	A-6	Passenger Address
E	P-32	Passenger Oxygen Control
E	R-32	Passenger Oxygen Control Alternate
E	K-33	Passenger Oxygen Release
E	K-16	Passenger Reading Center
E	K-15	Passenger Reading Fwd
E	W-30	Passenger Warning Signs
E	K-23	Passenger Warning Signs
S		Pedestal Lights
S		Pedestal Lights
E	S-25	Pneumatic System Control Left
E	T-25	Pneumatic System Control Right

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	F-22	Portable Data Loader
C		Position Lights
C		Potable Water Galleys/Lavs Freeze Protect
V		Potable Water Freeze Protection Galleys/Lavs
V		Potable Water Freeze Protection Supply Lines
P		Potable Water Htr
P		Potable Water Htr
C		Potable Water Supply Lines Freeze Protect
O	C-5	Pre-Recorded Announce & Boarding Music
E	T-24	Pressure Regulating & Shutoff Valve L
E	S-24	Pressure Regulating & Shutoff Valve R
L		Primary Longitudinal Trim
L		Primary Longitudinal Trim
L		Primary Longitudinal Trim
E	G-23	Primary Longitudinal Trim Brake
E	G-22	Primary Longitudinal Trim Control
E	H-9	Primary Trim Motor Heater
E	C-9	PSC Maint Display
O	B-14	R Engine Lock Prox Sensor Ch A
O	B-13	R Engine Lock Prox Sensor Ch B
O	C-8	R Engine Thrust Rvsr Ch A
O	C-9	R Engine Thrust Rvsr Ch B
E	F-17	Radio Altimeter-1
E	F-2	Radio Altimeter-2
O	B-1	Radio Altimeter-3
E	H-4	Radio Rack Fan
E	H-5	Radio Rack Fan
E	H-6	Radio Rack Fan
E	U-30	Radio Rack Fan Caution
E	H-7	Radio Rack Fan Standby Control
E	H-3	Radio Rack Fan Venturi
E	Z-29	Ram Air Temp & Probe Heater

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	J-3	Ram Air Valve
Y		Reading Lights Left
Y		Reading Lights Left
Y		Reading Lights Left
Y		Reading Lights Left
Y		Reading Lights Right
Y		Reading Lights Right
Y		Reading Lights Right
Y		Reading Lights Right
L		Right AC Bus
L		Right AC Bus
L		Right AC Bus
L		Right AC Bus
L		Right AC Bus
L		Right AC Bus
E	Z-28	Right Aft Lavatory Water Heater
E	Z-22	Right AOA Vane Htr
E	H-16	Right Aux Hyd Pump Control
L		Right Auxiliary Hydraulic Pump
E	A-6	Right Control Valve Position
E	R-21	Right DC Bus Sensing
E	T-27	Right Engine Anti-Ice Caution
E	X-40	Right Engine Fuel Switch
E	X-39	Right Engine Ignitor-1
O	B-9	Right Engine Ignitor-2
E	L-25	Right Engine P2T2 Prob Heat
O	B-11	Right Engine Start Ch A
O	B-12	Right Engine Start Ch B
O	B-10	Right Engine Start Switch
O	B-15	Right Engine Thrust Reverser
O	C-6	Right FADEC Ch A & Ch B
O	B-7	Right Fuel Shutoff Solenoid

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	W-34	Right Generator Switch Indication
E	L-32	Right Ground Control Relay
E	T-26	Right Hyd Pump Control
E	E-10	Right Hyd Brake Pressure
E	A-5	Right Hyd Oil Quantity
E	E-9	Right Hyd System Pressure
E	L-8	Right Inst Xfmr
E	L-17	Right Logo Lights
E	L-13	Right Nose Gear Landing & Taxi Lt
E	N-21	Right Pneumatic Overheat Detection
E	R-39	Right Proximity Switch Control
E	Z-21	Right Static Port Heater
E	T-28	Right Supply Air Flow
E	Z-24	Right Windshield Anti-Ice
E	N-23	Right Windshield Wiper
E	L-11	Right Wing Landing Light
E	L-12	Right Wing Landing Light Control
E	X-35	RPCDU DC Power
E	B-11	Rudder Hook Position-1
E	A-11	Rudder Hook Position-2
E	Z-30	Rudder Q Limiter Heater
E	S-22	Rudder Shutoff Valve Coil-1
E	T-22	Rudder Shutoff Valve Coil-2
E	S-21	Rudder Stop Lim-1
E	T-21	Rudder Stop Lim-2
E	T-31	SCP Captain’s Master Caution
E	G-14	Selcal
E	C-1	Sidewall Lighting Control
		Smoke Detector (Aft L Lav) Under Sink
		Smoke Detector (Aft R Lav) Under Sink
		Smoke Detector (Fwd Lav) Under Sink
E	J-14	Smoke Detector Fan

PANEL	LOCATION	CIRCUIT BREAKER NAME
E	P-36	Spoiler Knockdown
E	R-36	Spoiler Lockout
E	P-35	Spoiler Secu Inboard Channel
E	R-35	Spoiler Secu Outboard Channel
E	B-10	Stall Warning Alpha-1
E	A-10	Stall Warning Alpha-2
O	D-3	Standby Compass Lts 28 VAC
E	T-33	Standby Inst
C		Standby R/R Fan
C		Standby R/R Fan
C		Standby R/R Fan
E	R-30	Stick Pusher Control
E	X-23	Stick Pusher Pwr/FCC-1 Data Ldr
E	Z-23	FCC-2 Data Loader
E	K-9	Strobe
E	B-1	Surface Position-1
E	A-1	Surface Position-2
E	N-2	Tail Ice Protection Prsov
E	J-8	Tail Vent Fan
E	J-9	Tail Vent Fan
E	J-10	Tail Vent Fan
E	G-9	Tail Vent Fan Control
E	H-15	TCAS Computer
E	R-29	Trim Control Box
E	G-17	Trim Shutoff Relay
E	L-10	Upper Anti-Collision
C		Vac/Waste Blower Control
E	L-23	Vac/Waste Ovbd Vent Heater
C		Vacuum Blower
O	B-6	VHF Comm-1
E	G-4	VHF Comm-2
E	G-16	VHF Comm-3

PANEL	LOCATION	CIRCUIT BREAKER NAME
O	A-18	VIA-1 Backup Power
O	A-16	VIA-1 Main Power
O	A-22	VIA-2 Backup Power
E	E-2	VIA-2 Main Power
O	B-4	VOR/Marker Beacon-1
E	F-4	VOR/Marker Beacon-2
E	N-31	Warning Light Dimming
P		Waste Water Heater Cont
C		Water Quantity
E	F-5	Weather Radar Xcvr
X1		Wheel Well & Fwd Access Compt Lights
C		Wheel Well Serv Lts & 28 VAC Utility Outlet
E	X-26	Window Anti-Fog Capt, F/O & Center
C		Wing & Nacelle Flood Lights
E	M-29	Wing Ice Detection
E	M-22	Wing Ice Protection Prsov
E	B-13	YAW Damper
E	G-21	YAW Damper-1
E	G-8	YAW Damper-2

TABLE OF CONTENTS

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EMERGENCY EQUIPMENT

INTRODUCTION

This chapter describes the following: emergency lighting, standby cabin lighting, emergency exits, emergency equipment, and oxygen systems.

EMERGENCY LIGHTING

The emergency lighting system supplies lighting in the aircraft for at least 10 minutes during a total electrical power failure. The system operates independently from the usual lighting system. The system is controlled by the EMER LTS (Emergency Lights) switch on the overhead panel, which has three positions, OFF, ARM, and ON. In the ARM position the system can operate automatically. The ON position gives manual control. The guarded EMERGENCY LIGHTS switch on the forward attendant panel gives an alternative control to set the lights on. An alert message is displayed on the EAD when the emergency lights are not armed. All of the emergency lights operate from low voltage power supplies, except for the over- wing floodlights that operate from 28 VDC. The emergency lighting system includes:

1. Cockpit Emergency Lights: Emergency lights are in the overhead panel and give general lighting to the cockpit.

NOTE

Additionally, floodlights in the flight compartment are powered by the DC Transfer Bus.

2. Cabin Attendant Flashlights: There are four cabin attendant flashlights and holders in the passenger compartment. Two flashlights are adjacent to the forward cabin attendant panel, and two are adjacent to the aft right lavatory. Each holder includes an automatic charger for the flashlight.

3. Emergency Exit Signs: Exit signs show the location of each exit and give lighting to the related instructions and markings. An exit sign is at each door and over- wing exit.

4. Passenger Compartment Emergency Lights: Emergency lights are in the ceiling which supply general lighting to the cabin area. Also, white emergency path lights mounted on the seats show the path to the exits. Some of the lights at the exits are red to show the exit location.

5. Tail Compartment, Walkway, and Tailcone Evacuation Slide Area Lights. The tail compartment emergency lights give lighting to the evacuation slide area. These lights also supply lighting for the walkway area, and for the tailcone release handle.

6. Door Area and Emergency Over-wing Exit Lights. The emergency lights at the forward entrance, galley service, and aft pressure bulkhead doors give area lighting. These lights show the doors, door handles, and floor area. The emergency lights at the over- wing exits show the exit signs and doors. When the door is open, the lights show the wing area adjacent to the door.

7. Over- wing Emergency Evacuation Lights: Two floodlights (one on each side of the fuselage) show the over- wing escape paths and the adjacent ground area.

CABIN STANDBY LIGHTING

With loss of all electrical power except that provided by the three aircraft batteries, the cabin will be lit by the Cabin Standby lighting system. This system has lights located throughout the entire length of the cabin. Power comes off the Emergency DC Bus.

EMERGENCY EXITS

Cockpit: Normally, cabin exits will be used by flight crewmembers. However, two sliding clearview windows, adjacent to the windshields, provide an alternate escape route. Escape lines are provided adjacent to the clearview windows for use by crewmembers to lower themselves to the ground.

Cabin: There are seven cabin emergency exit doors; a forward entrance door, service door (right forward fuselage), four overwing emergency exit doors, (two each fuselage side), and, when the tail cone is jettisoned, the aft entrance door.

Operating instructions for each door are located on the interior and exterior surface of each door. Both forward entrance and service doors have identical handles and similar operating instructions.

The forward entrance and service doors are equipped with a “hold open” latch which secures the doors against the fuselage in the open position.

The forward entrance and service doors are equipped with self-illuminated slides that inflate and deploy automatically when the door is opened with the girt bar installed in airplane floor fittings. A back-up manual inflation handle is provided on each door slide girt should the slide fail to inflate automatically.

NOTE

For normal door operation, the girt bar on the forward entrance and service doors must be removed from the floor fittings and stowed in clips on the slide cover.

When the aft entrance door is opened using the emergency exit handle, the tail cone is jettisoned and a slide is automatically deployed and inflated. Back-up interior and exterior tailcone jettison handles and manual slide deployment handle are located behind the aft entrance door.

The overwing emergency exit doors have identical handles and emergency operating instructions.

EMERGENCY EQUIPMENT

The airplane is equipped with life vests, first-aid kits, an emergency medical kit, protective breathing equipment, portable oxygen cylinders, hand operated fire extinguishers (halon and water), and a fire axe. For location and quantity, see Emergency Equipment Location illustration.

OXYGEN SYSTEMS

Two independent oxygen systems are installed in the airplane: one in the cockpit for the flight crew and one in the cabin for the passengers and cabin attendants.

Flight Crew Oxygen System

Oxygen for the flight crew system is supplied from a high-pressure gaseous oxygen cylinder located behind the First Officer's seat. The composite cylinder has a pressure gage and an integrated pressure regulator/shutoff valve that supply oxygen to the individual mask-regulator compartments. A valve position indicator is located on the twist on-off handle of the cylinder.

The overboard discharge line for the flight crew oxygen system cylinder is connected to a port located below the First Officer’s cockpit window. A green blowout disk is installed inside the discharge port which can be observed during the crewmembers walkaround inspection.

Oxygen line pressure downstream of regulator is indicated by the OXY LINE PRESS gage on the aft overhead panel.

Each pilot and the jumpseat have a mask-regulator unit which consists of a quick donning full face mask and oxygen regulator. When the mask-regulator unit is removed from its compartment, oxygen is supplied to the mask. A regulator on the front of each mask controls the oxygen flow. The regulator has three positions: NORM, 100%, and EMER. When the NORM position is selected diluted oxygen flows to the mask, when 100% position is selected, 100% oxygen supplied. For protective breathing purposes (smoke in cabin, etc.) the regulator can supply 100% oxygen under pressure with the EMER position selected.

The mask has a red button on each side of the regulator. These buttons must be squeezed to inflate the oxygen mask for easy donning.

Passenger Oxygen System

Oxygen for the cabin, lavatories, and cabin attendants stations is supplied by self-contained chemical oxygen generator. The generator provides sufficient oxygen for at least 15 minutes of continuous use. The generator with its associated masks and interconnecting hoses are contained in the Passenger Service Unit (PSU).

Passenger masks are located in the cabin as follows:

- Four in each PSU on the right side of the cabin.
- Three in each PSU on the left side of the cabin.
- Two in each lavatory.
- Two at the forward cabin attendant station.
- Two at the aft cabin attendant station.

All oxygen compartment doors will open automatically if the cabin altitude exceeds approximately 14,150 feet. If cabin altitude exceeds 14,750 feet and the oxygen masks were not deployed, the NO MASKS alert will be displayed on the EAD.

CAUTION

The oxygen generator surface temperature may reach 500 degrees F (260 degrees C) when generating oxygen. Do not touch or attempt to remove generator, as burn injury can result. If an active generator is inadvertently removed from compartment, it must be placed in a metal container such as lavatory or galley sink. Heat will scorch other materials or fabrics.

NOTE

An odor similar to scorched cloth may be created by activation of generators. The odor does not affect the purity of the oxygen and there is no fire hazard.

As a backup to the automatic system, a PASS OXY MASK switch, located on the right side of the bulkhead behind the First Officer's seat, provides manual deployment of the masks. Moving the switch to EJECT opens all oxygen compartment doors. The oxygen masks will free fall from the PSU.

NOTE

Holding switch in EJECT position in excess of 5 seconds may cause damage to the oxygen compartment latches.

If necessary, each individual oxygen compartment door also can be opened manually.

PROTECTIVE BREATHING EQUIPMENT

One Protective Breathing Equipment (PBE) is located in the cockpit. The PBE is mounted behind the First Officer. Three PBEs are located in the cabin for use by the cabin attendants.

The Essex PBE is a self-contained unit that supplies oxygen to protect crew members from the effects of smoke, carbon dioxide, or other harmful gases and oxygen deficiency. The PBE uses a combination of Kapton and Teflon films for the hood material, metallized for additional heat resistance, a highly elastic silicone rubber neck seal, two cylinders to supply oxygen, and a scrubbing device to control carbon dioxide.

Activation is accomplished automatically by sharply pulling two oxygen cylinders apart from one another so that each valve’s retaining lever pulls free of the valve. O2 supply is approx 15 minutes.

The PBE incorporates a battery operated SERVICE/END-OF-SERVICE INDICATOR light located at just below eye level on the left side of the hood. The flashing light indicates the operating status of the PBE as follows:

- Green - PBE is activated and functioning correctly.
- Red/green (alternating) - Useful life of the product is exhausted.

At activation, the first cylinder releases oxygen at a faster rate, accompanied by a “whoosh” sound, as the oxygen enters the hood. For the hood to be fully operational, the second oxygen cylinder must also release its contents and illuminate the green light. If the unit does not inflate within 2 to 3 minutes, the PBE is not functioning properly and must be removed immediately.

Donning PBE

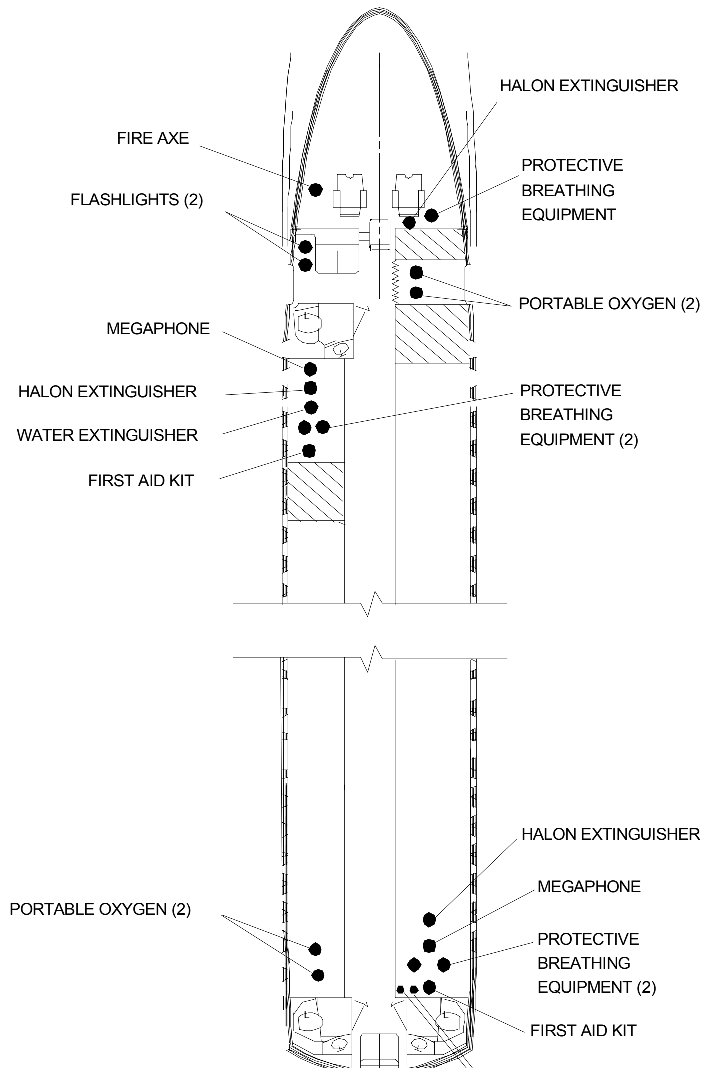
- Remove unit from the storage container.
- Activate and hold the open end of the hood.
- Bend over and grasp hood opening with thumbs and pull hood over head.
- Check neck seal for secure fit. All hairs must be completely tuck into the PBE.

PORTABLE OXYGEN CYLINDERS

Four portable oxygen cylinders, with continuous flow oxygen masks, are located in the cabin for use by the cabin attendants (two forward, two aft). Each cylinder contains a hand shutoff valve, relief valve, low and high continuous flow outlets, and carrying strap. Passenger continuous-flow type masks are attached to the cabin portable oxygen bottles.

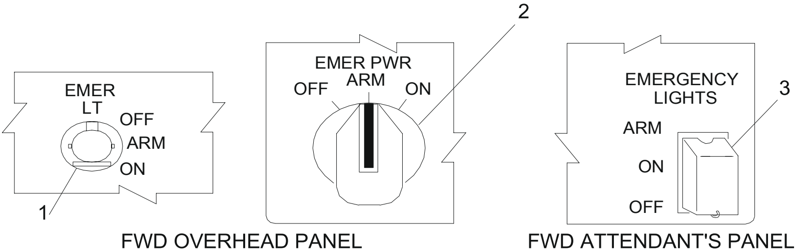
COMPONENTS

EMERGENCY EQUIPMENT LOCATION



CONTROLS AND DISPLAYS

EMERGENCY LIGHTING CONTROLS



1. EMER LT Switch

   OFF - Charges emergency battery packs from DC Transfer Bus. EMER LTS DISARM alert displayed on the EAD.

   ARM - Normal position. Arms emergency battery packs.

   ON - Illuminates emergency lights. EMER LTS DISARM alert displayed on the EAD.

2. EMER PWR Selector

   OFF - Deenergizes emergency power mode.

   ARM - Normal position.

   ON - Airplane battery supplies power to the AC, DC emergency bus and DC transfer bus. Extinguishes all emergency lights except cockpit emergency lights and cabin standby lights.

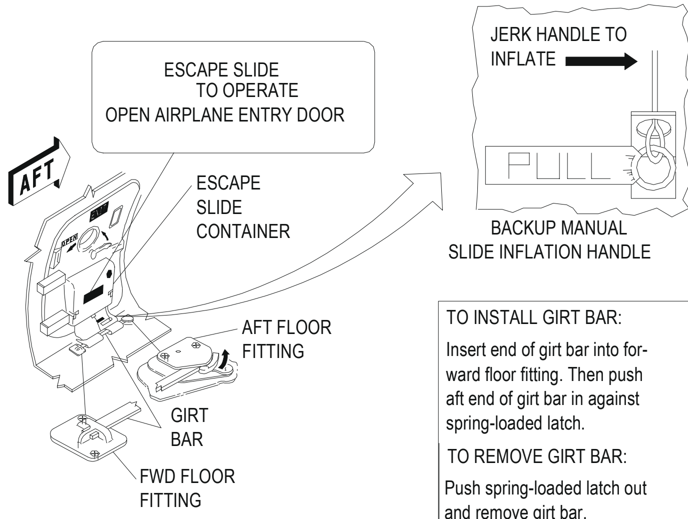
3. EMERGENCY LIGHTS Switch

   ARM - Arms emergency lights.

   ON - Overrides the EMER LT switch to illuminate emergency lights. If the EMER LT switch is at OFF, switch must be moved to ARM momentarily prior to ON.

   OFF - (Guarded) Normal position. Emergency lights are controlled by EMER LT switch on the overhead panel.

EMERGENCY EXITS - FWD DOOR & CLEARVIEW WINDOW



FWD SERVICE DOOR

TO INSTALL GIRT BAR:

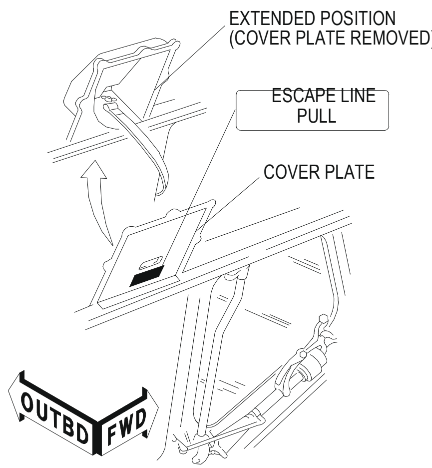
Insert end of girt bar into forward floor fitting. Then push aft end of girt bar in against spring-loaded latch.

TO REMOVE GIRT BAR:

Push spring-loaded latch out and remove girt bar.

TO OPEN CLEARVIEW WINDOW:

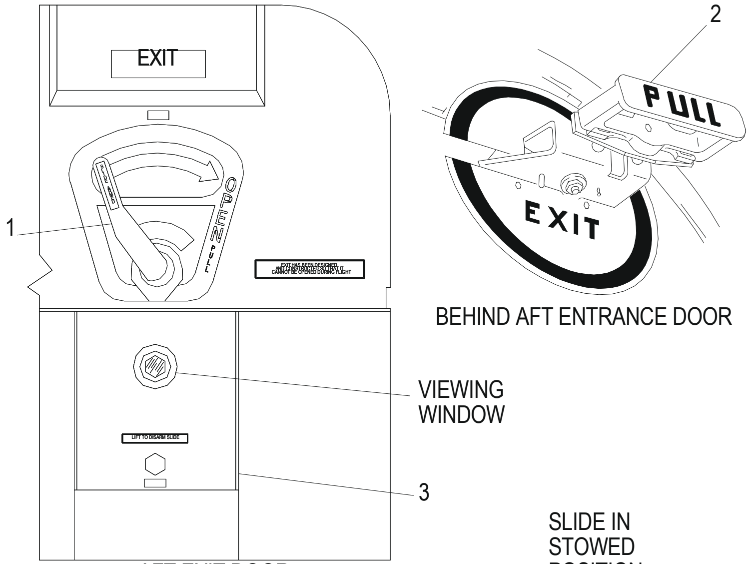
1. Pull handle aft to disengage overcenter lock.
2. Pull handle inboard to move window inboard.
3. Pull handle aft so that window slides aft to an open locked position.



CLEAR VIEW WINDOW
AND ESCAPE LINE (TYPICAL)

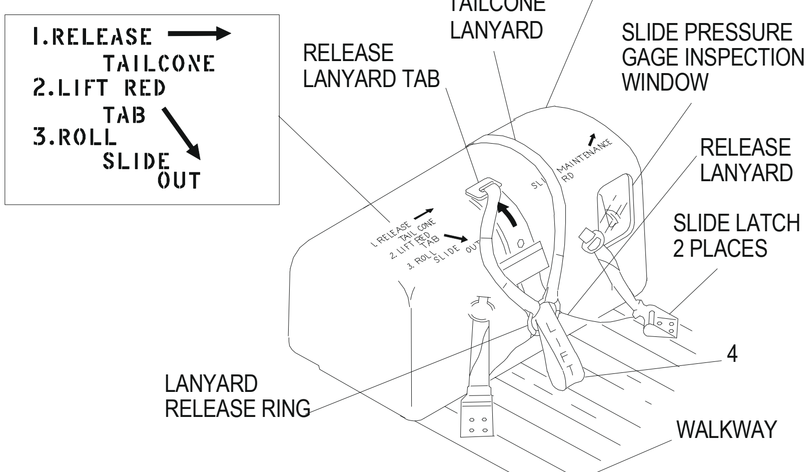
CAG(IGDS) KB1-3-0017

EMERG EXITS - AFT ENTRANCE DOOR & TAILCONE SLIDE



AFT EXIT DOOR

BEHIND AFT ENTRANCE DOOR



BEHIND AFT ENTRANCE DOOR

CAG(IGDS) KB1-3-0018A

1. Emergency Exit Handle (Cover Removed)

   Rotate Clockwise - Unlatches and opens door. Tailcone is jettisoned and evacuation slide is automatically deployed.
2. Back-Up Tail cone Interior Jettison Handle

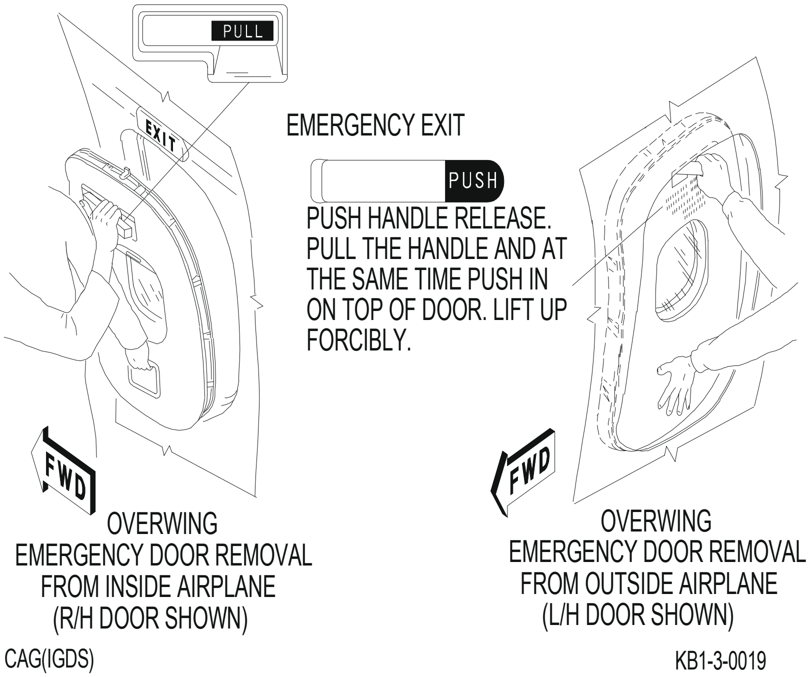
   PULL - Jettisons tailcone and deploys slide.
3. Center Head Rest Pad

   Lowered - (Shown) Emergency exit handle with cover available.

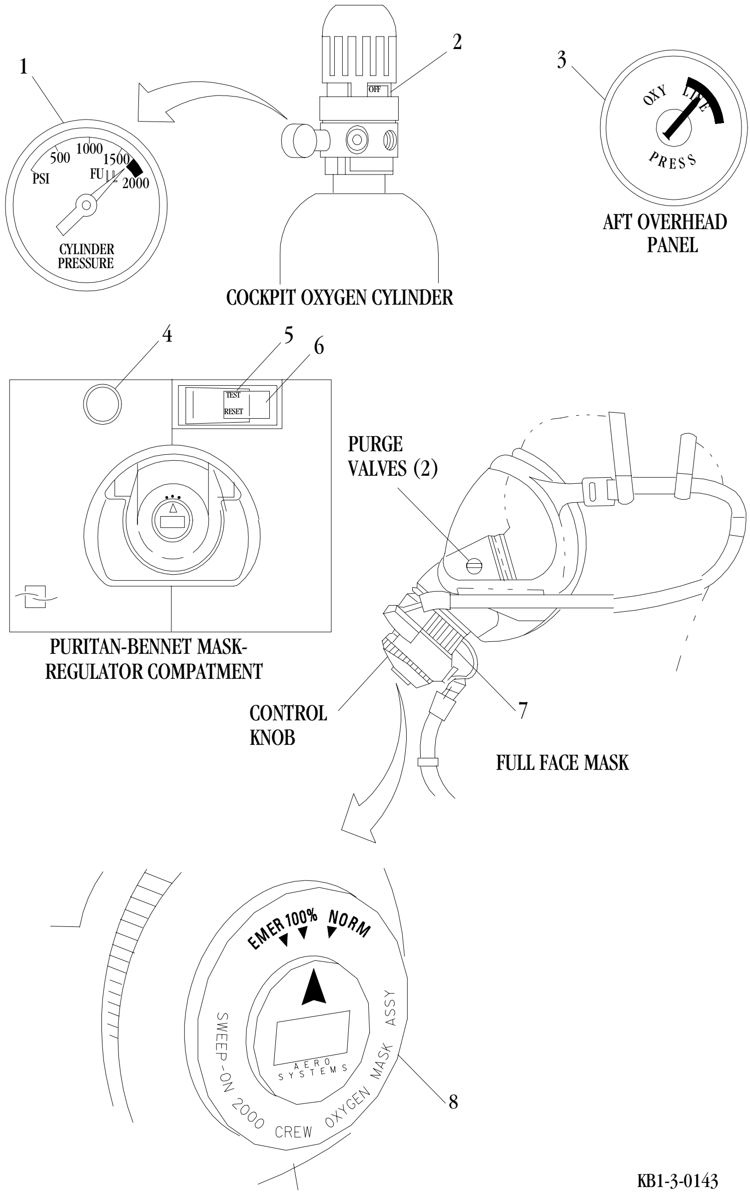
   Raised - Normal door handle and instructions available.
4. Slide Manual Deployment Handle

   LIFT - Releases slide from latches to deploy slide manually.

EMERGENCY EXITS - OVERWING EMERGENCY DOOR



OXYGEN - COCKPIT



1. **CYLINDER PRESSURE Gage**

   Indicates oxygen cylinder pressure.

2. **Valve Position Indicator**

   Indicates oxygen pressure regulator/ shutoff valve is ON or OFF.

3. **OXY LINE PRESS Gage**

   Indicates oxygen line pressure.

4. **Oxygen Flow Indicator**

   Blinks yellow when the TEST/RESET switch is pushed during test or during mask inhalation.

5. **TEST/RESET Switch**

   Push - Tests mask/regulator without removing the unit from its compartment. Oxygen flow indicator blinks yellow to indicate unit is functioning and oxygen system is leak free.

6. **Oxy On Flag**

   Indicates oxygen valve is on.

7. **Harness Inflation Switch**

   Push - Inflates mask harness.

8. **Regulator Control Knob**

   EMER - Supplies 100% oxygen regardless of cabin altitude. In addition, oxygen is supplied at a positive pressure through the purge valves.

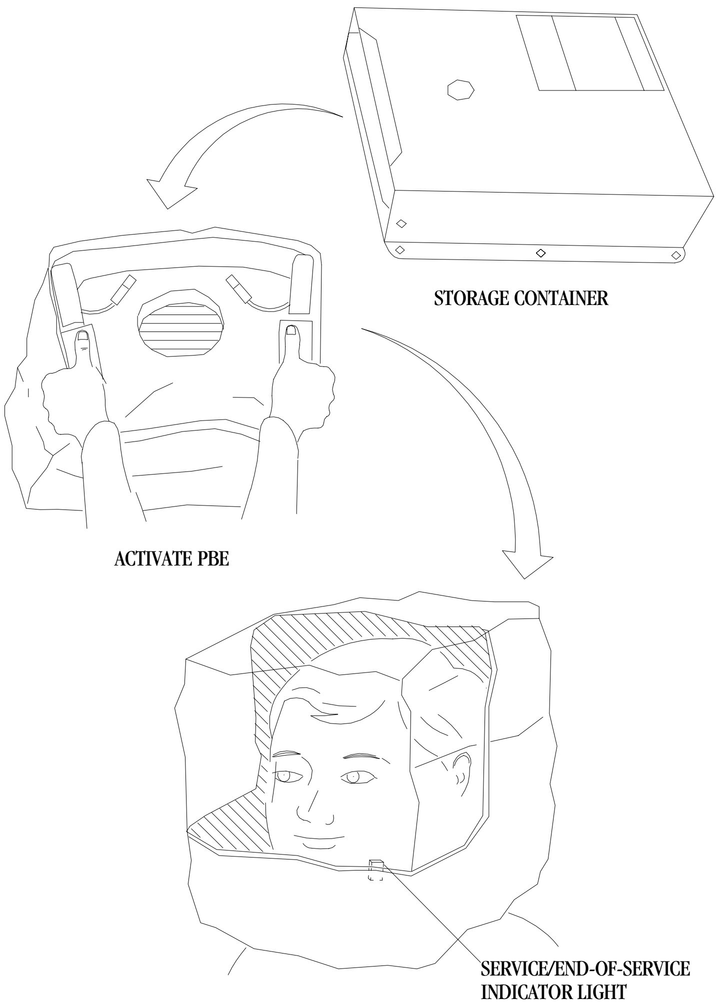
   100% - Supplies 100% oxygen upon inhalation regardless of cabin altitude.

   NORM - Supplies automatic oxygen dilution.

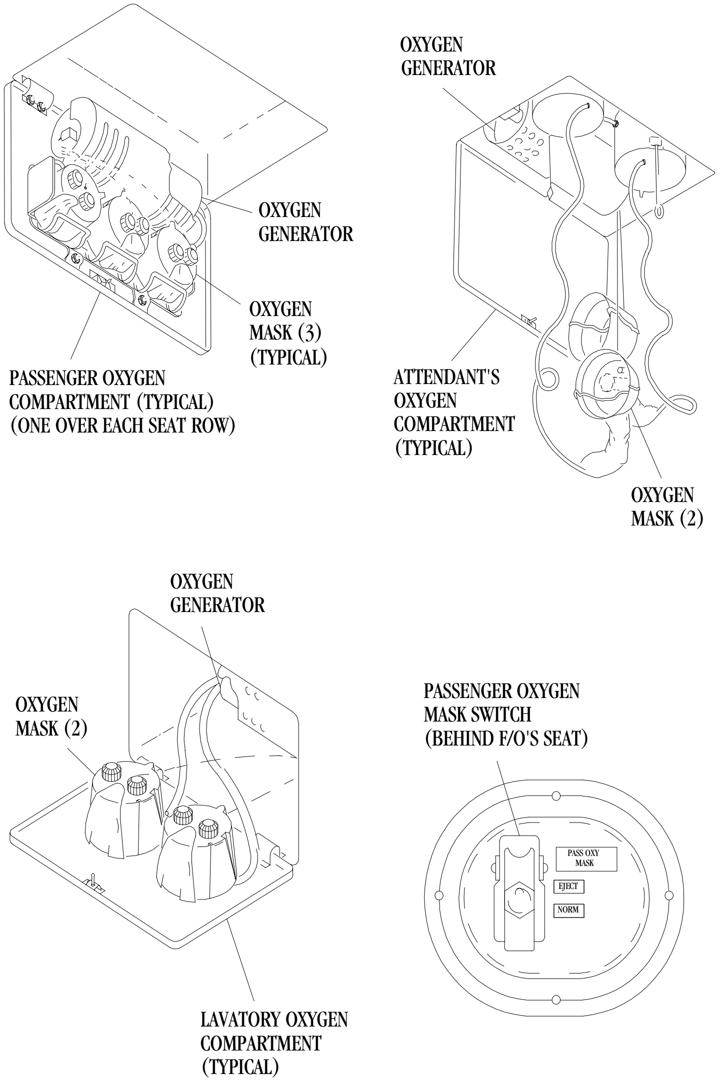
NOTE

The mask has red buttons on each side of the Regulator Control Knob. These buttons must be squeezed to inflate the oxygen mask for easy donning.

PROTECTIVE BREATHING EQUIPMENT

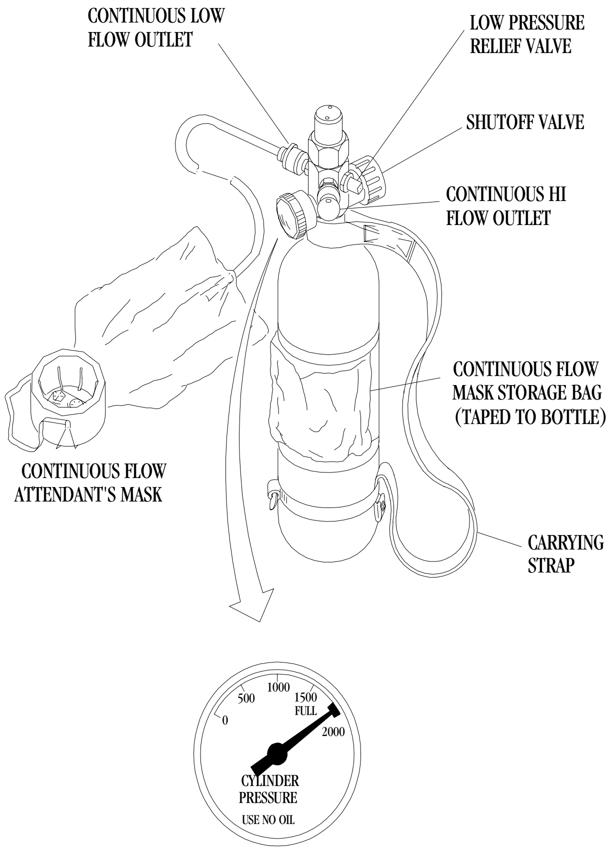


OXYGEN - CABIN



KB1-3-0128

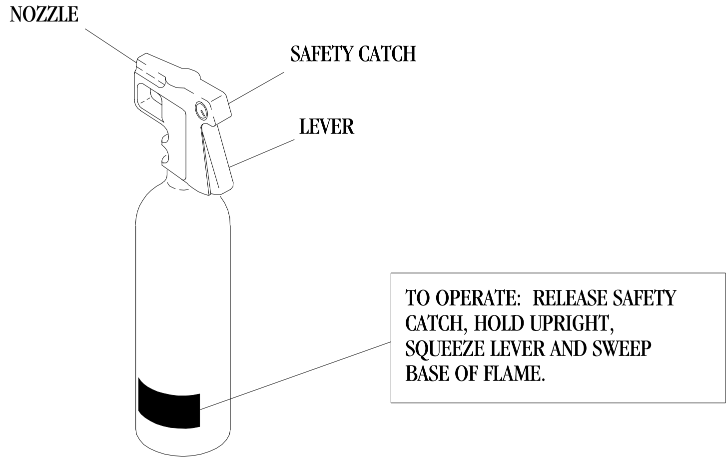
PORTABLE OXYGEN CYLINDER (TYPICAL)



CYLINDER PRESSURE GAGE

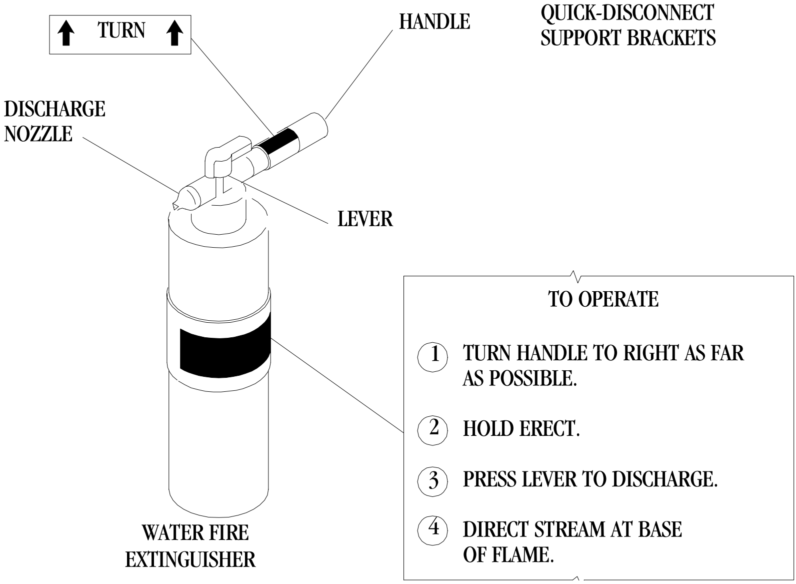
KB1-3-0023A

FIRE EXTINGUISHER



HALON BCF FIRE EXTINGUISHER

NOTE:
FIRE EXTINGUISHERS ARE INSTALLED IN QUICK-DISCONNECT SUPPORT BRACKETS



WATER FIRE EXTINGUISHER

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Red Boxed Alerts (Level 3)

NO MASKS (AIR) - Cabin altitude exceeds 14,750 feet and passenger oxygen masks have not automatically deployed.

Amber Alerts (Level 1)

EMER LTS DISARM (MISC) - EMER LT switch is in OFF position.

OVERWING DOOR (MISC) - One or more overwing emergency exit doors is not closed and locked.

INTENTIONAL BLANK

TABLE OF CONTENTS

ENGINE

APU

ENGINE

ENGINE INTRODUCTION

The airplane is equipped with two BR715 high by-pass turbofan engines. Each engine is equipped with a clamshell type thrust reverser.

The engines use a Full Authority Digital Engine Control (FADEC) in association with the appropriate airplane sub-systems to control engine functions from start to shutdown. FADEC has three main components: throttle, throttle module, and electronic engine control (EEC). FADEC is an integrated throttle-by-wire system.

The main component of the FADEC system is the Electronic Engine Control (EEC). FADEC converts pilot inputs to the throttles into electronic signals that are sent to the EECs. The EEC controls all engine functions. Each EEC has two channels for redundancy. Should one channel fail, the EEC will control and manage all vital engine functions on the remaining channel. The EECs optimize engine operation based on prevailing atmospheric conditions, certain airplane and engine conditions, and phase of flight. The EEC and FADEC are powered by a dedicated generator driven by the gearbox, with a backup power source from the aircraft's electrical system.

The EECs sends data to the cockpit displays. The EEC transmits engine data to the flight control computers (FCCs) and to the versatile integrated avionics (VIAs) which sends it to be displayed on the engine alert display and the secondary engine display.

COMPONENTS

The fan assembly and low pressure compressor are referred to as N1. Air flow produced by the N1 compressor continues to the high pressure compressor referred to as N2. High pressure air enters the combustion section where fuel mixes with air and is ignited. High speed gasses, created by combustion, then enter the turbine section and drive the turbines.

The first and second turbine stages drive the N2 compressor and the other stages drive the N1 compressor.

The accessory gear box is mounted below the engine and is driven by the N2 compressor.

The fan assembly and low pressure compressor section are displayed as N1 on the EAD. The fan produces a large percentage of the engine thrust. The current N1 is displayed as a pointer line moving inside the scale, and by a readout indicating in percent. The red line limit is indicated by a short red line across the scale. If N1 exceeds the red line limit, the pointer and digits become boxed in red and the ENG L/R RPM HI alert is displayed. Also, the N1 red line exceedance is displayed in small digits at the high end of the scale.

EPR is the primary thrust setting parameter and is a ratio of the turbine exhaust stream pressure to the engine inlet pressure. The current EPR is displayed as a pointer line moving inside the scale, and by a rolling digital readout. The T indicates the throttle position and moves along the outside of the scale. The V indicates the computed EPR. When the T fits within the V, the throttles are set to the computed thrust rating.

Behind the low pressure compressor is the high pressure compressor, N2. This compressor operates at a higher speed and is independent of N1. EEC controlled variable stator vanes in the N2 compressor control air flow through the compressor to achieve smooth acceleration and deceleration.

N2 is displayed on the EAD as a pointer line moving inside the scale, and a readout indicating in percent. The N2 red line limit is indicated by a short red line across the scale. If the N2 exceeds the red line limit, the pointer and digits become boxed in red and the ENG L/R RPM HI alert is displayed. Also, the N2 red line exceedance is displayed in small digits at the high end of the scale. During a manual start, a FUEL ON line is displayed across the scale to indicate the minimum N2 at which fuel should be turned on.

The diffuser and combustion section contains the combustion chamber, fuel nozzles and igniter plugs.

The high pressure turbine assembly drives the N2 compressor and the accessory drive gear box. The low pressure turbine assembly drives the fan and the N1compressor.

The TGT is displayed as a radial pointer moving inside the scale and a readout indication in degrees Celsius.

The TGT caution range is indicated by an amber line across the scale. If the TGT remains in the caution range for more than 5 minutes, then the pointer and the digital TGT readout turns amber (digits boxed). The red line limit is indicated by a short red line across the scale. If the TGT reaches the red line, the TGT readout and pointer turn red (digits boxed). The TGT exceedance is displayed in small digits at the high end of the scale and the ENG L/R TGT HI alert is displayed.

During engine operation, a lightning bolt is displayed to indicate when ignition is commanded on.

On the EAD, engine fuel flow is displayed in pounds per hour.

When the ENG EXCEEDANCE RESET button is pushed, any engine exceedance displayed on the EAD will be reset.

The accessory drive gearbox is driven by the N2 compressor. It drives accessories that support engine and airplane systems.

FUEL SYSTEM

The engine fuel system supplies fuel to the combustion section according to demands generated by the EEC. Fuel from the aircraft fuel system is first supplied to the low pressure stage of the engine driven fuel pump. Output from this pump then goes through the Combined Fuel Cooled Oil Cooler and the main fuel filter. Heat that is extracted from the oil helps prevent ice formation in the fuel. The low pressure stage ensures that adequate volume of fuel reaches the high pressure stage. This stage of the fuel pump increases the fuel pressure to supply the Fuel Metering Unit (FMU). The FMU controls fuel flow to the engine in response to input from the EEC. When the engine fuel switch is moved to off, a high pressure shutoff valve in the FMU closes immediately ensuring instantaneous engine shutdown. A fuel flow transmitter, located downstream of the FMU, measures fuel consumption.

OIL SYSTEM

Each engine oil system is self-contained. The system incorporates a tank and de-aerator, pressure pump, pressure filter, combined fuel cooled oil cooler, scavenge pumps and breather. The function of the oil system is cool and lubricate the engine bearings. Oil stored in a tank is supplied to a single element vane type pump. This pump pressurizes the oil and sends it through the oil filter, fuel cooled oil cooler, then to the bearing compartments and the accessory gearbox. The pressure pump oil filter contains a bypass valve. If the oil filter becomes clogged, the valve will open, allowing the oil to pass. When the pressure pump oil filter begins to clog and the differential pressure increases to a predetermined value, the ENG L/R FUEL FILTER alert is displayed on the EAD.

A four element vane type pump scavenges oil from the bearing compartment and the accessory gearbox. This oil is then returned to the oil tank through a combined scavenge line.

The engine oil system parameters are displayed as secondary engine data on the systems display.

Indicated oil pressure is measured as differential between the oil delivery pressure and scavenge line pressure. Oil pressure is displayed as a pointer line moving inside the scale, and a readout indicating psi. The normal oil pressure range is indicated by a green arc. The low pressure limit is indicated by a red line across the scale. If the pressure reaches the red line, the pointer and digits are boxed in amber and the ENG L/R OIL PRES LO alert is displayed on the EAD.

Indicated oil temperature is sensed in the scavenge return line to the tank. Oil temperature is displayed as a pointer line moving inside the scale, and a readout indication in degrees Celsius. The low temperature precaution range is indicated by a line across the scale. The high temperature precautionary range is just below the red line. If the oil temperature reaches the high caution range, the pointer and digits are boxed in amber and the ENG L/R OIL TEMP HI alert is displayed on the EAD. The high temperature limit is indicated by a red line across the scale. If the temperature reaches the red line, the pointer and digits are boxed in amber. Also, the ENG L/R OIL TEMP HI alert remains displayed on the EAD.

Also included on the secondary engine display is the oil quantity. Oil quantity is displayed as a pointer line moving inside a scale, and by a readout indication in quarts. During start, when the engine reaches idle, the scale is marked with a line to indicate the initial oil quantity.

When oil quantity decreases to two quarts, the digits are boxed in amber.

ENGINE VIBRATION

The engine vibration monitoring system, located on the SD synoptic, monitors the N1 and N2 rotor engine vibrations. The readout indicates vibration from 0.0 to 9.9 units. High limit is set at 4.0. When the vibration exceeds the high limit for a predetermined time, the digits turn amber and are boxed in amber and the ENG VIB HI alert is displayed on the EAD. The readout is the highest value of the areas monitored from each engine.

THRUST MANAGEMENT

The primary control mode utilizes EPR to calculate forward thrust. The EEC calculates in EPR command corresponding to throttle position. During approach, with the landing gear down, the EEC will increase the idle setting, to improve go-around performance. The thrust limits page displayed on the MCDU allows the crew to manually set a thrust limit mode for a specific phase of flight. Thrust limits are calculated by the EEC based on outside pressure and temperature, engine bleed configuration, and phase of flight. EPR thrust limit data generated by the EECs are sent to the VIAs for display on the EAD. The EAD displays the current thrust limit mode, engine pressure ratio limit, throttle position T symbol and actual engine pressure ratios.

The alternate control mode utilizes N1 to calculate forward thrust. N1 command is calculated from interpolation between redline N1 and idle N1 reference. If any of the resources for EPR control (air data failures, loss of probe heat), thrust management will automatically default to the N1 mode. Alternate control mode can also be manually selected by pushing FADEC MODE button or by advancing the throttles through the N1 mode gate. EPR will continue to be indicated when N1 mode is manually selected. However, the throttle position indicator (“T” bug) in the EAD will be removed.

CONTROLS AND INDICATORS

The Engine Control Panel and the ENG EXCEEDANCE RESET button are located on the forward overhead panel.

The Engine Control Panel has the FADEC MODE switches. These switches are guarded and have two functions. Each provides annunciation and manual selection of the alternate backup mode. When the EEC can no longer calculate a valid EPR, it automatically reverts to the alternate backup mode of thrust control (i.e. the thrust is controlled by N1 instead of EPR), and the SELECT and ALTN lights illuminate. On the EAD, the SELECT FADEC ALTN alert will be displayed. In the alternate backup mode, the EEC defaults to the N1 mode, an X is displayed on the EPR indicator and dashes replace the EPR limit. The autothrottle disconnects and remains disconnected as long as the engine is in the N1 mode. When the FADEC MODE switch is pushed, the SELECT light extinguishes. The ALTN light will remain illuminated and on the secondary engine display, the ENG L/R FADEC ALTN alert is displayed.

The Engine Control Panel also has the IGNITION switch. This switch has two positions, AUTO and ON. When the switch is in AUTO, one of the two ignition units for each engine is energized and the auto abort feature will be operational during start. The EEC alternates which ignition system is energized from one start to the next.

In flight, both units are energized if the engine flames out or if water in the N2 compressor is detected.

When the switch is moved to ON, the engine auto start or auto abort functions are disabled. When a FUEL L/R switch is moved to ON, both ignition units for that engine are continuously energized. There is no time limit for the ignition to be on, however, this mode will reduce igniter life if used for prolonged periods. On the EAD, ENG IGN OVRD ON will be displayed.

The ENG START L/R switches, located on the overhead panel, have two positions: in and out. When the switch is pulled out, it is magnetically held out. The switch illuminates and the EEC is commanded to open the engine start valve. When N2 reaches approx 40 percent, the start valve closes, the light extinguishes and the ENG START L/R switch pops back in.

The engine and alert display (EAD) contains engine indications. The systems display (secondary engine page) provides additional engine data. The thrust limits pages displayed on the MCDUs indicate the thrust selection mode the engine is operating on. Normally engine thrust modes are automatically selected appropriate to the phase of flight. However, if required, the crew can manually select a thrust mode using the line select key adjacent to the thrust mode desired.

The throttles have a main lever to set forward thrust and a piggyback lever to command and set reverse thrust. The throttles increase or decrease thrust by electronically commanding the EEC to schedule the required fuel flow.

Maximum thrust is commanded when the throttles are advanced to the max forward throttle gate. This gate is part of the throttle mechanism located under the pedestal. Movement of the throttles beyond the gate detent commands the EEC to the alternate/N1 mode of thrust control. EPR will continue to be displayed, however, thrust management or throttle response will be based on N1 not EPR.

The FUEL switches are located below the throttles on the center pedestal. During engine start when the switches are moved to the ON position, each EEC is commanded to open its respective fuel on/off valve. When the switches are moved to the OFF position during shutdown, the fuel on/off valves are commanded to close, shutting off fuel flow.

ENGINE STARTING

The engines may be started by using a pneumatic supply from the APU, external air source or from an operating engine using the pneumatic crossfeed system.

The engines have full automatic start capability. During auto-start, the EEC controls the starter air valve, fuel metering and ignition. Engine start is automatically aborted if any of the following anomalies is detected:

- Fuel on conditions not being satisfied.
- Hung Start.
- Starter cutout speed not reached within period of the starter duty timer.
- Hot Start.
- Loss of a valid N2 input.

The engines may be started manually. Manual Start mode is enabled by moving the ignition switch to ON. In manual, start auto abort is disabled and the crew controls the starting sequence.

THRUST REVERSER

Thrust reversers are hydraulically actuated pivoting door type. The assembly forms the rear part of the nacelle from the cowl doors and to the exhaust nozzle. A lock mechanism incorporated into the door assembly prevents uncommanded opening of both thrust reverser doors. Thrust reverser control levers are on the throttles.

When the reverser levers are moved to the reverse idle detent, the EECs will unlock and deploy the reversers, provided the EECs are not detecting any failure in the reverser systems. When the reversers are out of the stowed position, the reverser unlock indication (UL) will be displayed inside the EPR dials on the EAD. When the reversers are approximately halfway deployed, the reverse thrust indication (REV) will be displayed inside the EPR dials. When the levers are moved to the maximum thrust reverse position, the EEC is commanded to maximum reverse thrust. When the levers are moved past the mechanical gate into the emergency reverse position, the EEC will command the engine to increase the amount of reverse thrust. On the EAD, the emergency reverse thrust exceedance reminder will be displayed to remind the crew that maintenance will be required due to the use of emergency reverse thrust. On the EAD, REV will be displayed in red inside the EPR dials. In addition to the EPR indication, the REV L/R DEPLOYED alert will be displayed.

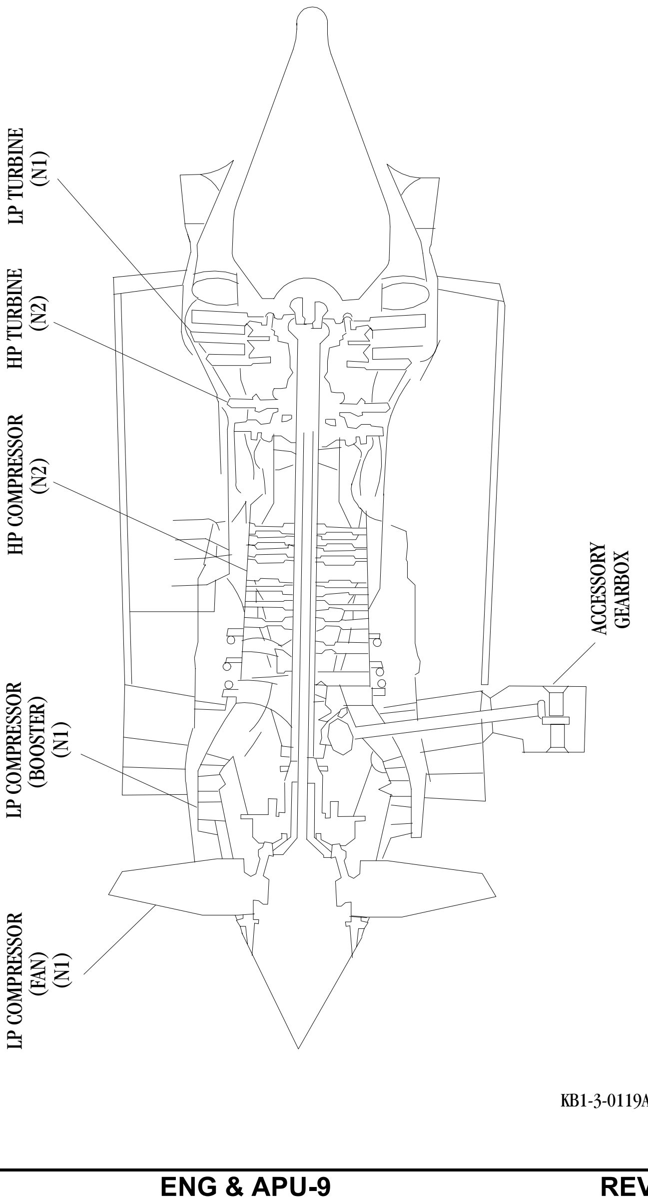
The reversers will only deploy when the respective engine is running. However, when landing with an engine shut down, the reverser on the inoperative engine is permitted for a brief time to deploy after nose wheel strut compression, In-flight, the thrust reversers are inhibited by nose and main gear strut compression switches. A switch in the aft fuselage provided override capability to permit reverser operation during maintenance while the engine is not running.

SYNCHRONIZER SYSTEM

The engine synchronizer system matches EPR or fan speeds to reduce crew workload and reduce noise. The EEC automatically controls the system. During takeoff the system synchronizes left EPR to the right EPR. During climb, cruise and descent, the system synchronizes fan speeds.

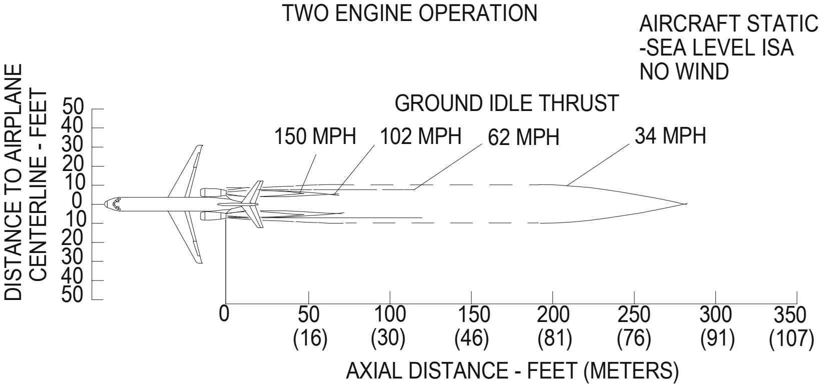
COMPONENTS

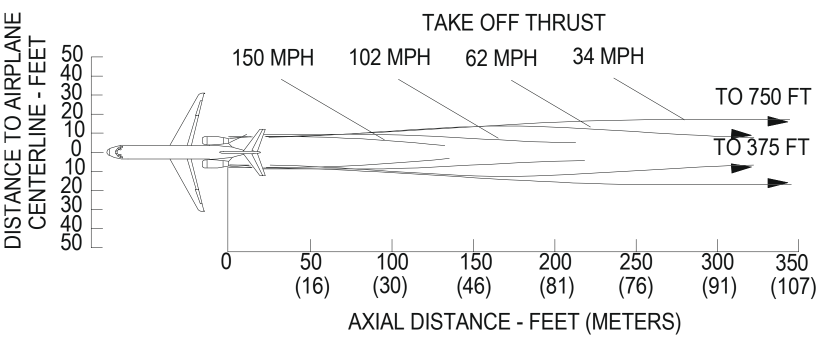
Engine Components

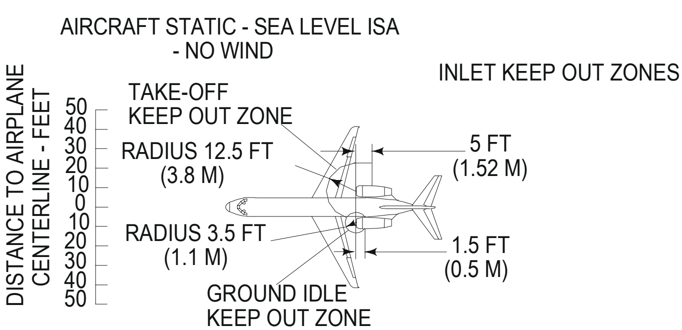


Jet Exhaust And Inlet Keep Out Zones

JET EXHAUST KEEP OUT ZONES
TWO ENGINE OPERATION







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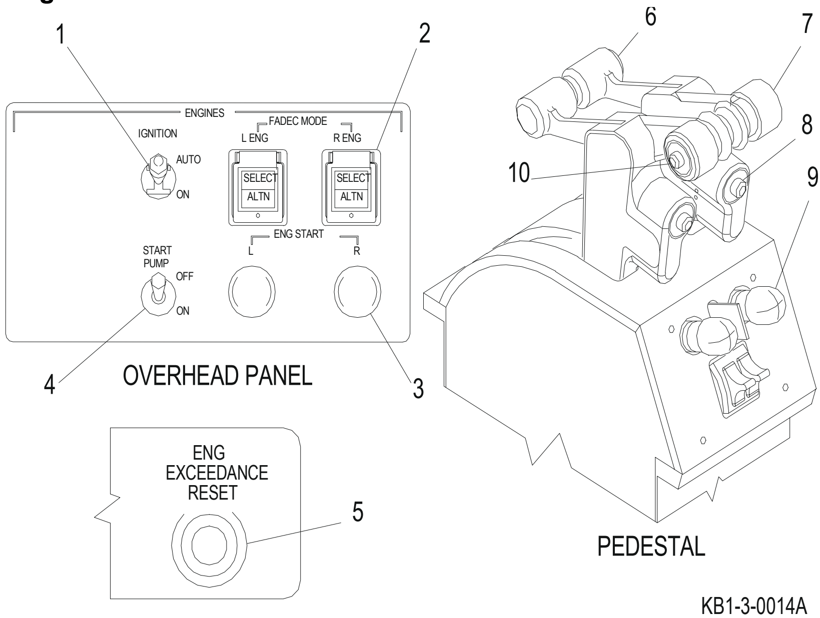
CONTROLS AND DISPLAYS

Engine Controls



1. **IGNITION Switch**

   AUTO - Initiates an automatic start sequence.

   ON - Initiates a manual ground start sequence and provides continuous power to the igniters.

   In flight, AUTO or ON positions both provide power to both igniters during starting.

2. **FADEC MODE Switches (L/R)**

   Push - Alternate backup mode comes on. Initially switch illuminates amber to indicate that the respective FADEC cannot measure or control EPR. Crew can then push this switch to select the alternate backup mode. SELECT extinguishes and ALTN remains illuminated.

3. **ENG START Switch (L/R)**

   Pull - Engine begins automatic start sequence. Switch illuminates amber.

4. **START PUMP Switch**

   ON - Turns start pump on with 28 volt DC power.

   OFF - Turns start pump off.

5. **ENG EXCEEDANCE RESET Switch**

   When depressed, resets exceedance, if any, on the EPR, N1, TGT, and N2 primary engine synoptic displays.

6. **Thrust Reverser Levers (L/R)**

   Pull aft - Thrust reversers deploy.

   The throttle lever must be at the idle stop to lift the reverse levers into the reverse range. There are no other mechanical interlocks. Reverse thrust has a detent at reverse idle.

   There is about a 20 pound per throttle lever load increase at maximum reverse power. If the lever is pulled aft through this 20 pound load increase, the EEC will select emergency reverse power.

7. **Throttles (L/R)**

   Each throttle transmits an electronic throttle position signal to the respective EEC. The EEC then controls engine thrust.

   Takeoff thrust in normal (EPR) control mode is marked by a 30 pound throttle lever load increase. This 30 pound load will apply to either throttle lever individually or to both levers if the levers are pushed forward beyond the Takeoff position.

   If a throttle lever is pushed forward beyond the takeoff gate, the respective engine EEC will switch to the alternate control mode. In the alternate mode the EEC will not automatically control to EPR limits.

8. Go-Around Switch

   These switches are covered in the Automatic Flight chapter.

9. FUEL Switches (L/R)

   ON - Fuel valve opens and fuel flows to the engine.

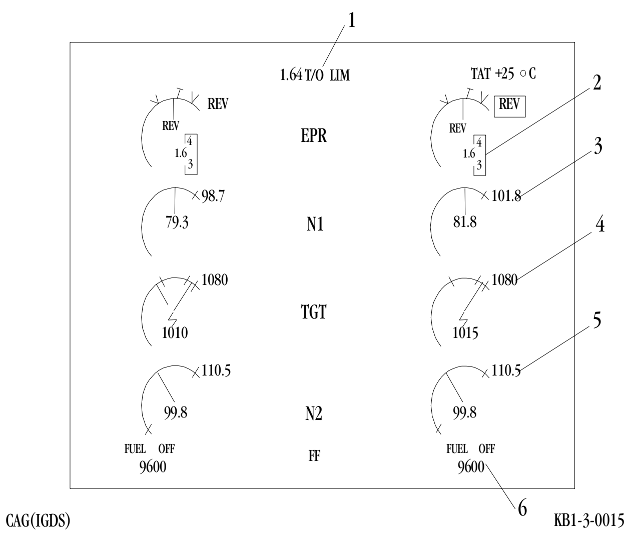
   OFF - Fuel valve closes.

   In ON position, this switch will illuminate red if a fire is detected or the engine fire handle is pulled. Switch remains illuminated until it is placed in OFF.

10. Autothrottle Disengage Switch

    Push - Disconnects the autothrottle system. However, high and low speed protection will remain. ATS OFF (in red) will flash on the PFD.

EAD - Primary Engine Display



1. **Thrust Rating and TAT**

   FMS limits and modes are magenta. Manually set modes are white. TAT is in degrees C.

2. EPR

   Throttle position is a white T riding on the scale. The computed EPR thrust rating is a magenta V riding on the scale. When the throttle is set to the computed thrust rating, the T fits in the V.

   The thrust reverser display is above the EPR digital value. It is blank for reverser stowed, amber U/L for in-transit, and green REV for reverser fully deployed. If emergency reverse power is selected, the amber boxed REV exceedance box appears. The box stays on if the engine power exceeds normal ratings. This exceedance can be reset with the ENG EXCEEDANCE RESET button on the overhead panel. A red REV will appear if there is an uncommanded thrust reverser deployment.

3. N1

   Display is white, but pointer and digits turn red (digits boxed in red) if N1 exceeds the redline limit. Maximum redline exceedance is shown in amber at the high end of the scale. This exceedance can be reset with the ENG EXCEEDANCE RESET button on the overhead panel.

4. TGT

   The display is white but the pointer and digits turn amber (digits boxed) if TGT exceeds the amber line for more than 5 minutes. The pointer and digits turn red (digits boxed) if TGT exceeds the redline. A cyan lightning bolt appears over the digits when ignition for that engine is on. Maximum redline exceedance, if any, is shown in amber at the high end of the scale. This exceedance can be reset with the ENG EXCEEDANCE RESET button on the overhead panel.

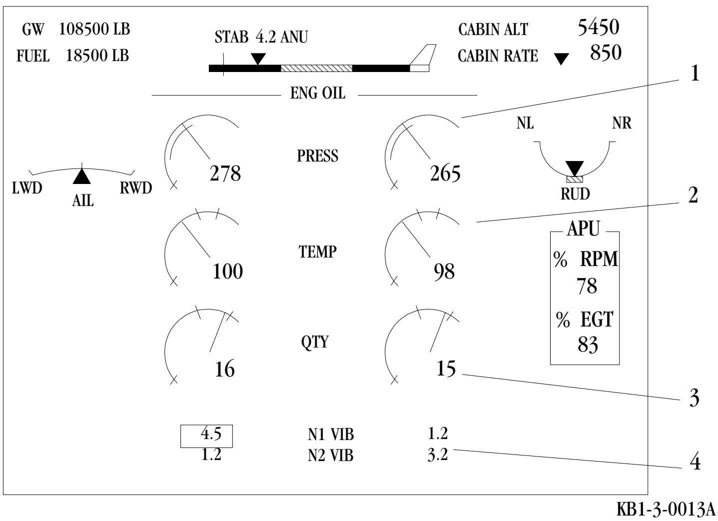
5. N2

   The display is white, but the pointer and digits turn red (digits boxed in red) if N2 exceeds the redline limit. During start a cyan line appears to indicate the minimum N2 at which fuel should be turned on. Maximum redline exceedance will be shown in amber at the high end of the scale and can be reset with the ENG EXCEEDANCE RESET button on the overhead panel.

6. Fuel Flow

   Fuel flow is in white digits. When the engine fuel valve is closed, a cyan FUEL OFF appears in place of the digits.

SD Synoptic - Secondary Engine



1. **Oil Pressure**

   A green arc shows the valid range. The digits are normally white. If the pointer moves out of the green arc, the digits and the pointer turn amber and the digits are boxed in amber. The pointer, digits, and box will turn red when the pointer moves below the redline.

2. **Oil Temperature**

   The white digits and pointer turn amber (digits boxed in amber) if the temperature falls below the low amber line limit. The digits and pointer turn red (digits boxed in red) if the high redline is exceeded or below the low red trigger limit.

3. **Oil Quantity**

   When the engine reaches minimum idle each scale has a cyan line showing initial quantity for consumption reference. The pointer and digits turn amber (digits boxed in amber) if quantity falls below the low oil quantity amber line.

4. **Engine Vibration**

   Digits are shown in white but will turn amber and will be boxed in amber if vibration levels exceed limits.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

ENG L/R BRG OVHT (ENG) - Overheat detected in the aft bearing compartment.

ENG L/R OIL PRES LO (AIR) - Respective engine oil pressure is low.

ENG L/R OIL TEMP HI (ENG) - Respective engine oil temperature exceeds redline limit.

ENG L/R RPM HI (ENG) - Respective N2 has exceeded the red line limit.

ENG L/R RPM LO (ENG) - N2 speed has dropped below idle (less than 55%).

ENG L/R TGT HI (ENG) - Respective engine TGT exceeds red line limit or exceeds amber line limit after 5 minutes.

SELECT FADEC ALTN (ENG) - An engine has reverted to N1 mode.

START VLV L/R OPEN (ENG) - Respective start valve is open when engine is above starter cutout speed (41 %).

Amber Alerts (Level 1)

ENG L/R FADEC ALTN (ENG) - Respective FADEC N1 mode has been selected.

ENG L/R FUEL FILTER (ENG) - Respective engine has high differential pressure across fuel filter indicating impending fuel filter clog.

ENG L/R OIL FILTER (ENG) - Respective engine has high differential pressure across oil filter. Oil temperature must be greater than 30°C.

ENG L/R START ABORT (ENG) - Ground only. During engine start, an abnormal condition is detected in the respective engine and autostart sequence is aborted.

ENG L/R SURGE (ENG) - Respective engine compressor surge or starting stall.

ENG L/R SYS FAIL (ENG) - Respective engine has a class 1 fault. No dispatch until fault is fixed.

ENG L/R SYS FAULT (STATUS) - Respective FADEC has detected an internal fault or loss of redundancy.

ENGINE VIB HI (ENG) - Engine vibration exceeds acceptable limits.

REV L/R DEPLOYED (ENG) - Thrust reverser doors are uncommanded deployed.

REV L/R FAULT (ENG) - Respective thrust reverser fault.

START AIR PRES LO (AIR) - Pressure in the manifold is insufficient for engine start.

Cyan Alerts (Level 0)

ENG IGN OVRD ON - Engine ignition switch is in ON position.

ENGINE COOL - Engine has cooled sufficiently after landing to be shut down.

APU

APU INTRODUCTION

The Auxiliary Power Unit (APU) provides adequate electrical power to operate all aircraft electrical systems simultaneously. It also provides a pneumatic pressure source for the air conditioning systems and engine starting. The electrical system has the higher priority for all operational conditions.

The APU is installed in an unpressurized, fireproof area, aft of the pressure bulkhead. Normal operating controls and fire extinguishing controls are located on the forward overhead panel APU control panel. APU exterior ground controls for fire fighting are located on the lower aft fuselage. (Refer to Fire Protection chapter for complete discussion).

APU RPM, EGT, air output and electrical output are controlled by an Electronic Control Unit (ECU) located in the electrical/electronic compartment.

APU parameters are displayed on the Systems Display (SD) secondary engine page.

APU START AND SHUTDOWN

The APU uses the airplane batteries for starting. The start sequence is fully automatic following the release of the MASTER switch to RUN. Normal starts include a delay period (up to approx. 40 seconds) to allow the inlet door to cycle to the fully open position.

With the APU on speed, electrical power is immediately available for distribution. With the APU AIR switch moved to ON, APU bleed air is available, except for the delay (2 minutes) following an initial start cycle.

During the start cycle, if specific faults are detected, or the start is not completed within a specific time frame, the APU automatically shuts down to preserve battery power and starter life.

At normal shutdown, the APU continues to run (for approximately 17 seconds) while the electrical system performs a No Break Power Transfer (NBPT). APU shutdown follows the transfer. This delay is bypassed when the cockpit APU FIRE CONT toggle switch (refer to Fire Protection chapter for complete discussion) is moved to the OFF & AGENT ARM position, or when the exterior ground APU toggle switch is moved to the SHUT OFF position, or when the APU is shut down by the ECU following detection of an APU compartment fire.

APU FUEL SUPPLY

APU fuel is normally supplied from the right main tank. Using crossfeed, fuel can be supplied from any tank.

The DC start pump or any AC-powered operating right main fuel boost pump can be used to supply fuel pressure to the APU. Fuel can also be supplied from the center tank, or the left main tank, provided the fuel X FEED valve is open, and AC power is available to the appropriate fuel boost pumps (refer to Fuel chapter for complete discussion).

NOTE

> When center tank pumps are used to supply fuel to the APU, a right main tank fuel boost pump should also be operating. When center tank fuel value is less than 800 pounds, using center tank pumps can force air into the APU fuel line. Air in the fuel line can cause APU flameout or prevent APU start.

APU FAULT DETECTION

The amber boxed APU FAULT alert is displayed during conditions which could result in APU damage in-flight. On the ground, when these conditions are present, the APU automatically shuts down, the fuel shutoff valve closes, and the amber APU AUTO SHUTDOWN alert is displayed.

In-flight, the ECU automatically shuts down the APU for an APU overspeed or an APU compartment fire. If an APU FAULT condition occurs in-flight, the APU automatically shuts down 10 minutes after landing, unless shut down sooner by the pilot.

AFT ACCESSORY COMPARTMENT OVERHEAT DETECTION

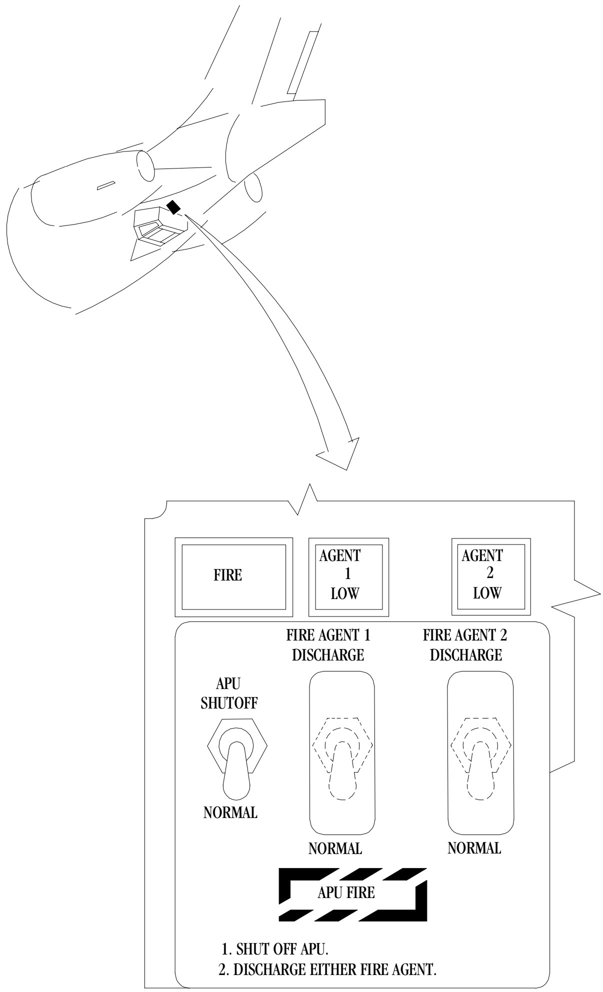
If the aft accessory compartment overheats, APU bleed air supply shuts off automatically. Automatic bleed air shutoff is inhibited during flight and engine start.

APU INLET DOOR SYSTEM

The APU inlet door is located on the aft upper left surface of the fuselage. It provides intake air for all APU operations. The door has three (3) positions and is set automatically by the ECU.

APU COMPONENTS

APU Ground Control Panel



APU GROUND CONTROL PANEL

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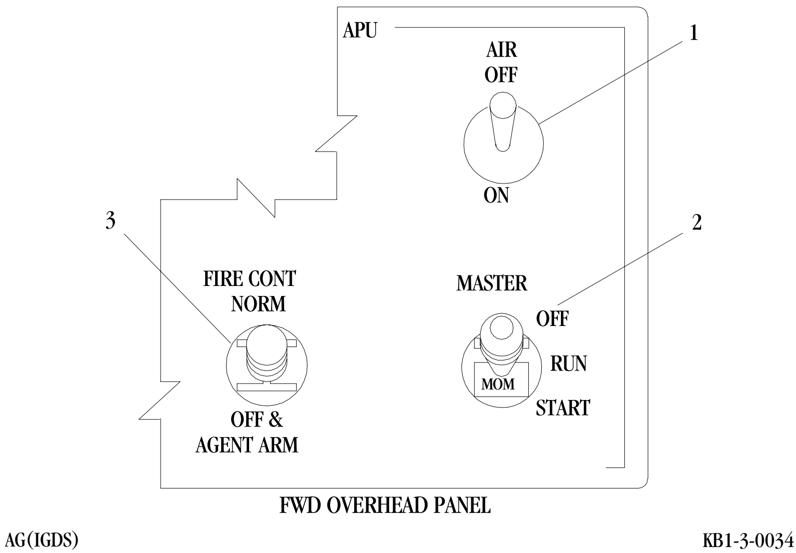
APU CONTROLS AND DISPLAYS

APU Panel



1. **AIR Switch**

   OFF - APU air to the pneumatic system is off.

   ON - APU air is supplied to the pneumatic system. APU bleed air is inhibited until 2 minutes after an APU start is initiated.

2. **MASTER Switch**

   OFF - Shuts down APU and closes inlet door.

   RUN - Allows APU to run and opens inlet door.

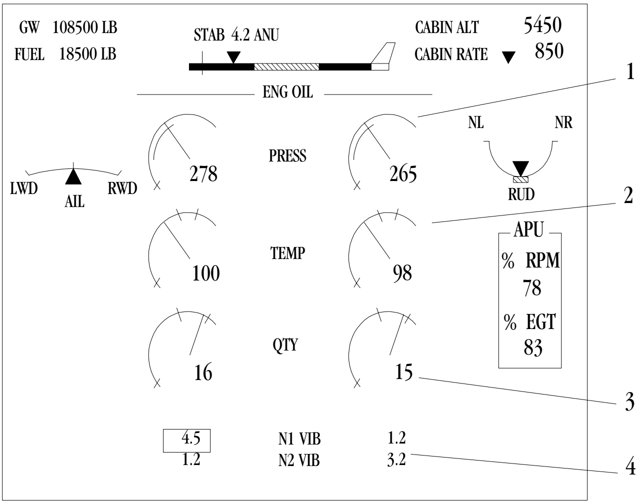
   START - (Momentary) Starts APU.

3. **FIRE CONT Switch**

   NORM - Normal operation. Allows APU to run.

   OFF & AGENT ARM - Shuts down APU immediately and arms fire extinguishers.

SD Synoptic - Secondary Engine (Typical)



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1. **APU Information Block**

   APU parameters appear when the APU MASTER switch is in RUN. Parameters also appear when the APU MASTER switch is OFF following APU shutdown if the APU inlet door is still open.

2. **% RPM Display - white**

   The APU RPM is displayed as a percentage of rated speed. The white digits become red and boxed when limits are exceeded.

3. **% EGT Display - white**

   APU EGT is displayed as a percentage of maximum continuous exhaust gas temperature. The white digits become red and boxed when limits are exceeded and return to white when those limits return to normal.

APU ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Red Boxed Alerts (Level 3)

APU FIRE (ENG) - APU compartment fire detected. APU shuts down.

Amber Boxed Alerts (Level 2)

APU EGT HI (ENG) - APU EGT exceeds 100%.

APU FAULT (ENG) - The APU detects a fault which results in auto shutdown on the ground, but prevents shutdown in flight.

Amber Alerts (Level 1)

APU DOOR OPEN (ENG) - The APU air inlet door is open with the APU commanded off.

APU AUTO SHUTDOWN (ENG) - APU detects a fault and automatically shuts down.

APU VALVE DISAG (AIR) - The APU air shutoff valve position disagrees with the APU AIR switch selection.

Cyan Alerts (Level 0)

APU AIR/ELEC ON - The APU is on and supplying both electrical and pneumatic power.

APU AIR ON - The APU is on and providing pneumatic power but not electrical power.

APU ELEC ON - The APU is on and providing electrical power, but not pneumatic power.

APU ON - The APU is running without load.

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FIRE WARNING AND PROTECTION

INTRODUCTION

The fire detection and extinguishing system provides fire warnings and fire extinguishing in the engine nacelles and the Auxiliary Power Unit (APU) compartment. The fire and extinguishing system also provides smoke detection and extinguishing for the lavatory and the lower cargo compartment.

FIRE DETECTION SYSTEM

The fire detection system consists of two independent, heat sensitive, detector loops (A and B) located in each engine and the APU. Each loop provides both fire and overheat detection.

In normal operation, with the LOOPS switch at BOTH, false fire warnings are minimized because both loops must be subjected simultaneously to fire or overheat conditions before they will activate the fire warnings. When a fire is detected in one loop, the system tests the other loop for its detection capability. If the other loop is capable, but is not yet detecting a fire, the system will wait for it to be heated to the alarm point before activating the fire warnings.

If one loop is confirmed defective, the airplane can still be dispatched, or continue in flight, using the single operational loop by moving the applicable LOOPS switch to the operational loop position. In this case, if a fire is detected in this loop, the fire warnings will be activated.

If one loop has a short circuit or loses power and the other loop is not capable of detecting a fire, the respective FIRE DET L/R FAIL and FIRE DET APU FAIL alerts will be displayed on the System Display (SD) secondary engine synoptic page.

Each lavatory is equipped with a smoke detector. When smoke in a lavatory is detected, aural and visual warnings will be generated. These warnings will remain until smoke in the lavatory has dissipated.

Engines

If both loops are detecting an engine fire, the warnings are:

- L /R ENG FIRE handle light(s) illuminated.

- FUEL switch light(s) illuminated.
- Aural/vocal warnings sound.
- ENGINE L/R FIRE alert(s) displayed on the EAD.
- MASTER WARNING lights illuminated.

Pulling the associated ENG FIRE handle to fully extended position causes the following:

- Closes fuel, hydraulic shutoff valve, and the bleed valve.
- Trips engine generator off.
- Arms both fire extinguishers.

The aural/vocal warnings can also be silenced by pushing the MASTER WARNING light. The ENG FIRE handle light(s) will remain illuminated until the fire is extinguished.

APU

If both loops are detecting an APU fire, the warnings are:

- APU automatically shuts down.
- APU FIRE alert displayed on the EAD.
- MASTER WARNING lights illuminated.
- FIRE light on the external APU ground control panel illuminated.
- Aural/vocal warnings and exterior fire warning horn sound.

The aural/vocal warnings shut off automatically after three cycles. Exterior fire warning horn will remain audible until the fire is extinguished.

Lavatories

When smoke is detected, the warnings are:

- MASTER CAUTION lights illuminate.
- Alert appears on EAD.
- Light illuminates red on the ceiling adjacent to the lavatory.
- Flight attendant master CALL lights illuminate red.
- HI-LO chime sounds on PA.

FIRE EXTINGUISHING SYSTEM

The engine and APU fire extinguishing system consists of two fire extinguisher agent containers and AGENT LOW lights.

Each container has separate discharge heads and distribution lines to each engine and APU. The ENG FIRE handles and the APU FIRE AGENT switches, located on the overhead panel, and the FIRE AGENT DISCHARGE switches on the APU ground control panel arm and discharge the selected fire extinguishing agent.

The AGENT LOW lights, located on the upper instrument panel and APU ground control panel, illuminate when pressure in container is below minimum, indicating that fire extinguishing agent has been discharged. In addition, FIRE AGENT LO alert will be displayed on the SD secondary engine synoptic page.

The lavatory fire extinguishing system consists of a heat-activated Halon extinguisher located inside the trash container. The system is automatic and self-contained. When the temperature at the extinguisher discharge tube tips is between 170 and 177 degrees F, the fusible tips melt, allowing the extinguishing agent to be discharged into the trash container.

Portable fire extinguishers are provided at strategic locations in the cabin and cockpit. Refer to Emergency Equipment chapter for specific locations.

CARGO COMPARTMENT SMOKE DETECTION AND FIRE SUPPRESSION SYSTEMS

The cargo compartment smoke detection and fire suppression systems consist of photoelectric smoke detectors, fire extinguishing agent containers, and cockpit controls and displays.

The smoke detection system consists of photoelectric smoke detectors mounted in a recessed pan in the ceiling of the cargo compartment. Two detectors are mounted per pan. Four pairs of detectors are located in the forward cargo compartment and two pairs are in the aft compartment. The system is designed as a dual detection system, but can revert to a single detection system, in either or both cargo compartments, by selection of the appropriate NORM or SINGLE position of the FWD/AFT switches on the CARGO SMOKE DET SYS panel. In NORM position, any two detectors (not necessarily in a single pan) will activate the alarm. In SINGLE position, any one detector will activate the alarm.

The fire suppression system uses chemical discharge to extinguish fires in the cargo compartment. The system consists of two Halon fire extinguishing agent containers connected to both forward and aft cargo compartments. The discharge nozzles are located at each smoke detector pan. The system can suppress a fire and maintain an atmosphere that will prevent reignition of a fire for a period of 60 minutes.

When smoke or fire is detected in the cargo compartment, the following will occur:

- MASTER WARNING lights will flash.
- CARGO SMOKE voice warning will be heard from the Central Aural Warning System (CAWS).
- Appropriate CARGO SMOKE FWD (or AFT) level 3 alert will be displayed on the EAD. Level 1 alert DISCH CARGO AGENT will be displayed on the SD with the consequence message LAND AT NEAREST SUITABLE AIRPORT.
- AIR synoptic page with the smoke detectors in alarm (red triangles) will be displayed on the SD.
- FWD (or AFT) CARGO SMOKE AGENT 1 DISCH PUSH switch will illuminate flashing. When the appropriate switch is pushed to discharge the fire-extinguishing agent, the light will go steady and will extinguish after the LOW light illuminates.
- FWD and AFT CARGO SMOKE AGENT 1 DISCH LOW lights will illuminate after the fire-extinguishing agent has been discharged.
- Level 1 alert CARGO AGENT 1 LO will be displayed on the SD.

Six minutes after the first bottle has been discharged, the following will occur:

- Level 1 alert DISCH CARGO AGENT will be displayed on the EAD.
- MASTER CAUTION lights will flash.
- FWD (or AFT) CARGO SMOKE AGENT 2 DISCH PUSH switch will illuminate flashing. When the appropriate switch is pushed to

discharge the fire-extinguishing agent, the light will go steady and will extinguish after the LOW light illuminates.

- FWD and AFT CARGO SMOKE AGENT 2 DISCH LOW lights will illuminate after the fire-extinguishing agent has been discharged.
- Level 1 alert CARGO AGENT 2 LO will be displayed on the SD.

Pushing and holding the CARGO SMOKE TEST button on the overhead panel tests system. The following will occur during the test:

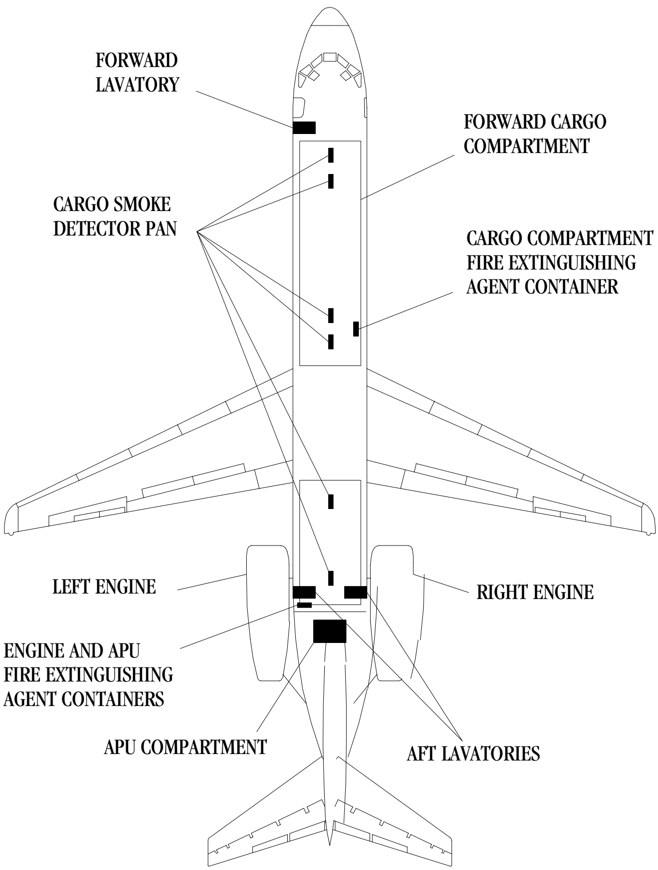
- CARGO SMOKE FWD and CARGO SMOKE AFT alerts will be displayed on the EAD.
- MASTER WARNING lights will be displayed.
- The detector symbols (either red triangles or boxed amber F) of AIR synoptic page will be displayed on the SD.
- All CARGO SMOKE AGENT 1 and 2 DISCH PUSH switches will illuminate.
- CARGO SMOKE voice warning will be heard.

During the system test in normal mode (FWD or AFT switch at NORM on the CARGO SMOKE DET SYS panel), if any detector is failed, the appropriate CRG SMK FWD (or AFT) FAIL alert will be displayed. The flight crew then should place applicable FWD/AFT switch in the SINGLE position to redo the test. The CRG SMK FWD SGL and/or CRG SMK AFT SGL will be displayed on the SD Status Page whenever the system is in the SINGLE mode.

The CRG SMK TEST PASS level 0 alert on the EAD indicates successful system test.

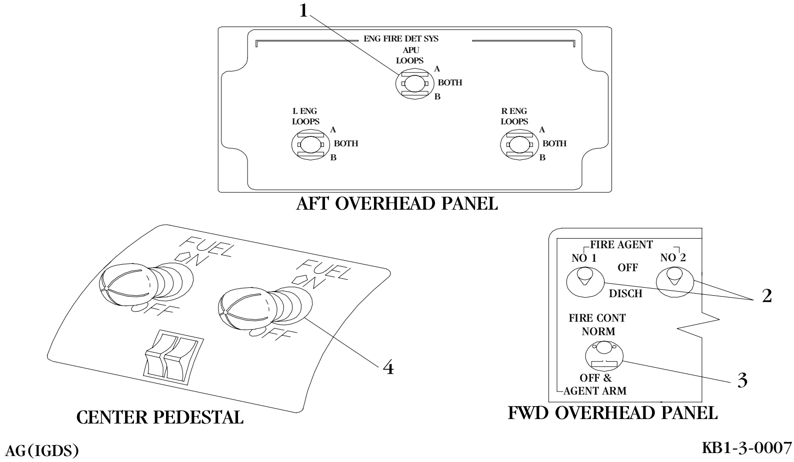
COMPONENTS

Fire Extinguishing System



CONTROLS AND DISPLAYS

Fire Controls/ Indicators



1. **LOOPS Switch (L ENG/R ENG/APU)**

   A/B - Connects engine or APU fire warning system to respective fire detector loop.

   BOTH - Normal position.

2. **APU FIRE AGENT Switch (NO 1/NO 2)**

   OFF - Normal position.

   DISCH - Discharges selected fire extinguishing agent into the APU compartment after the fire extinguishers are armed.

3. **APU FIRE CONT Switch**

   NORM - Normal position.

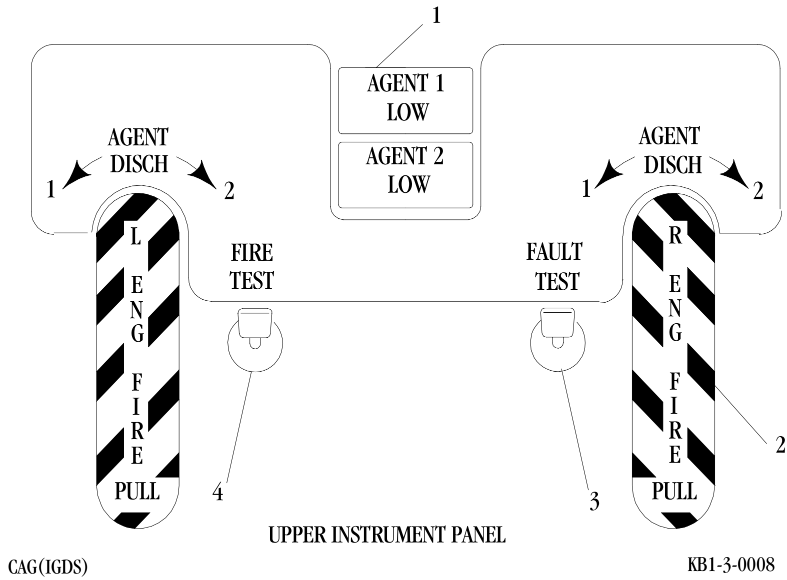
   OFF & AGENT ARM - Immediately shuts down APU and arms the fire extinguishers.

4. **FUEL Switch Light**

   Illuminated - Associated engine fire is detected or the system fire test is in progress.

   OFF - Extinguishes light.

Engine Fire Extinguishing Controls/ Indicators



1. **AGENT LOW Light (1/2)**

   Illuminated - Respective fire extinguishing agent has been discharged (pressure below minimum).

2. **ENG FIRE Handle (L/R)**

   Light Illuminated - Associated engine fire is detected or the system fire test is in progress.

   Pull - (Fully extended position) Shuts off associated engine fuel, hydraulic and pneumatic systems, trips engine generator off, and arms the fire extinguishers.

   Rotate - (After pulling) Discharges respective fire extinguishing agent into the engine.

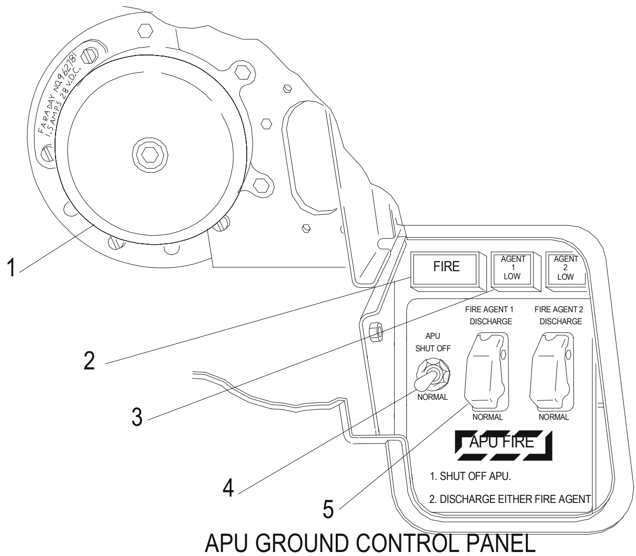
3. **FAULT TEST Switch (Maintenance Test)**

   Tests both A and B loops and components for faults.

4. **FIRE TEST Switch**

   Tests both A and B loops. A successful test is indicated by all fire warnings displayed on the EAD.

APU Fire Extinguishing Controls/ Indicators



CAG(IGDS) KB1-3-0009

1. **APU Fire Warning Horn**

   Sounds when APU compartment fire is detected.

2. **APU FIRE Light**

   Illuminated - APU compartment fire is detected.

3. **AGENT LOW Light (1/2)**

   Illuminated - Respective fire extinguishing agent has been discharged.

4. **APU SHUT OFF Switch**

   NORMAL - Normal position.

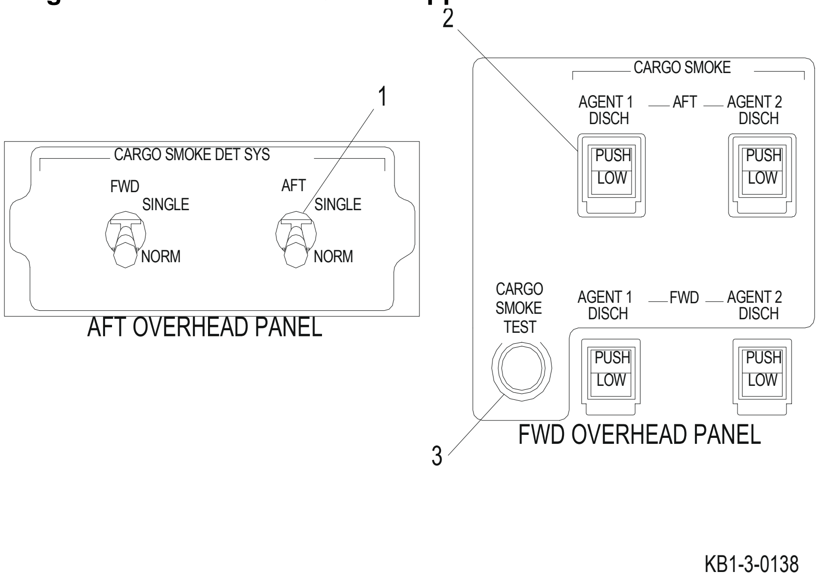
   SHUT OFF - Shuts down APU and arms fire extinguishers.

5. **FIRE AGENT DISCHARGE Switch (1/2)**

   NORMAL - (Guarded) Normal position.

   DISCHARGE - Discharges respective fire extinguishing agent into the APU compartment.

Cargo Smoke Detection & Fire Suppression Controls



1. **CARGO SMOKE FWD/AFT Switch (2)**

   SINGLE - Selects single smoke detection system.

   NORM - Selects normal dual smoke detection system.

2. **AFT/FWD CARGO SMOKE AGENT 1/2 DISCH Switch (4)**

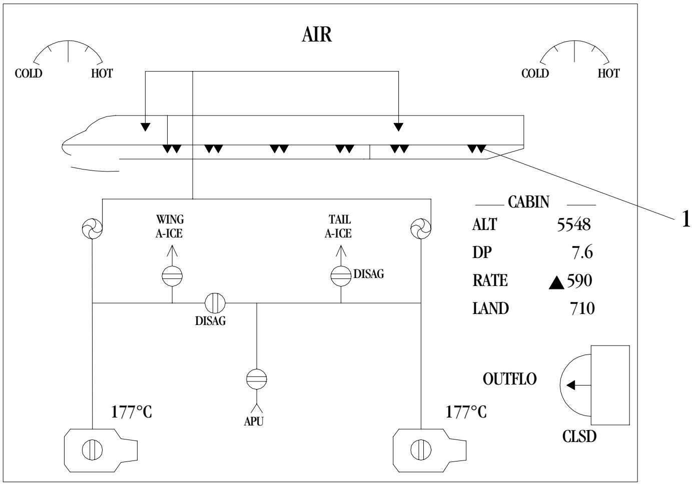
   PUSH switch illuminates flashing (red) indicates smoke/fire detected in the cargo compartment. Pushing switch discharges the fire-extinguishing agent and changes switch illumination to steady. Light will extinguish when the LOW light illuminates.

   LOW light illuminates (amber) after the fire-extinguishing agent has been discharged. PUSH switch light extinguishes.

3. **CARGO SMOKE TEST Button**

   Push and Hold - Tests system. Alerts are displayed on EAD, smoke detector status are displayed on SD AIR synoptic page, all PUSH switches illuminate, and CARGO SMOKE voice warning sound.

SD Synoptic - Air



KB1-3-0139

1. **Cargo Smoke Detector**
   No Triangle - Normal.
   Amber Boxed F - Failed detector.
   Red Triangle - Smoke detected.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Red Boxed Alerts (Level 3)

APU FIRE (ENG) - APU compartment fire is detected.

CARGO SMOKE FWD/AFT (AIR) - Smoke has been detected in forward/aft cargo compartment.

ENGINE L/R FIRE (ENG) - Engine fire detection system has detected a fire.

Amber Alerts (Level 1)

APU SQB 1/2/3 FAIL (STATUS) - Respective discharge cartridge has failed the manual fire test.

CARGO AGENT 1/2 LO (AIR) - Respective cargo compartment fire-extinguishing agent has been discharged.

CRG SMK FWD/AFT FAIL (AIR) - Respective forward/aft cargo compartment smoke detector test has failed.

CRG SMK FWD/AFT SGL (AIR) - Respective cargo compartment smoke detection system is operating in single mode.

DISCH CARGO AGENT (AIR) - Flight crew must discharge cargo compartment fire-extinguishing agent.

ENG L/R SQB 1/2 FAIL (STATUS) - Respective discharge cartridge has failed the manual fire test.

FIRE AGENT APU LO (ENG) - Optional third APU fire-extinguishing agent has been discharged.

FIRE AGENT 1/2 LO (ENG) - Respective engine fire-extinguishing agent has been discharged.

FIRE APU A/B FAULT (STATUS) - Respective APU detector loop has detected a fault.

FIRE DET APU FAIL (ENG) - Both APU detector loops are inoperative or a fire/overheat is detected in one of two active loops.

FIRE DET L/R FAIL (ENG) - Both detector loops are inoperative in the respective engine or a fire/overheat is detected in one of two active loops.

FIRE L/R A/B FAULT (STATUS) - Respective engine detector loop has detected a fault.

FIREX TEST FAIL (STATUS) - Manual fire discharge test has failed.

LAVATORY SMOKE (AIR) - Smoke has been detected in a lavatory.

Cyan Alerts (Level 0)

CRG SMK TEST PASS - Smoke detection system test is passed.

FIREX TEST PASS - Manual firex discharge test has passed (all squibs indicated continuity).

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TABLE OF CONTENTS

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FLIGHT CONTROLS

INTRODUCTION

The flight control system consists of mechanical, cable-controlled systems for longitudinal, directional, and lateral control. Electronic control is used for spoilers, longitudinal trim, directional trim, and lateral trim. No single control system failure will result in loss of airplane control.

System controls are on the overhead panel and pedestal. System alerts are displayed on the Engine and Alert Display (EAD). Control surface positions are displayed on the System Display (SD) CONFIGURATION synoptic.

CONTROLS

Rudder

The rudder assembly consists of the rudder and the rudder control tab.

There are two modes of rudder operation, powered and manual. Normally, the rudder is powered hydraulically by the right hydraulic system.

If manual mode is selected or if right hydraulic pressure is too low, the rudder control tab unlocks. In manual mode, the rudder pedals move the control tab on the rudder, and aerodynamic forces on the control tab move the rudder.

The HYD CONT RUDDER switch allows selection of manual rudder operation. When the switch is pushed, OFF illuminates, hydraulic power to the rudder is shut off, and the rudder reverts to manual operation. The RUDDER PWR OFF alert is displayed on the EAD.

The rudder is trimmed with the RUDDER TRIM knob by rotating and holding the knob momentarily to NOSE L or NOSE R. When the RDR CTR button is pushed, rudder trim is automatically centered to zero. Rudder trim information is displayed on the CONFIGURATION synoptic.

The rudder pedals are adjusted by pulling out on the individual rudder pedal adjustment knobs and positioning the pedals as desired.

A primary rudder limiter protects the empennage from excessive loads by progressively restricting rudder travel as airspeed increases. It is a mechanical system operated by ram air pressure from a pitot tube on the leading edge of the vertical stabilizer.

A second rudder restricting system provides backup rudder limiting to protect the empennage from overload, in the event the primary rudder limiter system fails. The system has two positions, restricted and unrestricted. The actuators of the system are controlled by the flight control computer (FCC), as a function of airspeed. When the airplane reaches a predetermined speed, the limiter engages and restricts rudder movement if the primary rudder throw limiter fails to properly limit rudder movement.

The limiter system uses two actuators. Each actuator is powered by its respective hydraulic system. If one hydraulic system fails, one actuator is capable of maintaining normal limiter operation. If both hydraulic systems fail, the return springs automatically disengage the backup limiter.

Rudder movement is displayed on the synoptic as a box in proportion to the amount of rudder deflection.

Ailerons

The ailerons are aerodynamically positioned by control tabs connected to the control wheels. An aileron bus cable assembly synchronizes aileron movement. The control wheels are spring-loaded to neutral.

The control wheels are linked together by a torque tube and an override mechanism. In the event that one control tab cable system or control wheel becomes jammed, roll control is still possible with the other tab by overriding the jammed component. The bus cable system positions both ailerons correctly.

The ailerons are positioned by aerodynamic forces on the control tabs. For greater roll control, with more than 5 degrees of control wheel input, the flight spoilers extend a proportionate amount on the downward moving wing.

The ailerons are trimmed by a trim tab outboard of the control tab on each aileron. The AILERON TRIM switches, located on the pedestal, operate the trim tabs for LEFT WING DOWN/RIGHT WING DOWN control. Aileron trim information is displayed on the CONFIGURATION synoptic.

Elevators

The elevators are aerodynamically positioned by control tabs, which are mechanically connected to the control columns. A variable load feel mechanism simulates aerodynamic forces and returns the control columns to an artificial center position when the columns are released.

An override mechanism installed on the torque tube connecting the two control columns allows the free column to disconnect from a jammed column when adequate force is applied. Each column still controls its respective elevator control tab and it will have its full range of movement. There is a spring mechanism in the tail section connecting the opposite tab. The spring limits the opposite tab to less than full movement. It is possible for each pilot to move his respective tab in opposite directions which may cause an undesirable roll of the aircraft.

The elevators, when deflected, are displayed as a box on the synoptic, in proportion to the amount of deflection.

Each elevator has two tabs, a control tab and a geared tab. The control column operates the control tabs, which then aerodynamically position the elevators. As each elevator moves, the geared tabs are deflected, providing aerodynamic assistance in moving the elevators.

A standby elevator cable loop system provides an alternate means of elevator control if an incontinent engine failure cuts the primary elevator control cables forward of the aft pressure bulkhead.

The elevator has two hydraulic boost cylinders that augment elevator control during a deep stall recovery, providing additional nose down capability. The actuators are powered by the left hydraulic system with an accumulator backup in the event system pressure is lost.

When the elevator augmentation system is activated by pushing the control columns full forward, the elevators move to full deflection, trailing edge down. This is displayed on the CONFIGURATION synoptic.

Spoilers

The spoilers have three functions:

Roll augmentation,

Inflight speed brakes,

Decrease lift and increase drag during a rejected takeoff, or during the landing roll.

The spoilers are controlled by the spoiler electronic control unit (SECU) and are hydraulically powered. The left hydraulic system operates the inboard spoiler panels. The right hydraulic system operates the outboard spoiler panels.

The SPD BRK lever, used to control the spoilers, has three positions: RET, armed, and EXT.

The spoilers supplement roll control, in conjunction with the ailerons, when the control wheel is moved approximately 5 degrees beyond the neutral position.

Spoiler position is displayed on the synoptic. When the spoilers are stowed, the spoiler panels are blanked. When the spoilers are partially deployed, a white outline displays the position between stowed and fully deployed. When the spoilers are fully deployed, the panels are green.

The spoilers may be used as speed brakes to increase the rate of descent or to decrease speed by positioning the SPD BRK lever. All four spoilers extend symmetrically. By squeezing the lever and moving it aft, the vernier feature of the lever allows the spoilers to be extended in any setting between fully retracted and fully extended.

When speed brake and roll augmentation are used simultaneously, the spoiler panels deflect in the same direction as the ailerons. When the speed brakes are fully extended, the spoiler panels on the upward moving wing retract in proportion to the amount of control wheel rotation, thus augmenting roll control.

Pulling the SPD BRK lever fully up to the armed detent arms the spoilers. Pushing down on the SPD BRK lever retracts the lever. The red band and ARM placard are visible on both sides of the lever when the spoiler is armed. When armed, the spoilers operate automatically to increase braking during landing, and during a rejected takeoff, by reducing lift and increasing drag. Selecting reverse thrust deploys the spoilers for a rejected takeoff. When landing, main wheel spin-up or a ground shift signal from the nose gear deploys the spoilers.

If a ground spoiler system malfunction occurs with the spoilers armed, the DISARM SPOILERS alert is displayed on the EAD. If the throttles are advanced to high thrust while the speed brakes are extended, the spoilers automatically retract.

Flaps/Slats

Both the flaps and the slats are hydraulically powered. Flaps and slats augment the lift of the wing during slow speed flight, as during the takeoff, approach or landing phases of flight.

The FLAP/SLAT control handle has fixed detents at the UP/RET, and 0, 13, 18, 25, and 40 degree positions. The 25 degree and 40 degree positions are fixed detents for setting landing flaps.

A go-around gate is installed at the 18 degree setting. The handle must be released into the detent and then raised again to move the handle forward.

The FLAP/SLAT handle can be moved from 0 degrees to the UP/RET detent to retract flaps and slats by lifting the handle up and moving it forward.

The FLAP T.O. SEL thumbwheel is used to select a detent position when a flap setting other than 13 or 18 degrees is needed. The FLAP T.O. SEL position indicator window displays the position of this movable detent.

Each flap is operated by an inboard and an outboard hydraulic actuator. The outboard actuators are powered by the left hydraulic system and the inboard actuators are powered by the right hydraulic system.

The leading edge slats are high-lift devices. Five individual slat sections on each wing operate as a single unit. The slats are positioned by cables connected to hydraulically powered drums.

The slat drum assemblies each have two hydraulic actuators, one powered by the left hydraulic system and one powered by the right hydraulic system. Either hydraulic system can operate the slats.

The slats are controlled with the FLAP/SLAT handle. There are two slat positions, UP/RET and EXT.

An alert is displayed on the EAD if there is a discrepancy between the left and right wing slats position or between slats position and the FLAP/SLAT control handle setting.

On the CONFIGURATION page of the SD synoptic, flaps position is displayed under each wing in fixed size boxes with an individual digital readout of flaps setting. When flaps are retracted, the boxes are not displayed.

Slats position is displayed on the CONFIGURATION page of the SD synoptic beneath the airplane symbol.

The flap/slat position indication is also displayed on the primary flight display (PFD). When the flaps are in transit, the selected FLAP/SLAT handle position is displayed. The displayed flap position is followed by an up or down arrow indicating the direction of flap movement during transit. The arrow is not displayed when the flaps reach the commanded position.

When the slats are selected and in transit, the message SLATS is followed by an up or down arrow indicating direction of slat movement during transit. The message and the accompanying arrow are not displayed when the slats reach the commanded position.

Horizontal Stabilizer Trim

Horizontal stabilizer trim is controlled by either the primary trim switches, the alternate trim switches, or by the autopilot. The primary trim switches are on the control wheel. The alternate trim switches (ALT LONG TRIM) are on the pedestal.

Two switches, moved simultaneously, operate stabilizer trim. One switch operates the trim motor and the other releases the brake.

When both primary trim switches on either control wheel are moved simultaneously, the primary trim brake is released and the primary trim motor drives the stabilizer in the commanded direction.

A warning horn sounds to alert the crew any time the stabilizer moves more than one half degree, and continues to sound once for each approximately half degree of stabilizer movement. Separate movement of either switch does not produce stabilizer movement.

When both ALT LONG TRIM switches on the pedestal are moved simultaneously, the alternate trim motor moves the stabilizer in the commanded direction at a rate slower than the primary trim motor. When in the spring-loaded OFF position, no power is applied. When moved to the NOSE DN or NOSE UP position, nose down or nose up control pressure is reduced. Separate movement of either switch does not produce stabilizer movement.

The autopilot trims the airplane using the alternate trim system. When the autopilot trims the stabilizer more than 2 degrees in 30 seconds, the “stabilizer motion” voice warning and a warning horn sound.

The STABILIZER TRIM switch is a guarded switch and has two positions: OFF and normal. When the switch is pushed, the OFF light illuminates and electrical power to the brake is removed. This sets the brake and prevents the primary trim motor from moving the stabilizer. When the switch is in the normal position and the OFF light is extinguished, the primary stabilizer trim is enabled.

Stabilizer position is displayed at the top of the SD synoptic secondary engine page as follows:

Horizontal bar displays the stabilizer range,

Position bug displays stabilizer relative position,

Digital readout displays the exact stabilizer position,

ANU for airplane nose up, and AND for airplane nose down, indicates the respective condition,

Zero line indicates the division between ANU and AND.

The stabilizer position indicator is also displayed at the top of the CONFIGURATION page of the SD synoptic, above the airplane symbol.

Takeoff Warnings

Takeoff warnings are activated if takeoff is attempted with improper control positions or configurations.

Once activated, aural and vocal warnings sound until the improper condition no longer exists.

Stall Warnings

Stall warnings alert the pilots of an approach-to-stall condition. Stick shakers activate. Following stick shaker activation, flashing red STALL annunciations appear on the Captain's and First Officer's PFD, an aural warning (klaxon) sounds, and a vocal warning ("stall") is activated.

The stall warnings are generated by angle-of-attack, horizontal stabilizer position, and flap/slat position inputs to the Flight Control Computers (FCCs).

A caution alert is displayed on the EAD to indicate a system failure.

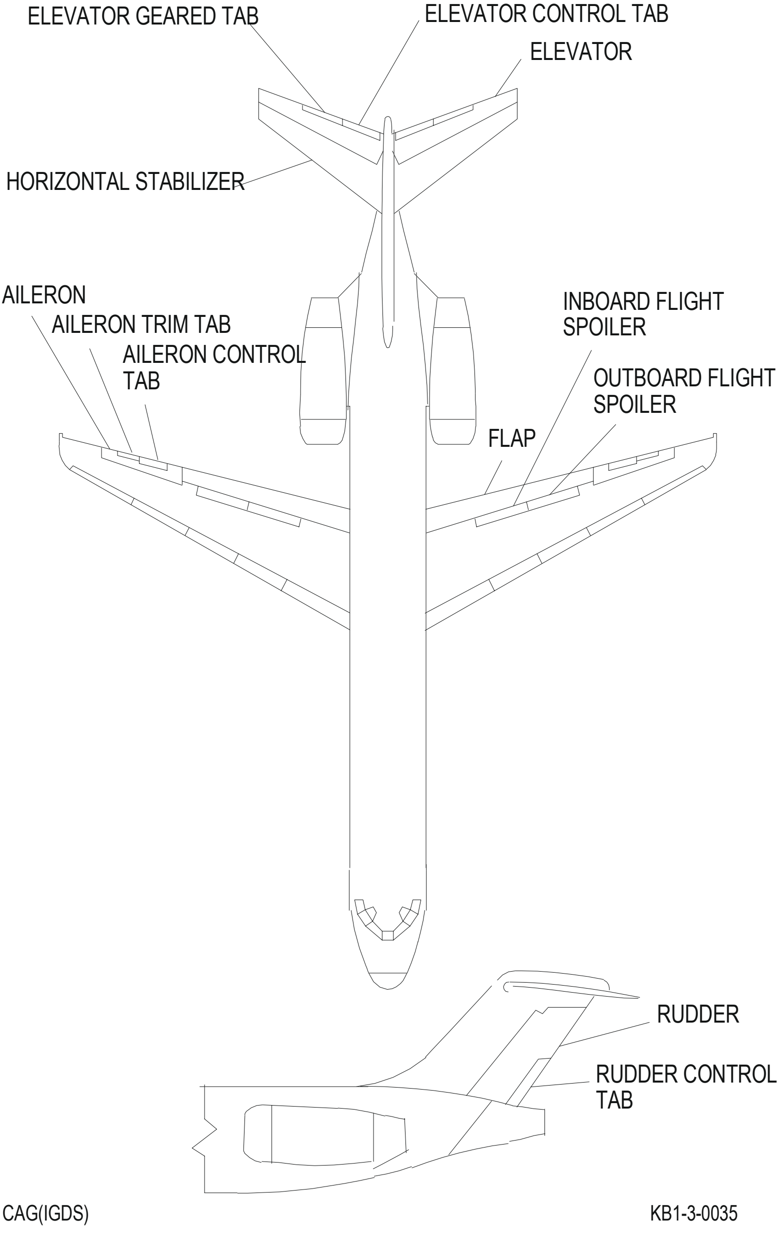
Stick Pusher

During detection of an imminent stall condition, the glareshield STICK PUSHER PUSH TO INHIBIT switchlights illuminate and the autopilot, if in use, disconnects. Abrupt forward movement of both control columns occurs, followed by stick shaker deactivation.

Forward pressure on the control columns continues until either the angle-of-attack is reduced below stick shaker onset, the gravity force is sufficiently reduced, or a STICK PUSHER PUSH TO INHIBIT switchlight is pushed. The flight crew has the ability to override the stick pusher system by pushing either switchlight.

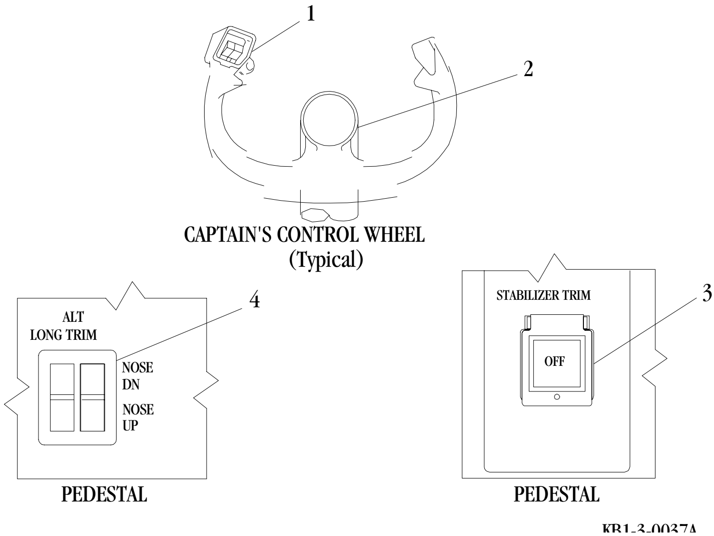
The stick pusher system is inhibited anytime a decreasing performance windshear is detected by either windshear computer.

MAJOR COMPONENT LOCATION



CONTROLS AND DISPLAYS

Control Column/Horizontal Stabilizer Trim Switches



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1. Control Column Elevator Primary Trim Switches

Move - (Forward simultaneously) Reduces nose down control pressure.

Move - (Aft simultaneously) Reduces nose up control pressure.

2. Control Column

Move - (Forward) Positions elevator control tab to decrease airplane pitch attitude.

Move - (Aft) Positions elevator control tab to increase airplane pitch attitude.

3. STABILIZER TRIM Brake Switch - amber

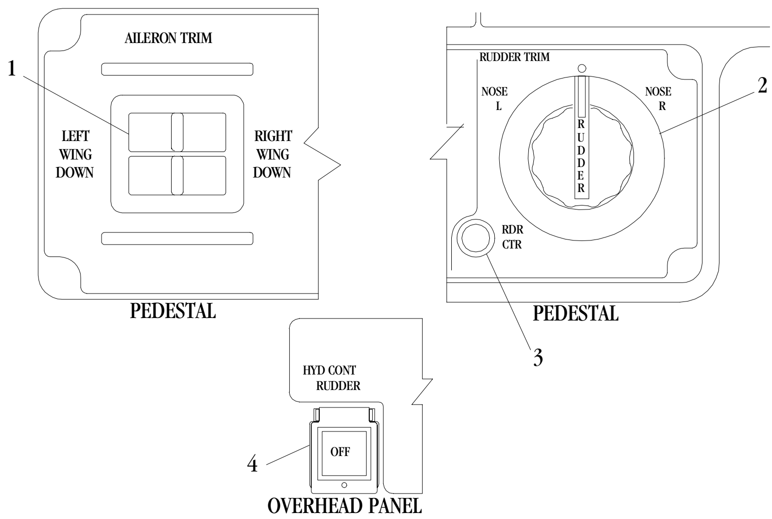
Push - Stops horizontal stabilizer movement. OFF illuminates.

4. ALT LONG TRIM Switches

NOSE DN - Move simultaneously to reduce nose down control pressure.

NOSE UP - Move simultaneously to reduce nose up control pressure.

Aileron and Rudder Trim, Rudder Switches



KB1-3-0062C

1. AILERON TRIM Switches

NOTE

Both switches should be moved simultaneously and in the same direction.

LEFT WING DOWN - Slide to reduce left aileron pressure.

RIGHT WING DOWN - Slide to reduce right aileron pressure.

2. RUDDER TRIM Knob

NOSE L - Rotate to reduce left rudder pressure.

NOSE R - Rotate to reduce right rudder pressure.

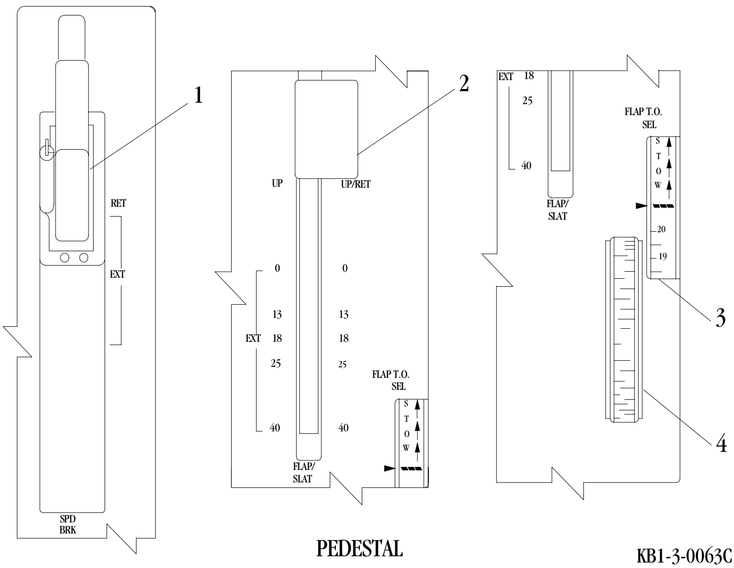
3. RDR CTR Switch

Push - Automatically resets rudder trim to zero.

4. HYD CONT RUDDER Switch - amber

Push - Selects manual rudder control. OFF illuminates.

Speed Brake Lever, Flap/Slat Controls (Typical),



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1. SPD BRK Lever

RET - Retracts speed brakes.

EXT - Extends speed brakes in flight (if flaps are not extended beyond 20 degrees), or after landing.

(Armed) - Extends ground spoilers at touchdown.

2. FLAP/SLAT Control Handle

UP/RET - Retracts flaps and slats.

EXT - Flap range (0, 13, 18, 25, 40 degrees).

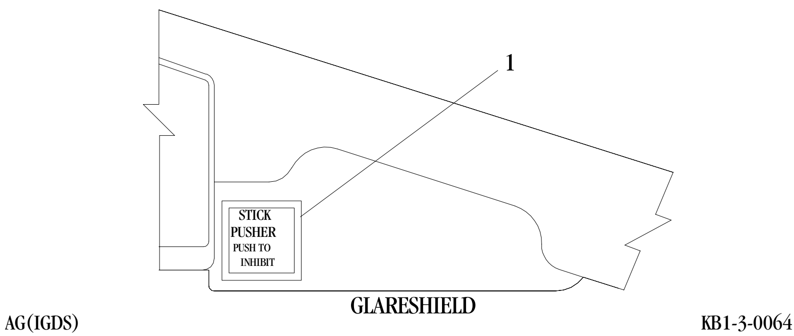
3. FLAP T.O. SEL Position Indicator Window

Responds to movement of FLAP T.O. SEL thumbwheel to indicate the selected takeoff flap setting (0, 13, and 18 degrees) or landing flap setting (25, 40 degrees).

4. FLAP T.O. SEL Thumbwheel

Rotate - Sets an adjustable detent which works in conjunction with the FLAP/SLAT control handle in setting flap position for optimum takeoff or landing performance.

Stick Pusher Inhibit Switch

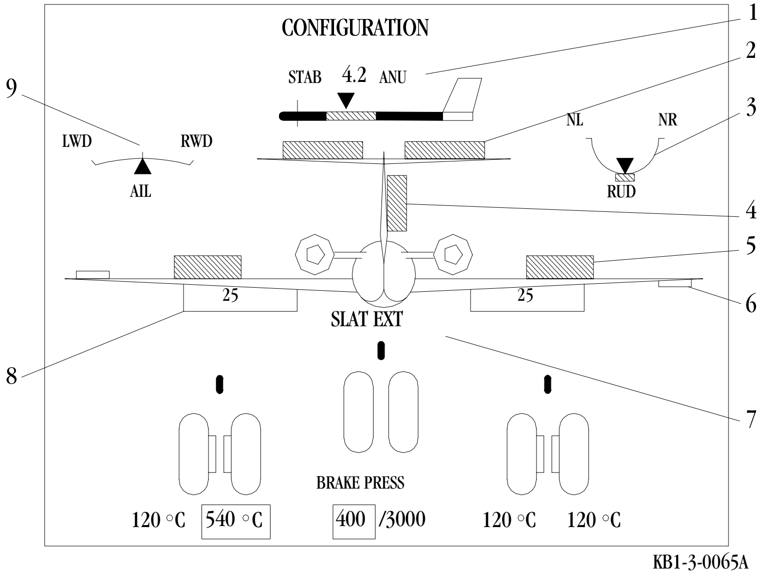


KB1-3-0064

1. Stick Pusher PUSH TO INHIBIT Switch - Amber

Push - Disengages automatic stall recovery system. Illuminates when the stall recovery system is activated.

SD SYNOPTIC - CONFIGURATION



1. Stabilizer Position

White - Stabilizer improperly set.

Green - Stabilizer properly set.

2. Elevator Position

Blank - Neutral.

White Outline - Between neutral and fully deflected.

Green - Fully deflected.

3. Rudder Trim

NL - Nose left trim added.

NR - Nose right trim added.

4. Rudder Position

Blank - Neutral.

White Outline - Between neutral and fully deflected.

Green - Fully deflected.

5. Spoilers

Blank - Stowed.

White Outline - Between stowed and fully deployed.

Green - Fully deployed.

6. Ailerons Position

Blank - Neutral.

White Outline - Between neutral and fully deflected.

Green - Fully deflected.

7. Slats

White - Proper position.

Amber - Improper position.

8. Flaps Position

Blank - Retracted.

White Outline - Deployed. Flap degree numerical depiction.

9. Aileron Trim

LWD - Left wing down trim added.

RWD - Right wing down trim added.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

ELEVATOR SPLIT (CONFIG) - A split between left and right elevator panels exists, possibly indicating a jammed condition.

FLAP DISAG (CONFIG) - Left and right flap positions disagree with each other or with commanded position.

RUDDER LIM FAIL (CONFIG) - Both primary and secondary rudder limiters failed to unrestricted position.

SLAT DISAG (CONFIG) - Left and right slat positions disagree with each other or with commanded position.

STICK PUSHER FAIL (MISC) - The stick pusher system has failed or is one failure away from an uncommanded push.

Amber Alerts (Level 1)

AGS FAIL - The Auto Ground Spoiler (AGS) system detects a failure which may cause the AGS to not deploy.

AIL TRIM FAIL (STATUS) - The aileron trim system has failed.

AUTO TRIM FAIL (CONFIG) - The FCC is unable to trim the stabilizer.

DISARM SPOILERS (CONFIG) - The Auto Ground Spoiler (AGS) system has detected a failure which may cause the AGS to not deploy.

PSEU FAIL (CONFIG) - The proximity sensor system has failed, resulting in loss of gear, door, and slat position information.

PSEU FAULT (STATUS) - The proximity sensor system has logged an internal fault, or detected a failure of a redundant sensor.

RUDDER LIM FAULT (CONFIG) - Either the primary or secondary rudder limiter system has failed to the rudder unrestricted position.

RUDDER PWR OFF (CONFIG) - The rudder is in manual mode either due to hydraulic failure, or pilot selection.

RUDDER RESTRICTED (CONFIG) - The rudder is restricted more than it should be for the flight condition.

SECU FAULT (STATUS) - A fault is detected in the Spoiler Electronic Control Unit (SECU).

SPEEDBRAKE DISAG (CONFIG) - The speed brakes are extended with throttles set at high power.

SPEEDBRAKE/FLAP (CONFIG) - The speed brakes are extended with the flaps in the landing range.

SPOILER FAULT (CONFIG) - The spoiler system detects a fault.

SPOILER INBD/OTBD FAIL (CONFIG) - The respective spoiler system has shut down in response to a detected failure or SECU channel failure.

STAB OUT OF TRIM (CONFIG) - The stabilizer is not responding to autopilot trim commands.

STAB TRIM OFF (CONFIG) - The STABILIZER TRIM shutoff switch is selected to OFF.

STALL WARN FAIL (MISC) - The stall warning system has failed.

STALL WARN FAULT (STATUS) - The stall warning system has lost two channels of stall warning and/or one channel of stick pusher.

STICK PUSHER FAIL (STATUS) - The stick pusher system has failed, or is one failure away from an uncommanded push.

YAW DAMP FAIL (CONFIG) - The yaw damper function has been shut off by the FCC.

Cyan Alerts (Level 0)

SPEEDBRAKE - The speed brakes are extended.

SPOILER SYS TEST - The spoiler system is in self-test.

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TABLE OF CONTENTS

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FUEL

INTRODUCTION

The fuel system consists of fuel tanks, fuel pumps, cockpit fuel controls, quantity indicating, and alerts. Fuel system controls are located on the overhead panel and on the pedestal. Fuel alerts are displayed on the Engine and Alert Display (EAD). Tank quantities and component status are displayed in the fuel synoptic page of Systems Display (SD).

FUEL TANKS

Fuel is stored in three integral wing tanks; a left main, center, and right main. Each fuel tank has an integral reservoir at the outboard end. Flapper valves installed in these reservoirs ensure that a head of fuel is retained at all times to keep boost pumps inlet submerged at all normal flight attitudes and during all normal maneuvers. The left and right tanks each have a capacity of about 9,266 lbs. The center tank has a capacity of about 6,077 lbs.

A continuous scavenging system prevents water from accumulating in the low points of the tanks. The system operates continuously when a boost pump is operating in the respective tank. The system consists of jet pumps, check valves and scavenge rakes.

FUEL VENTING

The fuel vent system permits equalization of pressure between tanks during all fuel conditions. the system also prevents siphoning and spilling of fuel during normal flight and ground maneuvers. Left and right main tanks are vented to the center tank, which in turn is then vented to the wing tip vent boxes. This venting arrangement permits overflow from the main tanks to drain into the center tank during fuel return to tank operation with the main tanks full.

FUEL RETURN TO TANK

Excess warmed fuel cycling through the engine fuel system is returned to the inboard cooled corner of each main tank. This warms the fuel in the tank, which retards wing ice formation due to cooled fuel. Fuel return to tank flow is inhibited by the EEC for many reasons, such as takeoff, landing, main tank fuel low or high fuel temperature.

REFUELING/DEFUELING

A single point refueling station is located at the right wing leading edge. Fill valves located next to the fuel load selector display panel can be operated manually or automatically through the fill pre-select. Access to the cockpit is not required to refuel and refueling can be accomplished using battery power only. The battery switch does not have to be on for refueling using the battery. If single point refueling equipment is not available, refueling can be accomplished through overwing fill fittings on the top outboard of each wing.

The aircraft can be defueled through a defueling shutoff valve using pressure from the boost pumps.

Fuel can be transferred between tanks by opening the defueling shutoff valve and the associated fill valves.along with the three fill valves (one for each tank). The fill valves can be operated manually with a switch or automatically through the fuel fill pre-select.

ENGINE AND APU FUEL SUPPLY

Each main tank has two AC boost pumps. The main tank boost pumps are arranged in parallel. The center tank pumps are arranged in series. Normally, fuel from the left main tank feeds the left engine and fuel from the right main tank feeds the right engine. However, if the center tank contains fuel, its higher pressure output will allow the center to feed both engines. A FUEL X-FEED lever on the pedestal controls a valve which permits use of fuel from either main fuel tank to both or a single operating engine. Crossfeeding is enabled when the valve is opened and the boost pumps on the receiving side are turned off.

Fuel to the APU is normally supplied from the right main tank. However, if the center tank contains fuel and its pumps are on, the center will supply the APU.

NOTE

Do not use the center tank to fuel the APU with less than 800 lbs. When using the center tank also have a right tank pump on.

NOTE

The APU burns approximately 350 pounds of fuel per hour on the ground.

A DC start pump located in the right main tank provides fuel pressure when starting the APU or engines when AC power is not available.

The fuel supply to the engine will shutoff when the respective FIRE handle in the cockpit is pulled.

FUEL QUANTITY INDICATING

Tank quantities, total quantity, and gross weight are displayed on the fuel synoptic page of the SD. The gross weight is displayed when the zero fuel weight is entered into the MCDU.

A fuel load selector display panel, in the leading edge of the right wing, also displays fuel quantity and load selection.

In the event of a Fuel Quantity Gauging System (FQGS) failure, fuel quantity may be determined while on the ground using magnetic dripless sticks installed at the bottom of each tank.

FUEL TANK CAPACITY CHART

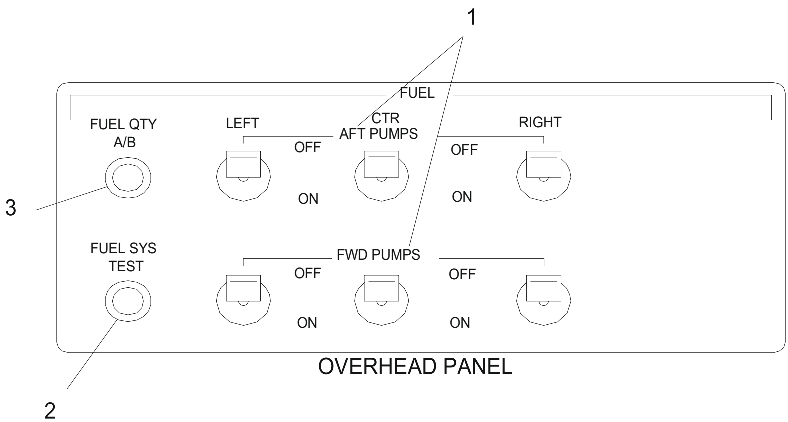
TANK	POUNDS@6.7 LBS/GAL
Left Wing Tank	9,266
Center Wing Tank	6,077
Right Wing Tank	9,266
TOTALS	24,609

NOTE

Once center tank fuel pumps are turned OFF, a migration of 200 pounds of fuel per hour to the center tanks is normal.

CONTROLS AND DISPLAYS

Fuel Control Panel



1. AFT/FWD PUMPS Switches (LEFT/CTR/RIGHT)

ON - Turns respective tank boost pump on.

OFF - Turns respective tank boost pump off.

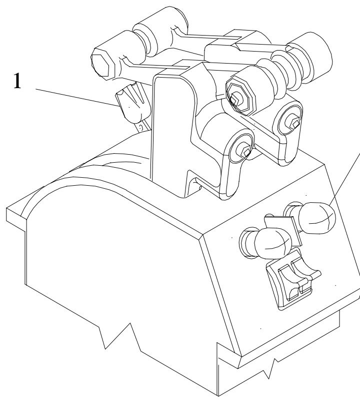
2. FUEL SYS TEST Button (Maintenance Function Only)

Push - When pushed and held for 2 seconds, starts a fuel system test display on the SD fuel page. System will remain in test for 45 seconds.

3. FUEL QTY A/B Button

Push - Selects the alternate channel of the fuel quantity gaging system.

Fuel X-Feed Lever And Fuel Switch



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1. FUEL X-FEED Lever

OFF - Closes fuel crossfeed valve. Left main tank feeds left engine and right main tank feeds right engine.

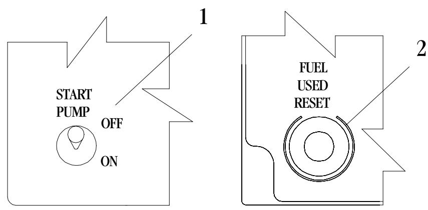
ON - Opens fuel crossfeed valve. Either or both main tanks can feed both engines or APU.

2. FUEL Switch

OFF - Shuts off fuel to respective engine, then turns off ignition.

ON - Commands EEC to energize ignition and open Fuel Metering Unit high pressure shutoff valve when start requirements are satisfied.

Start Pump Switch And Fuel Used Reset Button



OVERHEAD PANEL

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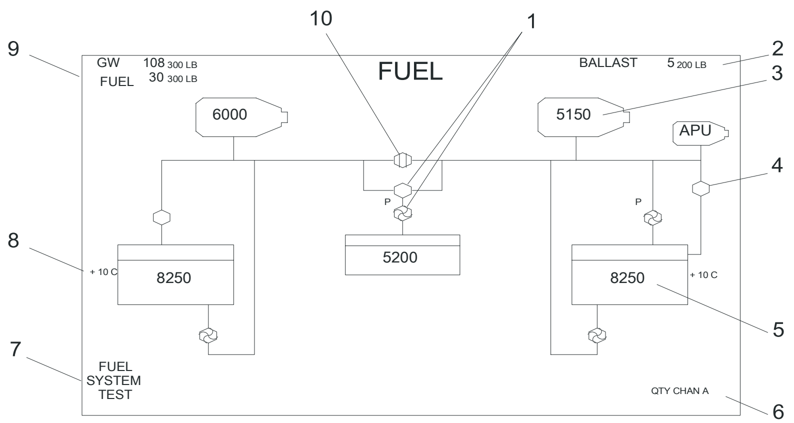
1. **START PUMP Switch**
   ON - Turns start pump on.

   OFF - Turns start pump off.
2. **FUEL USED RESET Button**
   Push - Resets fuel used digits on the fuel synoptic.

SD Synoptic - Fuel



1. **Fuel Pumps**
   White - Pumps are commanded off.

   Green - Pump is in on and is operating normally.

   Amber - Pump is commanded on but has low pressure. “P” appears.

2. **Ballast Fuel**
   Blank - Ballast fuel entered in MCDU is 0.

   Cyan - MCDU entered value is more than 0.

   Amber - FMS ballast fuel has changed after takeoff.

3. **Fuel Used**
   White - Fuel used per engine. Can be reset to 0 by pushing the FUEL USED RESET button on the overhead panel.

4. **Fuel Start Pump**
   Blank - Pump is off.

   Green - Pump is commanded on.

5. **Fuel Quantity**
   White - Total fuel quantity per tank. Includes ballast fuel.

6. **Fuel Quantity Channel Indicator**
   Indicates the currently active fuel quantity channel.

7. **Fuel System Test**
   Indicates that a fuel system test is in progress. Fuel quantity displays will show test value and ENG L/R FUEL PRESS alerts will be displayed if engine fuel pressure is low.

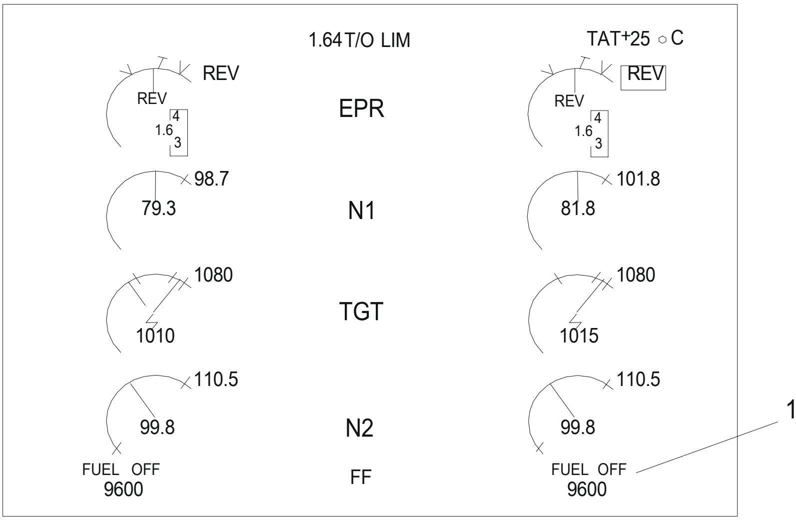
8. **Fuel Temperature**
   White - Fuel temperature in degrees C.

9. **Total Fuel Weight**
   White - Total usable fuel (total weight minus ballast fuel weight).

10. **Fuel Crossfeed Valve**
    White - Fuel crossfeed is off (valve closed).

    Green - Fuel crossfeed is on (valve open).

EAD - Primary Engine Display



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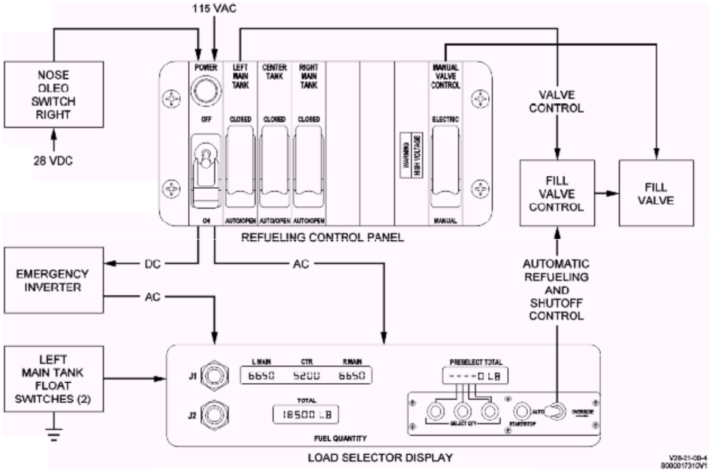
1. **Fuel Flow**
   Fuel flow is in white digits. When the engine fuel valve is closed, a cyan FUEL OFF appears above the digits.

WING REFUELING PANEL



1. Refueling Control Panel.

Panel can be fueled in AUTO, OVERRIDE or manual. In Auto a total quantity of fuel is put in the PRESELECT TOTAL window and aircraft fuels to that point. In OVERRIDE, “OVERRIDE” is displayed in the PRESELECT TOTAL tank and tanks are fully filled with fuel.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

BALST FUEL DISAG (FUEL) - Fuel quantity in the center or forward auxiliary fuel tank is less than the designated ballast fuel quantity.

CTR FWD/AFT PUMP LO (FUEL) - A center tank fuel pump is not producing pressure. System must be reconfigured to ensure center fuel can be used.

FUEL OFF SCHEDULE (FUEL) - Either the left or the right main tanks have low fuel while the center tank has usable fuel.

FUEL QTY FAULT (FUEL) - Loss of fuel gauging in one or more fuel tanks.

FUEL QTY SYS FAIL (FUEL) - Complete loss of fuel gauging on one channel.

Amber Alerts (Level 1)

CTR FWD/AFT PUMP OFF - Respective pump is off with usable fuel in center tank.

ENG L/R FUEL PRES (FUEL) - Respective engine has low fuel pressure.

FUEL LEVEL LO (FUEL) -Either the left or right main tanks have low fuel and the center tank has low fuel.

LAT FUEL UNBAL (FUEL) - Fuel quantities in the left and right main tanks differ by more than 1400 pounds.

SEL CTR PUMPS OFF (FUEL) - Center tank has low fuel and either center pump has low pressure or, center tank quantity is slightly greater than the ballast quantity with either pump on.

SEL CTR PUMPS ON (FUEL) - Center pumps are off with usable fuel in center tank.

TANK L/R PUMPS LO (FUEL) - Respective tank pump(s) have low pressure.

TANK L/R PUMPS OFF (FUEL) - Both forward and aft main tank pumps are commanded off with FUEL switch on.

TNK L/R FWD/AFT PMP LO (FUEL) - Respective pump pressure is low.

TNK L/R FWD/AFT PMP OFF - Respective pump is commanded off with associated FUEL switch in ON.

Cyan Alerts (Level 0)

ENG START PUMP ON - Fuel start pump is commanded on.

FUEL SYS TEST - Fuel system is in test mode.

FUEL XFEED ON - Fuel crossfeed open.

FUNCTIONAL SCHEMATIC

Pump And Valve Schematic

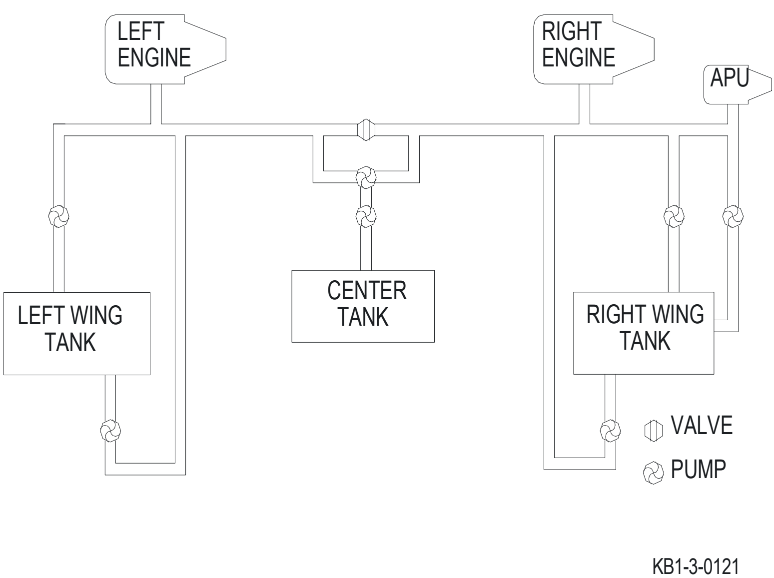


TABLE OF CONTENTS

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HYDRAULICS

DESCRIPTION AND OPERATION

GENERAL

The airplane has two independent (left and right) hydraulic systems.

Each system has a reservoir. During flight, hydraulic pressure is normally supplied by two engine-driven hydraulic pumps.

The hydraulic system also has an auxiliary pump which is an electric motor-driven pump with two functions: it serves as a backup to the right engine-driven pump, and can be used to pressurize the hydraulic systems on the ground when the engines are not running.

The hydraulic system also has a transfer pump which enables a pressurized hydraulic system (either left or right) to mechanically transfer pressure to an unpressurized system (either left or right) when both systems reservoir quantities are normal.

The main wheel wells have a ground service connection panel, a hand pump (for maintenance operations), and a spoiler shutoff and system bypass valve.

Hydraulic system controls are on the overhead panel.

System alerts are displayed on the Engine and Alert Display (EAD). Fluid pressures, quantities, and temperatures are displayed on the Systems Display (SD).

HYDRAULIC COMPONENTS

The hydraulic system contains the following components:

2. Hydraulic control panel
3. Hydraulic reservoirs
4. Engine-driven hydraulic pumps
5. Auxiliary pump
6. Transfer pump

HYDRAULIC COCKPIT CONTROLS AND INDICATORS

The hydraulic control panel is located on the forward overhead panel and hydraulic system information is displayed on the hydraulic synoptic page.

The switches for the left and right engine-driven pumps, the auxiliary pump and the transfer pump are located on the hydraulic control panel. The lines on the panel represent a simplified schematic of the hydraulic system.

HYDRAULIC RESERVOIRS

The left and right hydraulic system reservoirs are located in the respective main gear wheel wells. Each reservoir supplies fluid to its own system. The reservoir is protected against over-pressurization by a relief valve.

The reservoirs are displayed as rectangular boxes on the synoptic. Reservoir quantity is displayed by shading in each rectangle and numerical readouts below each rectangle. Each reservoir has a fixed quantity reference line to help determine if there is a leak in flight. The reference line appears after engine start when each engine reaches idle and remains stationary until engine shutdown. When reservoir quantity decreases to a predetermined level, the HYD L/R QTY LO alert is displayed on the EAD and is indicated on the synoptic. Also, a shutoff valve in each system automatically closes if either system reservoir falls below a minimum level.

When system temperature is above limits the amber boxed HYD L/R TEMP HI alert is displayed on the EAD and indicated on the synoptic.

An instruction plate in the main wheel well provides filling instructions and fluid quantity indications for both a pressurized and an unpressurized system.

HYDRAULIC PUMPS - ENGINE DRIVEN

The left and right hydraulic systems are pressurized by a hydraulic pump mounted on each engine. Pump operation is controlled by the L/R PUMP switches on the hydraulics control panel. The pump switches have two positions: ON and OFF.

When the engines are running and the pump switches are ON, the pumps supply pressure to their respective hydraulic system, regulated to 3000 psi. When electrical power is removed from an engine-driven pump, the pump defaults to on. When the switch is moved to the OFF position, the pump is electrically commanded to zero pressure output.

When pump output pressure drops below a predetermined value the letter P is displayed next to the respective pump symbol on the synoptic. Hydraulic system pressure readouts are digitally displayed on the synoptic. If system pressure is not within a predetermined value, the HYD L/R PRES LO alert is displayed on the EAD.

Fluid supply to the hydraulic system is stopped when the respective ENG FIRE handle is pulled.

HYDRAULIC PUMPS - AUXILIARY

The electrically driven auxiliary pump, located in the right wheel well, is a crew selectable backup for the right hydraulic system. The pump is powered by the left generator bus.

If the right engine-driven pump fails, or the right engine fails, the auxiliary pump may be used to supply pressure to operate all right system components, including the landing gear.

The AUX pump switch has two positions, ON and OFF. When the switch is ON, the auxiliary pump is commanded on. When the switch is OFF, the auxiliary pump is commanded off.

The auxiliary pump has built-in thermal protection. The pump automatically shuts down if it overheats.

HYDRAULIC PUMPS - TRANSFER

The transfer pump is located in the left wheel well. When selected ON by the crew, the pump mechanically transfers pressure from an operating pressure source to an unpressurized system through the use of an interconnected hydraulic motor and pump. This operation can be reversed to provide hydraulic pressure in either direction. No hydraulic fluid is transferred.

The TRANS pump switch has two positions, ON and OFF. The switch controls the power transfer unit shutoff valve assembly. When the switch is ON, the transfer pump shutoff valve is commanded open, enabling operation of the transfer pump. When the switch is

OFF, the transfer pump shutoff valve is commanded closed and the transfer pump is inoperative.

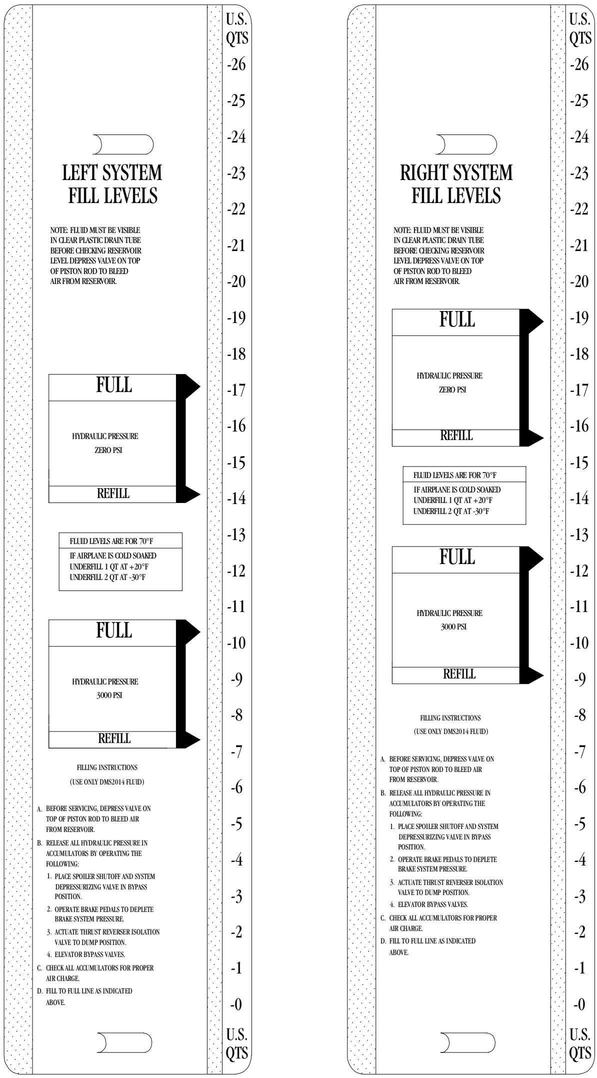
If the shutoff valves do not move to the commanded position, the valve symbol on the synoptic displays the commanded position, and the disagree symbol remains displayed. In addition, the HYD TRANS DISAG alert is displayed on the EAD.

HYDRAULIC ACCUMULATORS

There are seven accumulators in the hydraulic system. The system accumulators help to dampen the related system pressure surges and supplement the engine driven pumps during maximum hydraulic load. The brake system accumulators can supply backup pressure for the normal brake system pressure, and also supply the parking brake hydraulic pressure. The thrust reverser accumulators can supply backup hydraulic pressure for the normal thrust reverser pressure. One hydraulic accumulator can supply backup pressure for the left hydraulic system to operate the elevator boost system.

CONTROLS AND DISPLAYS

Reservoir Fill Level Placards



LEFT/RIGHT MAIN GEAR WHEEL WELLS

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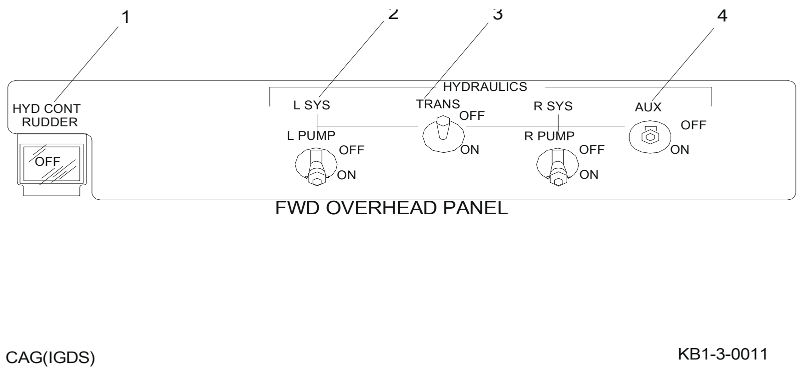
HYDRAULICS CONTROL PANEL



1. **HYD CONT RUDDER Switch**

   Push - Disconnects hydraulic power from rudder. OFF illuminates amber.

2. **L/R SYS/PUMP Switches**

   OFF - Removes hydraulic pressure from respective system. Fluid circulates for pump lubrication and cooling.

   ON - Pressurizes respective hydraulic system.

3. **TRANS Pump Switch**

   OFF - Closes shutoff valve on each side of Power Transfer Unit (PTU) to disconnect left and right systems.

   ON - Opens shutoff valve on each side of PTU to connect left and right systems.

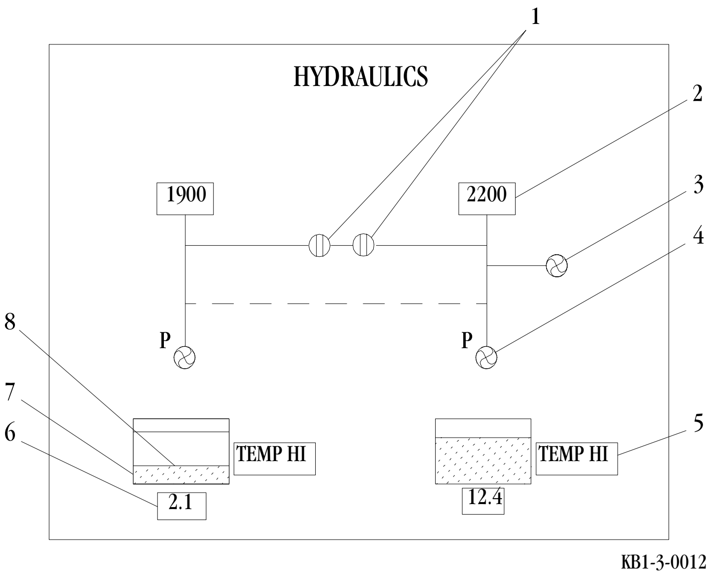
   Automatically allows the system with low pressure to be pressurized by the system with normal pressure in the event one system becomes low when the switch is selected ON.

4. **AUX Pump Switch**

   OFF - Turns off electric auxiliary pump.

   ON - Turns on electric auxiliary pump.

SD SYNOPTIC - HYDRAULICS



1. **Hydraulic Power Transfer Unit (PTU)**

   White - Commanded OFF. Vertical parallel lines appear.

   Green - Commanded ON. Horizontal parallel lines appear.

2. **Hydraulic Pressure**

   White - Pressure within limits.

   Amber - (Value boxed) Pressure exceeds high or low limits.

3. **Auxiliary Hydraulic Pump**

   White - Commanded OFF. Pump symbol is open.

   Green - Commanded ON with adequate pressure. Pump symbol is vaned.

   Amber - Commanded ON with low pressure. Pump symbol is vaned with letter P displayed.

4. **L/R Engine Hydraulic Pumps**

   White - Commanded OFF. Pump symbol is open.

Green - Commanded ON with adequate pressure. Pump symbol is vaned.

Amber - Commanded ON with low pressure. Pump symbol is vaned with letter P displayed.

5. **Hydraulic Fluid TEMP HI Display**

   Amber - (Boxed) Fluid temperature exceeds high limit.

6. **Hydraulic Fluid Quantity**

   White - Fluid level within limits.

   Amber - (Values boxed) Fluid levels below limits.

7. **Hydraulic Fluid Reservoir**

   White - Fluid level within limits. Reservoir outlined.

   Gray - Fluid level within limits. Fluid shaded.

   Amber - Fluid level exceeds low limits. Reservoir outlined/ shaded.

8. **Pre-Flight Hydraulic Fluid Level**

   Cyan - Normal.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

HYD L&R FAIL (HYD) - Both left and right hydraulic systems have failed.

HYD L/R PRES LO (HYD) - Respective hydraulic system pressure is low.

HYD L/R QTY LO (HYD) - Respective hydraulic reservoir fluid quantity is too low.

HYD L/R TEMP HI (HYD) - Respective hydraulic system fluid temperature is too high.

Amber Alerts (Level 1)

HYD AUX PUMP FAIL (HYD) - The auxiliary hydraulic pump is commanded on, but is not producing pressure.

HYD AUX PUMP OFF (HYD) - The auxiliary hydraulic pump is not on with the slats extended and at least one engine on.

HYD L/R OFF (HYD) - Engine-driven pumps, hydraulic Power Transfer Unit (PTU), and auxiliary pump (right system) are all commanded off.

HYD PUMP L/R FAIL (HYD) - Respective hydraulic pump is commanded on but not producing pressure.

HYD PUMP L/R OFF (HYD) - The respective hydraulic pump is commanded off.

HYD TRANS DISAG (HYD) - Hydraulic PTU commanded position (switch position) disagrees with actual position.

HYD TRANS OFF (HYD) - The hydraulic transfer pump is not on with slats extended and at least one engine running.

HYDRAULICS SCHEMATIC

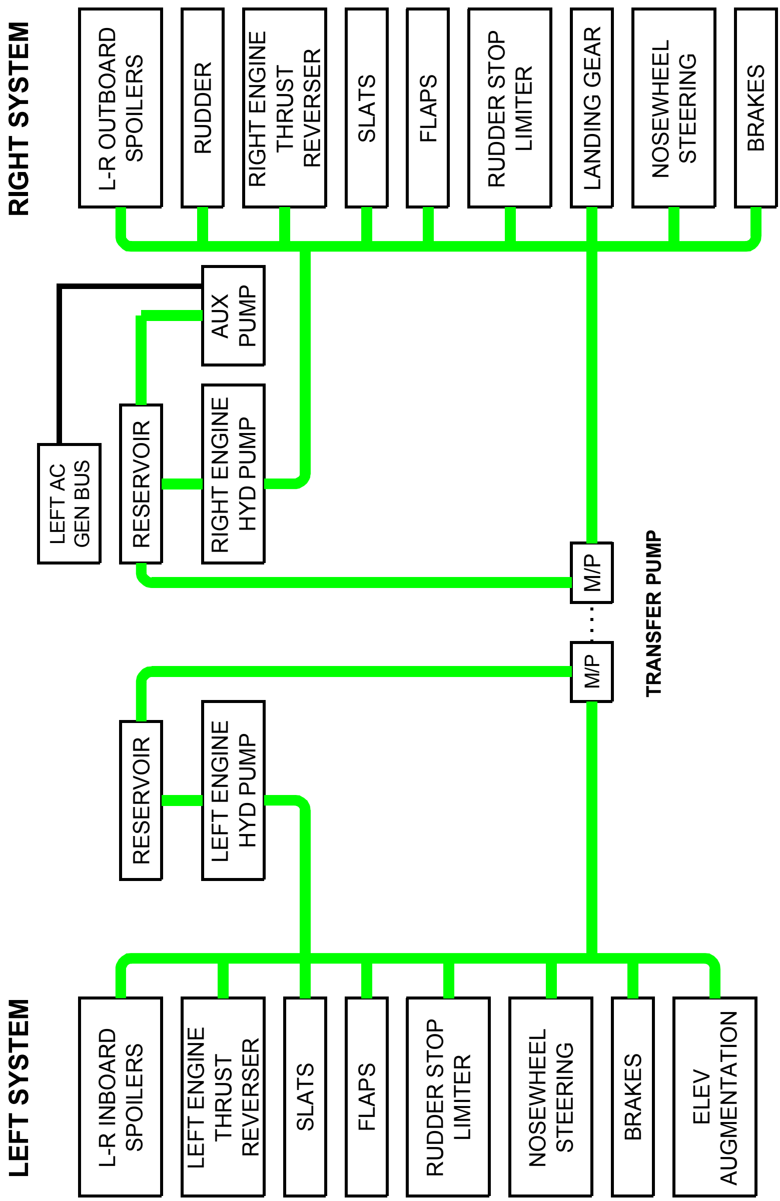


TABLE OF CONTENTS

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ICE AND RAIN PROTECTION

INTRODUCTION

The ice and rain protection system consists of the following:

- Wing, tail, and engine cowl anti-ice.
- Air data system and windshield anti-ice.
- Windshield wipers and anti-fog.
- On ground, upper wing surface ice detection system.

The wing slats and the horizontal stabilizer leading edge are anti-iced with engine bleed air. A cross-ship duct system permits heat to be supplied from either or both engines.

The engine nose cowls are anti-iced by separate bleed air systems.

The three pilot windshields are electrically anti-iced and anti-fogged. The clearview and overhead windows are also anti-fogged.

The wing ice detection system functions only on the ground.

WING ANTI-ICE

The wing anti-ice system provides inflight anti-icing of the leading edge slats. With the WING AIR FOIL switch selected ON, (normally left) engine bleed air flows through ducts in the wing leading edge to anti-ice the slats. The WING A-ICE ON alert is displayed.

With the WING AIR FOIL and TAIL AIR FOIL switches selected ON, the AIRFOIL A-ICE ON alert is displayed. With the WING AIR FOIL, TAIL AIR FOIL and L/R ENG anti-ice switches selected ON, the A-ICE ALL ON alert is displayed.

TAIL ANTI-ICE

The tail anti-ice system provides inflight anti-icing of the horizontal stabilizer leading edge. With the TAIL AIR FOIL switch selected ON, (normally right) engine bleed air flows through ducts to the horizontal stabilizer leading edge to anti-ice the tail. The TAIL A-ICE ON alert is displayed.

NOTE

If required, one engine can supply bleed air to both the wing and tail anti-icing systems with the isolation valve in auto. A control function will open and close valves so air is supplied to wing anti-ice system for 15 minutes, then air is supplied to the tail anti-ice system for two and one half minutes.

ENGINE ANTI-ICE

The engine anti-ice systems provide inflight and on ground anti-ice heat to their respective engine inlet cowl. The engine anti-ice systems are independent of the airfoil anti-ice system.

Engine anti-ice is controlled with the L and R ENG anti-ice switches. With both switches selected ON, hot air flows to both engine inlet cowls. The ENG A-ICE ON alert is displayed. If only one switch is selected ON, the respective ENG (L/R) A-ICE ON alert is displayed.

ICE DETECTION - ON-GROUND WING UPPER SURFACE

An on-ground wing upper surface ice detection system alerts the pilots prior to takeoff to the presence of wing upper surface ice.

On the ground, when ice is detected on either or both wing upper surfaces, the alert WING ICE DETECTED is displayed. The alert is inhibited during takeoff, landing, and in flight.

The system is tested by moving the WING ICE DET RESET/TEST switch to TEST. The system runs a self-test. Following a successful test, the “WING ICE DET PASS” Level O annunciator is displayed. The WING ICE L/R FAIL alert indicates a failed test, and the system will not reset.

The system is reset by moving the WING ICE DET RESET/TEST switch to RESET.

WINDSHIELD ANTI-ICE AND ANTI-FOG

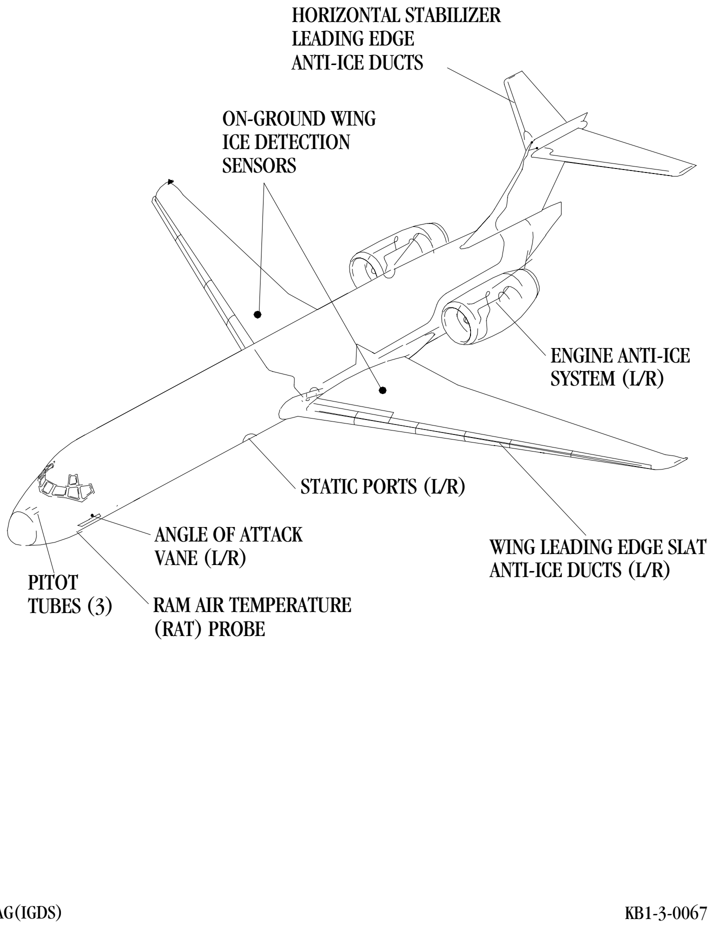
The three pilot windshields are electrically anti-iced and anti-fogged. The clearview and overhead windows are anti-fogged. The WINDSHLD ANTI-ICE and ANTI-FOG switches separately control the systems.

WINDSHIELD WIPERS

Windshield wipers are used for rain removal. Two independent WINDSHLD WIPER switches, one for each pilot windshield, control wiper operation.

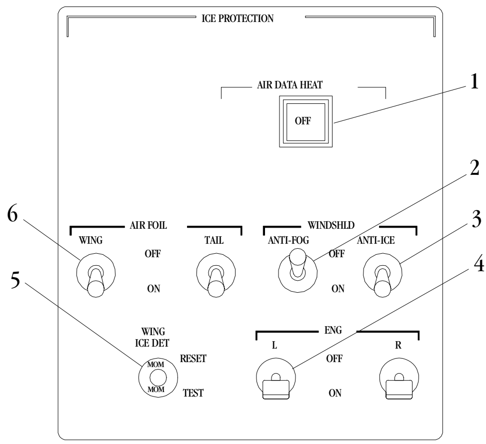
COMPONENTS

Major Component Location



CONTROLS AND DISPLAYS

Ice Protection Control Panel



FWD OVERHEAD PANEL

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1. **AIR DATA HEAT Pushbutton - amber**

   OFF - Illuminates when all air data system heaters are off.

   Dark when all heater circuits for pitots, rudder limiter, stall probes, static ports, and RAT probes are energized. On the ground, heat to RAT probe is inhibited.

2. **WINDSHLD ANTI-FOG Switch**

   OFF - Turns off windshield, clearview, and overhead window anti-fog.

   ON - Turns on windshield, clearview, and overhead window anti-fog.

3. **WINDSHLD ANTI-ICE Switch**

   OFF - Turns off windshield anti-ice.

   ON - Turns on windshield anti-ice.

4. **ENG L/R Anti-Ice Switches**

   OFF - Turns off respective engine anti-ice heat.

   ON - Turns on respective engine anti-ice heat.

5. **WING ICE DET Switch**

   RESET - Resets system and removes WING ICE DETECTED alert from the EAD. The system will not reset if ice remains on the sensors.

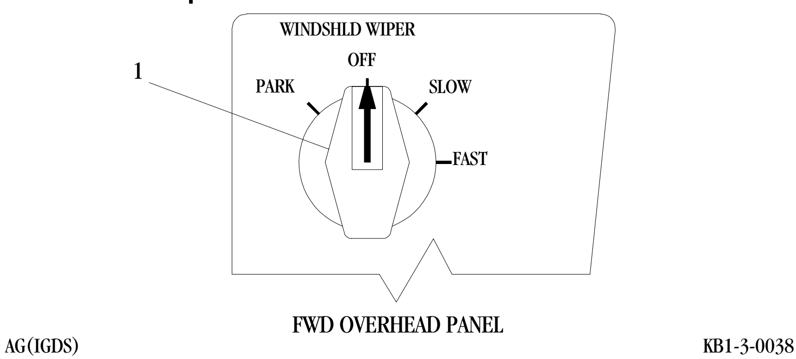
   TEST - Tests the wing ice detection system.

6. **AIR FOIL WING/TAIL Anti-Ice Switches**

   OFF - Turns off airfoil (WING)/horizontal stabilizer (TAIL) anti-ice.

   ON - Turns on airfoil (WING)/horizontal stabilizer (TAIL) anti-ice.

Windshield Wiper Selector



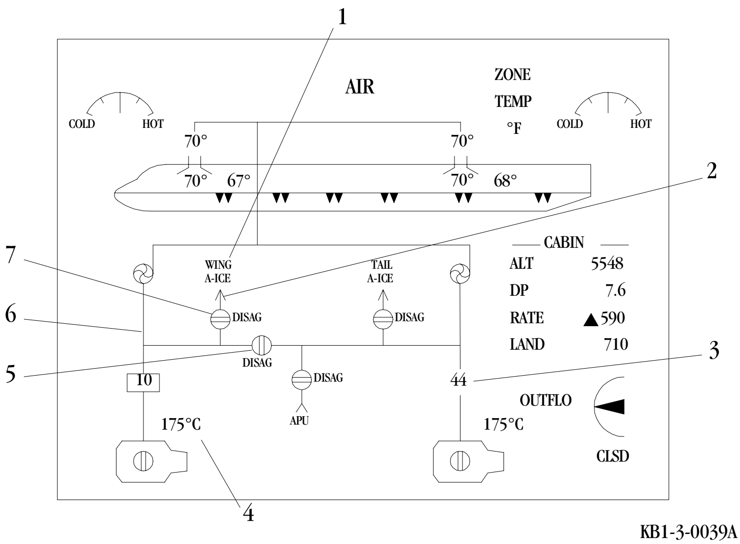
1. **WINDSHLD WIPER Selector**

PARK - Positions wiper to parked position.

OFF - Turns off wiper.

SLOW/FAST - Selects applicable operating speed.

SD Synoptic - Air (Typical)



1. **Wing/Tail Anti-Ice**

   Blank - Off.

   White - Commanded on. Commanded off with system pressurized.

   Red - Manifold failed.

2. **Wing Anti-Ice/Tail Anti-Ice Bleed Air**

   Blank - Anti-ice off.

   White - On the ground, anti-ice is commanded on. Also, anti-ice is commanded off with the system pressurized.

   Green - Anti-ice commanded on inflight.

   Amber - Anti-ice bleed air temperature out of limits.

3. **Engine Bleed Air Pressure**

   White - Normal.

   Amber - Exceeds limits.

4. **Engine Bleed Air Temperature**

   White - Normal.

   Amber - Anti-ice bleed air temperature out of limits.

5. **Isolation Valve**

   White - Commanded closed.

   Green - Commanded open.

   Amber - Valve position disagrees with commanded position.

6. **Engine Bleed Air Manifold Temperatures**

   White - No anti-ice.

   Green - Anti-ice available.

   Red - Burst duct in tail compartment.

7. **Wing/Tail Anti-Ice Valves**

   Blank - Closed.

   White - On with no pressure. Alternate system is pressurized and the letter A appears.

   Green - On.

   Amber - Commanded position disagrees with actual position when inflight. The word DISAG appears.

   Red - Manifold failed.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Red Boxed Alerts (Level 3)

TAIL MANF FAIL (AIR) - The pneumatic overheat detection system (PODS) detects a manifold failure in the tail anti-ice manifold and has not shut off tail ice protection.

TAIL TEMP L/R HI (AIR) - PODS detects an overheat condition or manifold failure in the tail compartment.

WING MANF FAIL (AIR) - PODS detects a manifold failure in the wing anti-ice manifold and has not shut off wing ice protection.

Amber Boxed Alerts (Level 2)

BLEED AIR L/R FAIL (AIR) - The pressure regulator valve, or a channel of the pneumatic system controller has failed.

BLD AIR L/R TEMP HI (AIR) - Pneumatic supply manifold temperature exceeds limits with bleed system in automatic (L/R BLEED switch in AUTO) for respective system.

BLD AIR L/R TEMP LO (AIR) - Bleed air temperature is too low to provide airfoil anti-ice protection.

TAIL A-ICE DISAG (AIR) - The tail anti-ice valve position disagrees with the commanded position.

TAIL A-ICE OFF (AIR) - The tail anti-ice system is shut down by PODS due to an overheat or a manifold failure.

WING A-ICE DISAG (AIR) - The wing anti-ice valve position disagrees with the commanded position.

WING A-ICE OFF (AIR) - The wing anti-ice system is shut down by PODS due to an overheat or a manifold failure.

WSHLD HEAT FAIL (MISC) - The windshield heater has overtemped.

Amber Alerts (Level 1)

AIR DATA HEAT OFF (MISC) - The AIR DATA HEAT pushbutton is selected OFF (the air data probe heater switch is off) and illuminated amber.

AOA HEAT L/R FAIL (MISC) - Respective angle-of-attack probe heater has failed with the AIR DATA HEAT pushbutton selected on.

DRAIN MAST HEAT (MISC) - The drain mast heater is inoperative.

ENG L/R A-ICE DISAG (AIR) - The respective anti-ice valve position disagrees with commanded position.

PITOT AUX/CAPT/FO FAIL (MISC) - The respective probe heater has failed.

PODS A-ICE FAULT (STATUS) - The pneumatic overheat detection system (PODS) has a fault in the wing or tail ice protection system and cannot detect a manifold failure.

PODS FAIL (AIR) - PODS has failed and cannot detect a manifold failure.

PODS FAULT (STATUS) - One loop or controller channel of the pneumatic overheat detection system (PODS) has failed. Manifold failure detection is operable.

PODS TEST FAIL (AIR) - The PODS system test has failed.

PSC FAULT (STATUS) - The pneumatic system controller (PSC) has recorded a fault requiring maintenance action.

RAT PROBE FAIL (MISC) - The ram air probe heater has failed with the AIR DATA HEAT pushbutton selected on in flight.

RUD PITOT FAIL (MISC) - The rudder limiter pitot tube heater has failed with the AIR DATA HEAT pushbutton selected on.

STATIC L/R HEAT (STATUS) - The respective static plate heater has failed with the AIR DATA HEAT pushbutton selected on.

WING ICE DETECTED (AIR) (Ground only) - Either wing ice detector has detected upper surface wing ice.

WING ICE L/R FAIL (AIR) (Ground only) - Respective wing ice detection system is inoperative.

WSHLD A-ICE OFF (MISC) - Windshield anti-ice is selected off.

Cyan Alerts (Level 0)

AIRFOIL A-ICE ON - Both wing and tail anti-ice is selected on.

A-ICE ALL ON - All engine and airfoil ice protection is selected on.

ENG A-ICE ON - Both ENG ANTI-ICE switches are on.

ENG L/R A-ICE ON - Respective system engine anti-ice switch is on.

PODS TEST PASS - The PODS preflight test is successful.

TAIL A-ICE ON - Tail anti-ice is selected on, or, wing and tail anti-ice are selected on and the system is in alternating mode.

WING A-ICE ON - Wing anti-ice is selected on, or, wing and tail anti-ice are selected on and the system is in alternating mode.

WING ICE DET PASS - The upper wing surface ice detection system test is successful.

WSHLD ANTI-FOG ON - The WINDSHLD ANTI-FOG switch is selected ON. Anti-fog heat to the windshields, the clearview and the overhead windows is on.

TABLE OF CONTENTS

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INSTRUMENT AND NAVIGATION

INTRODUCTION

This chapter describes the following systems: electronic instrument, air data, VOR/MB, ADF, ILS, radio altimeter, flight data recording, global positioning, weather radar, enhanced ground proximity warning, traffic alert and collision avoidance, and flight management.

ELECTRONIC INSTRUMENT SYSTEM

The Electronic Instrument System (EIS) consists of six flat panel Liquid-Crystal Display Units (DU) on the instrument panel, two EIS Control Panels (ECP), and one System Display Control Panel (SDCP). The system also includes one Bezel Light Sensor (BLS) on each DU, one Remote Light Sensor (RLS) on top of the glareshield, and two Versatile Integrated Avionics (VIA) units in the Electrical/ Electronics (E/E) compartment.

The EIS displays appear on the six DUs (numbered 1 thru 6 starting on the far left side). The displays are:

- DU1 and DU6 are the Primary Flight Displays (PFD).
- DU2 and DU5 are Navigation Displays (ND).
- DU3 is the Engine and Alert Display (EAD). The primary engine display appears on the upper 2/3 of the EAD. Alerts appear on the lower 1/3 of the EAD. The primary engine display is described in the Engines chapter. Alert display is described in the Airplane General chapter.
- DU4 is the System Display (SD). The SD displays either secondary engine data, systems synoptic, status pages, miscellaneous pages, or consequences pages. Selection is made by pushing the associated cue switch on the SDCP. The SD synoptic are described in the associated system chapter. SD alerts and related pages are described in the Airplane General chapter.

The RLS on top of the Captain's glareshield senses outside light. The BLSs on each DU sense inside light. Inside and outside light levels are compared and DU brightness is adjusted automatically.

SYSTEM DISPLAY CONTROL PANEL

The System Display Control Panel (SDCP), located on the pedestal, consists of BRT knobs, system cue switches, ND, CONSEQ, STATUS, and MISC switches.

Rotating the BRT knob adjusts brightness of each DU. Turning fully counterclockwise through a detent turns off the associated DU and reconfigures the other DUs to display minimum required data. The DUs are also reconfigured automatically when the airplane is in an emergency power condition in which only DU1, DU2 and DU3 are powered.

In case of DU failure, the EIS will reconfigure to display all data required for operation of the remaining DUs.

The system cue switches illuminate to identify the associated system that is generating alerts and/or warnings. Pushing a cue switch displays the associated system synoptic on the SD.

Pushing the CONSEQ, STATUS or MISC switch respectively displays alert related consequences, airplane system faults, or the miscellaneous page on the SD.

If five or fewer DUs are operating, pushing the ND switch will cause the existing SD to become an ND.

EIS CONTROL PANEL

The EIS Control Panel (ECP) consists of switches for selecting MAP, PLAN, TCAS, VOR or APPROACH display. TCAS display with advisories, FMS waypoints and waypoint constraints, non-tuned or active VOR/NDB stations, weather radar range and brightness, baroset values, radio altitude minimums and MAG/TRUE heading can be selected with the appropriate switches.

VERSATILE INTEGRATED AVIONICS UNITS (VIAS)

Two VIAs provide the following functions: data display, flight management computing, central aural warning, master warning and caution light activation, and flight data acquisition. The display function converts data received from airplane systems to graphic display on the DUs. Normally VIA-1 provides data for the DUs 1 - 3

(PFD, ND, and EAD). VIA-2 provides data for the DUs 4 - 6 (SD,ND and PFD).

In case of failure, either VIA unit will automatically provide data for all DUs.

DISPLAY UNIT COLORS

A consistent set of colors is used to display data on the DUs as follows:

- Red - warning, flight envelope and system limits.
- Amber - cautions and abnormal sources.
- Brown - earth.
- White - scales and associated figures.
- Green - engaged modes.
- Blue - sky.
- Cyan - advisory or status.
- Magenta - ILS deviation pointer and flight bars.

Color for system synoptic symbols are as follows:

- Red - warning state requiring immediate crew awareness and/ or action.
- Amber - abnormal state requiring crew awareness.
- White - inactive or commanded off and nomenclature.
- Green - active or commanded on.
- Cyan - general (static) information.

Color for system synoptic lines are as follows:

- Red - manifold failure.
- Amber - high temperature condition.
- White - primary flow lines with no flow.
- Green - primary flow lines with proper flow.

FAILURE ANNUNCIATIONS

Invalid data and cross-side miscompared data are the two types of failure annunciations. Invalid data is removed from the screen. Miscompared data is displayed with a miscompared flag.

When invalid data is removed from the screen, it may be replaced by a flag (some non-essential data is removed from the screen only). These flags consist of an X covering the area of removed data.

The Xs may be of two colors: Red Xs signify a loss of data requiring immediate crew awareness and action to restore the loss of data. Amber Xs signify a loss of data requiring immediate crew awareness but action to restore the data may be momentarily deferred.

Cross-side miscomparisons are generated when the EIS detects significant differences between the displayed data of the Captain's and First Officer's DUs. These comparisons are limited to attitude, airspeed, altitude, radio altitude, ILS and heading.

The detected miscomparisons are displayed in amber in the upper left-hand corner of the PFD, just outside of the attitude sphere. This annunciation blinks for five seconds, then remains as long as the miscompared condition exists.

DATA DROPOUT

In the event of EIS data loss, the PFD will display pitch, roll, and altitude. The EAD will display engine thrust settings.

PRIMARY FLIGHT DISPLAY (PFD)

The PFD displays the following:

- Conventional attitude indication.
- Flight director bars (pitch and roll).
- Lateral (localizer) deviation.
- Vertical (glideslope) deviation.
- Marker beacon.
- Radio altitude.
- Airspeed/Mach/taxi speed.
- Limit speed.
- Pitch limit/ bank angle limit indication.
- Vertical speed/ TCAS.
- Slip (lateral acceleration).
- Flight mode annunciation (FMA).

- Windshear and predictive windshear.
- Airplane configuration.
- Heading/track.
- STALL annunciation.
- Altitude/ baroset/ selected altitude.
- Marker beacon.

The PFD symbology maintains the basic T configuration with attitude in the center, airspeed on the left, altitude and vertical speed on the right, and direction of flight on the bottom.

NAVIGATION DISPLAY (ND)

The ND displays the following:

- Heading/ track.
- Selected heading, course.
- Drift angle.
- Vertical deviation.
- Windspeed and direction.
- DME distance.
- Distance to waypoint (DTW)/ estimate time of arrival (ETA).
- Active waypoint.
- MAP and Plan modes.
- GMT.
- VOR/ADF bearing and distance.
- VOR/LOC deviations.
- ADF bearing.
- To/From information.
- Ground speed.
- True airspeed.
- TCAS information.
- Weather radar.
- Course deviation or navigation map.
- Windshear/ predictive windshear.

Bearing pointer and weather radar displays are available in MAP, VOR and APPROACH modes only.

DU CONFIGURATION (SHEET 1)

FORMAT DISPLAYED					
DU1	DU2	DU3	DU4	DU5	DU6
L-PFD	L-ND	EAD	SD	R-ND	R-PFD
L-PFD	L-ND	EAD	R-SND	R-PFD	
L-PFD	L-ND	EAD	R-SND		R-PFD
L-PFD	L-ND	EAD		R-SND	R-PFD
L-PFD	L-ND		EAD	R-SND	R-PFD
L-PFD		L-ND	EAD	R-SND	R-PFD
	L-PFD	L-ND	EAD	R-SND	R-PFD
L-PFD	L-SND	EAD	R-PFD		
L-PFD	L-SND	EAD		R-PFD	
L-PFD	L-SND		EAD	R-PRD	
L-PFD		EAD	R-SND	R-PFD	
	L-PFD	EAD	R-SND	R-PFD	
L-PFD	L-SND	EAD			R-PFD
L-PFD	L-SND		EAD		R-PFD
L-PFD		EAD	R-SND		R-PFD
	L-PFD	EAD	R-SND		R-PFD
L-PFD	EAD			R-SND	R-PFD
L-PFD		EAD		R-SND	R-PFD
	L-PFD	EAD		R-SND	R-PFD
L-PFD			EAD	R-SND	R-PFD
	L-PFD		EAD	R-SND	R-PFD
		L-PFD	EAD	R-SND	R-PFD
L-PFD	L-SND	EAD			
L-PFD	L-SND		EAD		
L-PFD		L-SND	EAD		
	L-PFD	L-SND	EAD		
L-PFD	L-SND			EAD	
L-PFD		L-SND		EAD	
	L-PFD	L-SND		EAD	
EAD			R-SND	R-PFD	
	EAD		R-SND	R-PFD	
		EAD	R-SND	R-PFD	

L/R - Left/Right SND - Navigation/System Display Blank - Off

CAG(IGDS) KB1-3-0103

DU CONFIGURATION (SHEET 2)

FORMAT DISPLAYED					
DU1	DU2	DU3	DU4	DU5	DU6
L-PFD	L-SND				EAD
L-PFD		L-SND			EAD
	L-PFD	L-SND			EAD
EAD			R-SND		R-PFD
	EAD		R-SND		R-PFD
		EAD	R-SND		R-PFD
EAD				R-SND	R-PFD
	EAD			R-SND	R-PFD
		EAD		R-SND	R-PFD
			EAD	R-SND	R-PFD
L-PFD	EAD				
L-PFD		EAD			
	L-PFD	EAD			
L-PFD			EAD		
	L-PFD		EAD		
		L-PFD	EAD		
L-PFD				EAD	
	L-PFD			EAD	
		EAD		R-PFD	
			EAD	R-PFD	
L-PFD					EAD
	EAD				R-PFD
		EAD			R-PFD
			EAD		R-PFD
				EAD	R-PFD
					R-PFD
				R-PFD	
			R-PFD		
		L-PFD			
	L-PFD				
L-PFD					

L/R - Left/Right SND - Navigation/System Display Blank - Off

CAG(IGDS) KB1-3-0104

AIR DATA SYSTEM

Three pitot tubes are located on the nose of the airplane, one each for the Captain's, First Officer's and auxiliary pitot system. A rudder pitot tube, located on the leading edge of the vertical stabilizer, provides pitot pressure to operate the rudder throw limiter. Two static plates, located on each side of the airplane, and two alternate ports provide static pressure.

During normal operation, the Captain's pitot and static air data goes to Air Data Inertial Reference Unit (ADIRU)-1, and the First Officer's pitot and static air data goes to ADIRU-2. Alternate static and auxiliary pitot air data goes to the Integrated Standby Instrument System (ISIS).

INERTIAL REFERENCE SYSTEM

The inertial reference function of the ADIRU provides air data and inertial reference information to the PFD and ND. The ADIRU is controlled by a single IRS control panel located on the overhead panel. An independent back-up battery will provide power to ADIRU-2 for a minimum of 30 minutes If the normal power is lost. ADIRU-1 is powered by the airplane battery.

VHF OMNIDIRECTIONAL RANGE/MARKER BEACON (VOR/MB)

Two VOR receivers are normally tuned automatically by the VIA flight management computing function, but can be tuned manually. The identifiers of VORs currently providing update data to the VIA are displayed on the FMS POS REF 2/3 page. The ND automatically displays the identifier/ frequency of the tuned VORs. Manual VOR tuning is accomplished on the FMS NAV RADIO page.

VOR bearings and course deviation are displayed on the ND map display. VOR frequency and selected course are displayed in the lower left hand corner.

Outer, middle and inner marker beacons are displayed by symbols on the PFD. An aural tone sounds simultaneously with a symbol. Volume for the marker beacon is controlled on the audio control panel.

DISTANCE MEASURING EQUIPMENT (DME)

Two DME systems are normally tuned automatically by the VIA flight management computing function, but can be tuned manually. The identifiers of DMEs currently providing update data to the VIA are displayed on the POS REF 2/3 page. DME distance is displayed on the ND map display.

MULTIMODE RECEIVER (MMR) SYSTEMS

Two MMR systems (MMR-1 and MMR-2) provide ILS and Global Positioning System (GPS) functions.

The MMR ILS function provides localizer and glideslope guidance information to the flight control and display systems. The GPS function receives and processes satellite RF signals from the NAVSTAR GPS satellite constellation to provide position, velocity and time data to the VIA.

ILS frequency are normally tuned automatically by the VIA flight management computing function, but can be tuned manually using the MCDUs. ILS autotuning requires that an ILS approach be part of the active route and the airplane is less than 50 NM from the top of descent or less than 150 NM from the landing runway threshold. On initial takeoff, ILS autotuning is inhibited for 10 minutes to prevent clutter on the PFD. ILS selected course is displayed on the ND. Tuned ILS frequency is displayed on the PFD and ND in the approach mode.

RADIO ALTIMETER SYSTEM

The radio altimeter system provides terrain clearance (altitude) data during approach, landing, or climb out. The altitude range of the system is from 2,500 feet to touchdown. The system consists of two radio altimeter receiver/transmitters and antennas.

Altitude indications are displayed on the PFDs. The decision height minimum can be set with the MINIMUMS control knob on the ECP.

FLIGHT DATA RECORDING SYSTEM

The flight data recording system records data from airplane subsystems, sensors, and multifunction control and display unit (MCDU) inputs. The data are recorded on a crash-survivable flight data recorder which stores the last 25 hours of flight operation. The system consists of VIA digital flight data acquisition function, a triaxial accelerometer, flight data recorder, and a control panel on the overhead panel.

The recorder is automatically turned on when the airplane parking brake is released and either the FUEL switch is on.

An EVENT switch on the overhead panel can be pushed to mark an event on the recorder memory.

GLOBAL POSITIONING SYSTEM (GPS)

NOTE

GPS not available in first certification of the aircraft. Second certification expected in Fall of 2000.

A dual GPS (GPS-1 and -2) system consists of MMR receivers, GPS antennas, and sensor system. The MMR receives satellite positioning signals to provide airplane position to the VIA flight management function. GPS tuning is automatic and GPS position is displayed on the FMS POS REF page.

GPS position data is used if it is validated with ADIRU or radio navigation position. When the GPS position data is available and radio navigation position data is not available, a GPS/INERTIAL NAV ONLY message is displayed in the MCDU scratchpad. For this condition, the pilot is responsible for GPS position validation. If the GPS position cannot be validated, the GPS data must be manually turned off on the POS REF page.

WEATHER RADAR SYSTEM

The weather radar system, with forward-looking predictive windshear detection function, consists of a receiver/ transmitter, control panel, and antennas.

The radar detects and displays areas of severe weather and ground mapping on the ND. Different levels of precipitation are displayed with appropriate colors as green, yellow, red, and magenta.

Both the Captain and First Officer may choose their own range for displaying weather information.

Wx Radar Operation

Before Takeoff:

7. Perform TEST mode procedure.
8. Set Mode Selector to WX.
9. Set Range Selector to a range sufficient to display the area included in the planned flight path.
10. Adjust antenna TILT control down until ground returns appear. This ensures that the radar system is operational.
11. While observing for weather returns, slowly adjust the antenna TILT control in 1 or 2 degree steps to +15 degrees.
12. Just before takeoff, set antenna TILT control to +4 degrees.
13. The amount of background noise is not critical unless it obscures targets.

Climb-out:

8. Shortly after takeoff, slowly rotate antenna TILT control to +15°, then down to where ground returns appear, and then back to +4 degrees while searching for weather targets.
9. Maintain tilt setting of +4 degrees as long as aircraft's pitch attitude is approximately +15 degrees nose up or greater.
10. Repeat step 1 if course changes of 45 degrees or more are made during climb-out.

Cruise

1. As soon as practical, after reaching cruise altitude, select either the 40 NM range and set antenna TILT control to -10 degrees.

   The following exercise ensures that the radar beam is not over-scanning any targets beginning at 30 or 40 miles out to the longest range.

2. While scanning and observing display for weather targets, adjust antenna TILT control clockwise until a sprinkle of ground return appears.
3. Repeat step 2 for each range used.

Approach

1. Just before descent from cruise altitude, note TILT control setting.
2. As descent begins, increase TILT control setting in +1 degree increments for each 10,000 feet of planned descent. This keeps the display relatively free of ground clutter.

After descending to approximately 15,000 feet and when flying over exceptional terrain such as mountains or cities, it may be necessary to adjust the TILT control setting in +1 degree increments of tilt for 5,000 feet of planned descent.

Wx Radar Operations In Turbulence

Turbulence detection is a weather radar system option. Refer to the Operating Controls section of this Pilot's Manual for turbulence detection control location to determine if this option is available on the weather radar system installed in the aircraft.

For turbulence detection and evaluation use the following procedure:

NOTE

> Turbulence information is limited to the first 40 nautical miles. Turbulence in this range will be shown in magenta.

Turbulence detection requires the presence of precipitation. Therefore, turbulence detection does not display clear air turbulence.

1. Select TURB mode.
2. Select desired range.

PREDICTIVE WINDSHEAR DETECTION (PWS)

The Predictive Windshear (PWS) detection function detects microburst windshear hazard to provide visual and aural alerts during takeoff and landing. PWS alerts consist of an ICON of red and black bands with yellow boundaries showing location of any detected windshear on the NDs, appropriate messages on the PFDs, and aural alert through cockpit speakers/headsets.

PWS detection function is automatically activated in flight, regardless of radar mode selection (including OFF), when the airplane is below 2,300 feet radio altitude. Cockpit alerts are generated when the airplane is below 1,200 feet AGL and a microbust is detected. The azimuth coverage for PWS display is limited to +/-40 degrees of the airplane heading and detection range is limited to 5 NM ahead of the airplane.

Three levels of alerts for windshear conditions are warning, caution, and advisory.

PWS Warning Alert

PWS warning alerts are generated for windshear event detected within +/- 0.25 NM from the longitudinal axis of the airplane and within +/- 25 degrees of the airplane heading. Maximum range for warning alert is 1.5 NM ahead of the airplane during landing and 3 NM in takeoff.

During takeoff, warning alerts are inhibited from 100 knots airspeed until reaching 50 feet AGL. Alerts are inhibited below 50 feet AGL during landing.

The ICON, overlaid on the selected radar mode information, is displayed on ND and a red WINDSHEAR AHEAD message is displayed in the top left corner of the PFD. Aural alerts WINDSHEAR AHEAD, WINDSHEAR AHEAD are generated during takeoff and GO AROUND WINDSHEAR AHEAD during landing/go-around.

PWS Caution Alert

PWS caution alerts are generated for windshear events detected outside the warning alert region but within +/- 25 degrees of the airplane heading. Maximum rage for caution alert is 3 NM ahead of the airplane. Inhibiting conditions for caution alerts are the same as for the warning alerts.

In addition to the ICON displayed on ND, an amber WINDSHEAR AHEAD message is displayed in the top left corner of the PFD, and an aural alert MONITOR RADAR DISPLAY is generated.

PWS Advisory Alert

PWS advisory alerts are generated for windshear events detected outside the warning and caution alert regions but within +/- 25 degrees of the airplane heading. Maximum range for advisory alert is 5 NM ahead of the airplane. Only the windshear ICON is displayed on the ND.

PWS Aural Alert

The aural alerts are prioritized in the following order among the airplane systems:

1. Reactive Windshear (WAGs).
2. Predictive Windshear (PWS).
3. GPWS.
4. TCAS.

PWS ALERT LEVEL	VISUAL ALERT		AURAL ALERT	
	ND	PFD	TAKEOFF	APPROACH
ADVI-SORY	ICON	NONE	NONE	
CAUTION	ICON	AMBER “WIND-SHEAR AHEAD” MESSAGE	"MONITOR RADAR DISPLAY"	
WARNING	ICON	RED “WIND-SHEAR AHEAD” MESSAGE	"WINDSHEAR AHEAD, WIND-SHEAR AHEAD"	"GO AROUND WINDSHEAR AHEAD, GO AROUND WIND-SHEAR AHEAD"

ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

The EGPWS interfaces with the radio altimeters, ADIRUs, VIAs, ILS, and landing gear lever position to determine dangerous proximity to the terrain between 2,450 and 10 feet.

In addition to basic ground proximity warning, airport envelope modulation, terrain clearance floor, and terrain awareness and alerting display are provided

A BELOW G/S warning light, located on the Captain's and First Officer's instrument panel, terrain display on ND, PFD warning messages, and voice warnings will annunciate to indicate adverse conditions.

The system provides visual and aural warnings for the following conditions:

Mode 1 - Excessive Descent Rate

Mode 1 provides warning for excessive descent profiles with respect to altitude AGL during cruise and approach AGL. Two different warning boundaries are possible:

- Outer Boundary - Penetration will activate the amber GROUND PROX message on the PFD and generate voice warning SINKRATE.
- Inner Boundary - Penetration will activate the red GROUND PROX on the PFD and generate the voice warning (WHOOP WHOOP PULL UP).

Mode 2 - Excessive Terrain Closure Rate

Mode 2 provides warning based on RA and how rapidly that RA is decreasing. Mode 2 has two areas of applications as follows:

- Mode 2A - This mode is applied when the landing flaps are not down and the airplane is not on the glide slope. Upon penetration, the amber GROUND PROX message is displayed on the PFD and voice warning TERRAIN is generated.
- Mode 2B - Requires that landing flaps are down or that the airplane is on the glide slope during an ILS approach. When the boundary is penetrated, the amber GROUND PROX message is displayed on the PFD. The voice warning will be either TERRAIN or TERRAIN TERRAIN. If the condition persists, the voice warning will change to WHOOP WHOOP PULL UP.

Mode 3 - Altitude Loss After Takeoff

Provides a warning for significant altitude loss after takeoff or go-around with gear up and flaps are not in the landing configuration. Penetration of the boundary will result in the amber GROUND PROX message displayed on the PFD and voice warning DON'T SINK.

Mode 4 - Unsafe Terrain Clearance

Mode 4 exists in three forms:

- Mode 4A - Upper boundary is at 500-feet RA. If the airplane penetrates this boundary with the gear up, the voice warning will be TOO LOW GEAR and the amber GROUND PROX message will be displayed on the PFD. Above 190 knots, the upper boundary increases linearly with airspeed to a maximum of 1,000 feet RA at 250 knots or more. Penetration of this boundary generates a repetitive TOO LOW TERRAIN voice warning.
- Mode 4B - Upper boundary has decreased to 245 feet RA. If the airplane penetrates this boundary, the voice warning will be either TOO LOW GEAR (if gear up), or TOO LOW FLAPS (gear down and flaps not in landing configuration). The amber GROUND PROX message will be displayed on the PFD. Above 159 knots, the boundary increases linearly (same as mode 4A) and the voice warning is TOO LOW TERRAIN.

- Mode 4C - Provides a warning based on minimum RA clearance during takeoff. A value equal to 75 percent of the current RA is stored in a filter. If the altitude decreases below the stored value, a TOO LOW TERRAIN voice warning will be generated and the amber GROUND PROX message will be displayed on the PFD.

Mode 5 - Descent Below Glide Slope

Provides two levels of warning when the airplane descent is below the glide slope on an ILS approach.

- Mode 5 Soft Alert - Occurs when the airplane is more than 1.3 dots below the glide slope. The GLIDESLOPE voice warning is generated and the BELOW G/S light is illuminated.
- Mode 5 Hard Alert - Occurs when the airplane is more than 2 dots below the glide slope. The warnings are the same as the soft alert.

The warning can be cancelled by pushing the BELOW G/S switch at any time below 1,000 feet RA. The warning is reset by climbing above 1,000 feet or descending below 30 feet.

Mode 6 - Altitude Callouts/ Excessive Bank Angle Warning

Mode 6 provides optional callouts for descent through predefined radio altitudes between 2,500 and 5 feet AGL and excessive roll or bank angle warning.

Bank angle warning provides over banking protection during approach, climbout, and cruise. Additionally, the warning protects against wing strikes during landing.

The bank angle warning limits are determined by two factors as follows:

- The basic bank angle limits that vary linearly from 6 degrees at 0 feet (and below) RA to 40 degrees at 150 feet RA and above and
- The roll rate adjustment of 1.5 degrees added for every 1 degree roll rate (limited to +/- 6 degrees).

When bank angle exceeds the warning limits, voice warning BANK ANGLE are generated twice, and then suppressed unless the roll angle increases by an additional 20%.

If RA data is invalid, the bank angle warning limit will be 40 degrees.

AIRPORT ENVELOPE MODULATION

The airport envelope modulation feature provides improved alert/ warning protection at some key locations throughout the world while improving margins against nuisance warnings at others. Near certain airports, modes 4 and 5 are expanded to provide warnings consistent with normal approaches. Near other airports, modes 1, 2, and 4, are desensitized to prevent nuisance warnings that result from unusual terrain or approach procedures.

TERRAIN CLEARANCE FLOOR (TCF)

The Terrain Clearance Floor (TCF) is a terrain clearance envelope around airports. TCF alerts are based on current aircraft location, nearest runway center point position and radio altitude. When the TCF envelope is penetrated:

- TOO LOW TERRAIN voice warning is generated twice.
- Amber GROUND PROX message is displayed on PFD.
- Additional TOO LOW TERRAIN voice warning will be generated for every additional loss of radio altitude of approximately 20%.

TCF is active during takeoff, cruise, and final approach. The TCF alerts add to the existing Mode 4 protection by providing alerts based on insufficient terrain clearance including landing configuration.

TERRAIN AWARENESS

The terrain awareness features add a terrain “look ahead” capability of the GPWS. The features include terrain alerting and display functions.

Terrain display is the basic presentation on the ND upon system power up. The system displays a color-coded terrain map in MAP, VOR and APPR modes. The displays can be replaced at any time with weather radar information by pushing the WX BRT switch on the EIS control panel (ECP).

Terrain will be automatically displayed on the ND if the pop-up option is enabled and neither Captain nor F/O has terrain selected.

Terrain conditions are displayed and annunciated as follows:

- Terrain warning - Displayed in solid red on ND, red flashing GROUND PROX on PFD, and voice warning TERRAIN, TERRAIN, PULL UP or TERRAIN AHEAD, PULL UP.
- Terrain caution - Displayed in solid amber on ND, amber flashing GROUND PROX on PFD, and voice warning CAUTION TERRAIN or TERRAIN AHEAD.
- Terrain that is close, but is not of warning or caution condition, is in green, amber, or red dot patterns.

The following messages are displayed on the ND as applicable:

- TERRAIN (white) with selected range - Weather radar is deselected with the WX BRT switch on the ECP.
- TERRAIN TEST (white) - Pilot-initiated preflight GPWS test.
- TERRAIN RANGE DISAGREE (amber) - Display ranges on the NDs are not the same.

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

The TCAS is an airborne system that interrogates ATC transponders in nearby airplanes to identify and display potential collision threats. Visual and aural warnings are provided when a penetration of the TCAS protected airspace is predicted

Threat airplanes are displayed with data tags on the ND with different symbols and color codes to indicate threat level of each airplane. The data tag shows relative altitude and climb/descent in excess of 500 fpm of the intruders. TCAS cannot detect traffic unless the traffic has an operating transponder turned on. TCAS controls are on the transponder control panel and the EIS mode select panel.

A Resolution Advisory (RA) appears on the PFD and ND when a threat airplane is approximately 25 seconds from the Closest Point Of Approach (CPA). There are two types of RAs. Corrective RAs recommend changing vertical speed with a green fly-to zone on the PFD vertical speed display. Preventive RAs recommend not changing vertical speed with red forbidden zones on the PFD vertical speed display. On the ND, the RAs are red squares.

Voice warnings associated with RAs are as follows:

- MONITOR VERTICAL SPEED (2 times).
- CLIMB (3 times).
- CLIMB, CROSSING CLIMB (2 times).

- DESCEND (3 times).
- DESCEND, CROSSING DESCEND (2 times).
- REDUCE CLIMB (2 times).
- REDUCE DESCENT (2 times).
- INCREASE CLIMB (2 times).
- INCREASE DESCENT (2 times).
- CLIMB, CLIMB NOW (2 times).
- DESCEND, DESCEND NOW (2 times).
- CLEAR OF CONFLICT
- TRAFFIC, TRAFFIC.

Traffic Advisories (TA) are amber circles on the ND representing airplanes that are approximately 40 seconds from the CPA. There is no requirement to change or monitor vertical speed but visual acquisition of the threat airplane is required. The voice warning associated with TAs is TRAFFIC, TRAFFIC.

Proximate traffic are cyan diamonds on the ND that represent airplanes that are not threat traffic but are within 6 NM and 1200 feet vertically.

Other traffic are outline cyan diamonds on the ND representing nonthreat traffic that are outside the range of TA, RA, or proximate traffic.

Off scale RAs and TAs are shown by one half of the symbol at the edge of the display area. Data tags and vertical trend arrows are shown.

A two-mile range ring with an asterisk (*) at each of the twelve clock positions will appear when TCAS mode is selected on the ECP and the range goes to 10 NM.

TCAS Display Modes

Pushing the TRFC switch on the ECP displays proximate or other TCAS targets either full time or part time.

Full-Time Mode (TRFC selected). Pushing the TRFC switch displays proximate and other traffic regardless of the occurrence of a TA or RA. In this case, TRFC will appear in the lower left box on the ND.

Part-Time Mode (TRFC not selected). TAs and RAs cause TCAS targets to automatically appear on all ND modes except PLAN mode.

During a TA or RA, any proximate or other traffic will also be displayed.

TCAS mode - This ND mode is selected by pushing the TCAS switch on ECP. The ND will:

- Declutter (remove FMS course line, radar returns, bearing pointers, and waypoint symbols).
- Go to a 10-mile range.
- Display a 5-mile range ring and a 2-mile range ring (made of asterisks).

TCAS mode range can be changed by using the INCR/DECR switches on the ECP.

The 10-mile range is automatically selected only when selecting the TCAS display from MAP, PLAN, VOR or APPROACH. If the NAV display is already in TCAS mode at another range, pushing the TCAS switch again does not automatically select the ND back to the 10-mile range.

TCAS Operating Modes

TA/RA mode - This mode is selected from the transponder control panel. In this mode, TAs and RAs are generated on the basis of the calculated time for a threat airplane to reach the CPA. The CPA will vary with altitude. An RA is generated when an intruder is approximately 25 seconds from the CPA, depending on altitude. A TA is generated at approximately 40 seconds from the CPA.

TA mode - In this mode TCAS generates only TAs, proximate, and other traffic. RAs are not generated. When in this mode, a white TA ONLY message appears in the lower left of the ND and changes to flashing amber when a TA occurs. This mode can be selected from the transponder control panel or occurs automatically when:

- In flight below 1000 feet AGL (+/-100 feet).
- On ground and transponder control panel is set to TA or TA/RA.
- Whenever there is a GPWS warning or windshear guidance.

TCAS Operating Constraints

TCAS operating constraints are as follows:

- Descend RAs are inhibited below 1,200 feet AGL in takeoff and 1,000 feet AGL in approach.
- Increase descent RAs are inhibited below 1,450 feet AGL.
- Climb RAs are inhibited above 37,000 feet MSL.

- RAs are inhibited below 1,100 feet in takeoff and 900 feet in approach.
- There are no TCAS voice warnings below 500 feet (+/-100 feet).
- There are no TCAS voice warnings or RAs during windshear guidance.
- There are no TCAS voice warnings or RAs during GPWS warnings.
- RAs are based on pilots starting the maneuver within 5 seconds (for a corrective RA).

INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS)

The ISIS provides displays of altitude, airspeed (IAS and Mach number), attitude, and baro setting (in inches of mercury) on a LCD located in the forward pedestal. The system is electrically-operated and interfaced with the auxiliary pitot and alternate static port through two Air Data Modules (ADM).

System warm-up (approximately 1 minute) is initiated and the SELF TEST IN PROGRESS message is displayed on the LCD when the electrical power is on. An ALIGN message is displayed on the lower part of the attitude display when attitude alignment is in progress. If attitude failure occurs, a red ATT FAIL message will appear on the upper part of the attitude display. If altitude, airspeed or baroset display failure occurs, respective data will be removed and replaced by a red diagonal cross. All data will be removed and a big red diagonal cross will appear to indicate total system failure.

Pushing the ANNUN LT TEST button on the overhead panel displays ALIGN, ATT FAIL messages, and all red diagonal crosses overlay the displays. The system will be powered by the airplane battery if the electrical power is lost.

STANDBY MAGNETIC COMPASS

The standby magnetic compass provides a heading reference in relation to magnetic north. The Captain's and First Officer's viewing mirrors, mounted on the glareshield, permit viewing the standby compass.

FLIGHT MANAGEMENT SYSTEM (FMS)

The VIA Flight Management Function (FMF) interfaces with the Flight Control Computers (FCC), ADIRUs and NAV receivers. In addition, the system uses FMS performance and navigation data bases and crew entered data to perform the following: data display, navigation, performance management, guidance, and fault data storage.

FMS Navigation Function

The system computes Actual Navigation Performance (ANP) for all navigation modes. ANP is a theoretical number based on the error characteristics of the sensors used to update the position. ANP is compared to Required Navigation Performance (RNP) value. If the ANP exceeds RNP, a resetable level 1 alert and MASTER CAUTION lights will be activated, and a boxed RNP message will also be displayed on the ND. The message will flash for 5 seconds after initial alert. The ANP and RNP values are displayed on the MCDU POS REF page.

The navigation function generates airplane position and velocity data for the guidance and display functions. Horizontal navigation programs combine position velocity, acceleration and heading data from IRS, range and bearing from DME and VOR receivers, and altitude and true airspeed (TAS) from the ADIRU. These sensors are used to generate an airplane position, an estimate of position accuracy, ground speed, track angle, and wind vector data.

FMS position is computed based on selecting a navigation mode using the best sensors available. Localizer updating is the highest navigation mode priority and is used when a valid localizer is tuned during approach. When a valid localizer is not tuned, radio data is used as the primary updating sensor.

The highest priority FMS radio navigation mode combines ranges from two DME stations. As the airplane progresses along its flight path, FMS continuously selects DME stations and automatically tunes those stations which yield the most accurate estimate of position. If the bearings between two available DME stations do not form an angle between 30 and 150 degrees from the airplane, the FMS defaults to VOR/DME navigation mode. In the VOR/DME updating mode, the valid range and bearing from a VOR/DME station are used.

FMS Performance

The FMS performance modes optimize the airplane's vertical profile. Those performance or speed modes include economy (ECON), EDIT, MAX climb (CLB), and MAX endurance (END). Speed targets associated with these modes are:

ECON - The ECON climb, cruise, and descent phase speed/mach targets are calculated to obtain the minimum operating cost per mile traveled enroute, based on a default cost index.

EDIT - Pilot entered CAS/MACH for CLB and cruise (CRZ) phases of flight subject to flight envelope limits.

MAX CLB - The MAX CLB speed is a table look-up speed for best angle of climb.

MAX END - The MAX END and best holding speed targets are calculated for obtaining the least drag for maximum time aloft.

The performance functions include the computation of optimal speeds, predictions of time, and distances at all flight plan waypoints. It also covers the computations of reference parameters, such as maximum altitude.

After engine start, the fuel/weight calculation is updated on the basis of fuel tank readings and a time integration of the fuel flows to each engine.

The route of flight is displayed on the electronic instrument system (EIS) map display, and when the descent phase is active, FMS SPD and PROF modes will be disengaged.

FMS Guidance

Lateral guidance function includes route activation, route leg sequencing and updating.

The route activation function selects which of the two stored flight routes is active. Leg sequencing defines the transition between the legs of the active route and predicts when intercepts will occur based on wind and heading variations. The guidance function compares the airplane actual position with the desired flight path and sends commands to the autopilot and flight director that cause the airplane to fly along the desired path. The airplane's progress along each path segment is continuously monitored to determine when a path transition must be initiated. Direct guidance from the airplane present position to any waypoint, and lateral offset guidance on selected route leg types, is also available.

Lateral guidance function is engaged by pushing the NAV button on the flight control panel (FCP) after an active route has been entered and executed through the MCDU.

Vertical guidance encompasses the climb and cruise phases of the flight plan. The flight planning capability of the FMS includes means to enter published departure, arrival, and approach segments and individual waypoints that include altitude constraints. These constraints, as well as the entered cruise altitude define the vertical profile for which the FMS provides guidance. Vertical guidance function is engaged by pushing the PROF button on FCP.

In the climb portion of the profile, the Auto Flight System (AFS) will control thrust and speed by commands from the FMS. The airplane will climb at climb limit thrust to each altitude constraint, fly level at cruise thrust until past the constraint waypoint, and then resume the climb at climb limit thrust. The speed schedule is determined by the speed transition altitude. Below the speed transition altitude, the speed controls to 250 knots. Above the speed transition altitude, the system defaults to an economy climb schedule that is a function of gross weight at the top of climb and entered cruise altitude. After reaching the cruise altitude, PROF will maintain an economy cruise or crew-selected speed schedule until the descent phase is reached.

The descent path function does not provide path control. FMS SPD and PROF will disengage while in descent flight phase.

FMS Data Base

The data bases in the VIA contain performance data and navigation data.

The performance data provides the FMS data required to adapt the FMS performance function to the B717 airframe. Data stored includes drag and engine model, optimum speed, and maximum and minimum speeds.

The navigation data includes most of the information that the pilot would normally determine by referring to navigation charts. This information can be displayed on the MCDU or EIS MAP navigation display. The data includes location of VHF navigation aids, airports, runways, geographical reference points, standard instrument departures (SID), standard terminal arrival routes (STAR), approaches, and company routes.

Two sets of navigation data are updated by maintenance action every 28 days to correspond to the normal revision cycle for navigation charts. When the navigation chart revision date arrives, the new data is already in the FMS and ready for activation.

FMS Dual Mode

The FMS modes are DUAL, INDEPENDENT, and STANDBY.

DUAL mode is the normal operating mode of the FMS. When operating in DUAL mode, there is cross talk between the VIAs to ensure the following:

- MCDU entries made on one side are entered simultaneously into the other VIA. The respective MCDUs can display different pages, however, if the same page is displayed on each MCDU, the displays will be similar.
- Initiation of leg sequencing occurs simultaneously in both VIAs.
- Independent calculations of airplane position.
- Independent calculations of airplane gross weight.
- Independent calculations of active thrust limit.

NOTE

Recalculation of data by the FMS may cause momentary irregularities in displayed data.

After DUAL mode is established, both FCCs select the VIA on the same side as the FCC in control. This VIA will then become the master. This selection process ensures that both flight directors (FD) will be controlled with the same steering commands.

FMS Multifunction Control And Display Unit (MCDU)

FMS generated data, command entries, and performance data are displayed on the MCDU on individual full-screen pages. Each flight mode will have its own individual page or pages, as will other functions of the FMS such as: identification, initialization/reference, position initialization, position reference, navigation reference data, takeoff, approach, maintenance, data (sensor status), holding pattern, route data, route legs, and route progress.

Two different character sizes are used on the display pages. The larger is used for data that has been entered by the pilot or retrieved from the data base, such as speed/altitude constraints at identified waypoints. The smaller is used for data identification and also to display predicted or calculated data such as course/distance between waypoints. The top line on the MCDU is the title line, displaying flight

(continued)

mode, submode and the number of pages of that mode with an indication of which page is currently displayed. The bottom of the screen is the scratchpad area where messages are displayed and information is entered for selection into the appropriate data field.

Each page is made up of 6 data entry lines (excluding the title line and scratch pad line), left and right, creating 12 data fields. There are 24 characters per line. The screen is framed by 12 line select keys (LSK). These LSKs are used to enter information into the adjacent data field, select the FMS function or submode, or to select different pages whose title appears in the corresponding data field. The pilot uses the keyboard to type entries into the MCDU scratchpad. The data is then transferred into the appropriate data field using the LSK adjacent to that field.

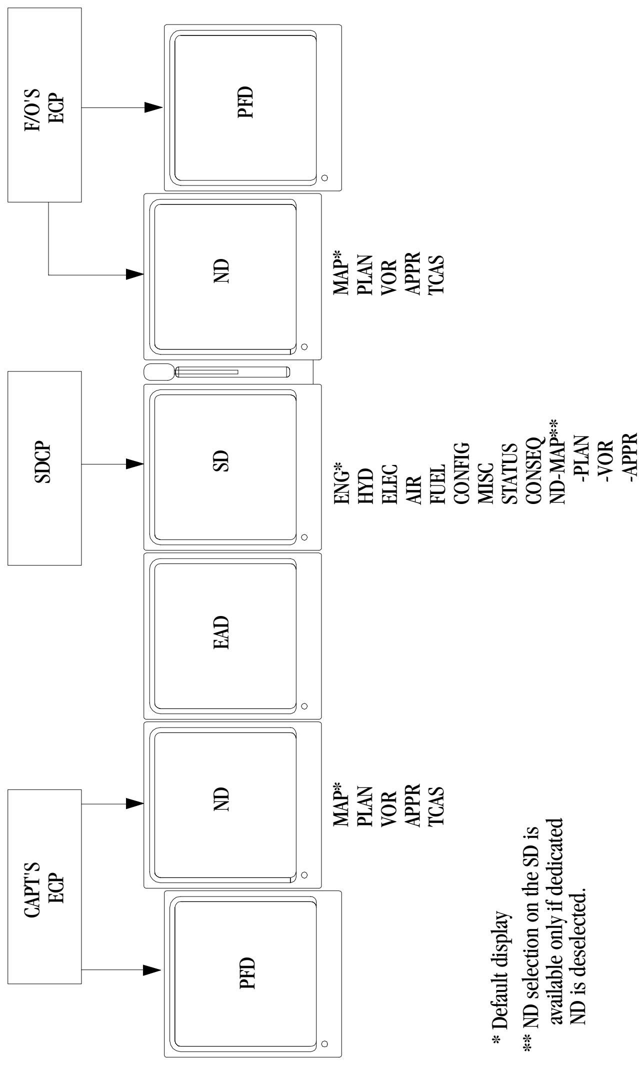
Data entered by the pilot into the MCDU is checked for reasonableness and validity. Rejected data and attempts to enter data into a non-accessible field will generate an INVALID ENTRY message in the scratchpad. Data necessary for system operation will be displayed as box prompts in the appropriate field, and optional data fields will be displayed as dashes.

Pushing an LSK when the scratchpad contains data causes its adjacent data field to accept the data. If the adjacent data field contains a prompt, pushing the LSK will carry out the prompted action. Data necessary for the flight or for flight calculations may not be deleted in flight. However, some data may be updated when the system is in operation. If data necessary for system operation are omitted during preflight, a message will appear indicating which data needs to be added. Individual data fields may be cleared by pushing the CLR key, then pushing the appropriate LSK for the data field. The CLR key will delete any entry or message in the scratchpad.

The MCDU is also used to display messages. Messages are either alerting or advisory, depending upon the severity of the set condition. The alerting messages cause the CDU MSG annunciation displayed on the ND.

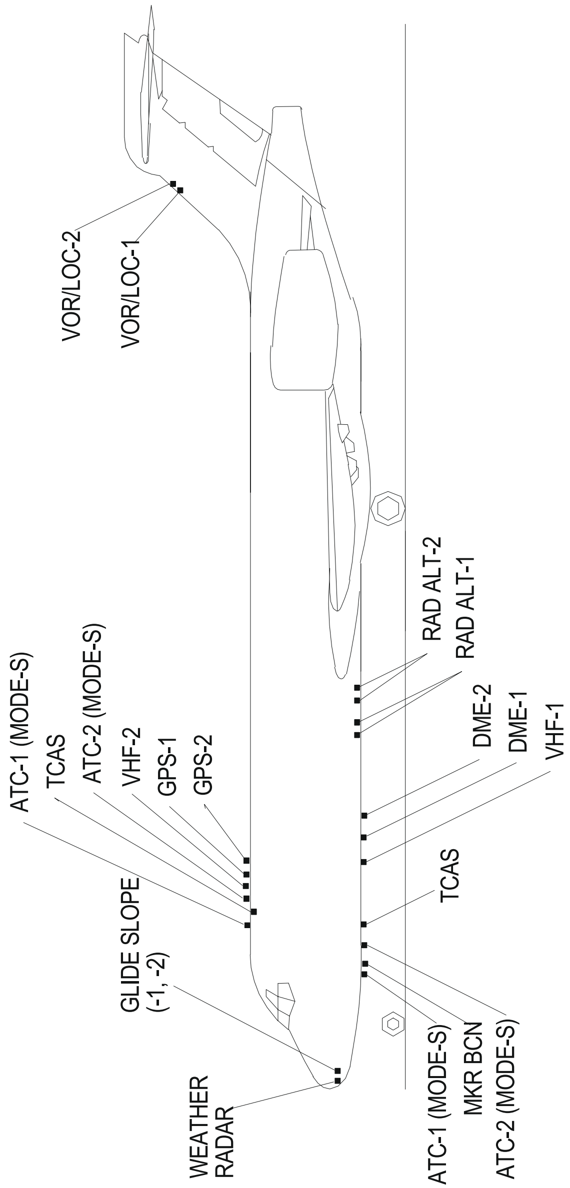
COMPONENTS

EIS Components & Displays



KB1-3-0105A

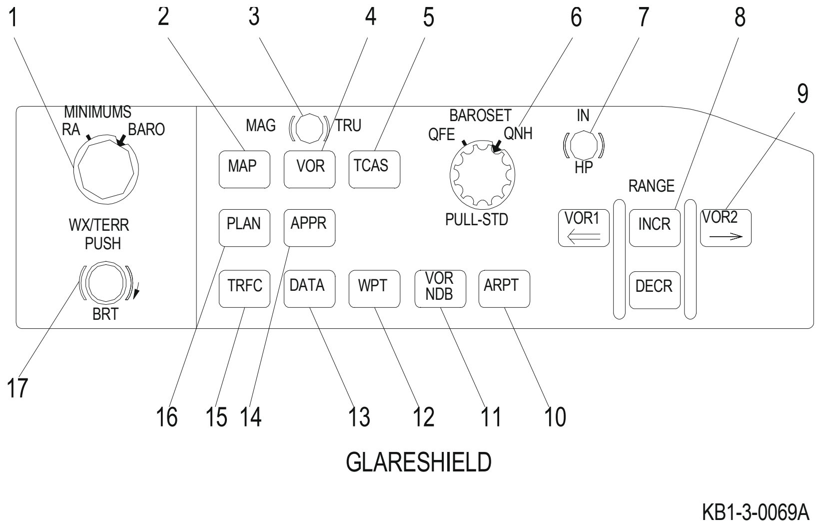
Antenna Locations



CAG(IGDS) KB1-3-0106

CONTROLS AND DISPLAYS

EIS Control Panel



1. **MINIMUMS Knob**

   RA - Sets RA bug on PFD altitude tape by rotating the inner collar.

   BARO - Sets BARO bug on PFD altitude tape by rotating the inner collar.

   Push - Resets PFD DH alert and silences aural warning.

2. **MAP Switch**

   Push - Selects MAP display on ND. Non-flight plan way-points, airports, navaids, weather radar data and bearing pointers are displayed.

3. **MAG/TRUE Button**

   Push - Selects MAG or TRUE reference for heading/track indicator on the ND MAP display.

4. **VOR Switch**

   Push - Selects VOR display on ND.

5. **TCAS Switch**

   Push - Selects dedicated TCAS display on ND with 10 NM autorange and 2 NM range ring.

6. **BAROSET Knob**

   QFE/QNH - Selects altitude above station (QFE) or altitude above sea level (QNH) by rotating inner collar. Value is displayed on PFD. Value is also displayed on the ISIS LCD if selected from the Captain's ECP.

   QFE - Inoperative.

   QNH - Selects altitude above sea level by rotating inner collar. Value is displayed on PFD. Value is also displayed on the ISIS LCD if selected from the Captain's ECP.

   Pull - Selects standard baroset (29.92). Value is displayed on PFD. Value is also displayed on the ISIS LCD if selected from the Captain's ECP.

   Pull - Selects standard baroset (29.92). Value is displayed on PFD. Value is also displayed on the ISIS LCD if selected from the Captain's ECP.

7. **IN/HP Button**

   Push - Changes BAROSET value in inches of mercury or hectopascals.

8. **INCR/DECR Switch**

   Push - Controls MAP range from 10 to 640 NM on ND.

9. **VOR Switches**

   Push - Controls bearing pointer display on ND.

10. **ARPT Switch**

    Push - Selects non-flight plan airports normally not displayed on ND.

11. **VOR/NDB Switch**

    Push - Selects display of non-tuned VORs, DMEs, VOR/DMEs, or non-directional beacons on ND. Tuned stations are not deselectable thru this switch.

12. **WPT Switch**

    Push - Selects display of non-flight plan waypoints on ND.

13. **DATA Switch**

    Push - Selects display of waypoint data on ND. Waypoint data consists of an identifier, crosstrack deviation, and waypoint constraint data.

14. **APPR Switch**

    Push - Selects APPROACH mode display on ND.

15. **TRFC Switch**

    Push - Selects full time TCAS display on ND.

16. **PLAN Switch**

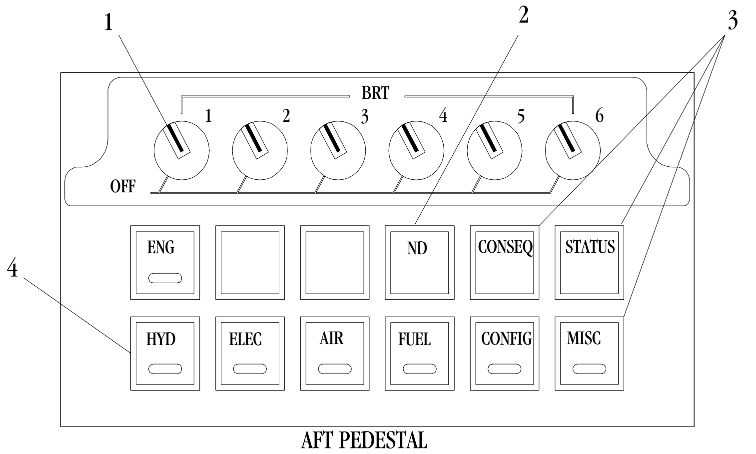
    Push - Selects PLAN mode display on ND.

17. **WX/TERR Switch**

    Rotate - Adjusts weather radar display brightness.

    Push - Turns on/off weather radar display. EGPWS terrain is displayed when weather radar is not selected.

EIS System Display Control Panel



1. **BRT Knob**

   Rotate - Adjusts respective DU brightness. Turning fully counterclockwise through a detent turns off respective DU.

2. **ND Switch**

   Push - With 1 or more DUs inoperative, causes the existing SD to become an ND.

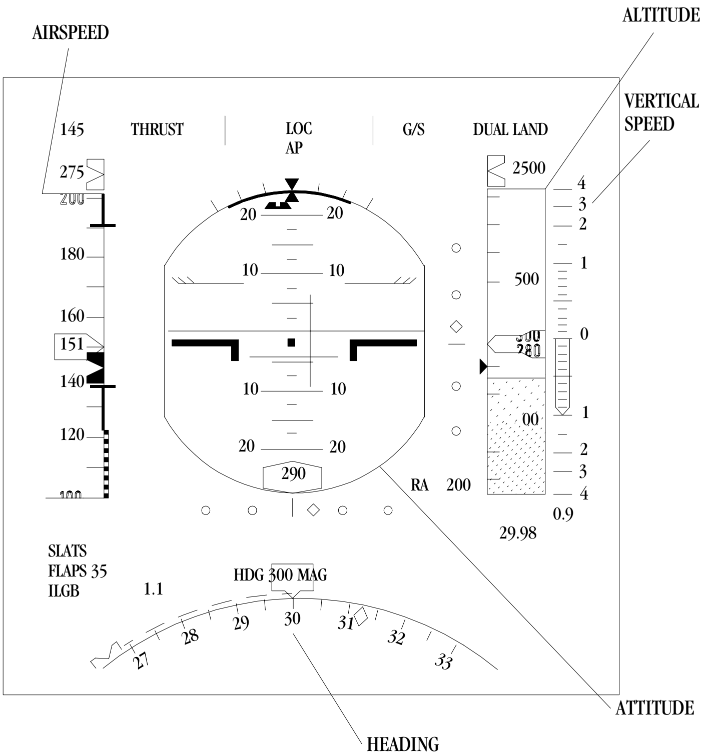
3. **CONSEQ/STATUS/MISC Switch**

   Push - Displays respective CONSEQUENCE, STATUS, or MISCELLANEOUS page on SD.

4. **System Cue Switch (6)**

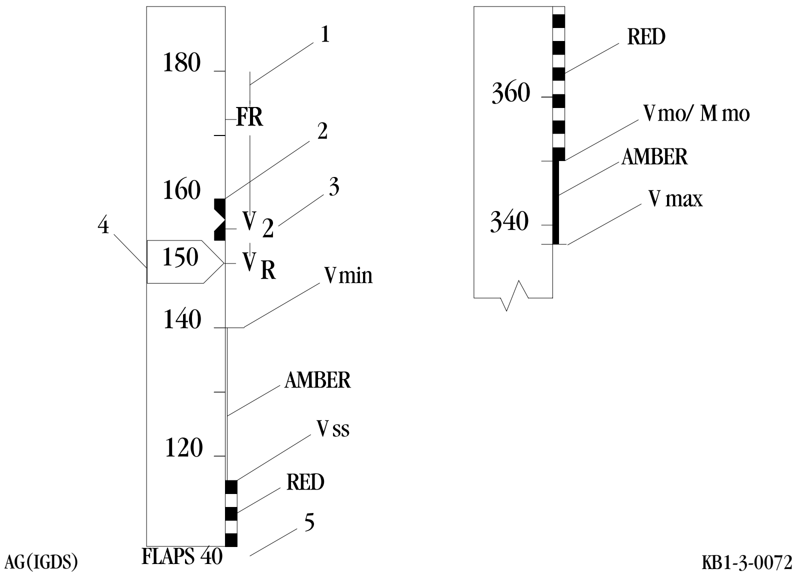
   Push - Displays applicable system (ENGINE, HYDRAULIC, ELECTRIC, AIR, FUEL or CONFIGURATION) synoptic page on SD.

EIS Primary Flight Display



CAG(IGDS) KB1-3-0071

PFD Airspeed Display



1. **Airspeed Trend**

Displayed as a green column. The end of the column is the airspeed to be achieved in 10 seconds.

2. **Airspeed Bug**

- White solid - Selected airspeed.
- White outline - Preselected airspeed.
- Solid magenta circle - FMS commanded airspeed.
- Outlined magenta circle - FMS speed not selected.

If selected speed is set lower than Vmin, the white bug stops at Vmin and an amber reference bug will be at the selected speed.

If selected speed is set lower than Vss, a red reference bug will be at the selected speed.

If selected speed is set higher than Vmo/Mmo, the white bug stops at Vmo/Mmo and a red reference bug will be at the selected speed.

Speed/Mach bugs can park off scale above or below the tape and a digital value will be displayed next to the bug.

Mach is displayed to the right of the airspeed when above 0.50 Mach.

If airspeed is no-computed data, ground speed and TAXI will be shown.

3. **Speed Bugs**

V1, VR, V2, FR, GR, SE, FE, and GE bugs are on outside of the tape. If Vspeeds have not been computed, V1, VR, and V2 are attached to dashed boxes.

4. **Airspeed**

Shown at the center of tape.

- Box and digits red - A/S below Vss or exceeds Vmo/Mmo.
- Box and digits amber - A/S below Vmin or exceeds Vmax.

Vss is the end of a red checker column.

Vmin is a line at the end of an amber column extending from Vss.

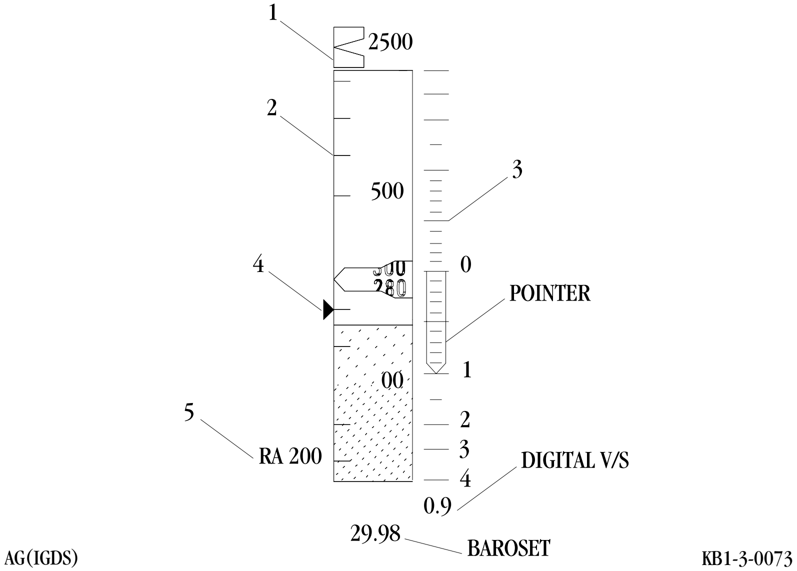
Vmo/Mmo is a line at the end of a red checker column extending from the high end of the tape.

Vmax is a line at the end of a narrow amber column extending down from Vmo/Mmo.

5. **Flap/Slat**

Invalid flap positions are flagged with an amber X. Slat messages turn amber and are boxed when they are in disagreement with extended flaps.

PFD Altitude/ Vertical Speed Display



1. **Altitude Bug**

- White outline - Preselected altitude.
- White solid - Selected altitude.
- Magenta circle - FMS constraint altitude. Circle is filled when FMS engaged. It is outlined if the crew has intervened in an FMS profile, FMS altitude is beyond FGCP set altitude, or FMS is engaged the preselected altitude.

Selected altitude bug may be parked off each end of altitude scale with digital display next to it.

2. **Altitude Tape**

Tick marks are 100-foot increments. White shading is for QNH display. Green shading is for QFE display. Feet are white. Altitude tape turns amber and flashes to correspond with CAWS altitude advisory alert.

If QFE operation is selected, baroset will change to QFE value and a box with QNH baroset value and altitude in feet will appear below the baroset.

3. **Vertical Speed**

Current vertical speed (V/S) is shown by a wide outline pointer. Range is +/- 4,000 fpm, with tick marks every 100 feet below 1,000 feet. Pointer appears when V/S is more than 100 fpm and remains until below 50 fpm.

If V/S is more than 100 fpm, current V/S is shown digitally above scale for positive V/S, or below scale for negative V/S.

Pointer fits in the selected V/S bug when the selected V/S is achieved.

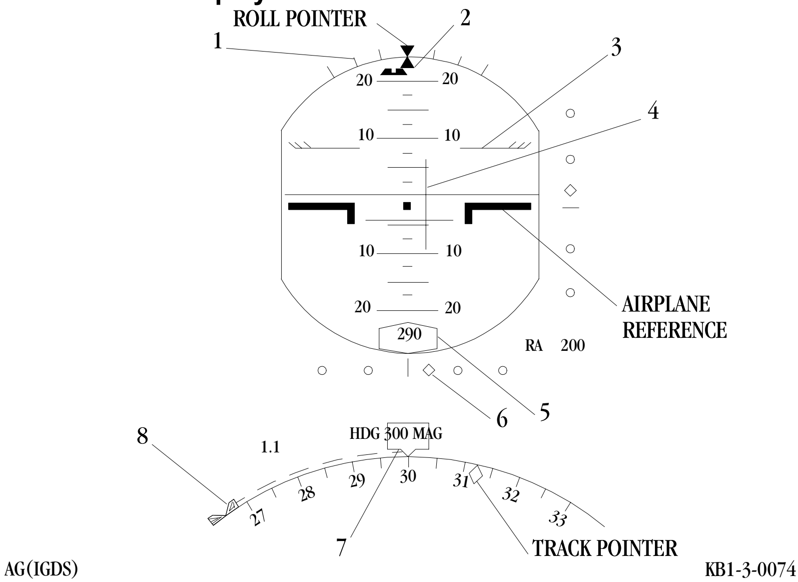
4. **Minimum Bug**

Solid triangle with white color (above minimum) or amber (below minimum). RA minimum bug is on the left side of the tape. BARO DH minimum bug is on the right side.

5. **Selected Minimum**

Value is amber, boxed and flashes for 5 seconds when minimum altitude is reached.

PFD Attitude Display



1. **Roll Indice**

   Short ticks show 10 and 20 degrees, long ticks show 30 and 60 degrees, and a triangle shows 45 degrees roll.

2. **Slip/Skid Indicator**

   Moves parallel to the horizon line in the direction of rudder required. Turns amber when separating from roll pointer.

3. **Pitch Limit Indicator - cyan**

   Indicates difference between airplane angle-of-attack (AOA) and stickshaker AOA. Turns amber just before stick-shaker and becomes red at stickshaker.

4. **Flight Director - magenta**

   Displayed automatically for go-around or windshear. Default condition is FD on.

5. **Radio Altitude**

   Displayed below 2,500 feet. Box and digits are white when above RA minimums and amber if below. Additionally, one of two rising runways may be enabled:

   - Box rising runway - Starts to move up at about 500 feet.
   - T rising runway - Begins rising at 200 feet RA and moves laterally with the localizer. It will flash for excessive localizer deviations (.27 dots). A lazy E on top of the digital RA provides localizer deviation alignment.

6. **ILS Deviation Pointer - magenta**

   Moves against respective dot scale. Respective pointer turns amber and flashes for excessive deviation. Scales are blank until an ILS is tuned.

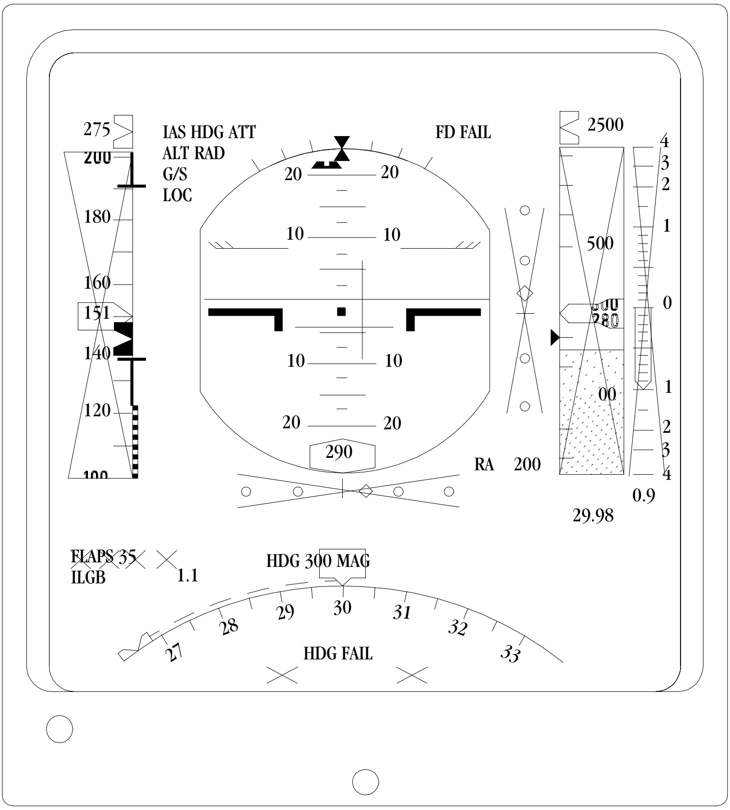
7. **Heading**

   Heading is MAG (dim white) but changes to TRU (cyan) at latitudes greater than 72 degrees.

8. **Heading Bug**

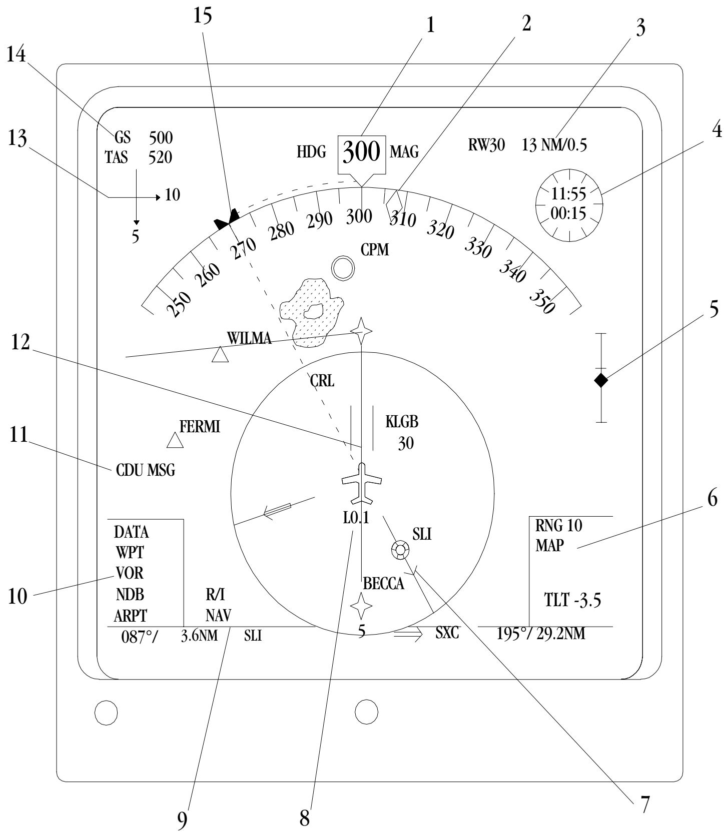
   Bug is outline when preselected and filled when selected.

PFD Test Display



CAG(IGDS) KB1-3-0078

Navigation Display-Map Mode (Typical)



The MAP mode is selected by pushing the MAP switch on the ECP. The MAP mode has the following characteristics:

- The map is referenced to the airplane position and heading (or track).
- It allows display of non-flight plan waypoints, airports, navaids, weather radar data, and bearing pointers.

KB1-3-0075

1. **Heading/Track**

   Displays HDG/TRK as the display orientation, current heading/track, MAG or TRU as the reference, and points to the heading on the compass rose.

2. **Track Pointer - green**

   Points to track in heading mode. Pointer is removed in track mode.

3. **Distance/Time-To-Go - magenta**

   Distance and time to the active FMS waypoint.

4. **Clock**

   Displays current time (UTC) on top and elapsed flight time on the bottom. Elapsed time starts at lift-off and stops at touchdown. Elapsed time resets to zero when the FMS is initialized for the next flight.

5. **FMS Vertical Deviation - magenta**

   Displays vertical deviation from selected VNAV path during decent only. Full scale deviation is 1,000 feet. For deviations more than 1,000 feet, half the pointer is visible in direction of the deviation.

6. **Weather Radar Message**

   Status messages:

   - RNG - Range displayed in NM.
   - MAP - Ground mapping mode.
   - STBY - No scanning, transmitter off.
   - WX - Weather radar detection on.
   - WXR OFF - Weather radar detection off.
   - WX/T - Weather/Turbulence detection on.
   - SCH - Search/Precipitation detection.
   - TURB - Turbulence detection on.
   - TEST - Test mode on.
   - GCS/ID - Ground clutter suppression on.
   - VAR - Variable gain.
   - ATT - Attitude (stabilization) inputs are invalid.
   - TLT - Tilt angle displayed in degrees.

Test messages appear above the status messages during Test mode:

- R/T - Receiver/transmitter problem.
- ANT - Antenna not scanning.
- CNTL - Control panel problem.
- COOL - High receiver/transmitter problem.
- CAL - Automatic calibration not available. Low transmitter power.
- ATT - Attitude (stabilization) inputs are invalid.

Messages appear in the center of ND:

- WRX ON - Flashes white. Radar on and airplane on ground.
- WXR FAIL - Flashes amber. Radar failure.
- WXR RANGE DISAGREE - ND range is 640 NM. Radar range capability is 320 NM.

7. **Bearing Pointer**

   Indicates bearing to the tuned station. Pointer 1 (cyan single arrow) always for left radios and pointer 2 (green double arrow) for right radios. Bearing pointer data is at the bottom of ND.

8. **Crosstrack Deviation**

   Displayed when the DATA switch on ECP is pushed.

9. **Navigation Mode**

   Messages displayed:

   - R NAV - Radio navigation only.
   - IRS NAV - Inertial navigation only.
   - R/I NAV - Radio and inertial navigation.
   - NO NAV - No navigation mode is active.
   - G/I - GNS/Inertial navigation.
   - GNS NAV - GNS navigation.
   - Any invalid mode is flagged with an amber X.

10. **Active MAP Mode**

    Additional map data is controlled with DATA, WPT, VOR, NDB, and ARPT mode switches on the ECP.

11. **CDU Message**

A message is displaying on the MCDU.

12. **Flight Plan Course**

Flight plans are shown according to selected range and are displayed from the last waypoint passed through all succeeding waypoints:

- Active - A series of magenta lines and arcs.
- Secondary - Cyan dotted lines.
- Provisional - (Alternate Destination). Magenta dotted lines and arcs.
- Offset - Long magenta dashed lines and arcs.
- Temporary - Short magenta dashed lines and arcs.

13. **Wind**

Cross track and along track are labeled with wind speed. For the vector display option, a white vector points wind direction with direction and speed in digits below. Wind is displayed when wind speed is more than 5 knots. Display is removed when wind speed is less than 3 knots.

A white vector points wind direction with direction and speed in digits below. Wind is displayed when wind speed is more than 5 knots. Display is removed when wind speed is less than 3 knots.

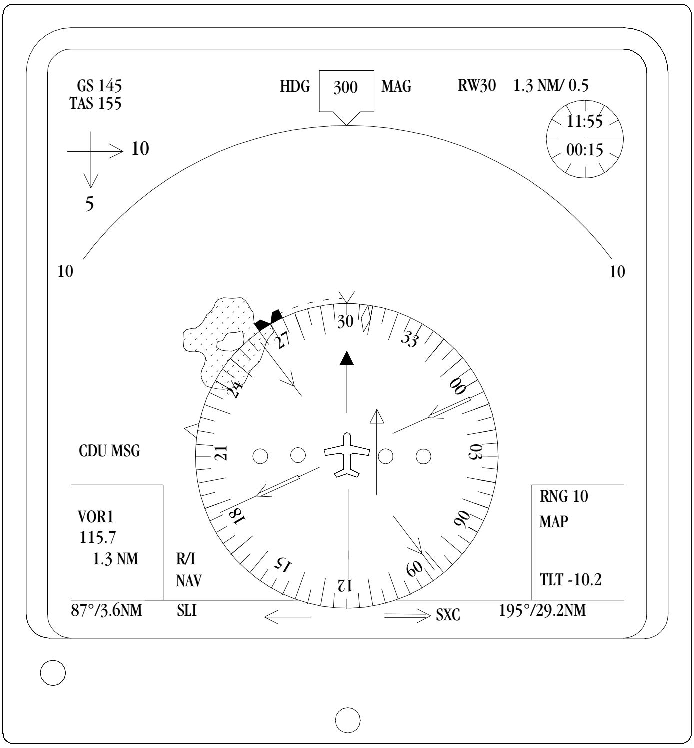
14. **Speed**

Indicates airplane ground speed and true airspeed.

15. **Selected Heading/Track Bug**

Selected heading/track is filled white bug. A white dotted arc is turn direction. A white dotted line extends from airplane symbol to the bug. The line is removed when a selected heading has been captured or the airplane is in FMS NAV with no preselected heading or track. Preselected bug is the same except that it is outlined only.

Navigation Display - VOR/APPR Mode (Typical)



The VOR mode is selected by pushing the VOR switch on the ECP.

The VOR mode has the following characteristics:

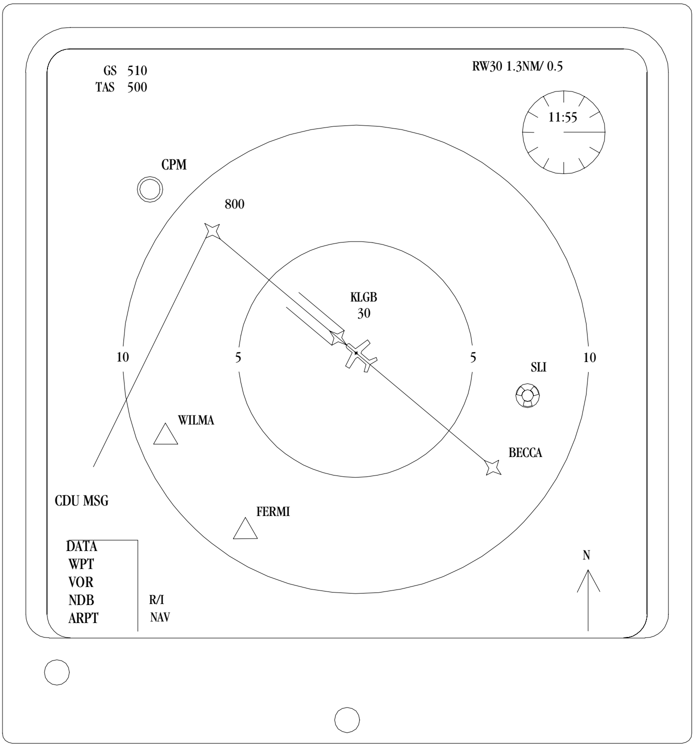
- Weather radar data may be displayed
- A compass rose is centered around the reference airplane and represents half the selected weather radar range. Current airplane heading is at the top.
- Selected heading is shown with a solid white bug on the compass. Preselected heading is shown with an outline bug on the compass.
- The CDI is a magenta arrow and bar showing deviation from selected VOR course. Four circles make up the CDI scale.
- To/from is shown by an arrow on the end of the CDI bar.
- CDI source and DME distance is shown in the lower left.

The APPR mode is selected by pushing the APPR switch on the ECP.

- The APPR mode is identical to the VOR mode except the source for the CDI data is ILS and the to/from arrow on the CDI bar is not shown.

KB1-3-0077

Navigation Display - Plan Mode (Typical)

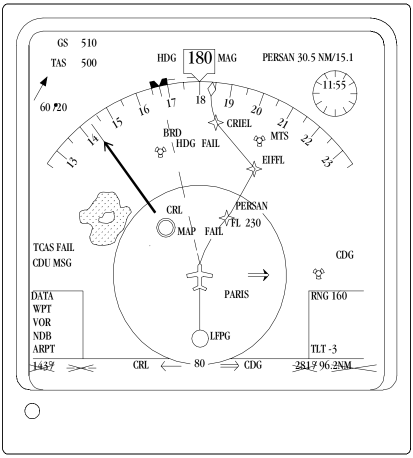


The PLAN mode is selected by pushing the PLAN switch on the ECP.
The PLAN mode has the following characteristics:

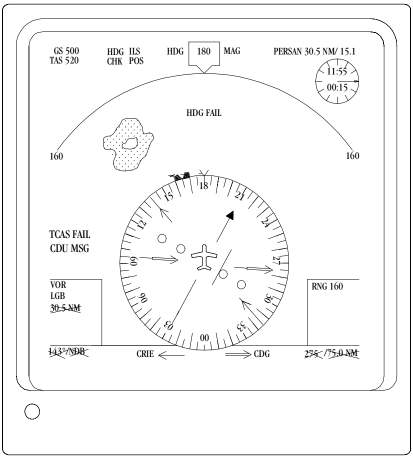
- It displays a north up flight plan.
- All map data may be displayed.
- Two range rings are centered in the display. The center of the rings corresponds with the reference waypoint selected through the MCDU. The half range ring is half the selected range.
- A north pointer is displayed in the lower right hand corner except when in the polar region (more than 85°) where the pole symbol is displayed.
- The airplane symbol is relative to true north when the present position is in the flight plan segment and range. When in the polar region (more than 85°), the airplane is relative to FMS true track.

KB1-3-0076

ND Test Displays (Typical)



MAP MODE

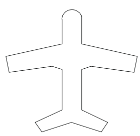
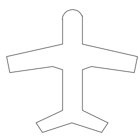
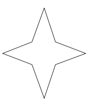
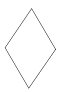
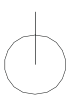
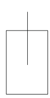
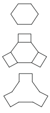
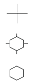


VOR/APPR MODE

All display failure indications will be displayed on the ND when the airplane is on the ground and the ANNUN LT TEST switch on the forward overhead panel is pushed.

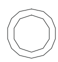
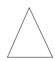
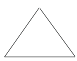
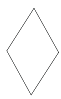
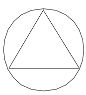
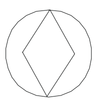
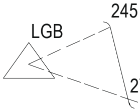
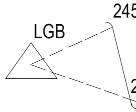
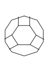
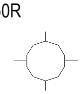
CAG(IGDS) KB1-3-0079

ND FLIGHT PLAN SYMBOLOGY (SHEET 1)

U.S. SELECTED	EUROPEAN SELECTED	EXPLANATION
		Airplane Symbol The airplane symbol is visible in all modes. In the PLAN mode the symbol will be displayed only if the present position of the airplane is within the flight plan segment and range. Symbol will point to true north, except in polar ranges above the 85¡ latitude when symbol will be referenced relative computed FMS track. In the MAP mode symbol will be oriented relative to airplane heading.
 PERSAN 12:00 FL230	 PERSAN 12:00 FL230	Waypoint and Waypoint Data The active (next) waypoint and its identifier are displayed in magenta; all other flight plan waypoints are displayed in white. Waypoint data consists of any constraint data from the FMS at the waypoint. Waypoint data is displayed in the same color (magenta or white) as the associated waypoint. Display of waypoint data is selected/deselected by pushing the DATA switch on the ECP.
		Airports Destination and departure airports are white and are displayed with runway lines (when available), or as parallel lines indicating runway orientation (scale 40 nautical miles or less). Display of Non-Origin/Destination airports (displayed as cyan circles) may be selected or deselected with the ARPT mode switch on the ECP.
 VOR VORTAC DME/TACAN	 VOR VORTAC DME/TACAN	VOR Non-tuned VOR, DME, or VOR/DME stations are displayed in cyan and can be selected or deselected by pushing the VOR switch on the MSP. Tuned stations (through MCDU) are displayed in white and are not deselectable through the ECP.

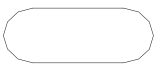
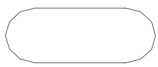
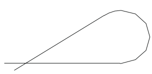
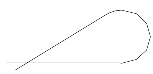
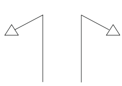
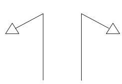
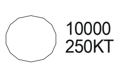
KB1-3-0080

ND Flight Plan Symbology (Sheet 2)

U.S. SELECTED	EUROPEAN SELECTED	EXPLANATION
		NDB Non-tuned or Non-Directional Beacons (NDB) are displayed in cyan and are selected/de-selected by pushing the NDB switch on the ECP. Tuned stations are displayed in cyan within a magenta circle and are not deselect-able through the ECP.
 LGB	 LGB	Ground Reference Points Ground reference points (non-flight waypoints) are displayed in cyan, and can be selected or deselected by pushing the WPT switch on the ECP.
 LGB		Selected Reference Points Up to two ground reference points or navaids may be selected through the MCDU. The appropriate symbol will be displayed in white circle. Points will be displayed even if sym-bology of the same class has been deselected through the ECP.
245 LGB  270	245 LGB  270	Selected Reference Points Radials Up to four (three selectable plus a beam) radials from selected reference points may be displayed as a white dashed line labeled with its bearing from the navaid. The display and selection of these radials is through the FMS MCDU.
250R  70	250R  70	Tuned Navaids Tuned navaids are displayed in magenta within a circle (indicating FMS selection).

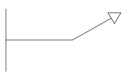
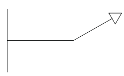
KB1-3-0081

ND Flight Plan Symbology (Sheet 3)

U.S. SELECTED	EUROPEAN SELECTED	EXPLANATION
		Holding Pattern Holding patterns are displayed using a race-track shaped symbol. For smaller ranges (80 n mi or less), the racetrack symbol is replaced with arcs and lines representing the actual flight path along the holding pattern. Holding patterns are generated by the FMS via the HOLD page. The pilot may select a holding pattern at present position (PPOS) or at a defined waypoint.
		Procedure Turns Procedure turns are displayed as a standard tear drop pattern. For smaller ranges (40 n mi or less) the procedure turn is replaced with arcs and lines representing the actual flight path in the procedure turn. Procedure turns are generated by the FMS through the PROC TURN page.
		Turn Direction Turn direction symbols are displayed in amber to indicate which direction to make a course change when it is not obvious such as a leg sequence discontinuity or a large course change.
		Speed Limit/Constraint (Climb or Descent) Altitude, speed limit, and a circle symbol represent the lateral path point the FMS predicts the climb or descent speed limit will be reached. Data is displayed in magenta. A speed limit may be entered or altered via the LEGS page on the MCDU. An altitude speed limit is defaulted into the flight plan as 250 knots at or below 10000 feet. Altitude speed limits may be altered or cleared.

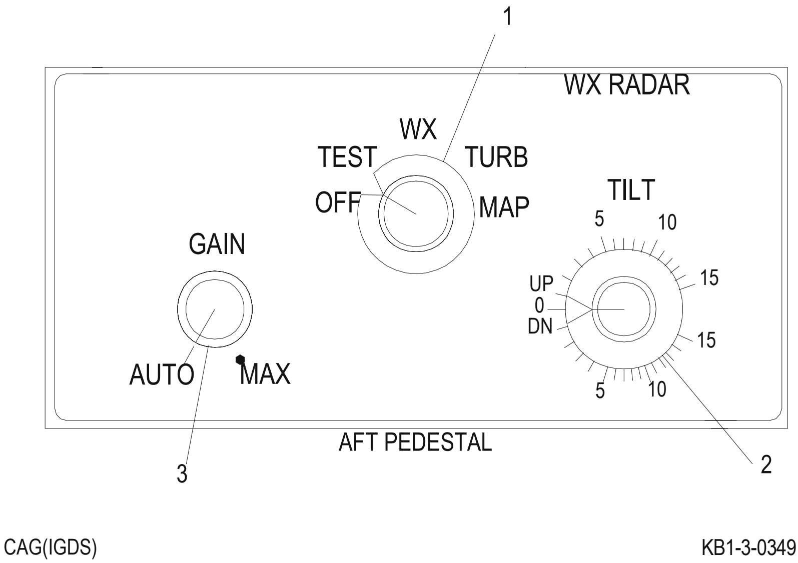
KB1-3-0082

ND Flight Plan Symbology (Sheet 4)

U.S. SELECTED	EUROPEAN SELECTED	EXPLANATION
		Step Climb The symbol is displayed in magenta and represents the lateral path point where the FMS predicts a step climb will begin.
		Top of Climb Flight level and a circle symbol represent the lateral path point along the flight path plan the FMS predicts the airplane will level off at the requested cruise level.

CAG(IGDS) KB1-3-0115

Weather Radar Control Panel



1. **Mode Selector**

   OFF - Turns radar off. PWS function is automatically enabled in flight below 2,300 feet RA.

   TEST - Tests system. If an LRU fault exists, test message on ND will identify failed component. In addition, PWS alerts are provided as follows:

   - PFD - Flashing amber and red WINDSHEAR AHEAD messages.
   - Aural Alert - MONITOR RADAR DISPLAY, GO AROUND WINDSHEAR AHEAD, and WINDSHEAR AHEAD, WINDSHEAR AHEAD.

   WX - Displays areas of precipitation.

   WX/TURB - Overlays turbulence on WX mode in magenta when turbulence exists.

   MAP - Displays local terrain feature.

2. **Antenna TILT Selector**

   Rotate - Tilts antenna up to +/- 15 degrees of the fuselage reference plane.

3. **GAIN Selector**

   MAX - Maximum receiver sensitivity.

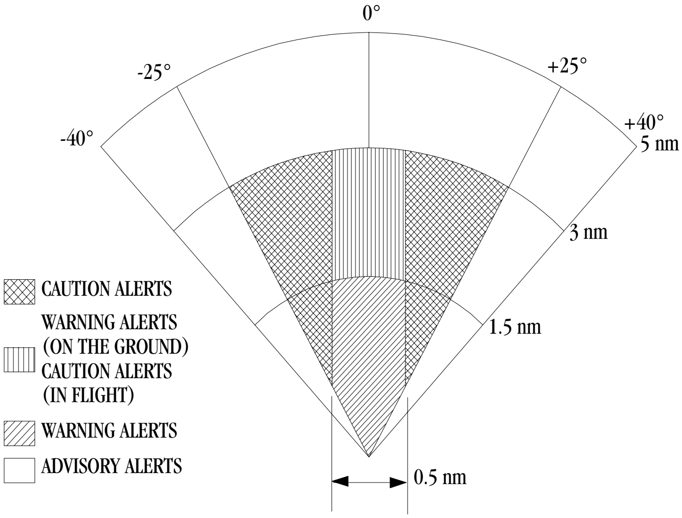
   AUTO - Automatically controls receiver sensitivity.

4. **STAB Switch**

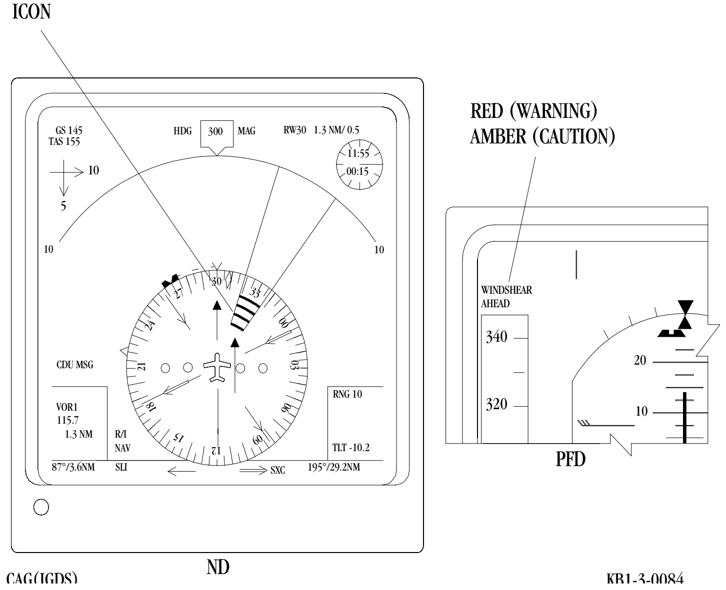
   ON - Provides a stabilized plane for antenna scanning to compensate for airplane pitch and roll.

   OFF - Maintains antenna alignment to airplane fuselage reference plane.

PWS Alerts

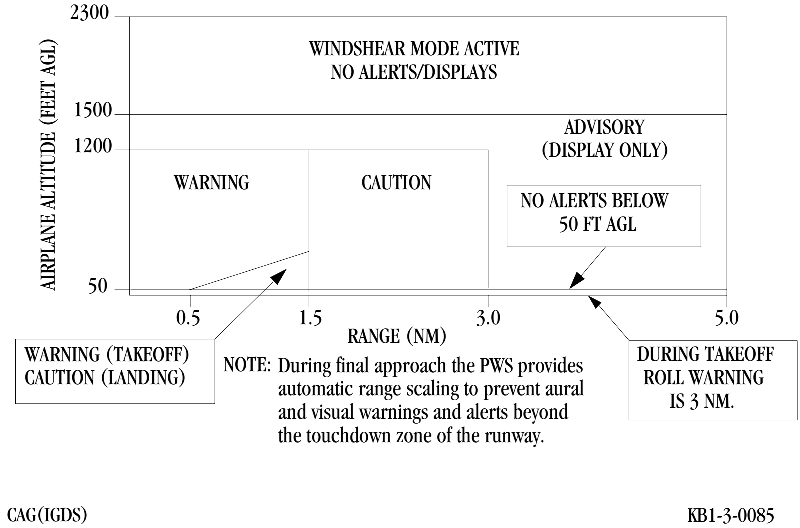


0°
-25°
+25°
-40°
+40°
5 nm
3 nm
1.5 nm
0.5 nm
CAUTION ALERTS
WARNING ALERTS (ON THE GROUND) CAUTION ALERTS (IN FLIGHT)
WARNING ALERTS
ADVISORY ALERTS

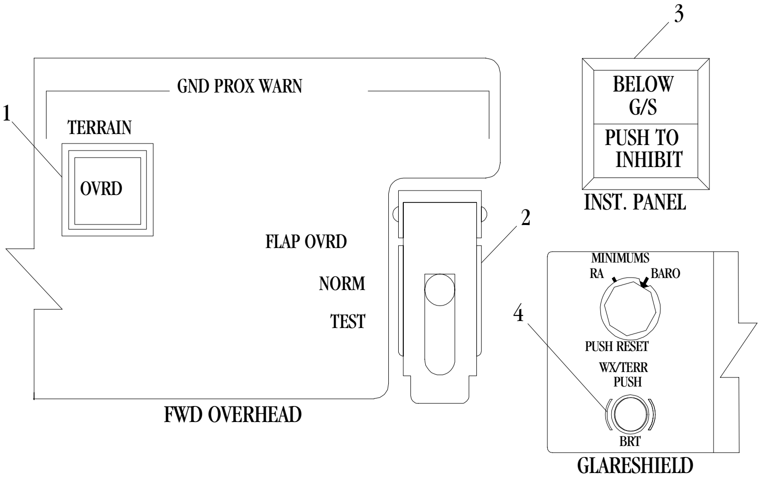


ICON
RED (WARNING)
AMBER (CAUTION)
GS 145
TAS 155
HDG 300 MAG
RW30 1.3 NM/ 0.5
11:55
00:15
CDU MSG
VOR1
115.7
1.3 NM
R/I
NAV
RNG 10
TLT -10.2
87°/3.6NM
SLI
SXC
195°/29.2NM
WINDSHEAR AHEAD
340
320
20
10
PFD
ND
CAG(IGDS)
KB1-3-0084

PWS Alert Envelope



EGPWS Controls



1. **TERRAIN Switch**

   Push - Disables the terrain awareness functions. Does not affect other EGPWS modes.

2. **GND PROX WARN Switch**

   FLAP OVRD - Inhibits warning when landing is made with less than normal landing flap configuration.

   NORM - Normal position.

   TEST - (Momentary) Tests system integrity.

3. BELOW G/S Switch

   Illuminate amber - Indicates excessive deviation below glide slope. Light is accompanied by voice warning GLIDE SLOPE.

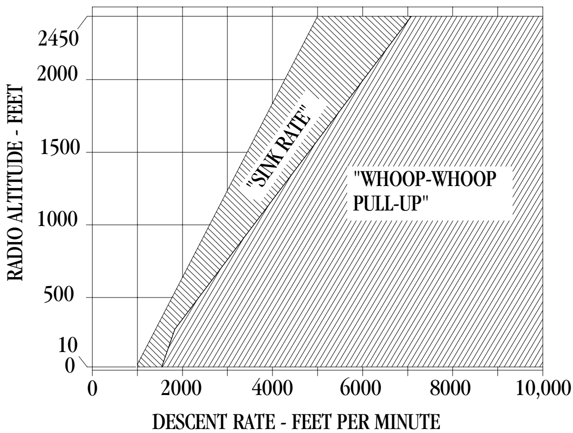
   Pushing switch when the airplane is below 1,000 feet RA inhibits or cancels warning.

4. **WX/TERR Switch**

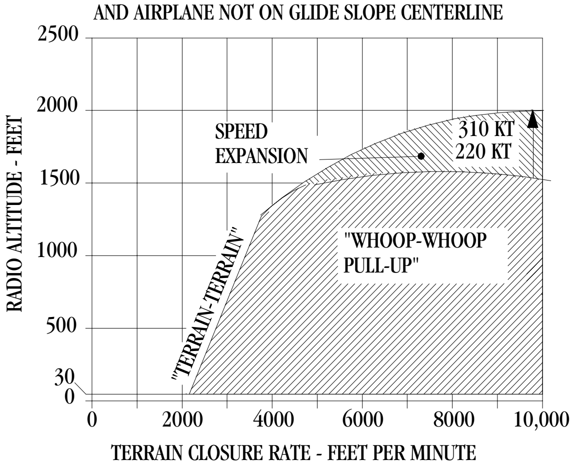
   Push - Selects weather radar display on ND (MAP, VOR and APPR modes). Push again to deselect weather radar. Terrain is displayed when weather radar is not selected.

EGPWS Envelope (Sheet 1)

MODE 1 - EXCESSIVE DESCENT RATE

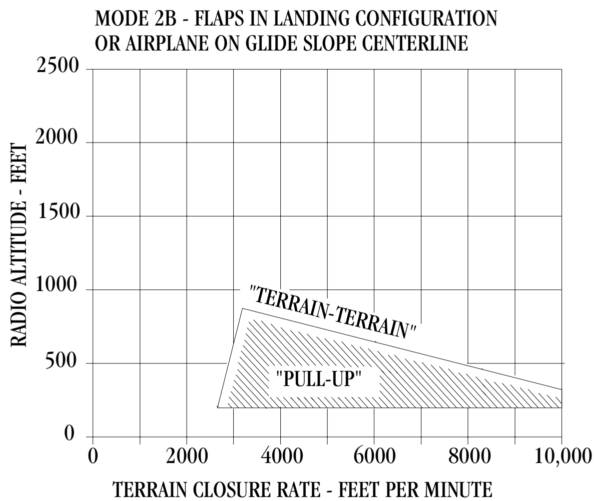


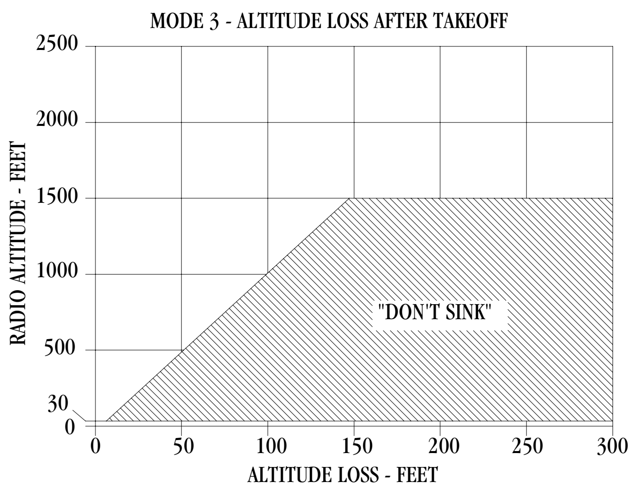
MODE 2A - FLAPS NOT IN LANDING CONFIGURATION
AND AIRPLANE NOT ON GLIDE SLOPE CENTERLINE



CAG(IGDS) KB1-3-0087

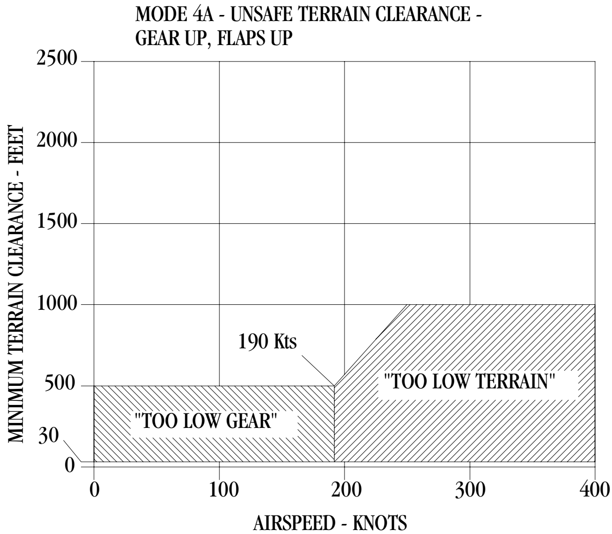
EGPWS Envelope (Sheet 2)

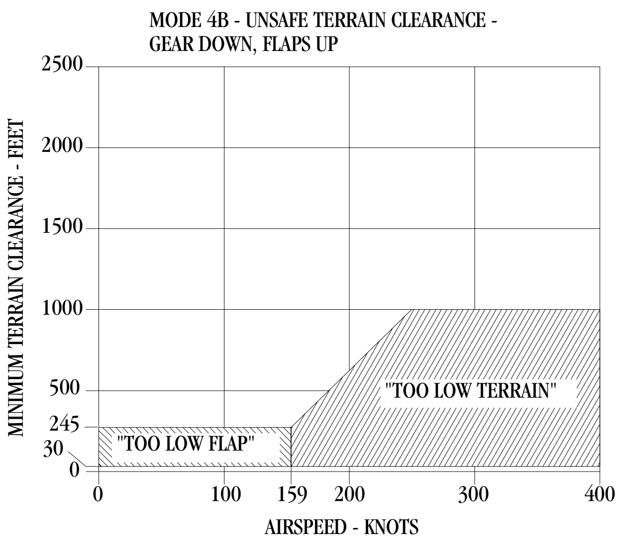




CAG(IGDS) KB1-3-0088

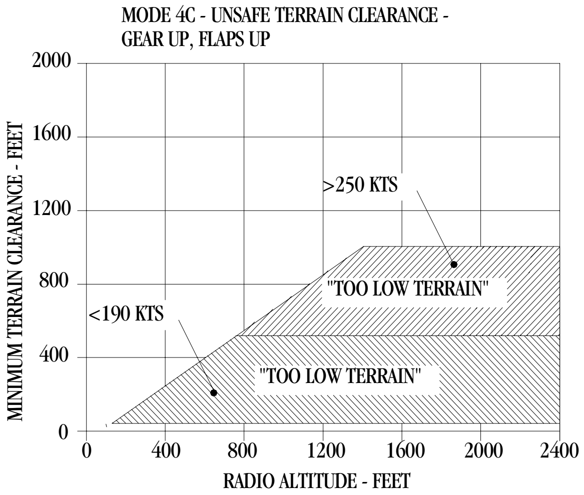
EGPWS Envelope (Sheet 3)

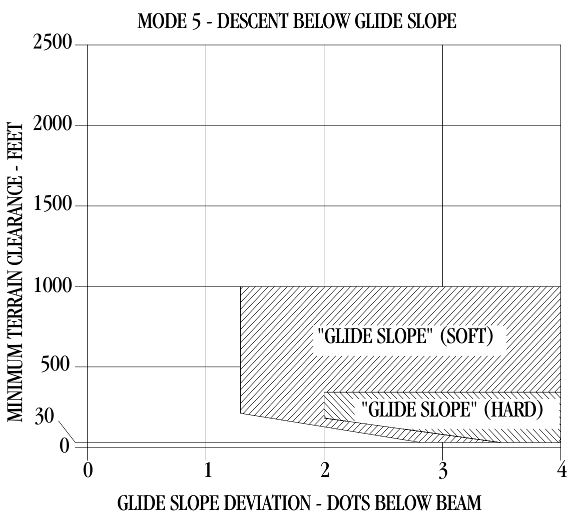




CAG(IGDS) KB1-3-0089

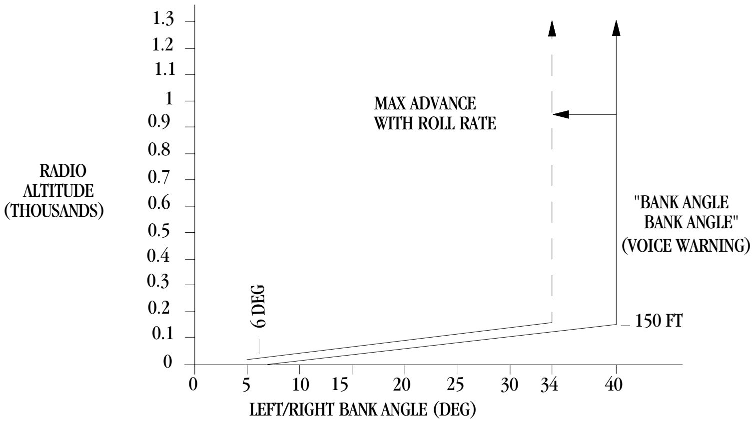
EGPWS Envelope (Sheet 4)





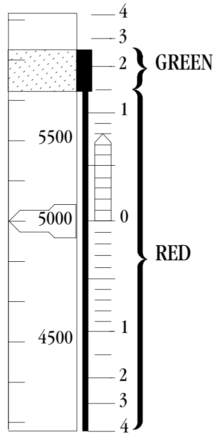
KB1-3-0090A

EGPWS - Bank Angle Warning Limits

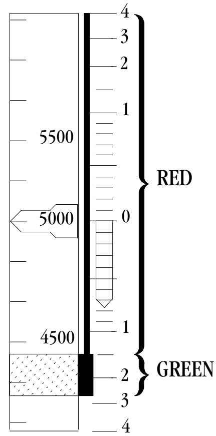


DB1-2-1666

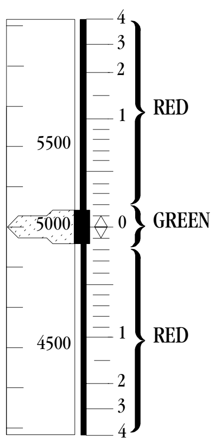
TCAS Resolution Advisories On PFD



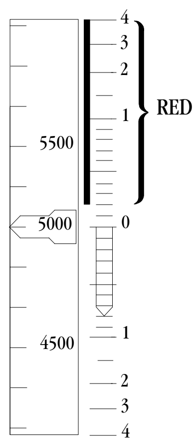
Corrective RA
Up Advisory
Climb >1500 fpm
Voice warning:
climb, climb, climb.



Corrective RA
Down Advisory
Descend >1500 fpm
Voice warning:
descend, descend,
descend.



Preventive RA
Don't Climb
Don't Descend
Voice warning: monitor
vertical speed.
No action required.

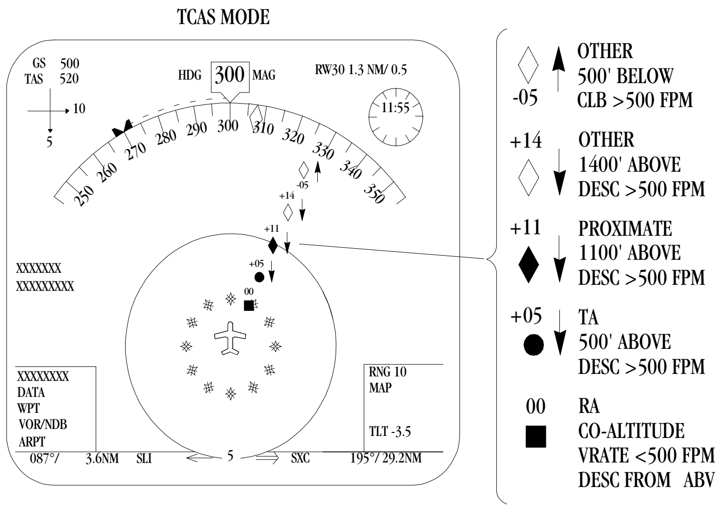


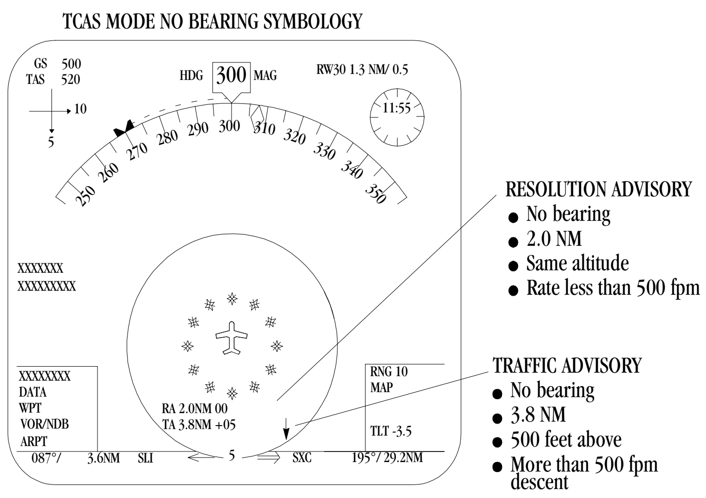
Preventive RA
Don't Climb
Voice warning: monitor
vertical speed.
No action required.

CAG(IGDS)

KB1-3-0092

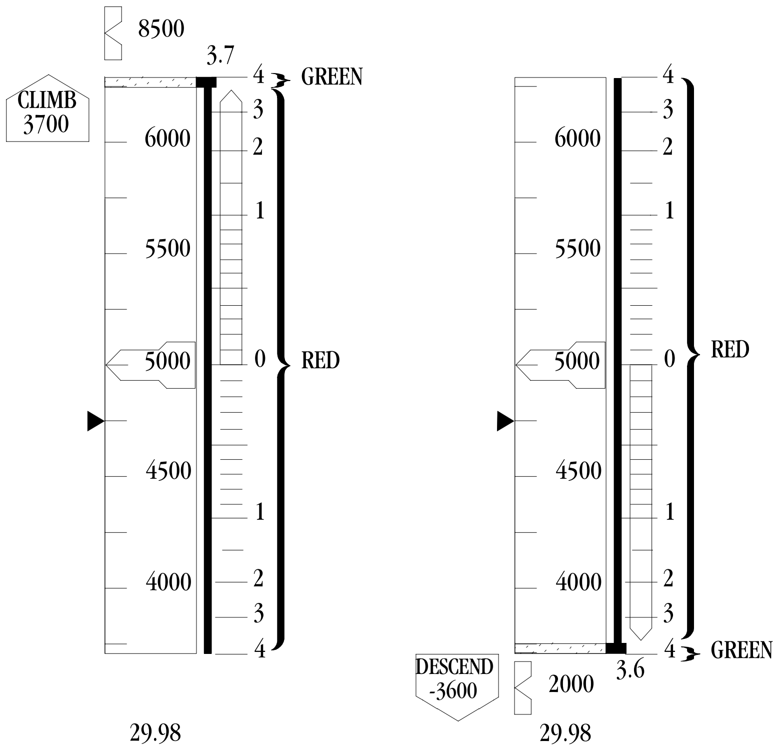
TCAS - ND Displays (Typical)





KB1-3-0093

TCAS - Off Scale RA On PFD



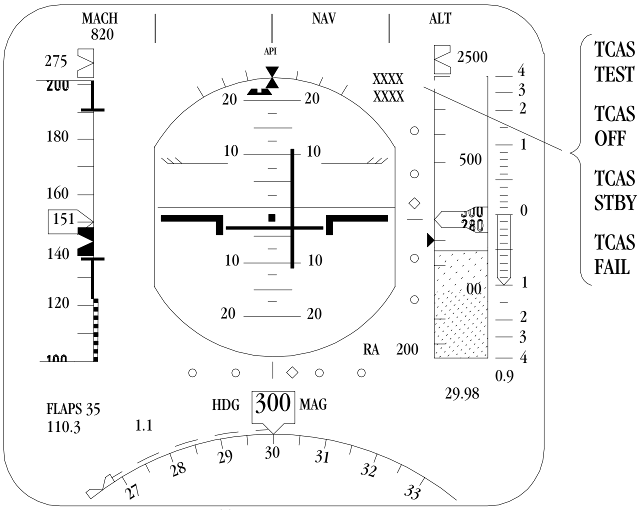
- Corrective RA
- Up advisory
- Climb 3700 fpm
- Voice warning:
  climb, climb, climb

- Corrective RA
- Down advisory
- Descend 3600 fpm
- Voice warning:
  descend, descend, descend

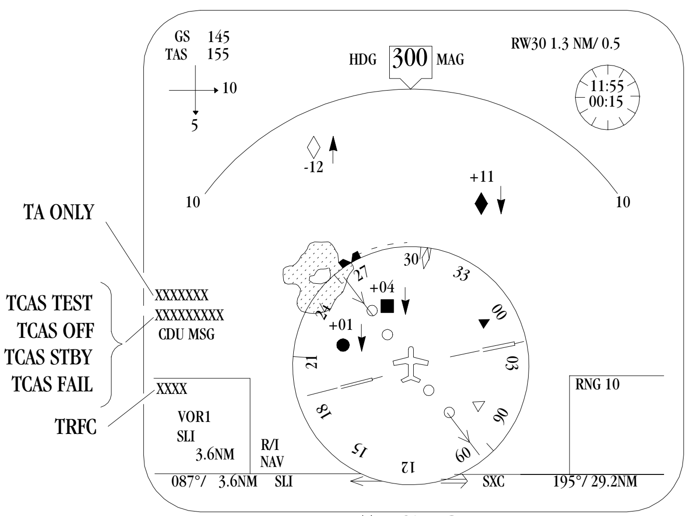
The limits of the PFD vertical speed tape are 4000 fpm climb and 4000 fpm descent. If an RA is more than 3000 fpm up/down, an appropriate climb or descend doghouse box appears. The required V/S appears in the box with the word CLIMB or DESCEND. The box and text are initially green, however, if desired V/S is not met the two lines forming the tip of the arrow are red and turn green when the required V/S is achieved.

CAG(IGDS) KB1-3-0094

TCAS Displays On PFD And ND



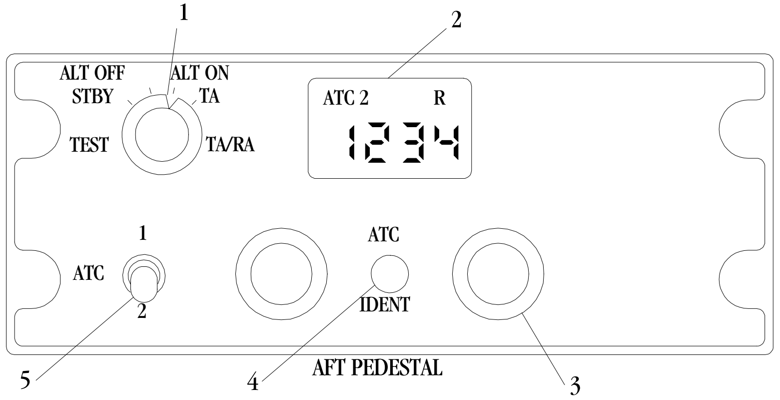
TYPICAL PFD



TYPICAL ND

CAG(IGDS) KB1-3-0095

ATC Transponder



1. **TCAS/Transponder Function Selector**

   TEST - Initiates system self test.

   STBY - Places system in standby.

   ALT OFF - Activates transponder without altitude reporting. TCAS is in standby.

   ALT ON - Activates transponder altitude reporting. TCAS is in standby.

   TA - Selects TCAS traffic advisory mode.

   TA/RA - Selects TCAS traffic and resolution advisory modes.

2. **Code Display Window**

   Displays code selected, active transponder and transponder function.

3. **Code Selector Knob (2)**

   Rotate - Selects transponder code.

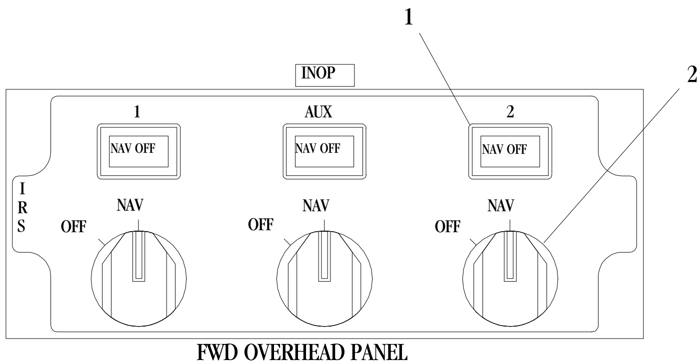
4. **IDENT Pushbutton**

   Push - Initiates pulse for identification (20 seconds).

5. **ATC Switch**

   1/2 - Selects respective transponder.

IRS Control Panel



1. **NAV OFF Light - amber**

Illuminates when:

- ADIRU is off.
- ADIRU is in align mode.
- Primary ADIRU failure.

Flashes if:

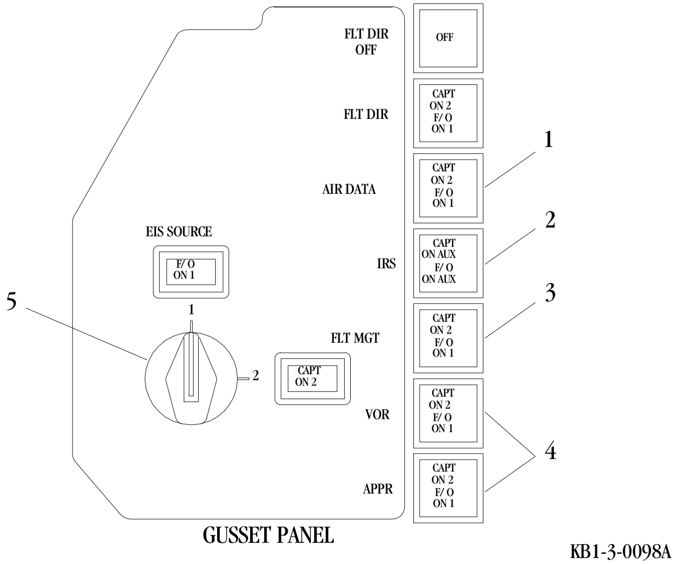
- During alignment, ADIRU does not receive present position initialization within 5 to 10 minutes of turn on.
- Present position entry fails the comparison test with either the stored or calculated present position.

2. MODE SELECTOR

OFF - Turns ADIRU off.

NAV - Normal position. After initial powerup, the align mode starts automatically. Align mode takes about 10 minutes if present position initialization has been done. A 3-minute fast realignment is done by cycling the selector from NAV to OFF to NAV within 5 seconds. Realignment is initialized with the existing attitude and heading.

Source Input Select Panel (Captain's)



1. AIR DATA Switch

   Push - Selects off-side ADIRU source for DUs. Switch illuminates amber. Pushing again restores normal, on-side ADIRU sources.

2. FLT MGT Switch

   Push - Selects off-side FMS source for DUs. Switch illuminates amber. Pushing again restores normal, on-side FMS sources.

3. VOR/APPR Switch

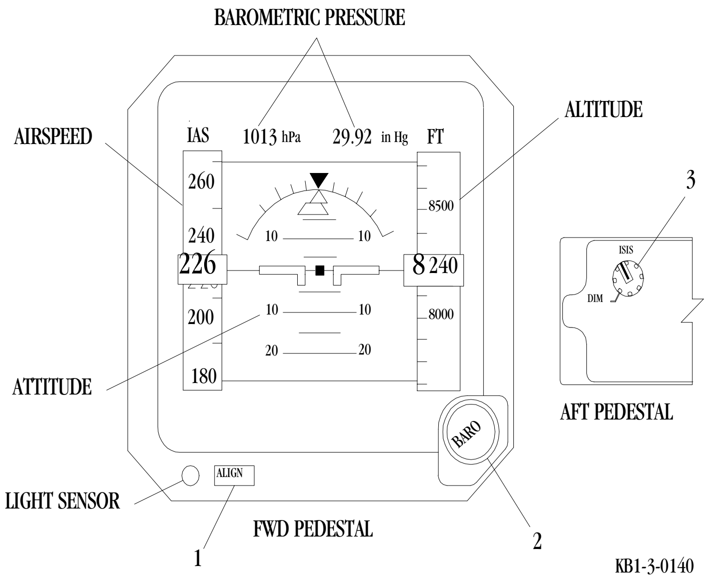
   Push - Selects off-side radio system. Switch illuminates amber. Pushing again restores normal, on-side radio sources.

4. EIS SOURCE Selector

   1 - Normal position for Captain's side.

   2 - Captain uses VIA-2 output for EIS. CAPT ON 2 light illuminates amber. If First Officer's selection is 1, F/O ON 1 light will illuminate amber.

Integrated Standby Instrument System



1. **ALIGN Button**

   Push - Resets attitude display. Airplane should be in level flight.

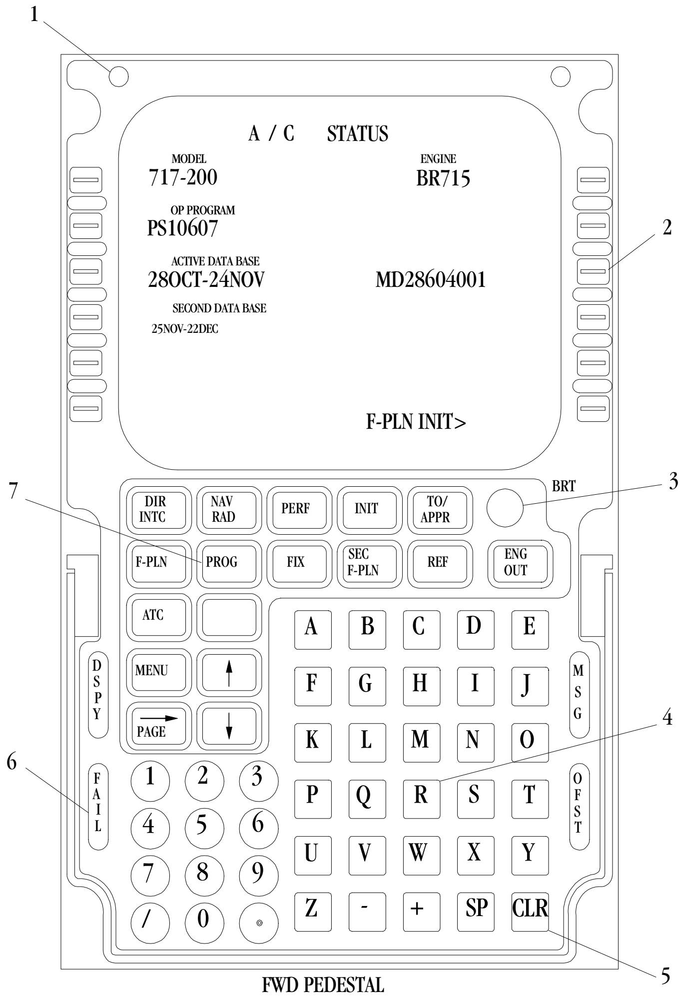
2. **BARO Set Knob**

   Sets barometric pressure display in inches of mercury.

3. **ISIS Knob**

   Rotate - Adjusts ISIS LCD brightness. The LCD will illuminate full bright automatically during electrical failure.

FMS - MCDU



KB1-3-0099A

1. **Light Sensor**

   Senses ambient light and automatically adjusts reference brightness level.

2. **Line Select Key**

   Push - Provides for the entry, selection, or deletion of information on an adjacent line.

   - Entry - Moves information to a selected line from scratchpad.
   - Selection - Selects a page, procedure, or performance mode as required. Moves information to scratchpad from selected line when the scratchpad is blank.
   - Deletes information from the selected line when DELETE is displayed in the scratchpad.

3. **BRT Knob**

   Rotate - Manually adjusts brightness of CRT display.

4. **Alpha/Numeric Keys**

   Push - Enters selected character into the scratchpad.

5. **Miscellaneous Keys**

   - CLR Key - Push to clear data in the scratchpad.
   - / Key - Used as a data separator.
   - SP Key - Not used.

6. **Message Light**

   MSG - Illuminates when the FMS generates a message displayed in the scratchpad.

   OFST - Illuminates when the airplane is flying a parallel offset of the active flight plan.

   DSPY - Illuminates when the current display is not related to the active flight plan leg or current performance mode.

   FAIL - Illuminates when the MCDU has stopped operating properly. The screen will be blank.

7. Function Keys

DIR INTC - Selects page for flying direct to, or intercepting a course to an off-route waypoint while on active leg.

NAV RAD - Selects NAV RADIO page for tuning VOR, ADF, and ILS.

PERF - Selects PERF page for performance modes.

INIT - Selects F-PLN INIT page for initialization.

TO/APPR - Selects TAKEOFF page when on the ground or APPR page in flight.

F-PLN - Provides access to the flight plan by leg description of the active flight plan route.

PROG - Selects PROGRESS page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates.

FIX - Selects FIX INFO page for creating reference point on the ND map.

SEC F-PLN - Selects SEC F-PLN INIT page for planning or evaluating changes to the active flight plan.

REF - Selects REF INDEX page where several reference pages can be accessed.

ENG OUT - Provides manual access to F-PLN or PERF page for review of engine-out performance. Automatic access is provided when FCC detects engine-out condition.

MENU - Selects MENU page to choose subsystems.

PAGE - Selects additional pages of a set when another page is required to complete the display of data.

ATC - Provides access to uplinked ATC messages if the FANS option is selected.

Up/Down Arrow - Provides up and down scrolling of flight plan, SID, STAR, and runway data that cannot be displayed on a single page. Can also be used to increment the latitude and longitude of the initial position data on the F-PLN INIT page.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

AIR DATA 1/2/ FAIL (MISC) - Respective air data system has failed.

DCU FAIL (MISC) - Data concentrator unit (DCU) has lost data.

IRS 1/2/AUX FAIL (MISC) - Respective inertial navigation portion of the ADIRU has failed.

Amber Alerts (Level 1)

ADIRU 1/2/AUX FAULT (STATUS) - Respective ADIRU has detected a fault.

ATC XPDR 1/2 FAIL (MISC) - Respective ATC transponder has failed.

DCU FAULT (MISC) - Data concentrator unit has lost data redundancy.

DME 1/2 FAIL (STATUS) - Respective DME receiver has failed.

EIS SINGLE SOURCE (MISC) - A single VIA channel is driving all six displays. Cross comparison is not available.

FLT REC FAIL (STATUS) - Flight data recorder has failed.

FMS 1/2 FAIL (MISC) - Respective flight management function within VIA 1/2 has failed.

GPS 1/2 FAIL (STATUS) - Respective GPS function of MMR has failed.

GPWS FAIL (MISC) - EGPWS computer has failed.

GPWS FAULT (MISC) - Displayed on SD when the ground proximity function of EGPWS has failed. Terrain awareness function is still operative.

ILS 1/2/3 FAIL (STATUS) - Respective ILS function of MMR has failed.

IRS BATT FAIL (MISC) - IDIRU-2 backup battery has failed.

IRS BATT LO (MISC) - ADIRU-2 backup battery is low.

IRS OFF (MISC) - One or more ADIRUs have been selected OFF.

IRS 1/2/AUX NO ALIGN (MISC) - Respective ADIRU has failed to complete an alignment.

IRS 2/AUX ON BATT (MISC) - ADIRU-2/AUX (optional) is powered by backup battery.

PRED WSHEAR FAIL (MISC) - Predictive windshear function of weather radar is inoperative.

PRED WSHEAR FAULT (MISC) - Predictive windshear has detected a fault.

TERRAIN FAIL (MISC) - Displayed on SD when the terrain awareness function of EGPWS has failed. The ground proximity function is still operative.

TERRAIN NOT AVAIL (MISC) - Displayed on SD when the terrain awareness function is not available.

UNABLE RNP (MISC) - Navigation system cannot meet required navigation performance (RNP) accuracy for the selected phase of flight.

VIA CONFIG DISAG (MISC) - VIA-1 and VIA-2 configurations do not agree.

VIA FAIL (MISC) - VIA computer has failed.

VIA FAULT (STATUS) - VIA computer has detected an internal fault.

VOR 1/2 FAIL (STATUS) - Respective VOR receiver has failed.

Cyan Alerts (Level 0)

CDU 1/2 MENU REQ - Respective MCDU is not displaying FMS pages.

GPWS FLAP OVRD - GND PROX WARN switch is in FLAP OVRD position.

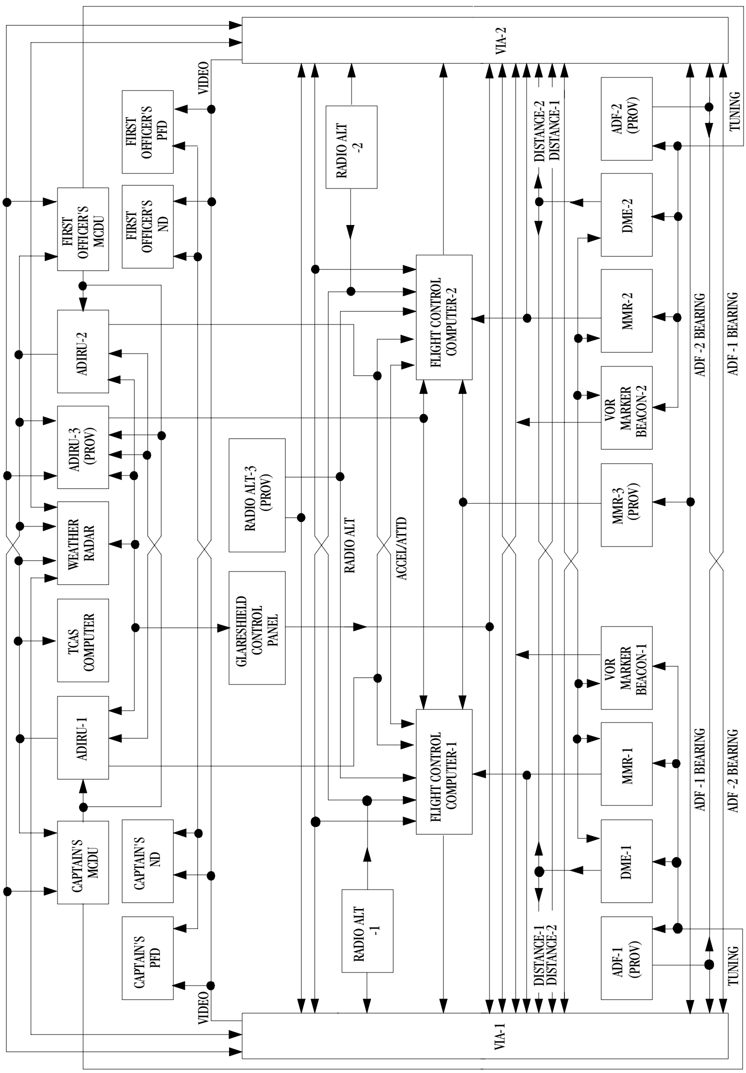
IRS IN ALIGN - IRS is in alignment mode.

PRED WSHEAR OFF - Weather radar is off when it should be on.

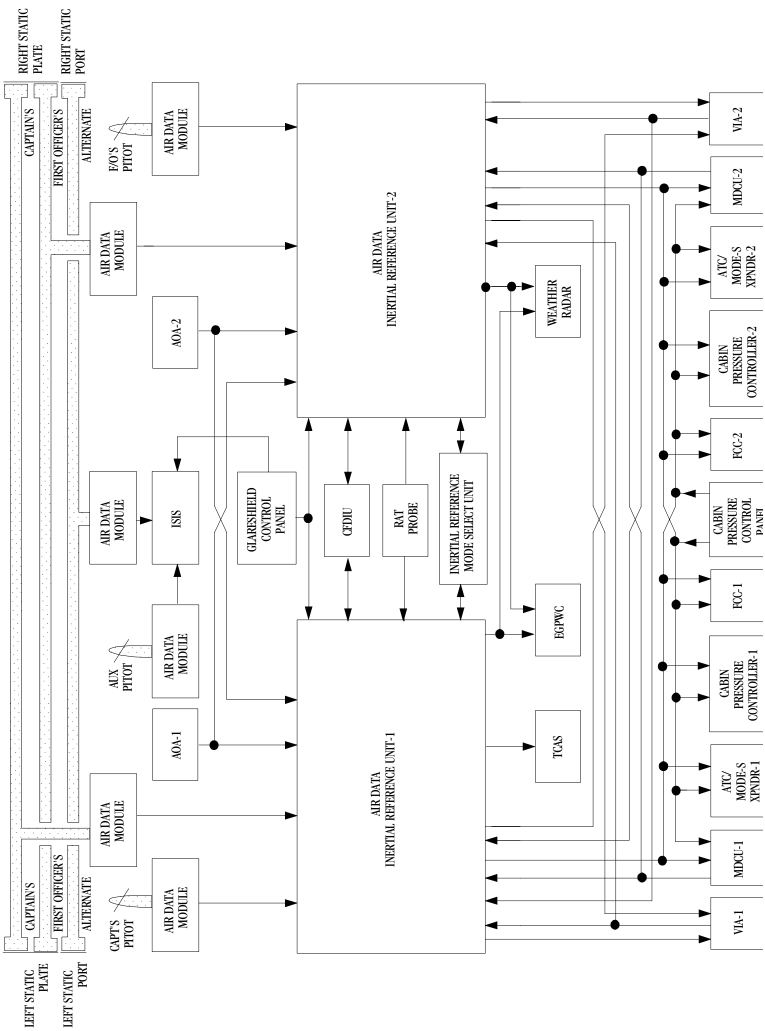
TERRAIN OVRD - EGPWS terrain mode is off.

FUNCTIONAL SCHEMATIC

Navigation System



Air Data System



FMS

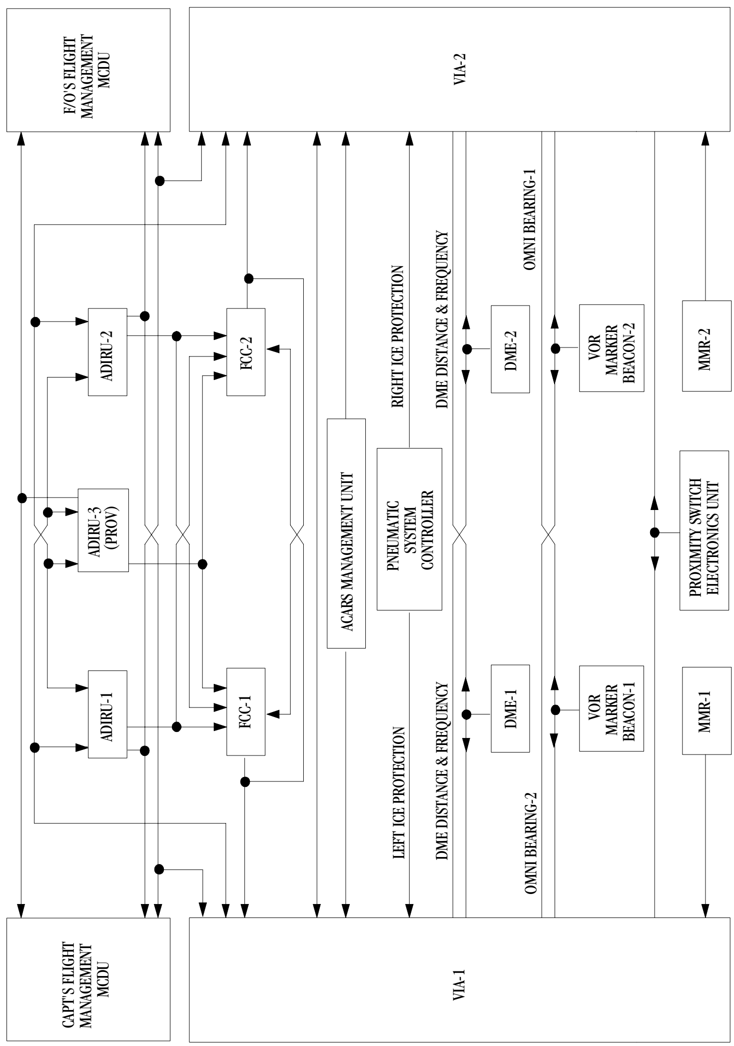

F/O'S FLIGHT MANAGEMENT MCDU
VIA-2
ADIRU-2
FCC-2
ADIRU-3 (PROV)
ACARS MANAGEMENT UNIT
PNEUMATIC SYSTEM CONTROLLER
RIGHT ICE PROTECTION
DME DISTANCE & FREQUENCY
DME-2
OMNI BEARING-1
VOR MARKER BEACON-2
MMR-2
PROXIMITY SWITCH ELECTRONICS UNIT
ADIRU-1
FCC-1
LEFT ICE PROTECTION
DME DISTANCE & FREQUENCY
DME-1
OMNI BEARING-2
VOR MARKER BEACON-1
MMR-1
CAPT'S FLIGHT MANAGEMENT MCDU
VIA-1

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TABLE OF CONTENTS

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LANDING GEAR AND BRAKES

INTRODUCTION

The airplane has a tricycle landing gear configuration consisting of a nose gear and two main gear assemblies. Pressure for extension and retraction of the landing gear is provided by the right hydraulic system.

Each main gear wheel is equipped with hydraulic disc brakes. Both hydraulic systems supply pressure for the brakes.

LANDING GEAR/BRAKE CONTROLS AND INDICATORS

The landing gear handle is located on the center instrument panel. Adjacent to the gear handle is the GEAR HANDLE RELEASE button. The gear position lights are located above and to the left of the gear handle, they indicate a safe or unsafe gear position. Landing gear positions are also indicated by the landing gear position indicators on the CONFIGURATION synoptic.

A warning horn and voice warning are also part of the gear position indicating system. The GEAR HORN button is located on the forward pedestal. When the GEAR HORN button is pushed, the landing gear warning horn is silenced, unless landing flaps have been selected.

Nose gear steering is controlled either by the nose gear steering wheel located on the left console or by the rudder pedals.

The toe portion of the rudder pedals is used to apply brake pressure. The PARK BRAKE knob is located in the center of the nose gear steering wheel. The ANTISKID switch is located on the forward overhead panel.

The crew is notified of advisories, faults or malfunctions in the landing gear, anti-skid or brake system by the warning and alerting system. Landing gear data is displayed on the CONFIGURATION page of the systems display. The lower portion of the display is a diagram of the tires and brakes. Secondary landing gear position indicators are displayed as small oval symbols. These symbols indicate a safe or unsafe condition.

GEAR HANDLE

8. Landing gear retraction and extension is controlled by the landing gear handle. The gear is retracted by pulling the handle out against spring tension moving it to the full UP position and then releasing it.
9. The gear is extended by pulling out on the handle moving it to the full DOWN position and releasing it.

EMERGENCY GEAR EXTENSION LEVER

The emergency gear extension lever is located in the floor on the right side of the pedestal and is used to extend the gear if the normal method fails. When the lever is raised and latched, the landing gear will free fall to the down and locked position.

NOSE GEAR

The nose gear consists of dual wheels mounted on a steerable shock strut. The gear is locked in both extended and retracted positions by an overcenter linkage. During normal operation, the nose gear is retracted and extended by hydraulic power. If a hydraulic power failure occurs when the gear is in the retracted position, the gear can be unlocked manually to free-fall to the extended and locked position by using the emergency gear extension lever.

Four doors enclose the wheel well when the nose gear is retracted. After the gear is extended, the forward pair of doors are closed and the aft pair are open.

MAIN GEAR

Each main gear consists of dual wheels mounted on the shock strut. The gear is retracted inboard into a wheel well. Two doors enclose the wheel well when the main gear is retracted. After the gear is extended, the inboard door hydraulically re-closes and the outboard door remains open.

The main gear is held in the retracted position by hydraulic pressure, if hydraulic pressure fails, the inboard door and its associated uplatch will hold the gear in the retracted position. Normally, the gear is retracted and extended by hydraulic power. If a hydraulic failure occurs when the gear is in the retracted position, the inboard door can be unlatched manually, using the emergency gear extension lever, to allow the gear to free-fall to the extended and locked position.

GEAR WARNING

Landing gear lights (LEFT, NOSE, RIGHT) and the Systems Display (SD) CONFIGURATION synoptic illuminate green to indicate that the landing gear and landing gear handle are in the down-and-locked position. The light(s) will illuminate red when the gear is not locked in the position that corresponds to the position of the gear handle.

The GEAR DOOR OPEN alert will be displayed anytime either one or both main gear doors are not closed.

The takeoff warning horn and vocal warning will sound when both throttles are advanced for takeoff when the parking brakes are set.

The landing gear warning horn and vocal warning will sound in the following conditions:

- Landing gear is not down and locked with flaps extended in the landing range.
- Landing gear is not down and locked, throttles retarded, airspeed is less than 210 KIAS, and altitude is below 1200 feet (radar altitude). The aural/vocal warning for this condition can be silenced by pressing the GEAR HORN button on the pedestal.

NOSEWHEEL STEERING

Nosewheel steering is hydraulically operated, using both hydraulic systems, and mechanically activated by use of the steering wheel or rudder pedals.

Normally the steering wheel provides control of the nosewheel steering through an arc of approximately 80 degrees left or right. The rudder pedals provide control of nosewheel steering through an arc of approximately 15 degrees left or right. With only one hydraulic system operating, steering is restricted (both in degrees and rate of turn) to approximately 55 degrees in the direction of the operating system and approximately 80 degrees in the direction of the inoperative system.

During gear retraction, the steering mechanism is deactivated and the nose gear is automatically centered.

Steering is also affected by use of the emergency gear extension lever. When the lever is raised, the right hydraulic system is isolated from the landing gear. As a consequence, nose gear steering is restricted to the left, even when both hydraulic systems are operating.

While the steering system is in the neutral position, the cylinders function as shimmy dampers. For towing, a manually operated bypass valve is provided to deactivate the steering system permitting manual turning of the nose gear.

BRAKES AND ANTISKID

Each main gear wheel is equipped with disc-type brakes operated by two independent hydraulic brake systems. Both hydraulic brake systems power each brake assembly. The systems are synchronized to simultaneously apply the brakes. Each is equipped with an accumulator of sufficient capacity to provide brake pressure to stop the airplane should both hydraulic systems fail.

The main gear wheels are equipped with fuse plugs. If the brakes overheat the plugs will melt, causing the tires to safely deflate. The temperature of each brake is displayed on the CONFIGURATION synoptic. When brake temperatures exceeds specific limitations, the digits are boxed in amber.

The brake pressure indication displays left and right brake system hydraulic pressure.

The parking brake is set by pushing the brake pedals, lifting the PARK BRAKE knob and releasing the brake pedals. When the parking brakes are set, the PARK BRAKE ON alert is displayed on the EAD.

NOTE

Brake pressure for parking is 1700 PSI minimum to assure at least 8 hours parking time.

WARNING

Do not set parking brake if "BRAKE OVER-HEAT" alert is displayed.

When ready for takeoff, and the parking brakes have not been released, a boxed BRAKES message is displayed. When the parking brakes are not released and the throttles are advanced, the PARK BRAKE ON alert is displayed. In addition, the takeoff warning horn and aural warning will sound.

Each brake system incorporates an anti-skid feature. The purpose of the anti-skid system is to allow maximum wheel braking without skidding the tires.

In addition, the anti-skid system provides touchdown protection in flight, which prevents brake application until after wheel spinup. At low taxi speeds, the anti-skid system is automatically disabled to allow manual braking.

The ANTISKID switch is located on the forward overhead. When the switch is pushed, the OFF light illuminates, indicating the anti-skid system is off and the ANTISKID OFF alert is displayed on the EAD. The anti-skid system is tested automatically whenever power is applied. When a malfunction occurs, an associated anti-skid alert is displayed.

NOTE

For an accurate brake wear indication, parking brake must be set.

CAUTION

If 10 minutes after parking the warmest brake is less than 260 degrees C and decreasing, and the “BRAKE OVERHEAT” light is not displayed on the EIS, then no waiting period or inspection is required prior to taxiing. However, if a brake is hotter than 260 degrees C, or the “BRAKE OVERHEAT” light is displayed, then a full 50 minute (ramp time) waiting period and a check of the tire pressures is required.

WARNING

Do not take off if any brake temperature exceeds 170°C.

GROUND SHIFT SENSING

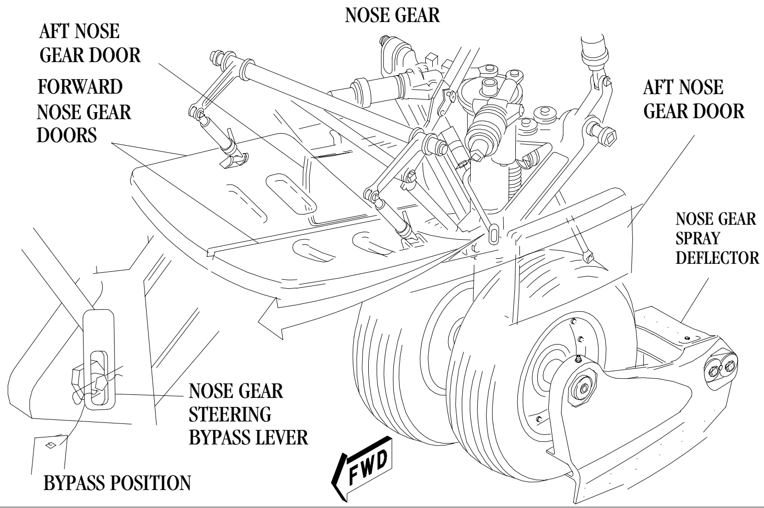
The ground shift sensing system signals various airplane systems as to whether the airplane is on the ground or in flight. The ground shift sensing mechanism is located on the nose gear. The linkage connects the ground shift relays to the nose gear strut position. When the strut extends, airplane systems are shifted into the flight mode by the left and right ground control relays.

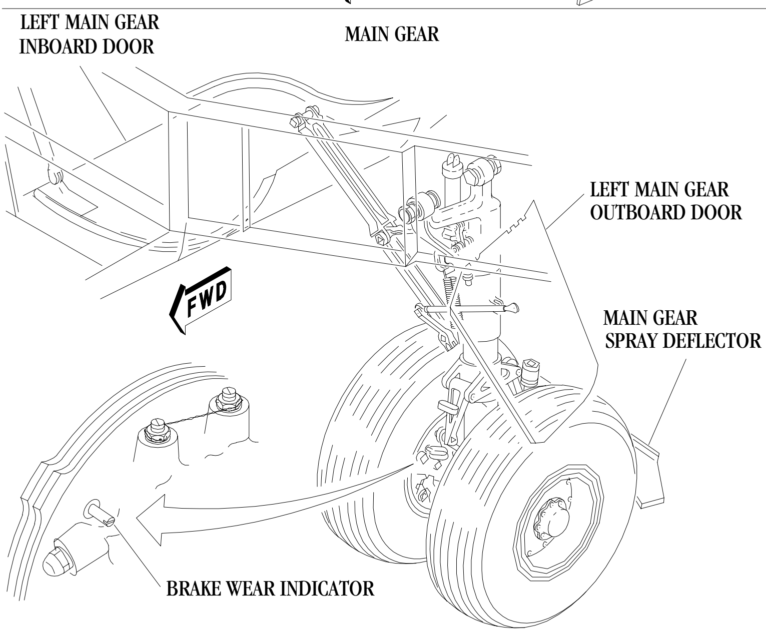
After landing with nose strut compression, the ground control relays are shifted to the ground mode. In addition, a ground control interlock switch is located above the nose gear to prevent a false ground mode signal as the gear extends.

The landing gear handle anti-retraction release mechanism is also connected to the ground shift sensing mechanism. When the airplane is on the ground, the handle is locked in the DOWN position. When the nose strut is extended, the anti-retract mechanism is released allowing gear handle movement to the UP position. If the anti-retract mechanism fails to release, the gear handle can be raised by pulling out the handle, then pushing the GEAR HANDLE RELEASE button and then moving the handle to the UP position.

COMPONENTS

Major Component Locations

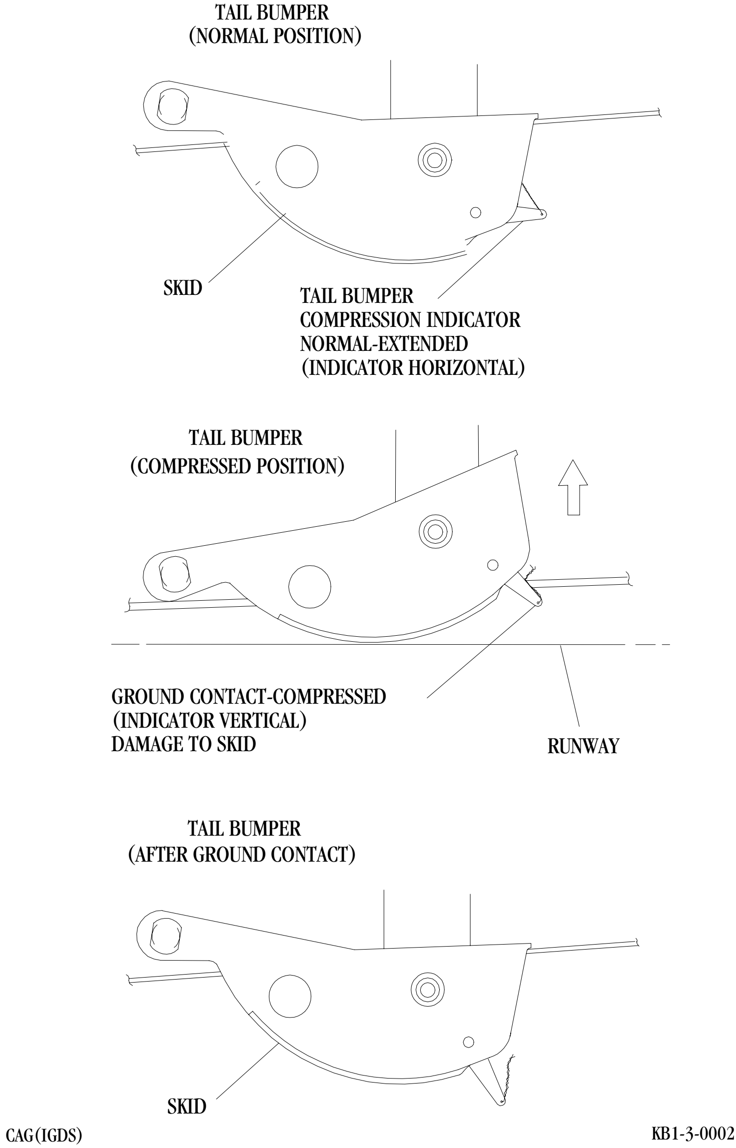




(LEFT MAIN SHOWN - RIGHT SIMILAR)

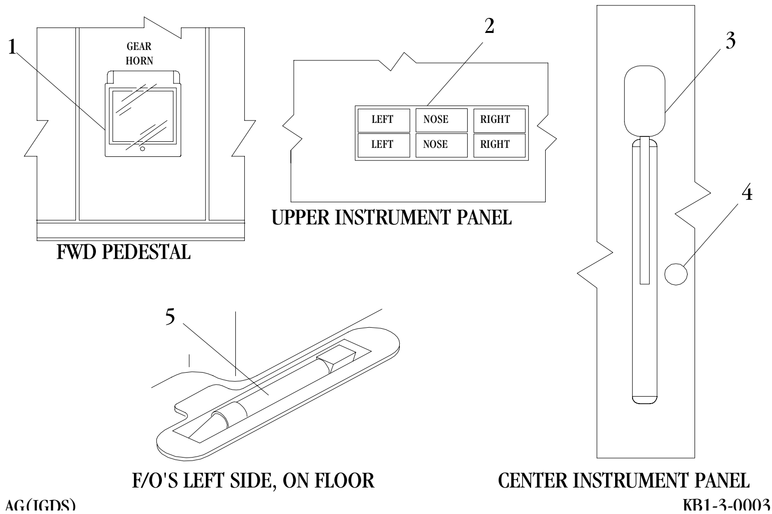
KB1-3-0001A

Tail Bumper And Compression Indicator



CONTROLS AND DISPLAYS

Gear Handle/Indicators



1. GEAR HORN Button (Forward Pedestal)

   Push - Silences landing gear warning horn and vocal warning except when gear is not down & flaps are extended for landing; gear must be down & locked to silence warning.

2. Gear Lights (LEFT, NOSE, RIGHT)

   Green - Landing gear is down and locked.

   Red - Respective landing gear is not locked in position that corresponds to the position of gear handle.

3. Gear Handle

   Up - Retracts landing gear.

   Down - Extends landing gear.

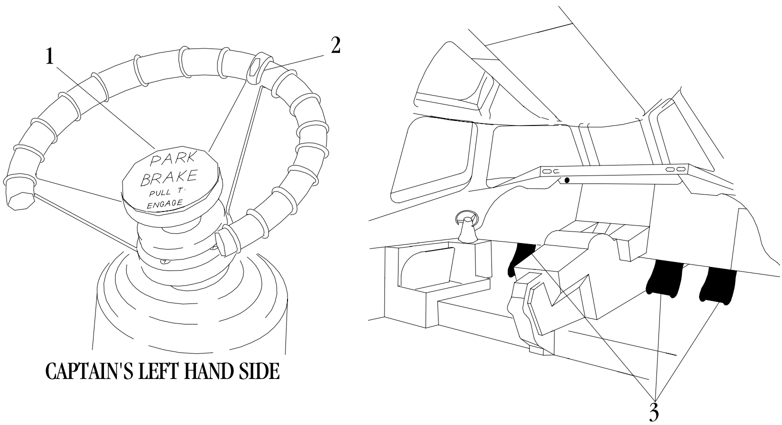
4. Gear Handle Release Button

   Push - Allows to raise gear handle in the event of ground shift system malfunction after takeoff.

5. Emergency Gear Extension Lever

   Pull - Allows landing gear to free-fall to down and locked position.

Brakes/Nosewheel Steering



KB1-3-0004

1. **PARK BRAKE Knob**

   Pull - Sets parking brake when both brake pedals are simultaneously depressed.

2. **Nose Gear Steering Wheel**

   Rotate - Overrides rudder pedal steering to turn nose wheel up to approx. 80 degrees in either direction.

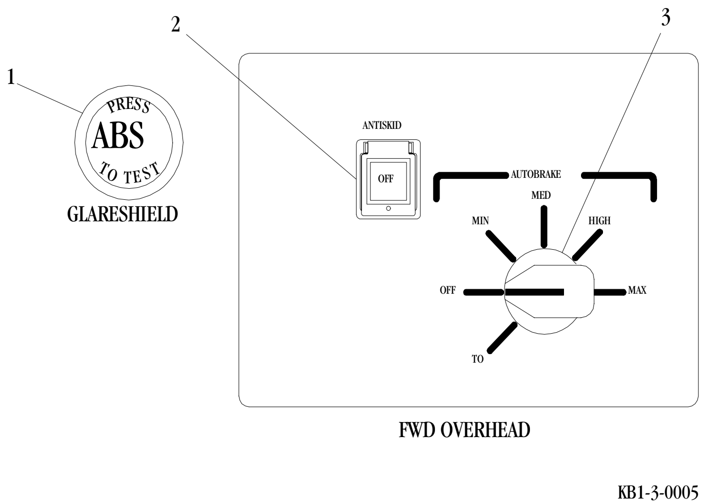
   Relative position of the nosewheel is indicated by the index on the wheel.

3. **Rudder/Brake Pedals**

   Push Full Pedal - Controls nosewheel steering up to approx 15 degrees in either direction.

   Push Top of Pedal - Actuates wheel brakes.

Antiskid Selector Panel

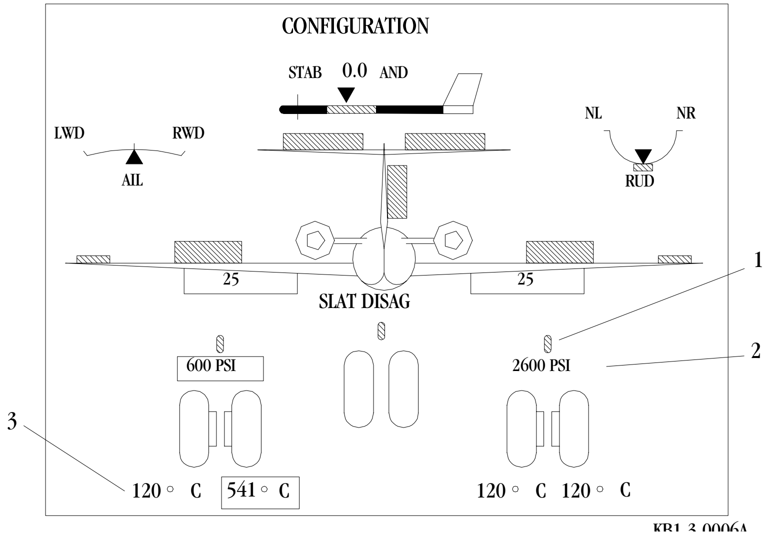


1. **ANTISKID Switch**

   ON - Activates antiskid system.

   OFF - Deactivates antiskid system.

SD Synoptic - Configuration



1. **Secondary Gear Lights**

   White - Landing gear is up and locked.

   Green - Landing gear is down and locked.

   Red - Indicates one of the following:

   Landing gear is not down & locked & gear handle is down

   Landing gear is in transit or not in agreement with gear handle

   Any unsafe gear condition exists.

   Green and Red - Disagreement in position indicators or ANNUN LT TEST Switch has been depressed.

2. **Brake Pressure**

   White - Normal range

   Amber - Falls below low pressure limit. Value is boxed.

3. **Brake Temperature**

   Indicates a relative value of wheel brake temperature:

   White - Normal range

   Amber - Exceeds temperature limits. Value is boxed.

NOTE

After landing, brake temperature differential up to 60°C on the same gear is considered normal.

ALERTS

NOTE

The associated cue switch is shown in parenthesis (XXX) following the alert.

Amber Boxed Alerts (Level 2)

ANTISKID L/R FAIL (CONFIG) - Respective antiskid system is inoperative.

BRAKE OVERHEAT (CONFIG) - Brake temperature exceeds 260°C. Resets when temperature falls below 230°C.

GEAR DOOR OPEN (CONFIG) - One of the main landing gear doors is open.

Amber Alerts (Level 1)

ANTISKID FAULT (STATUS) - (Ground only) Antiskid system has detected a fault. Antiskid is still fully functional.

ANTISKID OFF (CONFIG) - ANTISKID switch is OFF.

BRAKE PRES LO (CONFIG) - One or both brake accumulator pressures are low.

PSEU FAIL (CONFIG) - The proximity sensor system has failed, resulting in loss of gear, door, and slat position information.

PSEU FAULT (STATUS) - The proximity sensor system has logged an internal fault or detected a failure of a redundant sensor.

Cyan Alerts (Level 0)

PARK BRAKE ON - (Ground only) Parking brakes are set. If parking brakes are not set, indicates an antiskid malfunction.

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TABLE OF CONTENTS

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WEIGHT AND BALANCE

INTRODUCTION

AirTran uses the Adjusted Weight Unit Loading method - a fast and accurate means of calculating Weight and Balance for the B-717 aircraft.

DESCRIPTION OF THE LOADING SYSTEM

Adjusted Weight Unit

The Adjusted Weight Unit Loading is based on combining weight and balance units into one value, called Adjusted Weight Units, such that the aircraft weight and CG are determined by simple addition of Adjusted Weight Units. The first two digits to the left of the decimal and the digit to the right of the decimal correspond to the moment values expressed as Percent MAC Index Units. The remaining leading digits correspond to the weight values rounded to the nearest 100 lb increment.

Assumptions and Data

The assumptions and reference data used to develop this system, along with instructions for its use, are presented in AirTran's B717-200 Weight And Balance Manual. The datum weight and station 20% MAC were carefully selected in order to minimize the difference between the true CG (% MAC) and the approximate CG (Percent MAC Index Units). The Percent MAC Index Unit at the datum weight (104,000 lbs.) agrees exactly with the actual percent MAC. At all other gross weights, the CG, expressed as Percent MAC Index Units, is sufficiently close to the actual percent MAC.

Zero Fuel Weight and Takeoff Weight Center Of Gravity

The system is designed such that a Zero Fuel weight center of gravity check is made and a Takeoff weight center of gravity check is made. Each of these points must be within the depicted loading limit envelope.

Passenger And Baggage Weights

Standard Passenger Weights include a weight allowance of an average of one piece of carry-on baggage per passenger at a weight of 10 lbs. Passengers are allowed a maximum of one carry-on bag. AirTran standard weights are as follows:

Domestic Scheduled:	170 lbs. Summer
	175 lbs. Winter
Supplemental (Leisure Charter):	170 lbs. Summer
	175 lbs. Winter
Children ages 2 through 12	80 lbs.
Domestic or Supplemental: (Non-Standard groups)	Actual or Declared Weight (add 10 lbs. to weight for hand carried baggage).

The following are the seasonal dates:

- Summer: 1 May thru 31 Oct.
- Winter: 1 Nov thru 30 April.

On all supplemental flights carrying Leisure Charter groups, AirTran's policy is to use the normal average weights, charts, and manifests for Weight and Balance purposes. On supplemental flights carrying non-standard weight groups (i.e. athletic squads, etc.) AirTran Airways will use actual or declared passenger weights and add 10 lbs. per passenger for carry-on items.

Children under the age of two years are considered babes-in-arms and need not be accounted for in the weight and balance calculation.

Military Weights

On supplemental flights carrying military personnel all military personnel will be weighed or the weights of the personnel will be obtained by the gate agent from the military.

Baggage Weights

Average baggage weights are used according to the following schedule:

- Domestic scheduled: 25 lbs. per bag.
- Supplemental and Flag: 30 lbs. per bag.
- Military duffel bags: Military cargo will be weighed.

Cargo Weights

Any item not considered civilian baggage is cargo and actual weight must be used. This includes COMAT and aircraft parts. When working with cargo, ensure that the listed weight is in pounds. If the stated weight is in kilograms (kilos) multiply 2.205 to obtain pounds.

Mail

All mailbags must be clearly marked or tagged with the weight in pounds. Mail is treated as cargo.

BALLAST

When operating with low passenger and cargo loads, aircraft may experience problems with the CG exceeding the aft limit. When this occurs, the CG may be moved forward to bring it into limits by loading ballast into the forward cargo compartment. All ballast must be clearly marked with the weight in pounds. When ballast is loaded in the FWD cargo compartment it is treated as FWD cargo. AFT ballast is treated as AFT cargo. The following limitations apply:

- Each item of ballast must be clearly marked with weight in pounds.
- A torn bag may not be used.
- Check that ballast is secured.

Fuel Used As Ballast

If ballast is not available, fuel may be loaded into the center fuel tank and this fuel serves as ballast. The use of fuel as ballast is authorized.

Limitations on the use of fuel are listed below.

- The use of fuel as ballast must be approved by System Operations Control (SOC).
- Approval for the use of fuel as ballast is valid for one flight only. Subsequent flights require additional approval.
- Fuel used as ballast must be included in the zero fuel weight and the zero fuel weight center of gravity of the aircraft.
- The fuel quantity indicator for the tank or tanks being used for ballast must be operative.
- Ballast fuel may not be used during flight.

Procedures For Use of Fuel as Ballast

Obtain SOC approval for the use of ballast fuel.

Verify that the Fuel Quantity indicator of the ballast designated tank is operative.

Load the desired ballast fuel in the center tank.

Place placard(s) adjacent to the affected tank(s) pump switches. The placard will read:

Ballast Fuel Only - Do Not Use for Flight”.

Ensure that the ballast fuel is included as part of the zero fuel weight and zero fuel weight CG.

If it is necessary to operate subsequent fights with ballast fuel, repeat above steps for each flight.

The table on the following page provides Adjusted Weights for ballast fuel in the Center Wing Tank.

Center Wing Tank Ballast Adjusted Weights

WEIGHTS	ADJ WT UNITS	WEIGHTS	ADJ WT UNITS
600	599.9	3,600	3599.2
800	799.9	3,800	3799.1
1,000	999.8	4,000	3999.1
1,200	1199.8	4,200	4199.0
1,400	1399.7	4,400	4399.0
1,600	1599.7	4,600	4598.9
1,800	1799.6	4,800	4798.9
2,000	1999.6	5,000	4998.8
2,200	2199.5	5,200	5198.8
2,400	2399.5	5,400	5398.7
2,600	2599.4	5,600	5598.7
2,800	2799.4	5,800	5798.6
3,000	2999.3	6,000	5998.5
3,200	3199.3	6,077	6098.5
3,400	3399.2		

Termination Of Use Of Ballast Fuel

When ballast fuel is no longer needed it may be terminated as follows:

- Advise SOC that ballast fuel is not needed on the next flight.
- Remove the placard(s) as described in the section.
- Ensure fuel tanks are loaded in accordance with FUEL LOADING limitations in Limitations section.

PASSENGER LOADING

While passengers have assigned seating, some movement of passengers or cargo may be required to ensure that the center of gravity is within limits. Since the B717-200 is relatively tail heavy, aircraft load planning (i.e. seat assignments/cargo loading) should be carried out so that passenger and cargo compartments will be loaded from front to back in order to produce the most forward center of gravity possible for the given load.

BAGGAGE LOADING

The forward cargo bin should be loaded first and unloaded last during the loading process.

CREW CONFIGURATION WEIGHT CODES

There are six Crew Configuration Weight Codes:

C1	2 Pilots, 3 F/As (1 aft, 2 forward)
C2	2 Pilots, 3 F/As (1 aft, 2 forward) + 1 Observer
C3	2 Pilots, 4 F/As (2 aft, 2 forward)
C4	2 Pilots, 4 F/As (2 aft, 2 forward) + 1 Observer
CF1	2 Pilots
CF2	2 Pilots + 1 Observer

(Observer always sits in the cockpit.)

AIRTRAN AIRWAYS LOAD PLAN, OPS FORM FD-201

This form will be completed and signed by the person supervising the aircraft loading, and then delivered to the flight crew at least ten minutes prior to aircraft departure.

The following are detailed instructions for preparing the AIRTRAN AIRWAYS LOAD ADVISE FORM FD-201.

ITEM 1: FLIGHT: Enter the flight number.

ITEM 2: DATE: Enter the date of the flight. (Local)

ITEM 3: SHIP: Enter the aircraft's fleet number. (i.e. 917)

ITEM 4: CITY PAIR: Enter the city pair for loading information to be entered to the right.

ITEM 5: PAX: This entry on the form is subdivided into Business Class (rows 1-3), Forward Coach (rows 10-21), Aft Coach (rows 22-31), and children to include all aircraft occupants other than the crew and children under the age of 2. This includes revenue, non-revenue, and people riding on jumpseat paperwork. If the crew elects to have a jumpseat rider (JSR) occupy an actual jumpseat, the crew will deduct the person from the PAX entry and include them as crew weight on the form FD-300 Weight and Balance manifest.

ITEM 6,7: FORWARD BAGGAGE: This entry is to record the contents of the forward cargo compartment. Two boxes are provided, but only one should be used at a time. If the cargo compartment is loaded with only bags, then the bag count is all that needs to be entered in the box marked "#". If the cargo compartment is loaded with a mixture of bags and other items (i.e. comat, mail, cargo, etc.) then the bag count must be converted to a weight using the loading tables on the opposite side of the form and added to the weight of the other items. This weight is then recorded in the blank marked "LBS" (item 7), leaving the "#" box empty.

ITEM 8,9: AFT BAGGAGE: This entry is to record the contents of the aft cargo compartment. Two boxes are provided, but only one should be used at a time. If the cargo compartment is loaded with only bags, then the bag count is all that needs to be entered in the box marked "#". If the cargo compartment is loaded with a mixture of bags and other items (i.e. comat, mail, cargo, etc.) then the bag count must be converted to a weight using the loading table of the opposite side of the form and added to the weight of the other items. This weight is then recorded in the blank marked "LBS" (item 9), leaving the "#" box empty.

ITEMS 10-17: TOTALS: This row of boxes is what the crew will use to enter data onto the weight and balance manifest (Form FD-300). The station agent will enter amounts in these boxes by totaling the information in the boxes above for each respective entry. (i.e. PAX, CHILDREN, ETC.)

NOTE

The total of Business, Fwd Coach, Aft Coach and Children should equal the number of passengers on board other than infants under the age of 2. Crew, including occupants of a cockpit or F/A jumpseat, are not recorded on this form. Do not double count children.

ITEM 18: CITY PAIR: Enter the city pair for the loading information to be entered to the right.

ITEM 19: INFANTS: Record the number of infants (under age 2). This number is used by the crew to figure the total number of souls on board if the need arises.

ITEM 20: UMs: Record the number of unaccompanied minors traveling on this flight.

ITEM 21: WHEELCHAIRS: Record the number of passengers requiring wheelchair assistance at the destination.

ITEM 22: LOADED BY: Signature of the ramp agent responsible for aircraft loading.

Instructions for using the Form and a Baggage Weight Conversion Chart is printed on the back of each form.

SAMPLE LOAD PLAN FORM (FD 201)

AirTran ***Load Plan*** **Flight # __(1)__ Date __/(2)/__ Ship _(3)_**

	PAX INFO				CARGO / BAGGAGE INFO			
CITY PAIR					FORWARD		AFT	
	Bus. Class	Fwd Coach	Aft Coach	Children	#	LBS	#	LBS
(4) –	(5)	(5)	(5)	(5)	(6)	(7)	(8)	(9)
–								
TOTALS	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

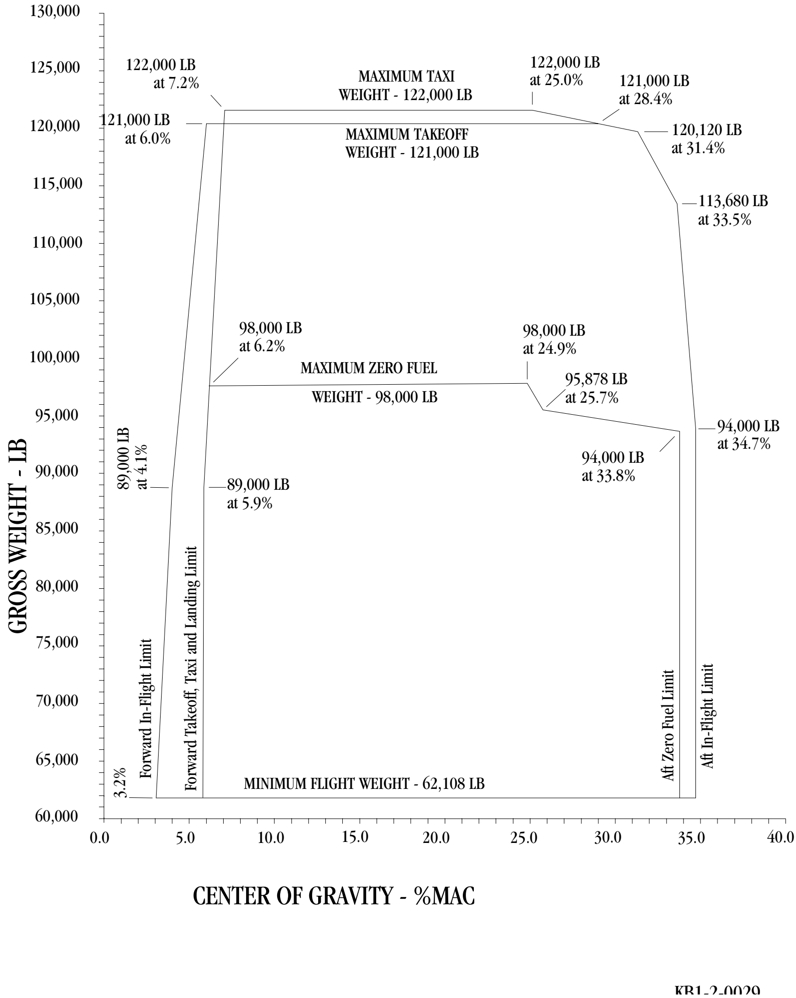
ADDITIONAL INFORMATION

CITY PAIR	Infants	UM's	Wheelchairs
(18)–	(19)	(20)	(21)
–			

LOADED BY: (Signature)_______(22)___________________________

FORM FD-201 1/99 [1]

CENTER OF GRAVITY ENVELOPE



WEIGHT AND BALANCE MANIFEST FORM INSTRUCTIONS (FD-300)

The weight and balance must contain the following at takeoff time:

Weights of:

- Aircraft (including oil);
- Fuel;
- Baggage;
- Passengers;
- Crewmembers.

Max allowable weights for:

- Takeoff performance;
- Enroute performance;
- Landing performance.

Total aircraft weight.

Center of gravity within limits.

Form FD-300 Instructions

The following are detailed instructions for preparing B717-201 Weight and Balance Manifest Form FD-300.

ITEM 1-4: Enter the **“LOCAL” DATE, FLIGHT NUMBER, DEPARTURE STATION AND A/C NUMBER** (i.e., 701) in the spaces provided.

ITEM 5: CAPTAIN: Print the Captain’s name.

ITEM 6: F/O: Print the First Officer’s name.

ITEM 7: AIRCRAFT EMPTY WT. (AEWT): Enter the aircraft empty weight units as reflected on the computerized flight plan.

ITEM 8: CREW WT. CODE: Enter the crew weight code from the top left of Form FD-300.

ITEM 9: CREW WEIGHT: Enter the adjusted weight units for the appropriate crew. Refer to Crew Code Listing on rear of Form FD-300.

ITEM 10: BASIC OPER. WT. (BOW): Enter the basic operating weight as the sum of the AEWT plus the crew wgt (Items 7 + 9).

ITEM 11: BUS CLASS PAX: Enter the adjusted weight units for the number of business class passengers from the back of Form FD-300.

ITEM 12: FWD. COACH PAX: Enter the adjusted Weight Units for the number of passengers in the forward coach cabin from the back of Form FD-300.

ITEM 13: AFT COACH PAX: Enter the adjusted Weight Units for the number of passengers in the aft coach cabin from the back of Form FD-300.

ITEM 14: CHILDREN: Enter the adjusted Weight Units for the number of children from the back of Form FD-300.

NOTE

The addition or deletion of up to 5 passengers (the passengers and their bags) is permitted without recalculating the passenger weight provided the calculated takeoff gross weight is not within 1000 lbs. of any limiting weight. Limiting weights of an aircraft include the structural weight limitations, and the Performance Limited Max Allowable Takeoff Weight (item 38 of this form).

ITEM 15:FORWARD CARGO: Enter the Adjusted Weight Units for the weight or # of bags in the forward cargo compartment. This number can be found on the back of the Form FD-300.

ITEM 16:AFT CARGO: Enter the Adjusted Weight Units for the weight or # of bags in the aft cargo compartment. This number can be found on the back of the Form FD-300.

ITEM 17:FUEL BALLAST: Enter the indexed weight for the amount of fuel used as ballast as obtained from the AOM fuel ballast chart.

ITEM 18: ZERO FUEL WEIGHT/PERCENT MAC INDEX UNITS-: Enter the sum of items 10 through 17. <u>This weight must not exceed the MAX ZFW limit of the aircraft as shown on the flight release.</u> The ZFW Percent MAC Index Units are the last 3 digits of the Zero Fuel Weight enclosed in the small black box. Refer to the Loading Limits Envelope on the right side of the Form FD-300. Use the grid to locate and mark the intersection of the zero fuel weight and the ZFW Percent MAC Index Units. This point must fall within the forward and aft loading limit. If not, redistribute cargo/passengers.

ITEM 19: TAKEOFF FUEL (LBS.): Enter the Adjusted Weight Units for the fuel. This number can be found on the back of the Form FD-300. This number has the standard 500 lb. taxi burn already accounted for in the weight and C.G.

NOTE

If the taxi burn is 1,000 pounds instead of 500 pounds, then you must interpolate between the fuel adjusted weight units .

Example

Ramp fuel is 20,000 pounds with taxi burn of 1,000 pounds. In this case, instead of looking at 20,000 on the back of the FD-100, you would look at the 20,000 pound line and the 19,000 pound line and interpolate between the two adjusted weight units. You would get an adjusted weight of 19001.8.

ITEM 20:TAKE-OFF GROSS WEIGHT/ PERCENT MAC SETTING: Enter the sum of items 18 and 19. <u>This weight must not exceed the Maximum Structural or performance limited Take-off weight for the aircraft as shown on the flight release</u>. The Percent MAC Setting will be the last 3 digits displayed in the double lined box. Refer to the Loading Limits Envelope on the right side of the form FD-300. Use the grid to locate and mark the intersection of the Take-off weight and Percent MAC Units. This point must fall within the forward and aft loading limit. If not, redistribute cargo/passengers. The flight crew will validate runway selection and performance limited take-off weight.

ITEM 21:FUEL CONSUMPTION: Enter the fuel consumption weight here as obtained from the fuel burn on the flight release.

ITEM 22:EST. LANDING WT.: Subtract item 21 from item 20 and enter the result in the space provided. This weight must not exceed the Maximum Structural Landing Weight or the performance limited weight at the destination airport (*see next item*).

ITEM 23:DEST. MAX. LDG. WT.: Enter the maximum allowable landing weight as obtained from the Runway Analysis Manual or the Flight Release for the destination airport in the space provided. Use the most restrictive weight shown (i.e., Runway, Approach Climb, or Structural Landing Weight).

ITEM 24:CORRECTIONS: If corrections need to be made at any point in the calculations, draw a line through the incorrect part of the calculation and continue the calculations from that point down in the corrections column.

NOTES

The shaded areas of Form FD-100 are not required to be filled in. They are provided as work areas for the convenience of the crew.

Items 25-37 are optional. Normally the Max Allowable Takeoff Weight, found on the Performance Data page of the Dispatch Release papers, is entered directly into item 38. If desired, shaded item boxes 25-37 may be used for Wind and/or MEL/CDL corrections to compute the Max Allowable Takeoff Weight. The Runway and Second Segment Climb Weights for item boxes 29 and 34 are obtained from the Stewart Manual. The computed Corrected Runway Limited and Second Segment Climb Weights are then compared with the Maximum Structural Takeoff Gross Weight (box 37). The lowest of these three numbers is entered into item box 38. Be aware that this computation does not consider fuel burn or Max Landing Weight at the next station.

ITEM 25: TEMP/WIND: Enter the reported temperature and wind direction/velocity for the departure airport.

ITEM 26: RNWY: Enter the runway number and the flap setting to be used for takeoff.

ITEM 27: RNWY LMT WT.: Enter the limited gross weight for the runway, temperature, and flaps.

ITEM 28: WIND COMP.: For the wind direction/velocity entered in item 25, enter the wind component in the space provided.

ITEM 29: LBS./KTS: Enter the weight correction factor for head or tailwind component, as appropriate, found at the bottom of the runway analysis chart for the runway number entered in item 26.

ITEM 30: WIND COMP WEIGHT CORRECTION: Multiply item 28 by item 29 and enter the resultant weight here in the item 30.

ITEM 31,32:PENALTIES: Refer to the flight release or Runway Analysis page. If any weight penalties are to be applied to the runway limited weight, note the nature of the penalty (e.g., "ANTI-SKID INOP") in item 31, then enter the total weight penalty in item 32.

ITEM 33: CORRECTED RUNWAY LIMITED WEIGHT: Add (for headwind) or subtract (for tailwind) item 30 and subtract item 32 from item 27. Enter the result here in item 33.

ITEM 34: SECOND SEGMENT CLIMB WEIGHT: Enter the second segment climb limited weight for the temperature and flaps noted in items 25 and 26.

ITEM 35: PENALTIES: Follow the instructions for ITEMS 31 and 32. If weight penalties are to be applied to the second segment climb limited weight, enter them here in item 35.

ITEM 36: CORRECTED SECOND SEGMENT CLIMB WEIGHT: Subtract item 35 from item 34 and enter the result here in item 36.

ITEM 37:MAX. STRUCT. TAKEOFF GROSS WEIGHT: Enter the aircraft's Maximum Structural Weight here in item 37.

ITEM 38:MAX. ALLOWABLE TAKEOFF WEIGHT: Enter the Maximum Allowable Takeoff Weight (from the computer flight plan) or the lesser of items 33, 36 or 37.

ITEM 39: PILOT NAME: Print the name of the person preparing the Form FD-300. This can be either the Captain or First Officer.

ITEM 40: SIGNATURE: Signature of the preparer (name on item 39).

ITEM 41: NOTES: This block is optional for ATIS, clearance information, performance, power settings or any other notes.

SAMPLE WEIGHT AND BALANCE FORM FD 300

AirTran

717-200
WEIGHT & BALANCE

FORM FD-300
[SAMPLE]

12 Seat Business
105 Seat Coach

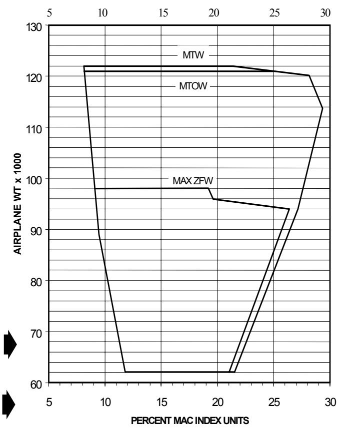
Crew WT Code Table (See back side for wgts).

C1: 2 Pilots, 1 Aft F/A, 2 Fwd F/As
C2: 2 Pilots, 1 Aft F/A, 2 Fwd F/As, 1 Flt Deck Obs
C3: 2 Pilots, 2 Aft F/As, 2 Fwd F/As,
C4: 2 Pilots, 2 Aft F/As, 2 Fwd F/As, 1 Flt Deck Obs
CF1: 2 Pilots
CF2: 2 Pilots, 1 Flt Deck Obs

All grayed areas are optional information and are not required to be filled out for each flight. They are provided as worksheet/calculation space.

DATE:	(1)
FLIGHT:	(2)
STATION:	(3)
A/C NO:	(4)
CAPTAIN:	(5)
F/O:	(6)

WEIGHT AND BALANCE			CORRECTIONS	
A/C EMPTY WT. (AEWT)		(7)		(24)
CREW WT.: Code (8)	+	(9)	+	
BASIC OPER. WT (BOW)		(10)		
PAYLOAD: BUS. CLASS PAX	+	(11)	+	
PAYLOAD: FWD COACH PAX	+	(12)	+	
PAYLOAD: AFT COACH PAX	+	(13)	+	
PAYLOAD: CHILDREN	+	(14)	+	
PAYLOAD: FORWARD CARGO	+	(15)	+	
PAYLOAD: AFT CARGO	+	(16)	+	
PAYLOAD: FUEL BALLAST	+	(17)	+	
ZERO FUEL WEIGHT	=	(18)		
TAKEOFF FUEL (LBS.)	+	(19)	+	
TAKEOFF WEIGHT/ PERCENT MAC	=	(20)		
FUEL CONSUMPTION	-	(21)	-	
EST. LANDING WT.	=	(22)		
DEST. MAX. LDG. WT.	=	(23)		



TAKEOFF WEIGHT DATA

TEMP: (25) **WIND:** (25)	
RNWY: (26) **FLAPS:** (26) **RNWY LMT WT.=**	(27)
WIND COMP.: (28) **KTS** x (29) **LBS./KT**	± (30)
PENALTIES (MEL/CDL): (31)	- (32)
CORRECTED RUNWAY LIMITED WEIGHT =	(33)
SECOND SEGMENT CLIMB WEIGHT =	(34)
PENALTIES (MEL/CDL):	- (35)
CORRECTED SEC. SEG. CLIMB WEIGHT =	(36)
MAX. STRUCT. TAKEOFF GROSS WEIGHT =	(37)
MAX ALLOWABLE TAKEOFF WEIGHT: ENTER THIS NUMBER FROM THE RELEASE PAPERWORK DATA OR THE LOWEST OF THE BOXED ITEMS ABOVE.	(38)

PILOT NAME: ____________(39)____________________

SIGNATURE: ____________(40)____________________

I CERTIFY THE APPLICABLE AIRPORT RUNWAY ANALYSIS DATA HAS BEEN REVIEWED FOR DEPARTURE AND DESTINATION AIRPORTS AND THE ABOVE TAKEOFF AND LANDING WEIGHTS MEET THOSE REQUIREMENTS.

NOTES: ________(41)____________________________

NOTE: Addition or deletion of up to 5 passengers (the passengers and their bags) is permitted without recalculations if not within 1000 lbs of any limiting wgt.

DISPOSITION OF WEIGHT AND BALANCE FORMS (FD-300 & FD-201)

A. The Pilot in Command shall carry in the airplane to its destination a signed copy of Form FD-300 and FD-201. The original of each FD-300 and FD-201 shall be retained on file at the departure station for at least three months.

B. Procedure:

1. After the flight crew has completed all required entries on the affected forms, the station will retain the Original (white) copy. The yellow copy of each form will be carried with the ship papers to the next destination.
2. At the completion of the flight, the flight crew may destroy the yellow copy of the affected forms.
3. Each Station Manager will retain the original (white) copy of each form for not less than three months, unless requested by appropriate authority to forward specific records to AirTran Headquarters. After the expiration of the required three-month retention period, the station may destroy the white copy.

LOADING TABLES

Standard Loading Tables are shown on the reverse page. They break out passenger, cargo, and fuel index units.

Military loading tables are on the following page. On supplemental flights carrying military personnel use of actual weights is required by the Department of Defense. For such occasions the following special procedures are required:

1. Recording must be made of weights of each passenger by passenger compartment (PSGR 1, PSGR 2, PSGR 3) and totaled by compartment.
2. Lookup is then made by compartment on the Military Loading Table, as required. Lookups will be made to the nearest 200 lb increment (rounding up for any fractional part).
3. Resulting values are then substituted for the normal lookup table data.

STANDARD WEIGHT LOADING TABLES

PASSENGERS**

NO. PAX	ADJ WT UNITS SUMMER*	ADJ WT UNITS WINTER*
BUSINESS CLASS		
1	199.5	199.5
2	299.1	399.1
3	498.6	498.6
4	698.2	698.1
5	897.7	897.7
6	997.3	1097.2
7	1196.8	1196.7
8	1396.4	1396.2
9	1495.9	1595.8
10	1695.4	1795.3
11	1895.0	1894.8
12	1994.5	2094.4
FORWARD COACH		
1	199.8	199.8
2	299.6	399.6
3	499.4	499.3
4	699.1	699.1
5	898.9	898.9
6	998.7	1098.7
7	1198.5	1198.5
8	1398.3	1398.2
9	1498.1	1598.0
10	1697.9	1797.8
11	1897.6	1897.6
12	1997.4	2097.4
13	2197.2	2297.1
14	2397.0	2496.9
15	2596.8	2596.7
16	2696.6	2796.5
17	2896.4	2996.3
18	3096.1	3196.0
19	3195.9	3295.8
20	3395.7	3495.6
21	3595.5	3695.4
22	3695.3	3895.2
23	3895.1	3994.9
24	4094.9	4194.7
25	4294.6	4394.5
26	4394.4	4594.3
27	4594.2	4694.0
28	4794.0	4893.8
29	4893.8	5093.6
30	5093.6	5293.4
31	5293.4	5393.2
32	5393.1	5592.9
33	5592.9	5792.7
34	5792.7	5992.5
35	5992.5	6092.3
36	6092.3	6292.1
37	6292.1	6491.8
38	6491.9	6691.6
39	6591.7	6791.4
40	6791.4	6991.2
41	6991.2	7191.0
42	7091.0	7390.7
43	7290.8	7490.5
44	7490.6	7690.3
45	7690.4	7890.1
46	7790.2	8089.9
47	7989.9	8189.6
48	8189.7	8389.4
49	8289.5	8589.2
50	8489.3	8789.0

NO. PAX	ADJ WT UNITS SUMMER*	ADJ WT UNITS WINTER*
FWD COACH (CONT'D)		
51	8689.1	8888.8
52	8788.9	9088.5
53	8988.7	9288.3
54	9188.4	9488.1
55	9388.2	9587.9
AFT COACH		
1	200.1	200.1
2	300.3	400.3
3	500.4	500.4
4	700.5	700.6
5	900.7	900.7
6	1000.8	1100.8
7	1200.9	1201.0
8	1401.1	1401.1
9	1501.2	1601.2
10	1701.3	1801.4
11	1901.5	1901.5
12	2001.6	2101.7
13	2201.7	2301.8
14	2401.9	2501.9
15	2602.0	2602.1
16	2702.1	2802.2
17	2902.3	3002.3
18	3102.4	3202.5
19	3202.5	3302.6
20	3402.7	3502.8
21	3602.8	3702.9
22	3702.9	3903.0
23	3903.1	4003.2
24	4103.2	4203.3
25	4303.3	4403.4
26	4403.5	4603.6
27	4603.6	4703.7
28	4803.8	4903.9
29	4903.9	5104.0
30	5104.0	5304.1
31	5304.2	5404.3
32	5404.3	5604.4
33	5604.4	5804.6
34	5804.6	6004.7
35	6004.7	6104.8
36	6104.8	6305.0
37	6305.0	6505.1
38	6505.1	6705.2
39	6605.2	6805.4
40	6805.4	7005.5
41	7005.5	7205.7
42	7105.6	7405.8
43	7305.8	7505.9
44	7505.9	7706.1
45	7706.0	7906.2
46	7806.2	8106.3
47	8006.3	8206.5
48	8206.4	8406.6
49	8306.6	8606.8
50	8506.7	8806.9

BAGGAGE/CARGO

CARGO WEIGHT BAGS	CARGO WEIGHT LBS	ADJ WT UNITS FWD CARGO	ADJ WT UNITS AFT CARGO
1- 4	100	99.8	100.1
5- 8	200	199.6	200.2
9- 12	300	299.4	300.3
13- 16	400	399.2	400.4
17- 20	500	499.1	500.5
21- 24	600	598.9	600.6
25- 28	700	698.7	700.7
29- 32	800	798.5	800.8
33- 36	900	898.3	900.9
37- 40	1000	998.1	1001.0
41- 44	1100	1097.9	1101.1
45- 48	1200	1197.7	1201.2
49- 52	1300	1297.5	1301.3
53- 56	1400	1397.4	1401.4
57- 60	1500	1497.2	1501.5
61- 64	1600	1597.0	1601.6
65- 68	1700	1696.8	1701.7
69- 72	1800	1796.6	1801.8
73- 76	1900	1896.4	1901.9
77- 80	2000	1996.2	2002.0
81- 84	2100	2096.0	2102.1
85- 88	2200	2195.8	2202.2
89- 92	2300	2295.7	2302.3
93- 96	2400	2395.5	2402.4
97- 100	2500	2495.3	2502.5
101- 104	2600	2595.1	2602.7
105- 108	2700	2694.9	2702.8
109- 112	2800	2794.7	2802.9
113- 116	2900	2894.5	2903.0
117- 120	3000	2994.3	3003.1
121- 124	3100	3094.1	3103.2
125- 128	3200	3194.0	3203.3
129- 132	3300	3293.8	3303.4
133- 136	3400	3393.6	3403.5
137- 140	3500	3493.4	3503.6
141- 144	3600	3593.2	3603.7
145- 148	3700	3693.0	3703.8
149- 152	3800	3792.8	3803.9
153- 156	3900	3892.6	3904.0
157- 160	4000	3992.4	4004.1
161- 164	4100	4092.3	4104.2
165- 168	4200	4192.1	4204.3
169- 172	4300	4291.9	4304.4
173- 176	4400	4391.7	
177- 180	4500	4491.5	
181- 184	4600	4591.3	
185- 188	4700	4691.1	
189- 192	4800	4790.9	
193- 196	4900	4890.7	
197- 200	5000	4990.6	
201- 204	5100	5090.4	
205- 208	5200	5190.2	
209- 212	5300	5290.0	
213- 216	5400	5389.8	

CREW CODES

Fwd & Aft Lav Config

Code	Interior Catered	Interior Non-Catered
C1	1196.5	997.1
C2	1395.8	1196.4
C3	1396.7	1197.4
C4	1496.1	1396.7
CF1	N/A	498.2
CF2	N/A	697.6

FUEL

FUEL WT -LBS-	ADJ WT UNITS
5000	4499.7
6000	5499.8
7000	6499.8
8000	7499.9
9000	8500.0
10000	9500.1
11000	10500.2
12000	11500.4
13000	12500.5
14000	13500.7
15000	14500.9
16000	15501.1
17000	16501.4
18000	17501.7
19000	18502.0
20000	19501.7
21000	20501.5
22000	21501.2
23000	22501.0
24000	23500.7
24650	24200.5

CHILDREN

1	100.0
2	199.9
3	199.9
4	299.8
5	399.8
6	499.7
7	599.7
8	599.7
9	699.6
10	799.6
11	899.5
12	999.5
13	999.4
14	1099.4
15	1199.4
16	1299.3
17	1399.3
18	1399.2
19	1499.2
20	1599.2
21	1699.1
22	1799.1
23	1799.0
24	1899.0
25	1998.9
26	2098.9
27	2198.9
28	2198.8
29	2298.8
30	2398.7
31	2498.7
32	2598.6
33	2598.6
34	2698.6
35	2798.5
36	2898.5
37	2998.4
38	2998.4

(*) SUMMER: MAY 1 TO OCT 31 (*) WINTER: NOV 1 TO APRIL 30 **IF MILITARY CHARTER FLT, USE MILITARY TABLE. 01-Sep-99

MILITARY WEIGHT LOADING TABLES

PASSENGERS

BUSINESS CLASS

LBS.	ADJ WT UNITS
200	199.5
400	398.9
600	598.4
800	797.9
1000	997.3
1200	1196.8
1400	1396.2
1600	1595.7
1800	1795.2
2000	1994.6
2200	2194.1
2400	2393.6

FORWARD COACH

LBS.	ADJ WT UNITS
200	199.7
400	399.5
600	599.2
800	799.0
1000	998.7
1200	1198.5
1400	1398.2
1600	1598.0
1800	1797.7
2000	1997.5
2200	2197.2
2400	2397.0
2600	2596.7
2800	2796.5
3000	2996.2
3200	3196.0
3400	3395.7
3600	3595.5
3800	3795.2
4000	3995.0
4200	4194.7
4400	4394.5
4600	4594.2
4800	4794.0
5000	4993.7
5200	5193.5
5400	5393.2
5600	5592.9
5800	5792.7
6000	5992.4
6200	6192.2
6400	6391.9
6600	6591.7
6800	6791.4
7000	6991.2
7200	7190.9
7400	7390.7
7600	7590.4
7800	7790.2
8000	7989.9
8200	8189.7
8400	8389.4
8600	8589.2
8800	8788.9
9000	8988.7
9200	9188.4
9400	9388.2
9600	9587.9
9800	9787.7
10000	9987.4

FWD COACH (CONT'D)

LBS.	ADJ WT UNITS
10200	10187.2
10400	10386.9
10600	10586.7
10800	10786.4
11000	10986.1

AFT COACH

LBS.	ADJ WT UNITS
200	200.2
400	400.3
600	600.5
800	800.6
1000	1000.8
1200	1200.9
1400	1401.1
1600	1601.3
1800	1801.4
2000	2001.6
2200	2201.7
2400	2401.9
2600	2602.0
2800	2802.2
3000	3002.4
3200	3202.5
3400	3402.7
3600	3602.8
3800	3803.0
4000	4003.2
4200	4203.3
4400	4403.5
4600	4603.6
4800	4803.8
5000	5003.9
5200	5204.1
5400	5404.3
5600	5604.4
5800	5804.6
6000	6004.7
6200	6204.9
6400	6405.0
6600	6605.2
6800	6805.4
7000	7005.5
7200	7205.7
7400	7405.8
7600	7606.0
7800	7806.1
8000	8006.3
8200	8206.5
8400	8406.6
8600	8606.8
8800	8806.9
9000	9007.1
9200	9207.3
9400	9407.4
9600	9607.6
9800	9807.7
10000	10007.9

BAGGAGE/CARGO

CARGO WEIGHT BAGS/LBS		ADJ WT UNITS FWD CARGO	ADJ WT UNITS AFT CARGO
1- 4	100	99.8	100.1
5- 8	200	199.6	200.2
9- 12	300	299.4	300.3
13- 16	400	399.2	400.4
17- 20	500	499.1	500.5
21- 24	600	598.9	600.6
25- 28	700	698.7	700.7
29- 32	800	798.5	800.8
33- 36	900	898.3	900.9
37- 40	1000	998.1	1001.0
41- 44	1100	1097.9	1101.1
45- 48	1200	1197.7	1201.2
49- 52	1300	1297.5	1301.3
53- 56	1400	1397.4	1401.4
57- 60	1500	1497.2	1501.5
61- 64	1600	1597.0	1601.6
65- 68	1700	1696.8	1701.7
69- 72	1800	1796.6	1801.8
73- 76	1900	1896.4	1901.9
77- 80	2000	1996.2	2002.0
81- 84	2100	2096.0	2102.1
85- 88	2200	2195.8	2202.2
89- 92	2300	2295.7	2302.3
93- 96	2400	2395.5	2402.4
97- 100	2500	2495.3	2502.5
101- 104	2600	2595.1	2602.7
105- 108	2700	2694.9	2702.8
109- 112	2800	2794.7	2802.9
113- 116	2900	2894.5	2903.0
117- 120	3000	2994.3	3003.1
121- 124	3100	3094.1	3103.2
125- 128	3200	3194.0	3203.3
129- 132	3300	3293.8	3303.4
133- 136	3400	3393.6	3403.5
137- 140	3500	3493.4	3503.6
141- 144	3600	3593.2	3603.7
145- 148	3700	3693.0	3703.8
149- 152	3800	3792.8	3803.9
153- 156	3900	3892.6	3904.0
157- 160	4000	3992.4	4004.1
161- 164	4100	4092.3	4104.2
165- 168	4200	4192.1	4204.3
169- 172	4300	4291.9	4304.4
173- 176	4400	4391.7	
177- 180	4500	4491.5	
181- 184	4600	4591.3	
185- 188	4700	4691.1	
189- 192	4800	4790.9	
193- 196	4900	4890.7	
197- 200	5000	4990.6	
201- 204	5100	5090.4	
205- 208	5200	5190.2	
209- 212	5300	5290.0	
213- 216	5400	5389.8	

FUEL

FUEL WT -LBS-	ADJ WT UNITS
5000	4499.7
6000	5499.8
7000	6499.8
8000	7499.9
9000	8500.0
10000	9500.1
11000	10500.2
12000	11500.4
13000	12500.5
14000	13500.7
15000	14500.9
16000	15501.1
17000	16501.4
18000	17501.7
19000	18502.0
20000	19501.7
21000	20501.5
22000	21501.2
23000	22501.0
24000	23500.7
24650	24200.5

CREW CODES

	Interior		
Fwd & Aft Lav Config	Code	Catered	Non-Catered
	C1	1196.5	997.1
	C2	1395.8	1196.4
	C3	1396.7	1197.4
	C4	1496.1	1396.7
	CF1	N/A	498.2
	CF2	N/A	697.6

01-Sep-99

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TABLE OF CONTENTS

PERFORMANCE

SYSTEMS OPERATIONS

The Weight and Balance system, Runway Analysis Manual, and performance data in this chapter supplement the data from the Flight Management System (FMS). Sufficient data should also be available from the Runway Analysis Manual and this chapter to complete a flight with the FMS inoperative.

Observance of the thrust settings, speeds and weight restrictions set forth in the above referenced documents, will assure compliance with federal regulations for routine operation within the AirTran route system.

OFF-LINE OPERATIONS

When required to operate into or out of an airport not listed in the Runway Analysis Manual, the Takeoff and Landing data will be furnished to the Captain by Dispatch.

DEMONSTRATED CROSSWIND

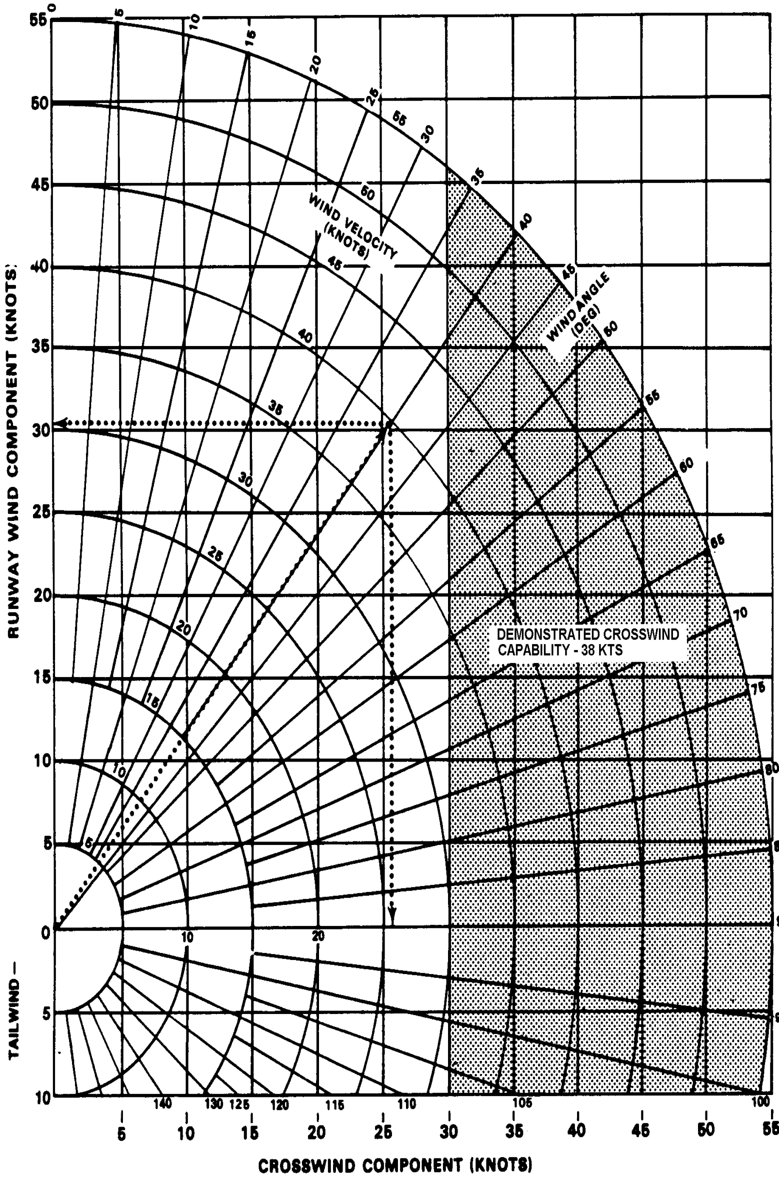
The limiting crosswind value has not been determined. However, the maximum demonstrated crosswind component for takeoff and landing is 40 knots reported wind at a 50 foot height.

CROSSWIND TAKEOFF AND LANDING

A Wind Component Chart is in this section. When wind information for takeoff or landing is supplied by a control tower or by ATIS, the wind direction is in degrees magnetic. When wind direction is derived from weather reports or teletype weather sequences, wind direction will be in degrees true. In this case, the appropriate station magnetic variation must be applied to obtain wind direction in degrees magnetic.

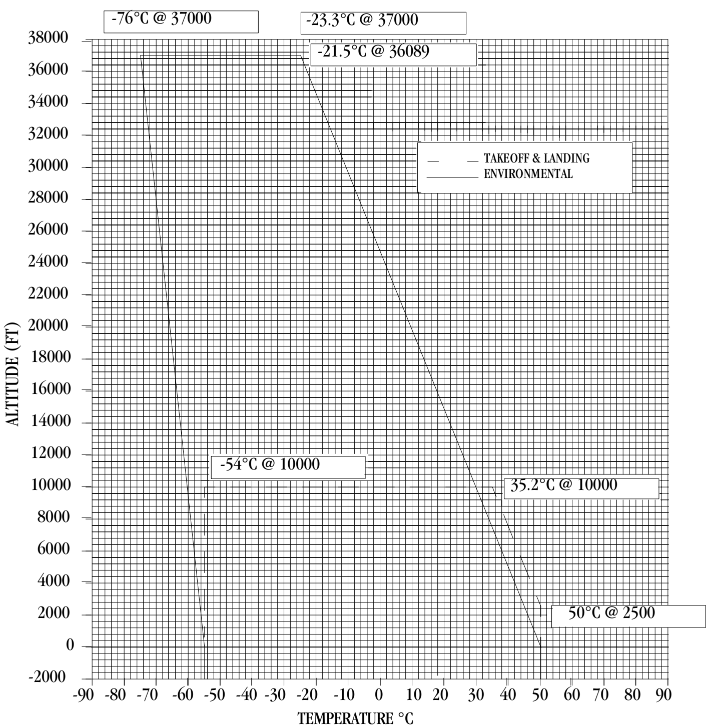
Runways are usually numbered to the nearest ten degrees magnetic heading.

WIND COMPONENT CHART



ENVIRONMENTAL ENVELOPE FOR AIRCRAFT OPERATION

ALTITUDE AND TEMPERATURE LIMITS FOR TAKEOFF, LANDING AND ENROUTE OPERATION



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TAKEOFF AND LANDING SPEED CARDS

The TAKEOFF AND LANDING SPEED card is a quick method of accurately determining takeoff and landing speeds for the B-717 aircraft. The card has instructions on the reverse (Wet Runway) side.

Takeoff Speed “Flip” Card Dry Runway Side

B-717 (18.5 ENGINES) TAKEOFF AND LANDING SPEED CARD

TAKEOFF SPEEDS - DRY RUNWAY V1, VR, V2 FOR MAX TAKEOFF THRUST

WEIGHT	Flaps 5°			Flaps 13°			Flaps 18°		
(1000 LB)	V1	VR	V2	V1	VR	V2	V1	VR	V2
121	147	151	157	140	144	149	136	140	145
120	146	150	156	139	143	148	135	139	144
118	144	149	155	137	141	147	133	138	143
116	143	147	153	136	140	146	132	136	142
114	141	146	152	134	138	144	130	135	140
112	140	144	150	133	137	143	129	133	139
110	138	143	149	131	135	142	127	132	138
108	136	141	148	129	134	141	125	130	137
106	134	140	146	127	132	139	123	129	136
104	132	138	145	126	131	138	122	127	134
102	130	137	143	124	129	136	120	126	133
100	128	135	142	122	128	135	118	124	132
98	126	133	141	120	126	134	116	122	131
96	124	131	139	118	124	132	114	121	129
94	123	130	138	116	123	131	113	119	128
92	121	128	136	114	121	129	111	118	126
90	119	126	135	112	119	128	109	116	125
88	117	124	133	110	117	127	137	115	124
86	115	122	132	108	115	125	125	114	122
84	113	121	130	106	114	124	113	112	121
82	110	119	129	104	112	122	101	111	119
80	108	117	127	102	110	121	99	110	118
78	106	116	125	100	110	120	94	110	116
76	103	114	124	98	110	118	93	110	115
74	101	113	122	95	110	117	91	110	113
72	98	111	121	93	110	115	90	110	112
70	96	110	119	91	110	114	88	110	110

V1, VR ADJUSTMENTS – ALTITUDE AND TEMPERATURE*

TEMP		V1				VR			
°C	°F	0	1000’	2000’	3000’	0	1000’	2000’	3000’
50	122	5	5	6	6	2	2	2	2
45	113	4	4	4	4	1	1	1	2
40	104	3	3	3	3	1	1	1	1
35	95	1	2	2	2	1	1	1	1
30	86	0	0	1	1	0	0	0	0

MINIMUM TAKEOFF SPEEDS DRY RUNWAY, MAXIMUM TAKEOFF THRUST

		SL			1,000 ft.			2,000 ft.		
°C	°F	V1MCG	VRmin	V2min	V1MCG	VRmin	V2min	V1MCG	VRmin	V2min
50	122	100	107	115	98	105	113	96	103	111
45	113	103	109	118	101	107	116	99	105	114
40	104	106	111	121	103	109	119	101	107	116
35	95	108	114	124	106	112	122	104	110	119
30	86	111	116	127	109	114	125	106	112	122
28	82	111	116	127	110	115	126	107	113	123
26	79	111	116	127	110	115	126	108	114	124
24	75	111	116	127	110	115	126	108	114	124
22	72	111	116	127	110	115	126	108	114	124
20	68	111	116	127	110	115	126	108	114	124
0	32	111	116	127	110	115	126	109	114	125
-20	-4	112	116	128	110	115	126	109	114	125
-40	-40	112	116	128	110	115	126	109	114	125

9/17/99 AirTran

Takeoff Speed "Flip" Card Wet Runway Side

B-717 (18.5 ENGINES) TAKEOFF AND LANDING SPEED CARD

TAKEOFF SPEEDS - WET RUNWAY V1, VR, V2 FOR MAX TAKEOFF THRUST

WEIGHT	FLAPS 5			FLAPS 13			FLAPS 18		
(1000 LB)	V1	VR	V2	V1	VR	V2	V1	VR	V2
121	140	151	157	132	144	149	128	140	145
120	139	150	156	131	143	148	127	139	144
118	137	149	155	129	141	147	126	137	143
116	135	147	153	127	139	146	124	136	141
114	133	146	152	126	138	144	122	134	140
112	131	144	150	124	136	143	121	133	139
110	129	143	149	122	135	142	119	131	138
108	127	141	148	120	134	141	117	130	136
106	125	140	146	118	132	139	116	129	135
104	124	138	145	117	131	138	114	127	134
102	122	137	143	115	129	136	112	126	133
100	120	135	142	113	128	135	110	124	131
98	118	133	141	111	126	134	108	123	130
96	116	131	139	109	124	132	106	121	129
94	114	130	138	107	123	131	104	119	127
92	112	128	136	105	121	129	102	118	126
90	110	126	135	103	119	128	100	116	124
88	108	124	129	102	117	127	100	115	123
86	106	122	129	102	115	125	101	114	122
84	103	121	128	101	114	124	100	112	121
82	101	119	128	101	112	122	100	111	119
80	99	117	127	100	110	121	100	110	118
78	98	116	125	100	110	120	100	110	117
76	98	114	124	100	110	118	100	110	115
74	97	113	122	100	110	117	100	110	114
72	97	111	121	100	110	115	100	110	112
70	96	110	119	100	110	114	100	110	110

VREF SPEEDS (40° FLAPS)

Weight	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120
Airspeed	112	114	115	117	118	120	121	123	124	125	126	128	129	131	132	133	134	136	137	139	140	141	142	144	145

Directions for Using Tables

Takeoff Data

Takeoff data is computed by entering the TAKEOFF SPEEDS Charts with the actual takeoff weight of the aircraft and using the V1, VR, and V2 speeds for the planned flap setting. Tables are available for Dry (top chart on opposite side) and Wet (top chart on this side) runways.

Once V1, VR, and V2 are obtained from the TAKEOFF SPEEDS charts, do the following:

- Aircrews should make adjustments (add) to V1 and VR based on the temperature and altitude (middle chart on opposite side).
- Aircrews should ensure that V1 is greater than V1MCG (found on bottom chart of opposite side). (This applies to both wet and dry runways). If not greater, than the new V1 is V1MCG
- Aircrews should insure that VR is greater than VRMIN (found on bottom chart of opposite side). (This applies to both wet and dry runways). If not greater, than the new VR is VRMIN
- Aircrews should insure that V2 is greater than V2 MIN (found on bottom chart of opposite side). (This applies to both wet and dry runways). If not greater than the new V2 is V2MIN.

Landing Data

Landing speeds (VREF) are for 40 flaps. Approaches using other than 40 flaps, use landing data provided in the QRH.

9/17/99

AirTran

RUNWAY ANALYSIS MANUAL EXPLANATION

Takeoff Data Presentation

The following is the explanation of takeoff data presented in the Runway Analysis Manual published by Stewart Aviation Data Inc. Each aircraft has a copy of this manual.

1. Page Title - includes
    - a) Aircraft Type (B717-200)
    - b) Type of Data (Takeoff Performance)
    - c) Flap position
    - d) Engines
2. Date and Bleed/Brake/Tire Configurations - includes:
    - a) Date data was produced
    - b) Eng A/I (On or Off)
    - c) A/C Packs (On or Off)
    - d) Anti-Skid (Operative or Inoperative)
    - e) Tires
3. Airport Information - includes:
    - a) IATA/ICAO ID and Magnetic Variation
    - b) City/State
    - c) Airport Name
    - d) Airport Elevation
4. Structural Limit of the Aircraft
5. Description of data which follows.
6. Limit Codes: Each limiting weight (except Second Segment Climb) has a limit code printed after it.
7. Sub Headings - include
    - a) Takeoff EPR
    - b) OAT - Degrees C
    - c) Second Segment Climb limited gross weight
    - d) Runway Numbers (one runway per column)
    - e) OAT - Degrees F
8. Max allowable takeoff gross weights.
9. Wind derivatives (corrections to 0 wind weights).

10. Runway Length and Slope: Given in Feet & Percent

11. Max Level-off Height: Ensures level off at prescribed height acceleration to final segment climb speed all within 5 min T/O thrust.

12. Clutter, Auto Ground Spoiler Actuator Inop and Anti-Skid Inop Corrections.

NOTE

Corrections for Slush: If there is less than 1/8 inch of slush, no corrections need to be made. Between 1/8 and ¼ inch of slush use the ¼ inch correction. Above ¼ to ½ inch, use ½ inch correction. For dry snow, for 1/2 to 2 inches, use the ¼ inch slush correction, for dry snow depths above 2 inches to 4 inches, use the ½ inch slush correction.

Example: Airport Data - KMDW; Runway- 13C; OAT- 20; Wind- Tailwind 5 knots.

Find: Max allowable Brake Release Wgt and Takeoff EPR

A. Enter takeoff data chart with OAT (Degrees C), second column from left, (if in degrees F then enter in far right column not shown on example page.)

B. Proceed right one column: Read second segment limiting weight (equals 123.3 thousand pounds)

C. Proceed right to column for Runway 13C. Read limiting weight. (equals 105.2 thousand pounds - note that it is obstacle limited)

D. Drop down to bottom column. Read tailwind correction in lbs/kt (550 lbs/kt). At 5 knots total correction is 2,750 pounds. Takeoff Gross Weight restriction is 105.2 - 2.75 = 102.450 thousand lbs.

E. Proceed left from Step A, Read Takeoff EPR (EPR=1.44)

F. Additional corrections will be made for contaminated runway, manual spoilers, etc.

Takeoff Data Example

```
DATE: 07/22/2000  2           B717-200  1              MDW/KMDW   VAR 02°W
ENG ANTI-ICE: OFF         TAKEOFF PERFORMANCE          CHICAGO, ILLINOIS
A/C PACKS:     ON              FLAP:  5                   MIDWAY AIRPORT
ANTI-SKID:   OPERATIVE     ENG: BR715_A1-30               ELEV:    620 FT
TIRES: 225 MPH
                      STRUCTURAL LIMIT: 121000 LBS  4
```

5 MAX ALLOWABLE BRAKE RELEASE WEIGHT @ 0-WIND - 100'S LBS & LIMIT CODES

6 LIMIT CODES: R = RUNWAY; T = TIRE SPEED; B = BRAKE; * = OBSTACLE; W = Vmcg; L = LEVEL-OFF HEIGHT

7 MAX T.O. EPR	OAT -C-	SEC. SEG. CLIMB	RUNWAYS 04R	22L	13C	31C					OAT -F-
1.44	-18	1206	1077*	1067*	1089*	1126*					0
1.44	-14	1206	1072*	1063*	1085*	1118*					7
1.44	-10	1206	1067*	1058*	1081*	1113*					14
1.44	-6	1206	1061*	1053*	1078*	1108*					21
1.44	-4	1205	1060*	1051*	1077*	1104*					25
1.44	-2	1205	1056*	1049*	1074*	1103*					28
1.44	0	1205	1054*	1046*	1072*	1099*					32
1.44	2	1205	1051*	1044*	1071*	1097*					36
1.44	4	1205	1048*	1042*	1068*	1093*					39
1.44	6	1205	1047*	1038*	1066*	1090*					43
1.44	8	1204	1043*	1037*	1064*	1088*					46
1.44	10	1204	1041*	1033*	1061*	1085*					50
1.44	12	1204	1039*	1032*	1060*	1081*					54
1.44	14	1204	1035*	1029*	1058*	1080*					57
1.44	A 16	B 1203	1033*	1027*	1056*	1076*					61
1.44	18	1203	1031*	1025*	C 1055*	1073*					64
1.44	20	1203	1027*	[illegible]	1052*	1071*					68
1.44	22	1203	1027*	1021*	1050*	1067*	8				72
1.44	24	1202	1023*	1017*	1048*	1064*					75
1.44	26	1202	1020*	1016*	1046*	1063*					79
1.44	28	1202	1018*	1014*	1044*	1059*					82
1.44	30	1187	1008*	1004*	1033*	1050*					86
1.43	32	1164	995*	989*	1019*	1034*					90
1.41	34	1141	982*	976*	1004*	1021*					93
1.40	36	1119	967*	961*	990*	1008*					97
1.39	38	1097	954*	949*	975*	994*					100
1.38	40	1075	940*	934*	961*	981*					104
1.37	42	1054	927*	920*	947*	966*					108
1.36	44	1031	913*	907*	930*	952*					111
1.35	46	1008	899*	893*	915*	937*					115
1.35	48	985	886*	879*	[illegible]	924*					118
1.34	50	963	872*	866*	886*	909*					122
ADD LBS/KT HW			130	130	D 120	150	9				
SUBT LBS/KT TW			620	630	550	660					
RUNWAY LENGTH -FT			6446	6446	6522	6522	10				
RUNWAY SLOPE - %			-0.23	0.23	0.08	-0.08					
MAX LVL-OFF HT-FT			800	800	800	800	11				

CLUTTER, MANUAL SPOILERS AND ANTI-SKID INOP CORRECTIONS								
WET RUNWAY - LBS	1800	2000	1900	1900				
1/4" SLUSH - LBS	21000	18700	18900	18900		12	F	
1/2" SLUSH - LBS	N/A	N/A	N/A	N/A				
MAN SPOILRS - LBS	1400	1300	1400	1400				
A-SKID INOP - LBS	N/A	N/A	N/A	N/A				

INSTRUCTIONS FOR USE OF CLUTTER, MAN SPOILRS, ANTI-SKID INOP DATA

1. SUBTRACT GROSS WEIGHT PENALTY FOR APPROPRIATE CLUTTER CONDITION, MAN SPOILERS OR ANTI-SKID INOP FROM THE RUNWAY LIMITED GROSS WEIGHT.
2. SELECT V-SPEEDS FOR THE CORRECTED GROSS WEIGHT.

Landing Data Presentation

The following is an explanation of the landing data presented in the Runway Analysis Manual published by Stewart Aviation Data Inc.

1. Page Title - includes
   - a) Aircraft Type (B717-200)
   - b) Type of data (Landing Data)
   - c) Engines
2. Date and Bleed Configurations
   - a) Date (Date data was produced)
   - b) A/C Packs (On or Off)
3. Airport Information
   - a) IATA/ICAO OD & Mag Variation
   - b) City/State
   - c) Airport Name
   - d) Airport Elevation
4. Structural Limit:
5. Landing Flap Position: (Flaps 40)
6. Sub Heading
   - a) Brake System Operation (Man Spoilers, Anti-skid inop)
   - b) Runway Number and Runway Lengths (actual and usable beyond threshold)
   - c) Runway surface condition: Dry or Wet
   - d) Max Landing Weight at 0 Wind
   - e) Headwind Correction (lbs/kt) - when 0 wind weight is less than structural limit, it may be increased by the amount shown for each knot of headwind.
   - f) Critical Tailwind - this is the tailwind condition up to which the 0-wind weight is valid.

g) Tailwind Correction (lbs/kt) - When the Critical Tailwind is less than max (10 knots tailwind) the 0-wind weight must be reduced by the amount shown for each knot of tailwind greater than the critical Tailwind.

7. Landing Data for Dry Runway (note for Dispatch purposes we are always dispatched using wet runway data).

8. Landing Data for Wet Runway.

9. Approach/Landing Climb (for three Anti-Icing Conditions) limit weights for the temperatures shown. Ice-Conditions: These weight penalties are to be applied to the Approach/Landing Climb weight (with or w/o wing A/I ON) when any part of a flight is conducted in icing conditions and the forecast landing temperature is below 20 degrees C (68 degrees F).

10. Max Brake Energy (Quick Turn-Around) limit weights for temperatures shown. Max Brake Energy weights are not considered limiting. However, if they are exceeded a 35 minute ground time is required. Brake energy limited weights are dependent upon wind. Wind corrections are provided in the far right hand column.

Landing Data Chart Use Example:

Destination Airport: KMCO, Runway in Use: 18R, Wx Forecast: Rain, 10 kt headwind, 26 degrees C, 92,000 lbs lnd wgt. (from dispatch sheet).

A. Enter lower portion of chart WET with runway number.

B. Proceed right to Max Wgt @ 0 knots =104,000 lbs

C. Proceed right one column: Headwind Correction = 0 lbs per knot

D. Multiply the headwind correction found in step C by the headwind. (in example there is no headwind correction)

E. Add D to B Field Length Limited Landing Weight.

F. Enter bottom portion of chart with forecast OAT.

G. Drop down - read approach/landing climb weight: = 121,300 lbs (well above structural, not limiting)

H. From step G, drop down, read max quick turn around brake energy limit weight =99,500 lbs (well above landing weight, not a factor).

The planned landing gross weight form flight plan is less than all landing limit weights, therefore it is legal to dispatch.

Landing Data Example

1

DATE: 12/06/2000 B717-200 MCO/KMCO VAR 05°W
A/C PACKS: 2 LANDING DATA ORLANDO, FLORIDA
ALL ON 4 ENG: BR715_A1-30 INT'L AIRPORT
ELEV: 96 FT
STRUCTURAL LIMIT: 104000 LBS

****
* FLAPS 40 * 5
****

BRAKE SYSTEMS OPERATION	RNWY NO	RNWY LENGTHS ACTUAL	RNWY LENGTHS USABLE	RNWY SUR-FACE	MAX WT 0-WIND 100S LBS	ADD LBS/KT H.W. LBS	CRIT T.W. KTS	SUBT LBS/KT T.W. LBS
ALL SYSTEMS OPERATIVE	17	10000	10000	DRY	1040	0	10	0
	35	10000	10000	DRY	1040	0	10	0
	18R	12004	12004	DRY	1040	0	10	0
	36L	12004	12004	DRY	1040	0	10	0
	18L	12005	12005	DRY	1040	0	10	0
	36R	12005	12005	DRY	1040	0	10	0
MANUAL SPOILERS	17	10000	10000	DRY	1040	0	10	0
	35	10000	10000	DRY	1040	0	10	0
	18R	12004	12004	DRY	1040	0	10	0
	36L	12004	12004	DRY	1040	0	10	0
	18L	12005	12005	DRY	1040	0	10	0
	36R	12005	12005	DRY	1040	0	10	0
ANTI-SKID INOP	17	10000	10000	DRY	NA			
	35	10000	10000	DRY	NA			
	18R	12004	12004	DRY	NA			
	36L	12004	12004	DRY	NA			
	18L	12005	12005	DRY	NA			
	36R	12005	12005	DRY	NA			
ALL SYSTEMS OPERATIVE	17	10000	10000	WET	1040	0	10	0
	35	10000	10000	WET	1040	0	10	0
	18R	12004	12004	WET	1040	0	10	0
	36L	12004	12004	WET	1040	0	10	0
	18L	12005	12005	WET	1040	0	10	0
	36R	12005	12005	WET	1040	0	10	0
MANUAL SPOILERS	17	10000	10000	WET	1040	0	10	0
	35	10000	10000	WET	1040	0	10	0
	18R	12004	12004	WET	1040	0	10	0
	36L	12004	12004	WET	1040	0	10	0
	18L	12005	12005	WET	1040	0	10	0
	36R	12005	12005	WET	1040	0	10	0
ANTI-SKID INOP	17	10000	10000	WET	NA			
	35	10000	10000	WET	NA			
	18R	12004	12004	WET	NA			
	36L	12004	12004	WET	NA			
	18L	12005	12005	WET	NA			
	36R	12005	12005	WET	NA			

7

8

APPROACH & LANDING CLIMB LIMIT WEIGHTS - 100's LBS

OAT - °F / °C	-20 / -28	0 / -17	20 / -6	40 / 4	50 / 10	60 / 15	80 / 26	100 / 37	120 / 48	ICING CONDTS
NO A/I	1218	1217	1217	1216	1215	1215	1213	1121	995	- 13
ENG A/I	1177	1177	1176	1175	1175					- 12
WING A/I	1096	1096	1095	1095	1094					

9

MAX QUICK TURN AROUND - BRAKE ENERGY WGTS - 100's LBS									TW/HW
0-WIND WEIGHT	1103	1078	1055	1034	1023	1013	995	976	959	- 7 / + 2

10

REFERENCE TAKEOFF DATA

AirTran pilots will obtain their takeoff and landing speeds for wet and dry runways from the Speed Cards shown on pages P-5 and P-6, however the following data is also provided to supply the pilot with additional information. Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry tables. Correct takeoff speeds for altitude and temperature. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 5			FLAPS 9			FLAPS 13			FLAPS 15			FLAPS 18		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
130	156	158	162	152	154	158	148	150	154	147	148	152	145	146	150
120	148	151	156	144	147	152	140	143	148	139	142	146	137	139	144
110	139	143	149	136	140	145	132	136	142	131	134	140	129	132	138
100	130	135	142	127	132	139	123	128	135	122	127	134	120	125	132
90	120	127	135	117	123	132	114	120	128	113	119	127	111	117	125
80	110	117	127	107	114	124	104	111	121	103	110	120	101	108	118
70	98	107	119	95	104	116	92	101	114	91	100	112	90	98	110

Check to ensureV1 is greater than or equal to V1MCG.

V1, VR, V2 Adjustments*

TEMP		V1				VR				V2			
		PRESS ALT (FT)				PRESS ALT (FT)				PRESS ALT (FT)			
°C	°F	0	1000	2000	3000	0	1000	2000	3000	0	1000	2000	3000
50	122	5	5	6	6	2	2	2	2	0	0	0	0
45	113	4	4	4	4	1	1	1	2	0	0	0	0
40	104	3	3	3	3	1	1	1	1	0	0	0	0
35	95	1	2	2	2	1	1	1	1	0	0	0	0
30	86	0	0	1	1	0	0	0	0	0	0	0	0
28	82	0	0	0	0	0	0	0	0	0	0	0	0
26	79	0	0	0	0	0	0	0	0	0	0	0	0
24	75	0	0	0	0	0	0	0	0	0	0	0	0
-20	-4	0	0	0	0	0	0	0	0	0	0	0	0

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)						
	-2.0	-1.0	0.0	1.0	1.7	-10	0	10	20	30	40	50
130	-4	-2	0	2	3	-1	0	0	0	1	1	1
120	-4	-2	0	2	3	-1	0	0	0	1	1	1
110	-3	-2	0	2	3	-1	0	0	1	1	1	1
100	-3	-2	0	2	3	-1	0	0	1	1	1	2
90	-3	-2	0	2	3	-1	0	0	1	1	2	2
80	-3	-2	0	2	3	-2	0	0	1	1	2	2
70	-3	-1	0	1	2	-2	0	1	1	2	2	3

***V1 not to exceed VR**

VMinimum Control Speed VMCG And V1

Regulations prohibit scheduling takeoff with a V1 less than minimum control on the ground, VMCG. It is therefore necessary to compare the adjusted V1 to VMCG. To find VMCG enter the VMCG table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than VMCG, set V1 equal to VMCG.

The final VR is the higher of corrected VR vs. VRMIN table, and the final V2 is determined by choosing the higher of corrected V2 vs. V2MIN. The V2MIN is determined by: V2MIN = VRMIN + (V2COR. - VRCOR.). For some takeoff conditions, V1 can be limited by maximum brake energy. Brake energy limits should be checked at hot airports, or when operating with tailwinds and/or with overspeed where higher V1's are involved. Final V1's should always be checked with V1MBE table. If V1 is higher than V1MBE, decrease brake release weight by 5000 lbs as indicated for each 1 knot V1 exceeds V1MBE.

V1(MCG) , VR(Min)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)							
		0		1000		2000		3000	
°C	°F	V1MCG	VRmin	V1MCG	VRmin	V1MCG	VRmin	V1MCG	VRmin
50	122	100	107	98	105	96	103	95	101
45	113	103	109	101	107	99	105	97	103
40	104	106	111	103	109	101	107	99	105
35	95	108	114	106	112	104	110	101	108
30	86	111	116	109	114	106	112	104	110
28	82	111	116	110	115	107	113	105	111
26	79	111	116	110	115	108	114	106	112
24	75	111	116	110	115	108	114	107	113
-20	-4	112	116	110	115	109	114	107	113

V1MBE

Brake Energy Limits

WEIGHT (1000 LB)	TEMPERATURE								ALTITUDE CORRECTIONS			
	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C	PRESSURE ALTITUDE (FT)			
	-4°F	14F	32° F	50° F	68° F	86° F	104° F	122° F	SL	1000	2000	3000
130	173	169	166	163	160	158	155	153	0	-3	-6	-9
120	179	176	173	169	167	164	161	159	0	-3	-6	-9
110	188	184	181	178	174	172	169	166	0	-3	-6	-9
100	196	193	189	186	182	179	177	174	0	-3	-7	-10
90	208	204	200	197	193	190	187	184	0	-3	-7	-10
80	220	215	211	208	204	201	197	194	0	-4	-7	-11

Takeoff Speeds - Wet Runway V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 5			FLAPS 9			FLAPS 13			FLAPS 15			FLAPS 18		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
130	150	158	162	145	154	158	142	150	154	140	148	152	138	146	150
120	141	151	156	137	147	152	133	143	148	132	142	146	130	139	144
110	132	143	149	128	140	145	125	136	142	123	134	140	121	132	138
100	122	135	142	119	132	139	115	128	135	114	127	134	112	125	132
90	112	127	135	109	123	132	106	120	128	104	119	127	102	117	125
80	101	117	127	98	114	124	95	111	121	94	110	120	92	108	118
70	89	107	119	86	104	116	84	101	114	82	100	112	81	98	110

Check to ensureV1 is greater than or equal to V1MCG.

WET RUNWAY: V1, VR, V2 Adjustments

TEMP		V1				VR				V2			
		PRESS ALT (FT)				PRESS ALT (FT)				PRESS ALT (FT)			
°C	°F	0	1000	2000	3000	0	1000	2000	3000	0	1000	2000	3000
50	122	7	8	8	8	2	2	2	2	0	0	0	0
45	113	5	6	6	6	1	1	1	2	0	0	0	0
40	104	4	4	4	5	1	1	1	1	0	0	0	0
35	95	2	2	3	3	1	1	1	1	0	0	0	0
30	86	0	0	1	1	0	0	0	0	0	0	0	0
28	82	0	0	0	0	0	0	0	0	0	0	0	0
26	79	0	0	0	0	0	0	0	0	0	0	0	0
24	75	0	0	0	0	0	0	0	0	0	0	0	0
-20	-4	0	0	0	0	0	0	0	0	0	0	0	0

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)						
	-2.0	-1.0	0.0	1.0	1.7	-10	0	10	20	30	40	50
130	-6	-3	0	3	5	-2	0	0	1	1	2	2
120	-6	-3	0	3	5	-2	0	1	1	2	2	3
110	-6	-3	0	3	5	-2	0	1	1	2	2	3
100	-5	-3	0	3	4	-2	0	1	1	2	3	4
90	-5	-2	0	2	4	-3	0	1	2	2	3	4
80	-5	-2	0	2	4	-3	0	1	2	2	3	4
70	-5	-2	0	2	4	-3	0	1	2	2	3	4

***V1 not to exceed VR**

WET RUNWAY: V1(MCG), VR(MIN) (Max Takeoff Thrust)

TEMP		PRESSURE ALTITUDE (FT)							
		0		1000		2000		3000	
°C	°F	V1MCG	VRmin	V1MCG	VRmin	V1MCG	VRmin	V1MCG	VRmin
50	122	100	107	98	105	96	103	95	101
45	113	103	109	101	107	99	105	97	103
40	104	106	111	103	109	101	107	99	105
35	95	108	114	106	112	104	110	101	108
30	86	111	116	109	114	106	112	104	110
28	82	111	116	110	115	107	113	105	111
26	79	111	116	110	115	108	114	106	112
24	75	111	116	110	115	108	114	107	113
-20	-4	112	116	110	115	109	114	107	113

Stabilizer Trim Settings For Takeoff

TEMP		PRESSURE ALTITUDE (FT)							
		0		1000		2000		3000	
°C	°F	V1MCG	VRmin	V1MCG	VRmin	V1MCG	VRmin	V1MCG	VRmin
50	122	100	107	98	105	96	103	95	101
45	113	103	109	101	107	99	105	97	103
40	104	106	111	103	109	101	107	99	105
35	95	108	114	106	112	104	110	101	108
30	86	111	116	109	114	106	112	104	110
28	82	111	116	110	115	107	113	105	111
26	79	111	116	110	115	108	114	106	112
24	75	111	116	110	115	108	114	107	113
-20	-4	112	116	110	115	109	114	107	113

Stab Trim Setting Max Takeoff Thrust

FLAP SETTING (DEGREES)	C.G. %MAC							
	5.9	10	14	18	22	26	30	34.7
20	-9.5	-8.1	-6.8	-5.5	-4.2	-2.9	-1.6	0.0
15	-9.0	-7.7	-6.5	-5.2	-4.0	-2.7	-1.5	0.0
10	-8.0	-6.9	-5.8	-4.6	-3.5	-2.4	-1.3	0.0
5	-7.0	-6.0	-5.0	-4.1	-3.1	-2.1	-1.1	0.0

VREF

The Reference Speed table contains flaps 40 and 25 landing speeds for a given weight. Apply wind correction shown as required.

VREF

WEIGHTS (1000LB)	FLAPS	
	40	25
120	145	149
115	142	146
110	139	142
105	136	139
100	132	136
95	129	132
90	126	129
85	122	125
80	118	122
75	115	118
70	111	114

For approach speed add wind factor of 1/2 headwind component + gust (max 20kts)

Takeoff EPR

To find Max Takeoff EPR based on normal engine bleed for air conditioning packs on, see the Runway Analysis Manual explanation earlier in this section. For packs off operation, apply the EPR correction shown below in the table. No takeoff EPR correction is required for engine and wing anti-ice.

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.018	0.018	0.018	0.019	0.019
WING ANTI-ICE ON	-0.025	-0.027	-0.027	-0.027	-0.028	-0.029	-0.029	-0.030	-0.031	-0.032	-0.032	-0.033
ENGINE ANTI-ICE ON	-0.019	-0.020	-0.021	-0.021	-0.021	-0.022	-0.022	-0.023	-0.024	-0.025	-0.026	-0.027

No adjustment for engine anti-ice for OAT<10°C below 7500 ft and OAT< 4°C at 10500 ft (with OAT linearly decreasing from 10°C to 4°C from 7500 ft to 10500 ft)

MAXIMUM CLIMB EPR

The following table shows Max Climb EPR , normal engine bleed for packs on and ant-ice off. Speeds used for the climb are 250 knots to 10,000 feet, then 290 knots until .72 Mach is obtained. Enter the table with airport pressure altitude and TAT and read EPR. EPR adjustments are shown for anti-ice operation.

Max Climb EPR

Based on engine bleeds for Packs On, Engine and Wing A/I Off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	37
	250	250	290	290	290	290	0.72	0.72	0.72
60	1.1869	1.1917							
55	1.2072	1.2092	1.1952						
50	1.2302	1.2278	1.2154						
45	1.2543	1.2524	1.2381	1.2437					
40	1.2791	1.2774	1.2655	1.2679	1.2608				
35	1.3049	1.3038	1.2937	1.2974	1.2882	1.2764			
30	1.3127	1.3312	1.3226	1.3281	1.318	1.3063			
25	1.3127	1.3593	1.3527	1.3602	1.3508	1.3377	1.3208		
20	1.3127	1.3598	1.3827	1.3956	1.3864	1.3732	1.3528		
15	1.3127	1.3598	1.3827	1.4331	1.4239	1.4123	1.3886	1.3696	1.3599
10	1.3127	1.3598	1.3827	1.4486	1.4615	1.4513	1.4275	1.4041	1.3952
5	1.3127	1.3598	1.3827	1.4486	1.493	1.4907	1.4675	1.441	1.4305
0	1.3127	1.3598	1.3827	1.4486	1.493	1.5338	1.5097	1.4825	1.4714
-5	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5548	1.5266	1.5159
-10	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.5719	1.5612
-15	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.6102	1.6007
-20	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.6398	1.6327
-25	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.6434	1.6496
-30	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.6434	1.6496
-35	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.6434	1.6496
-40	1.3127	1.3598	1.3827	1.4486	1.493	1.5385	1.5956	1.6434	1.6496

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)					
	0	10	20	30	35	37
A/C HIGH FLOW	-0.013	-0.019	-0.023	-0.027	-0.030	-0.032
ENGINE ANTI-ICE	-0.017	-0.025	-0.032	-0.046	-0.048	-0.049
WING AND ENGINE ANTI-ICE	-0.039	-0.031	-0.070	-0.093	-0.103	-0.110

No adjustment for engine anti-ice for OAT<10°C below 7500 ft and OAT<4°C at 10500 ft (with OAT linearly decreasing from 10°C to 4°C from 7500 ft to 10500 ft)

GO-AROUND EPR

To find Max Go Around EPR based on normal engine bleed for packs on, enter the Go-Around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. For packs off operation, apply the EPR correction shown below the table. No EPR correction is required for engine and wing anti-ice.

Go-around EPR (-2000 FT Through 6000 FT) Based on engine bleeds for Packs On

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)							
°F	°C	°C	-2000	0	1000	2000	3000	4000	5000	6000
134	57	60	1.286	1.286	1.286	1.285	1.285			
125	52	55	1.309	1.307	1.306	1.305	1.306	1.306		
116	47	50	1.333	1.331	1.330	1.329	1.328	1.327	1.327	1.326
108	42	45	1.357	1.355	1.354	1.353	1.352	1.351	1.350	1.349
99	37	40	1.369	1.380	1.379	1.378	1.378	1.376	1.375	1.374
90	32	35	1.369	1.407	1.406	1.405	1.404	1.403	1.402	1.400
81	27	30	1.369	1.419	1.430	1.435	1.434	1.432	1.431	1.429
72	22	25	1.369	1.419	1.430	1.441	1.453	1.464	1.463	1.461
63	17	20	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
54	12	15	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
45	7	10	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
36	2	5	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
27	-3	0	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
18	-8	-5	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
9	-13	-10	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
1	-17	-15	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
-8	-22	-20	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
-17	-27	-25	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
-26	-32	-30	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
-35	-37	-35	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
-44	-42	-40	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488
-53	-47	-45	1.369	1.419	1.430	1.441	1.453	1.465	1.476	1.488

Go Around - EPR Adjustments For Engine Bleeds -2000 FT Through 6000 FT

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)							
	-2000	0	1000	2000	3000	4000	5000	6000
PACKS OFF	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.018
A/C HIGH	-0.013	-0.013	-0.013	-0.014	-0.014	-0.014	-0.015	-0.015
WING ANTI-ICE ON	-0.025	-0.027	-0.027	-0.027	-0.028	-0.029	-0.029	-0.030

FLIGHT WITH UNRELIABLE AIRSPEED/TURBULENT AIR PENETRATION

Pitch attitude and average % N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from a blocked or frozen pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

NOTE

Altitude and/or vertical speed indications may also be unreliable.

Flight With Unreliable Airspeed/Turbulent Air Penetration: Climb (275/.72) Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)*		WEIGHT (1000 LB)			
		130	110	90	70
37000	PITCH ATT			4.4	4.7
	V/S (FT/MIN)			1200	2200
30000	PITCH ATT	3.8	4.0	4.3	4.9
	V/S (FT/MIN)	700	1400	2200	3200
20000	PITCH ATT	5.3	5.4	5.7	6.6
	V/S (FT/MIN)	1500	2000	2800	3800
10000	PITCH ATT	9.2	9.4	10.2	11.9
	V/S (FT/MIN)	2200	2900	3800	5200
SEA LEVEL	PITCH ATT	9.8	10.2	11.1	13.1
	V/S (FT/MIN)	2400	3100	4000	5400

*** Altitude and /or vertical speed may also be unreliable**

Cruise (.75/275) Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)*		WEIGHT (1000 LB)			
		130	110	90	70
37000	PITCH ATT			2.3	1.3
	%N1			81.50	77.90
35000	PITCH ATT		2.7	1.9	1
	%N1		84.20	80.30	77.40
30000	PITCH ATT	2.7	2	1.3	0.5
	%N1	84.60	81.30	78.80	77.00
25000	PITCH ATT	2.9	2.1	1.3	0.6
	%N1	80.80	77.80	75.40	73.50
20000	PITCH ATT	3.1	2.3	1.5	0.7
	%N1	76.60	73.70	71.30	69.40
15000	PITCH ATT	3.3	2.5	1.7	0.9
	%N1	72.30	69.30	66.90	64.90

*** Altitude and /or vertical speed may also be unreliable**

Descent (250) Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)*		WEIGHT (1000 LB)			
		130	110	90	70
37000	PITCH ATT	0.8	0.1	-0.7	-1.8
	V/S (FT/MIN)	-2,200	-2,100	-2,000	-2,200
30000	PITCH ATT	1	0.2	-0.8	-2
	V/S (FT/MIN)	-2,100	-2,000	-2,000	-2,200
20000	PITCH ATT	1.6	0.6	-0.5	-1.8
	V/S (FT/MIN)	-1,800	-1,700	-1,800	-1,900
10000	PITCH ATT	1.6	0.5	-0.7	-2.1
	V/S (FT/MIN)	-1,600	-1,600	-1,700	-1,900
SEA LEVEL	PITCH ATT	1.4	0.2	-1.1	-2.6
	V/S (FT/MIN)	-1,500	-1,600	-1,700	-1,900

*** Altitude and /or vertical speed may also be unreliable**

Holding (1.42 VSTALL) Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)*		WEIGHT (1000 LB)			
		130	110	90	70
10000	PITCH ATT	4.8	4.9	4.9	5
	%N1	66.30	61.90	56.80	51.80
5000	PITCH ATT	4.8	4.9	4.9	5
	%N1	62.40	58.20	54.10	49.10

*** Altitude and /or vertical speed may also be unreliable**

Flight With Unreliable Airspeed/Turbulent Air Penetration
Holding (1.42 Vstall)
Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)*		WEIGHT (1000 LB)			
		130	110	90	70
10000	PITCH ATT	4.8	4.9	4.9	5
	%N1	66.30	61.90	56.80	51.80
5000	PITCH ATT	4.8	4.9	4.9	5
	%N1	62.40	58.20	54.10	49.10

*** Altitude and /or vertical speed may also be unreliable**

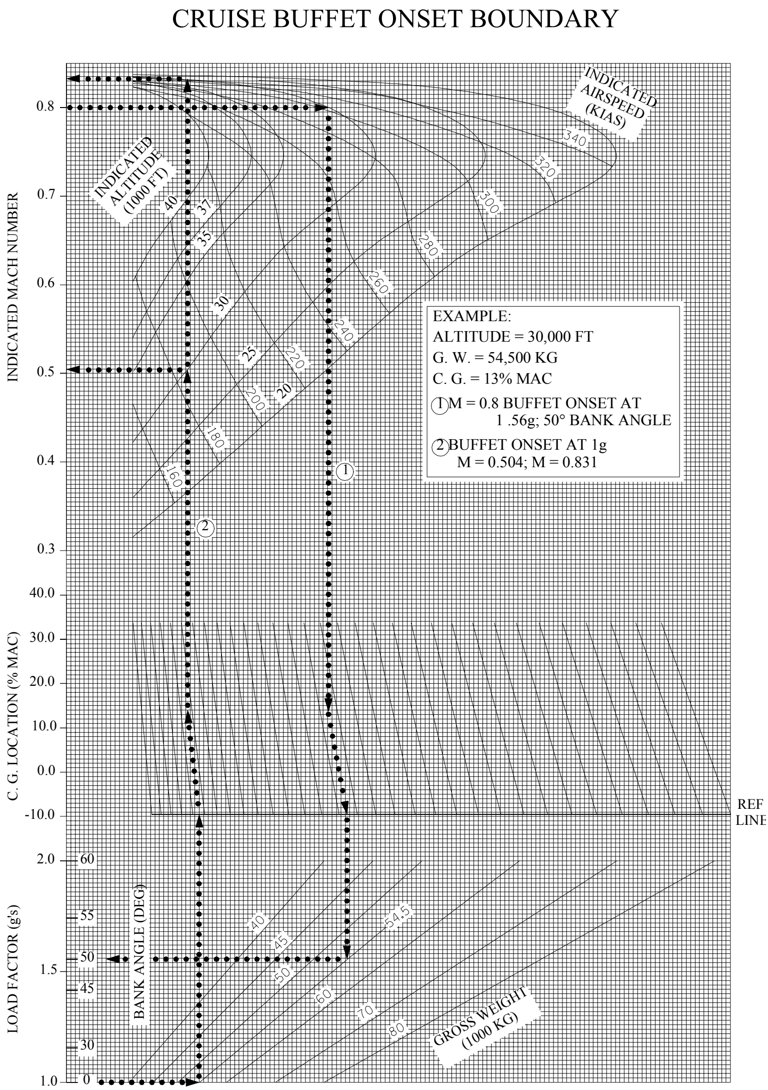
Terminal Area (5000 FT)
%N1 for Level Flight

FLAP POSITION (SLATS EXT) (SPEED)		WEIGHT (1000 LB)			
		130	110	90	70
FLAPS 0 (GEAR UP)	PITCH ATT.	9.7	9.7	9.7	9.7
(1.42 Vstall)	%N1	65.62	61.50	56.00	50.57
FLAPS 5 (GEAR UP)	PITCH ATT.	10.7	10.7	10.7	10.7
(1.32 Vstall)	%N1	66.92	62.26	57.00	51.27
FLAPS 13 (GEAR UP)	PITCH ATT.	9.5	9.5	9.5	9.5
(1.32 Vstall)	%N1	68.58	63.72	58.73	52.51

Final Approach (1500 FT)
%N1 for 3° Glideslope

FLAP POSITION (SLATS EXT) (SPEED)		WEIGHT (1000 LB)			
		130	110	90	70
FLAPS 13 (GEAR UP)	PITCH ATT.	6.5	6.5	6.5	6.5
(1.32 Vstall)	%N1	46.68	43.35	39.80	35.60
FLAPS 40 (GEAR DWN)	PITCH ATT.	5.1	5.0	4.9	4.7
(1.23 Vstall + 5)	%N1	65.43	61.17	56.22	50.68

CRUISE BUFFET ONSET BOUNDARY



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LONG RANGE CRUISE MAXIMUM OPERATING ALTITUDE

These tables provide the maximum operating altitude. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 29° may cause the airplane to lose speed and/or altitude.

NOTE

The altitudes shown in the tables result in buffet related maneuver margins of 1.2g (33 degree bank) or are limited to the maximum certified altitude of 37,000 ft.

Long Range Cruise Max Operating Alt: Max Operating Altitude

ISA+10°C and below

WEIGHT (1000) LB	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20(33°)	1.25(36°)	1.30(39°)	1.40(44°)	1.50(48°)
130	31100	-8	31600*	31400	30500	28700	27300
120	32900	-12	34000	33100	32200	30500	29100
110	34700	-16	35900	35000	34100	32400	31000
100	36700	-19	37000	37000	36100	34400	33000
90	37000	-19	37000	37000	37000	36600	35300
80	37000	-19	37000	37000	37000	37000	37000
70	37000	-19	37000	37000	37000	37000	37000
60	37000	-19	37000	37000	37000	37000	37000

ISA+15°C

WEIGHT (1000) LB	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20(33°)	1.25(36°)	1.30(39°)	1.40(44°)	1.50(48°)
130	31100	-3	27200*	27200*	27200*	27200*	27200*
120	32900	-7	31800*	31800*	31800*	30500	29100
110	34700	-11	35300*	35000	34100	32400	31000
100	36700	-14	37000	37000	36100	34400	33000
90	37000	-14	37000	37000	37000	36600	35300
80	37000	-14	37000	37000	37000	37000	37000
70	37000	-14	37000	37000	37000	37000	37000
60	37000	-14	37000	37000	37000	37000	37000

ISA+20°C

WEIGHT (1000) LB	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20(33°)	1.25(36°)	1.30(39°)	1.40(44°)	1.50(48°)
130	31100	3	23600*	23600*	23600*	23600*	23600*
120	32900	-1	27100*	27100*	27100*	27100*	27100*
110	34700	-5	31100*	31100*	31100*	31100*	31000
100	36700	-8	36100*	36100*	36100	34400	33000
90	37000	-8	37000	37000	37000	36600	35300
80	37000	-8	37000	37000	37000	37000	37000
70	37000	-8	37000	37000	37000	37000	37000
60	37000	-8	37000	37000	37000	37000	37000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

LONG RANGE CRUISE CONTROL

This tables provide target EPR, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude.

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)							
		23	25	27	29	31	33	35	37
130	EPR	1.30	1.33	1.37	1.42				
	MACH	.711	.750	.774	.779				
	KIAS	310	315	312	301				
	FF/ENG	3026	3082	3075	3005				
120	EPR	1.25	1.30	1.34	1.38	1.42			
	MACH	.669	.714	.753	.775	.778			
	KIAS	290	299	304	300	288			
	FF/ENG	2677	2783	2830	2816	2743			
110	EPR	1.22	1.25	1.30	1.34	1.38	1.42		
	MACH	.633	.669	.715	.754	.776	.778		
	KIAS	274	278	287	291	287	276		
	FF/ENG	2378	2436	2535	2578	2560	2490		
100	EPR	1.19	1.21	1.25	1.29	1.34	1.38	1.42	
	MACH	.615	.631	.665	.712	.753	.775	.778	
	KIAS	266	262	266	273	278	275	264	
	FF/ENG	2172	2144	2191	2282	2326	2311	2247	
90	EPR	1.15	1.18	1.21	1.24	1.29	1.33	1.37	1.42
	MACH	.586	.610	.627	.658	.704	.748	.774	.778
	KIAS	253	253	249	251	259	264	262	252
	FF/ENG	1941	1939	1914	1943	2026	2074	2066	2023
80	EPR	1.13	1.15	1.17	1.20	1.23	1.27	1.32	1.36
	MACH	.558	.578	.602	.621	.646	.691	.738	.770
	KIAS	240	239	239	237	236	242	249	249
	FF/ENG	1721	1710	1709	1692	1695	1763	1821	1834
70	EPR	1.10	1.12	1.13	1.16	1.18	1.21	1.25	1.30
	MACH	.533	.548	.568	.590	.614	.632	.670	.720
	KIAS	229	226	225	224	224	220	224	231
	FF/ENG	1520	1497	1484	1480	1477	1458	1496	1569
60	EPR	1.08	1.09	1.10	1.12	1.14	1.16	1.19	1.22
	MACH	.510	.522	.536	.553	.574	.598	.620	.644
	KIAS	219	215	212	209	208	208	206	205
	FF/ENG	1359	1322	1293	1275	1265	1263	1253	1257

HOLDING

Target EPR, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMS optimum holding speed schedule. This is the higher of 1.5 VSmin or 1.3g to buffet. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read EPR, IAS and fuel flow per engine.

Holding Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	37000
130	EPR	1.07	1.09	1.11	1.15	1.22	1.31	1.43		
	KIAS	248	249	250	251	257	267	278		
	FF/ENG	2670	2630	2590	2570	2630	2780	2930		
120	EPR	1.06	1.08	1.10	1.13	1.19	1.27	1.39		
	KIAS	239	239	240	241	244	255	262		
	FF/ENG	2490	2430	2390	2360	2380	2500	2630		
110	EPR	1.05	1.07	1.09	1.12	1.16	1.23	1.34	1.48	
	KIAS	228	229	230	231	232	240	247	262	
	FF/ENG	2310	2240	2190	2150	2150	2220	2350	2550	
100	EPR	1.05	1.06	1.08	1.10	1.14	1.20	1.29	1.42	1.47
	KIAS	218	218	219	220	221	224	234	243	248
	FF/ENG	2140	2070	1990	1960	1930	1960	2070	2190	2280
90	EPR	1.04	1.05	1.06	1.09	1.12	1.17	1.24	1.36	1.41
	KIAS	207	207	208	208	209	211	219	225	230
	FF/ENG	1970	1900	1810	1760	1730	1730	1800	1900	1960
80	EPR	1.03	1.04	1.05	1.07	1.10	1.14	1.20	1.30	1.34
	KIAS	195	195	196	196	197	198	201	210	212
	FF/ENG	1810	1730	1640	1570	1540	1520	1540	1630	1670
70	EPR	1.03	1.03	1.04	1.06	1.08	1.11	1.16	1.23	1.28
	KIAS	182	182	183	183	184	185	186	193	196
	FF/ENG	1640	1560	1470	1410	1360	1330	1320	1370	1420
60	EPR	1.02	1.03	1.03	1.05	1.06	1.09	1.12	1.18	1.21
	KIAS	169	169	169	170	170	171	172	173	176
	FF/ENG	1500	1420	1330	1240	1180	1140	1120	1120	1150

These tables include 5% additional fuel for holding in a racetrack pattern.

SLIPPERY RUNWAY LANDING DISTANCE

All landing distances shown are at least 115% of the required landing distance. ***It is recommended that landings not be attempted when braking action is reported as poor except in the case of emergency.*** If the surface is affected by water, snow or ice, and the braking action is reported as “good”, conditions should not be expected to be as good as on clean dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. Read landing distance for the reported braking action and apply the corrections for weight, airport pressure altitude, wind, approach speed and runway slope as required.

Slippery Runway Landing Distance Ref Landing Distance (FT)

BRAKING CONFIGURATION	REPORTED BRAKING ACTION			
	DRY	GOOD	MEDIUM	POOR
MAX MANUAL BRAKING	2610	3660	4550	5510

Landing Distance Adjustments (FT)

CONDITIONS		ADJUSTMENTS			
TEMP	PER 10° C ABOVE ISA	70	100	130	160
WEIGHT	PER 10000 LB BELOW 90000 LB	-190	-280	-370	-480
	PER 10000 LB ABOVE 90000 LB	200	290	380	500
AIRPORT PRESSURE ALTITUDE	PER 1000 FT ABOVE SEA LEVEL	90	130	170	210
WIND	PER 10 KTS HEADWIND	-100	-170	-240	-340
	PER 10 KTS TAILWIND	450	730	1120	1670
APPROACH SPEED	PER 10 KTS ABOVE VREF	390	430	470	500
SLOPE	PER 1% DOWNHILL SLOPE	80	200	320	690
	PER 1% UPHILL SLOPE	-30	-60	-110	-170
*REVERSE THRUST	1 REVERSER INOPERATIVE	240	770	1550	2820
	2 REVERSERS INOPERATIVE	310	1490	2390	8360

Actual (unfactored) distances are shown. Based on flaps 40, VREF 40 approach speed.
Landing Distance required includes air distance.
Max manual braking includes 2 engine maximum reverse thrust. Correct as applicable for inoperative reversers.

BRAKE COOLING SCHEDULE

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Reference Brake Energy Per Brake table with the airplane weight and brakes on speed at the appropriate temperature and altitude condition. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff using maximum manual braking or autobrakes (if installed). Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the Event Adjusted Brake Energy Per Brake table with the appropriate reference brake energy per brake and the type of braking used during landing (Max Manual, MAX Auto, HIGH, MED, MIN) The resulting number is the adjusted brake energy per brake, and represents the energy absorbed in each brake during landing. For rejected takeoff, no adjustment to brake energy is necessary.

The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitoring System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest indicated brake temperature approximately 15 minutes after the airplane has come to a complete stop or after the gears have retracted in-flight to determine recommended cooling schedule.

Brake Cooling Schedule Ref Brake Energy Per Brake (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 LB)	OAT (°F)	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
		0	2000	4000	0	2000	4000	0	2000	4000	0	2000	4000	0	2000	4000	0	2000	4000
130	0	9.1	9.8	10.5	13.8	14.8	15.9	19.3	20.7	22.2	25.5	27.3	29.4	32.4	34.7	37.4	39.8	42.8	46.0
	40	9.8	10.5	11.3	14.8	15.9	17.1	20.7	22.2	23.9	27.3	29.4	31.6	34.7	37.4	40.2	42.8	46.0	49.5
	80	10.5	11.3	12.2	15.9	17.1	18.5	22.2	23.9	25.8	29.4	31.6	34.1	37.4	40.2	43.3	46.0	49.5	53.3
	120	11.3	12.2	13.1	17.1	18.5	19.9	23.9	25.8	27.8	31.6	34.1	36.7	40.2	43.3	46.7	49.5	53.3	57.5
120	0	8.5	9.2	9.8	12.8	13.8	14.8	17.9	19.2	20.6	23.5	25.3	27.2	29.8	32.0	34.4	36.6	39.3	42.3
	40	9.2	9.8	10.6	13.8	14.8	16.0	19.2	20.6	22.2	25.3	27.2	29.2	32.0	34.4	37.0	39.3	42.3	45.5
	80	9.8	10.6	11.4	14.8	16.0	17.2	20.6	22.2	23.9	27.2	29.2	31.5	34.4	37.0	39.9	42.3	45.5	49.0
	120	10.6	11.4	12.3	16.0	17.2	18.5	22.2	23.9	25.8	29.2	31.5	33.9	37.0	39.9	43.0	45.5	49.0	52.8
110	0	7.9	8.5	9.1	11.9	12.7	13.7	16.4	17.6	19.0	21.6	23.2	24.9	27.3	29.3	31.5	33.4	35.8	38.5
	40	8.5	9.1	9.8	12.7	13.7	14.7	17.6	19.0	20.4	23.2	24.9	26.8	29.3	31.5	33.9	35.8	38.5	41.5
	80	9.1	9.8	10.6	13.7	14.7	15.9	19.0	20.4	22.0	24.9	26.8	28.9	31.5	33.9	36.5	38.5	41.5	44.7
	120	9.8	10.6	11.4	14.7	15.9	17.1	20.4	22.0	23.7	26.8	28.9	31.1	33.9	36.5	39.3	41.5	44.7	48.2
100	0	7.3	7.9	8.5	10.9	11.7	12.6	15.0	16.1	17.3	19.6	21.1	22.7	24.7	26.5	28.5	30.2	32.4	34.8
	40	7.9	8.5	9.1	11.7	12.6	13.5	16.1	17.3	18.6	21.1	22.7	24.4	26.5	28.5	30.7	32.4	34.8	37.5
	80	8.5	9.1	9.8	12.6	13.5	14.6	17.3	18.6	20.1	22.7	24.4	26.3	28.5	30.7	33.1	34.8	37.5	40.3
	120	9.1	9.8	10.6	13.5	14.6	15.7	18.6	20.1	21.7	24.4	26.3	28.3	30.7	33.1	35.7	37.5	40.3	43.5
90	0	6.7	7.2	7.8	9.9	10.7	11.5	13.6	14.6	15.7	17.7	19.0	20.4	22.2	23.8	25.6	26.9	28.9	31.1
	40	7.2	7.8	8.3	10.7	11.5	12.3	14.6	15.7	16.9	19.0	20.4	22.0	23.8	25.6	27.5	28.9	31.1	33.4
	80	7.8	8.3	9.0	11.5	12.3	13.3	15.7	16.9	18.2	20.4	22.0	23.7	25.6	27.5	29.7	31.1	33.4	36.0
	120	8.3	9.0	9.7	12.3	13.3	14.3	16.9	18.2	19.6	22.0	23.7	25.5	27.5	29.7	32.0	33.4	36.0	38.9
80	0	6.1	6.6	7.1	8.9	9.6	10.3	12.1	13.0	14.0	15.7	16.9	18.1	19.6	21.0	22.6	23.7	25.5	27.4
	40	6.6	7.1	7.6	9.6	10.3	11.1	13.0	14.0	15.1	16.9	18.1	19.5	21.0	22.6	24.3	25.5	27.4	29.5
	80	7.1	7.6	8.2	10.3	11.1	12.0	14.0	15.1	16.2	18.1	19.5	21.0	22.6	24.3	26.2	27.4	29.5	31.7
	120	7.6	8.2	8.8	11.1	12.0	12.9	15.1	16.2	17.5	19.5	21.0	22.7	24.3	26.2	28.3	29.5	31.7	34.2

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.
If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 59°F.

Event Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

TYPE OF BRAKING		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)							
		10	15	20	25	30	35	40	45
RTO	MAX MAN/AUTO	10	15	20	25	30	35	40	45
LANDING	MAX MAN	8.0	12.3	17.0	21.8	26.7	31.8	37.1	42.5
	HIGH (9 FPSS)	5.8	9.1	12.7	16.5	20.4	24.4	28.5	32.8
	MED (6.5 FPSS)	4.6	7.5	10.5	13.7	17.1	20.5	24.0	27.7
	MIN (5 FPSS)	3.5	5.7	8.2	10.7	13.5	16.3	19.1	22.1

Brake Cooling Schedule Recommended Cooling Time (Minutes)

	EVENT ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)					
	11.5	16.5	22	28	28 TO 30	30 & ABOVE
	BRAKE TEMPERATURE MONITORING SYSTEM INDICATION (°C)					
	110	150	195	250	250 TO 270	270 & ABOVE
INFLIGHT GEAR DOWN	1.6	3.1	4.4	5.7	CAUTION	FUSE PLUG MELT ZONE
GROUND	30	60	85	108		

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added. The indicated brake temperature represents the total energy per brake. Table includes credit for reverse thrust.

When in caution zone, wheel fuse plugs may melt. Unless required, do not set parking brake. Delay takeoff. If the “BRAKE OVERHEAT” alert comes on: wheel, tire, and brake inspection are required after the alert extinguished. If “BRAKE OVERHEAT alert occurs after takeoff, flight conditions permitting, extend gear until “BRAKE OVERHEAT” alert extinguishes plus 5 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi. Wheel, tire and brake replacement may be required. If “BRAKE OVERHEAT” alert occurs after takeoff, flight conditions permitting, extend gear until “BRAKE OVERHEAT” alert extinguishes plus 5 minutes.

Recommended Maximum Takeoff Brake Temperature

Equal to or less than 170°.

Alternate Quick Turn Calculation (With operative BTMS)

If 10 minutes after parking the temperature of the warmest brake is less than 260° and decreasing and the “BRAKE OVERHEAT” alert is not displayed: no waiting period or inspection is required. If the warmest brake temperature exceeds 260°C or if the “BRAKE OVERHEAT” is or has been diplayed since landing, the full 50 minute waiting period and a check of tire pressures is required.

ENGINE INOP

Max Continuous EPR - Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read EPR.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .76M to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR Table should be used to determine EPR for the given conditions.

Engine Out Initial Max Continuous EPR: (Based on 0.76M, Pack On High, and Anti-Ice Off)

TAT C	PRESSURE ALTITUDE (1000 FT)								
	21	23	25	27	29	31	33	35	37
20	1.384	1.364	1.351	1.342	1.332	1.322			
15	1.422	1.402	1.389	1.380	1.369	1.358	1.347		
10	1.437	1.440	1.428	1.419	1.409	1.397	1.385	1.373	1.363
5	1.437	1.451	1.468	1.460	1.449	1.438	1.426	1.413	1.401
0	1.437	1.451	1.474	1.501	1.491	1.480	1.468	1.455	1.442
-5	1.437	1.451	1.474	1.503	1.532	1.522	1.511	1.499	1.486
-10	1.437	1.451	1.474	1.503	1.532	1.557	1.552	1.542	1.530
-15	1.437	1.451	1.474	1.503	1.532	1.557	1.578	1.580	1.571
-20	1.437	1.451	1.474	1.503	1.532	1.557	1.578	1.599	1.602
-25	1.437	1.451	1.474	1.503	1.532	1.557	1.578	1.599	1.604
-30	1.437	1.451	1.474	1.503	1.532	1.557	1.578	1.599	1.604
-35	1.437	1.451	1.474	1.503	1.532	1.557	1.578	1.599	1.604
-40	1.437	1.451	1.474	1.503	1.532	1.557	1.578	1.599	1.604

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	21	23	25	27	29	31	33	35	37
ENGINE ANTI-ICE	-0.035	-0.036	-0.037	-0.041	-0.044	-0.046	-0.047	-0.048	-0.049
WING AND ENGINE ANTI-ICE	-0.076	-0.076	-0.078	-0.084	-0.090	-0.095	-0.099	-0.103	-0.111

Engine Inop Max Continuous EPR: 37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	0.51	1.670	1.670	1.6703	1.670	1.649	1.625	1.598	1.563	1.519	1.479		
200	0.63	1.644	1.644	1.6439	1.644	1.644	1.627	1.599	1.566	1.525	1.479	1.436	
240	0.74	1.609	1.609	1.6093	1.609	1.609	1.609	1.601	1.570	1.530	1.485	1.441	1.400
280	0.86	1.560	1.560	1.5595	1.560	1.560	1.560	1.560	1.560	1.533	1.491	1.447	1.405
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	0.49	1.671	1.671	1.671	1.671	1.656	1.632	1.606	1.574	1.533	1.4907		
200	0.60	1.647	1.647	1.647	1.647	1.647	1.634	1.609	1.577	1.538	1.4911	1.448	
240	0.71	1.616	1.616	1.616	1.616	1.616	1.616	1.610	1.581	1.543	1.4968	1.453	1.411
280	0.82	1.573	1.573	1.573	1.573	1.573	1.573	1.573	1.573	1.545	1.5018	1.458	1.416
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	0.47	1.662	1.662	1.662	1.662	1.661	1.638	1.638	1.581	1.542	1.499	1.462	
200	0.58	1.639	1.639	1.639	1.639	1.639	1.639	1.639	1.584	1.545	1.503	1.459	1.422
240	0.68	1.609	1.609	1.609	1.609	1.609	1.609	1.609	1.586	1.550	1.508	1.464	1.422
280	0.79	1.566	1.566	1.566	1.566	1.566	1.566	1.566	1.566	1.554	1.513	1.469	1.428
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	0.45	1.653	1.653	1.653	1.653	1.644	1.620	1.590	1.553	1.510	1.4685		
200	0.55	1.632	1.632	1.632	1.632	1.632	1.621	1.593	1.556	1.513	1.4699	1.429	
240	0.66	1.602	1.602	1.602	1.602	1.602	1.602	1.595	1.560	1.518	1.4739	1.433	1.393
280	0.76	1.559	1.559	1.559	1.559	1.559	1.559	1.559	1.559	1.522	1.4793	1.438	1.397
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	0.43	1.643	1.643	1.643	1.626	1.626	1.598	1.564	1.522	1.478	1.441		
200	0.53	1.622	1.622	1.622	1.622	1.622	1.600	1.566	1.525	1.481	1.439	1.403	
240	0.63	1.593	1.593	1.593	1.593	1.593	1.593	1.569	1.529	1.485	1.442	1.403	1.366
280	0.73	1.551	1.551	1.551	1.551	1.551	1.551	1.551	1.534	1.490	1.447	1.407	1.368
320	0.82	1.494	1.494	1.494	1.494	1.494	1.494	1.494	1.494	1.494	1.452	1.411	1.373
27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	0.41	1.633	1.633	1.633	1.633	1.6313	1.606	1.573	1.532	1.489	1.448	1.416	
200	0.51	1.613	1.613	1.613	1.613	1.6125	1.607	1.575	1.535	1.492	1.450	1.411	1.379
240	0.60	1.582	1.582	1.582	1.582	1.5822	1.582	1.578	1.539	1.495	1.453	1.413	1.374
280	0.70	1.539	1.539	1.539	1.539	1.5391	1.539	1.539	1.539	1.500	1.458	1.417	1.377
320	0.79	1.485	1.485	1.485	1.485	1.4848	1.485	1.485	1.485	1.485	1.461	1.421	1.382

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	27	29	31	33	35	37
ENGINE ANTI-ICE	-0.041	-0.044	-0.046	-0.047	-0.048	-0.049
WING AND ENGINE ANTI-ICE	-0.084	-0.090	-0.095	-0.099	-0.103	-0.111

Engine Inop Max Continuous EPR: 25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	0.39	1.622	1.622	1.622	1.622	1.612	1.583	1.543	1.498	1.457	1.420		
200	0.49	1.603	1.603	1.603	1.603	1.603	1.585	1.546	1.501	1.459	1.420	1.384	
240	0.58	1.572	1.572	1.572	1.572	1.572	1.572	1.548	1.504	1.461	1.422	1.383	1.346
280	0.67	1.526	1.526	1.526	1.526	1.526	1.526	1.526	1.508	1.465	1.425	1.386	1.347
320	0.76	1.474	1.474	1.474	1.474	1.474	1.474	1.474	1.474	1.468	1.428	1.389	1.351
24000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	0.38	1.615	1.615	1.615	1.615	1.614	1.586	1.548	1.504	1.462	1.424	1.394	
200	0.48	1.594	1.594	1.594	1.594	1.594	1.586	1.550	1.507	1.464	1.425	1.387	1.358
240	0.57	1.563	1.563	1.563	1.563	1.563	1.563	1.552	1.510	1.467	1.426	1.389	1.351
280	0.66	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.513	1.470	1.430	1.391	1.353
320	0.75	1.470	1.470	1.470	1.470	1.470	1.470	1.470	1.470	1.470	1.433	1.394	1.357
22000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	0.37	1.607	1.607	1.607	1.607	1.597	1.562	1.522	1.4796	1.440	1.405		
200	0.46	1.585	1.585	1.585	1.585	1.585	1.564	1.524	1.4818	1.442	1.404	1.370	
240	0.55	1.553	1.553	1.553	1.553	1.553	1.553	1.525	1.4839	1.444	1.405	1.368	1.335
280	0.63	1.513	1.513	1.513	1.513	1.513	1.513	1.513	1.4864	1.446	1.407	1.369	1.334
320	0.72	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.4666	1.449	1.410	1.372	1.335
20000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	0.35	1.605	1.605	1.605	1.605	1.605	1.586	1.548	1.506	1.465	1.428	1.396	
200	0.44	1.585	1.585	1.585	1.585	1.585	1.585	1.550	1.507	1.467	1.429	1.392	1.362
240	0.53	1.555	1.555	1.555	1.555	1.555	1.555	1.552	1.509	1.467	1.430	1.393	1.356
280	0.61	1.514	1.514	1.514	1.514	1.514	1.514	1.514	1.511	1.469	1.431	1.394	1.357
320	0.69	1.470	1.470	1.470	1.470	1.470	1.470	1.470	1.470	1.470	1.433	1.396	1.358
18000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	0.34	1.587	1.587	1.587	1.587	1.587	1.555	1.514	1.474	1.436	1.401	1.401	
200	0.42	1.566	1.566	1.566	1.566	1.566	1.556	1.516	1.476	1.437	1.401	1.401	
240	0.51	1.536	1.536	1.536	1.536	1.536	1.536	1.518	1.477	1.438	1.401	1.401	1.333
280	0.59	1.498	1.498	1.498	1.498	1.498	1.498	1.498	1.478	1.439	1.401	1.401	1.331
320	0.67	1.457	1.457	1.457	1.457	1.457	1.457	1.457	1.457	1.440	1.402	1.402	1.331

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	18	20	22	24	25
ENGINE ANTI-ICE	-0.034	-0.035	-0.035	-0.036	-0.037
WING AND ENGINE ANTI-ICE	-0.073	-0.077	-0.076	-0.077	-0.078

Engine Inop Max Continuous EPR: 16000 FT to 0 FT PA

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	0.33	1.571	1.571	1.571	1.571	1.571	1.563	1.522	1.481	1.444	1.409	1.376	
200	0.41	1.547	1.547	1.547	1.547	1.547	1.547	1.523	1.482	1.445	1.409	1.375	1.345
240	0.49	1.515	1.515	1.515	1.515	1.515	1.515	1.515	1.483	1.445	1.409	1.372	1.339
280	0.57	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.445	1.408	1.372	1.337
320	0.64	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.408	1.372	1.337

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	0.31	1.545	1.545	1.545	1.545	1.545	1.526	1.486	1.448	1.414	1.381	1.352	
200	0.39	1.523	1.523	1.523	1.523	1.523	1.523	1.486	1.448	1.413	1.380	1.348	1.321
240	0.47	1.493	1.493	1.493	1.493	1.493	1.493	1.486	1.447	1.412	1.377	1.343	1.314
280	0.54	1.460	1.460	1.460	1.460	1.460	1.460	1.460	1.448	1.411	1.376	1.342	1.310
320	0.62	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.411	1.376	1.341	1.308

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
160	0.30	1.5156	1.516	1.516	1.516	1.516	1.488	1.450	1.416	1.384	1.354	1.329	
200	0.38	1.4948	1.495	1.495	1.495	1.495	1.487	1.450	1.414	1.381	1.351	1.322	
240	0.45	1.4691	1.469	1.469	1.469	1.469	1.469	1.449	1.413	1.379	1.347	1.317	1.290
280	0.52	1.4393	1.439	1.439	1.439	1.439	1.439	1.439	1.412	1.378	1.345	1.313	1.284
320	0.60	1.4061	1.406	1.406	1.406	1.406	1.406	1.406	1.406	1.377	1.344	1.311	1.280

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
160	0.29	1.485	1.485	1.485	1.485	1.485	1.485	1.450	1.416	1.384	1.355	1.329	1.306
200	0.36	1.466	1.466	1.466	1.466	1.466	1.466	1.449	1.414	1.381	1.351	1.324	1.298
240	0.43	1.444	1.444	1.444	1.444	1.444	1.444	1.444	1.414	1.379	1.348	1.319	1.292
280	0.51	1.418	1.418	1.418	1.418	1.418	1.418	1.418	1.414	1.378	1.344	1.315	1.287
320	0.58	1.386	1.386	1.386	1.386	1.386	1.386	1.386	1.386	1.377	1.342	1.312	1.282

5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	0.26	1.423	1.423	1.423	1.423	1.423	1.423	1.417	1.386	1.358	1.331	1.306	1.282
200	0.33	1.406	1.406	1.406	1.406	1.406	1.406	1.406	1.383	1.354	1.327	1.301	1.275
240	0.40	1.387	1.387	1.387	1.387	1.387	1.387	1.387	1.382	1.351	1.323	1.297	1.270
280	0.46	1.363	1.363	1.363	1.363	1.363	1.363	1.363	1.363	1.347	1.318	1.290	1.263
320	0.53	1.337	1.337	1.337	1.337	1.337	1.337	1.337	1.337	1.337	1.314	1.285	1.257

0 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	0.24	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.359	1.332	1.307	1.283
200	0.30	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.328	1.302	1.277
240	0.36	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.324	1.297	1.272
280	0.42	1.317	1.317	1.317	1.317	1.317	1.317	1.317	1.317	1.317	1.317	1.293	1.266
320	0.48	1.294	1.294	1.294	1.294	1.294	1.294	1.294	1.294	1.294	1.294	1.288	1.260

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	5	10	12	14	16
ENGINE ANTI-ICE	-0.020	-0.022	-0.027	-0.028	-0.030	-0.032
WING AND ENGINE ANTI-ICE	-0.047	-0.052	-0.060	-0.063	-0.066	-0.069

Engine Out Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown Speed/Level Off Altitude: 100 ft/min Residual Rate Of Climb, Max Continuous Thrust

WEIGHT(1000 LB)		OPTIMUM DRIFTDOWN SPEEDS (KIAS)	LEVEL OFF ALTITUDE FT		
START DRIFTDOWN	LEVEL OFF		ISA+10°	ISA+15°	ISA+20°
130	124	245	14100	12000	9500
120	115	238	17300	15400	13500
110	106	230	20200	18800	17000
100	96	221	22800	21700	20200
90	87	211	25800	24900	23400
80	77	199	28900	28200	27100
70	68	186	32300	31700	31000
60	58	173	35800	35300	34800

Single Engine Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Altitude Capability: 100 Ft/min Residual Rate Of Climb, Max Continuous Thust

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA+10°C	ISA+15°C	ISA+20°C
130	4500		
120	11800	5500	
110	16300	13400	7000
100	20000	18100	15400
90	23000	21600	19900
80	26500	25300	23600
70	30200	29400	28100
60	34100	33500	32600

Single Engine Long Range Cruise Control

The table provides target EPR, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn. To conservatively account for APU fuel burn, add TBD lb/hr to fuel flow values.

Single Engine Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		12	14	16	18	20	22	24	26	28	30
130	EPR										
	MACH										
	KIAS										
	FF/ENG										
120	EPR	1.41	1.47								
	MACH	.511	.528								
	KIAS	273	271								
	FF/ENG	5000	5059								
110	EPR	1.37	1.41	1.46							
	MACH	.499	.510	.526							
	KIAS	266	262	260							
	FF/ENG	4585	4542	4587							
100	EPR	1.33	1.36	1.40	1.45	1.52					
	MACH	.488	.497	.508	.523	.550					
	KIAS	260	255	251	249	252					
	FF/ENG	4213	4137	4091	4119	4271					
90	EPR	1.29	1.32	1.35	1.39	1.43	1.49				
	MACH	.474	.485	.495	.505	.518	.541				
	KIAS	253	249	244	240	236	237				
	FF/ENG	3846	3772	3701	3654	3646	3736				
80	EPR	1.26	1.28	1.31	1.34	1.37	1.41	1.47	1.55		
	MACH	.456	.469	.480	.491	.500	.512	.531	.568		
	KIAS	242	240	237	233	228	224	223	230		
	FF/ENG	3476	3411	3341	3280	3220	3186	3231	3443		
70	EPR	1.22	1.24	1.27	1.29	1.32	1.35	1.39	1.43	1.50	
	MACH	.430	.446	.460	.473	.484	.494	.505	.520	.546	
	KIAS	229	228	227	224	221	216	212	209	211	
	FF/ENG	3078	3034	2983	2923	2861	2799	2760	2759	2848	
60	EPR	1.18	1.20	1.22	1.24	1.27	1.29	1.32	1.35	1.40	1.45
	MACH	.399	.415	.432	.447	.462	.475	.486	.497	.508	.525
	KIAS	212	212	212	212	210	207	204	200	196	194
	FF/ENG	2644	2623	2594	2556	2510	2453	2400	2351	2321	2338

Engine Inop Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Single Engine Holding: Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
130	EPR	1.25	1.29	1.38			
	KIAS	248	249	250			
	FF/ENG	5090	5060	5080			
120	EPR	1.22	1.26	1.34	1.45		
	KIAS	239	239	240	241		
	FF/ENG	4690	4650	4620	4770		
110	EPR	1.19	1.23	1.30	1.39	1.55	
	KIAS	228	229	230	231	232	
	FF/ENG	4300	4250	4200	4240	4490	
100	EPR	1.17	1.20	1.26	1.34	1.47	
	KIAS	218	218	219	220	221	
	FF/ENG	3910	3860	3800	3780	3920	
90	EPR	1.15	1.17	1.23	1.30	1.39	1.55
	KIAS	207	207	208	208	209	211
	FF/ENG	3530	3470	3410	3360	3390	3600
80	EPR	1.12	1.15	1.19	1.25	1.33	1.46
	KIAS	195	195	196	196	197	198
	FF/ENG	3150	3100	3030	2970	2950	3040
70	EPR	1.10	1.12	1.16	1.21	1.28	1.37
	KIAS	182	182	183	183	184	185
	FF/ENG	2770	2720	2660	2590	2550	2550
60	EPR	1.08	1.10	1.13	1.17	1.22	1.30
	KIAS	169	169	169	170	170	171
	FF/ENG	2390	2340	2290	2230	2180	2140

This table includes These tables include 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN DATA

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

NOTE

Because the FMS does not incorporate a gear down position input, the VNAV mode is not to be used during gear down operations. There is no accountability for gear drag and no provisions for the FMS to generate climb, cruise and descent speed schedules or fuel predictions appropriate for gear down flight.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Gear Down Long Range Cruise Altitude Capability: Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 LB)	MAX CRUISE THRUST LIMIT PRESS ALT (FT)		
	ISA+10°C	ISA+15°C	ISA+20°C
130	19100	16300	9900
120	22000	20200	17200
110	24100	24000	21600
100	26300	26300	25500
90	28600	28600	28600
80	31200	31200	31200
70	34100	34100	34100
60	37000	37000	37000

Gear Down Long Range Cruise Control ISA: Based on engine bleed for packs on, engine anti-ice on or off

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT) 10	15	21	23	25	27	29	31	33	35
130	EPR	1.25	1.32								
	MACH	.461	.502								
	KIAS	255	253								
	FF/ENG	3658	3656								
120	EPR	1.22	1.29	1.42							
	MACH	.445	.485	.540							
	KIAS	246	244	242							
	FF/ENG	3365	3335	3441							
110	EPR	1.19	1.26	1.36	1.42						
	MACH	.429	.467	.520	.539						
	KIAS	237	235	232	232						
	FF/ENG	3082	3041	3073	3124						
100	EPR	1.17	1.22	1.31	1.36	1.41					
	MACH	.411	.448	.499	.517	.537					
	KIAS	227	225	223	222	221					
	FF/ENG	2799	2753	2736	2763	2807					
90	EPR	1.14	1.19	1.27	1.30	1.35	1.40				
	MACH	.393	.428	.477	.495	.513	.533				
	KIAS	217	215	213	212	211	210				
	FF/ENG	2523	2473	2434	2433	2455	2490				
80	EPR	1.12	1.16	1.23	1.26	1.29	1.33	1.38	1.44		
	MACH	.373	.407	.453	.470	.488	.507	.527	.548		
	KIAS	206	204	202	201	200	199	199	198		
	FF/ENG	2254	2198	2151	2142	2136	2149	2176	2224		
70	EPR	1.10	1.13	1.19	1.21	1.24	1.27	1.31	1.35	1.41	
	MACH	.352	.383	.428	.444	.461	.479	.497	.517	.538	
	KIAS	194	192	190	189	189	188	187	186	186	
	FF/ENG	1990	1931	1878	1863	1854	1846	1847	1867	1898	
60	EPR	1.08	1.10	1.15	1.17	1.19	1.22	1.25	1.28	1.32	1.37
	MACH	.329	.358	.399	.415	.431	.448	.465	.484	.504	.524
	KIAS	181	179	177	177	176	175	175	174	173	173
	FF/ENG	1735	1669	1611	1596	1583	1571	1563	1555	1563	1583

Gear Down Holding: Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
130	PR	1.15	1.18	1.24	1.32				
	KIAS	248	249	250	251				
	FF/ENG	3750	3740	3750	3810				
120	EPR	1.13	1.16	1.21	1.28	1.40			
	KIAS	239	239	240	241	244			
	FF/ENG	3450	3430	3430	3450	3620			
110	EPR	1.11	1.14	1.19	1.25	1.34	1.50		
	KIAS	228	229	230	231	232	240		
	FF/ENG	3160	3130	3120	3130	3200	3550		
100	EPR	1.10	1.12	1.16	1.22	1.29	1.42		
	KIAS	218	218	219	220	221	224		
	FF/ENG	2870	2840	2810	2810	2830	3000		
90	EPR	1.08	1.10	1.13	1.18	1.25	1.35	1.52	
	KIAS	207	207	208	208	209	211	219	
	FF/ENG	2590	2550	2520	2500	2510	2570	2890	
80	EPR	1.07	1.08	1.11	1.15	1.21	1.29	1.42	
	KIAS	195	195	196	196	197	198	201	
	FF/ENG	2320	2280	2230	2200	2200	2210	2350	
70	EPR	1.06	1.07	1.09	1.12	1.17	1.24	1.33	1.50
	KIAS	182	182	183	183	184	185	186	193
	FF/ENG	2070	2010	1950	1920	1900	1900	1940	2160
60	EPR	1.05	1.05	1.07	1.10	1.13	1.19	1.26	1.37
	KIAS	169	169	169	170	170	171	172	173
	FF/ENG	1820	1760	1690	1640	1620	1600	1610	1670

This table includes These tables include 5% additional fuel for holding in a racetrack pattern.

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TABLE OF CONTENTS

FLOWS

PROCEDURES AND TRAINING

INTRODUCTION

This chapter contains procedures, profiles, and techniques for operating the Boeing 717 airplane under varying conditions.

Always follow the normal, abnormal, and emergency procedures in this AOM, supplemented by these procedures and techniques.

Airspeeds provided in the training section are recommended speeds, the Captain may need to vary these speeds in line operations.

GETTING TO THE RUNWAY

Pushback/Towing

The following safety and operating precautions apply to all airplane towing procedures and should be strictly adhered to. These precautions include the following:

- Prior to any movement, ensure cabin is properly prepared, all cargo doors and main gear doors are closed and wheel chocks are removed.
- Ensure IRU alignment has been completed (PFD displays TAXI).
- Ground communications are in the FOM, Chapter 5.
- Establish positive contact with towing personnel and ramp control.

NOTE

Flash taxi lights on and off during a pushback/tow if you need to get the signalman's attention and a headset is unavailable for the signalman's use.

- Verify anti-collision lights are on.
- Release or set parking brakes only when so directed by towing personnel.
- In congested areas, request wing walkers to ensure clearance between airplane, adjacent airplanes, equipment, and buildings.
- Ensure towing speed is not excessive.
- Be alert for any situation which may require cockpit crew intervention with towing operation.

- Ensure last few feet of towing are in a straight line to align gear and relieve tire and tow bar twisting stresses.
- Ensure all towing personnel are well clear of airplane, pins removed, and a positive all clear signal has been received prior to taxi.

Power Back

The power back maneuver can be an efficient means for the airplane to depart the gate and transition to the taxi phase. There are, however, several factors of safety and passenger comfort that must be considered before commencing the maneuver and during the maneuver itself. These considerations are as follows:

- Power back can be performed only in approved ramp areas.
- Prior to power back, the Captain and Ramp Signalman will discuss the specific power back procedure to be accomplished. The discussion will include:
  - Obstructions that may affect the power back.
  - Initial forward movement. Power back path (straight ahead or direction/degree/rate of turn.
  - Visual signals to be used in the power back
- Ground marshalling signals are in the FOM, Chapter 5.
- Ramp must be clear of contamination.
- There must be no more than moderate precipitation.
- Use minimum reverse thrust required.
- Do not use brakes while the airplane is moving rearward.
- Both pilots should have their heels on the floor during the power back maneuver.
- Both reversers and reverser unlock indications must be operative.
- Signal wands are required (they also must be lighted at night).
- The signalman standing in front of the aircraft must be wearing protective eye goggles.
- A power back should not be accomplished if there is an airplane moving at an adjacent gate.

Executing The Power Back Maneuver

Having received ground control clearance for power back, Captain signals readiness to begin power back with a flash of nosewheel light. To commence power back:

- Release brakes and advance throttles to begin forward movement. Allow the airplane to move forward slightly (2-3 feet maximum) prior to going into reverse to move main gear tires off the flat spot.
- When signalman gives the stop signal, apply brakes to stop the airplane and apply reverse thrust to reverse idle detent.
- Check that both engines are in reverse thrust, then, upon signalman's signal, release brakes and drop heels to the floor.
- A power back should not require more than approximately 1.10 EPR. Initially, reversers should be placed in reverse idle.
- Monitor the signalman continuously and apply reverse thrust as required to initiate movement.
- Control airplane speed by modulating reverse thrust as required, or moving one reverse thrust lever to forward thrust idle if speed is too fast.
- Minor tracking adjustments can be made with the nose wheel steering. Power back turn may be initiated only after straight back movement. On cue from the signalman, the turn is accomplished by turning the nose steering wheel in the direction indicated by the pointed wand. Taxi speed may decrease as the turn is initiated.
- If, during power back, the airplane stops and cannot be moved without exceeding engine limitations, the Captain must discuss the situation with the signalman to determine what action is required to continue movement.
- Brakes are not to be used when the airplane is in rearward movement. If brakes are inadvertently applied and airplane starts to tip, move throttles into forward thrust immediately.
- The stop signal is given by the signalman only after the forward thrust signal is given and the airplane is no longer moving back.
- When straight ahead signal is given, come out of reverse, and proceed with normal taxi techniques.

Taxi

A lightly loaded airplane may develop a slight bounce during taxi. This may be corrected by decreasing or increasing taxi speed.

The airplane is very sensitive to inputs from the nose gear steering wheel. In order to make a smooth entry into a turn, initiate the turn very slowly or lead the entry with rudder pedal steering. A very positive nosewheel centering action, if not smoothly controlled, may cause discomfort in the passenger compartment. In order to relieve stress, nosewheel should always be centered before coming to a stop. With both hydraulic systems in operation, nose gear steering wheel provides steering through a maximum of approximately 80° right or left of centerline. With only one hydraulic system operating, steering is restricted (both in degrees and rate of turn) to approximately 55° in the direction of the operating system and, unrestricted through a maximum of 80° in the direction of the inoperative system.

Nose gear steering through rudder pedals is very smooth and effective and provides steering through an arc of approximately 15° right or left of centerline. Rudder pedal steering can be overridden by nose gear steering wheel. When checking rudder throw, hold nose gear steering wheel to prevent scrubbing nose tires.

Attempt to roll forward before turning to avoid use of high power settings and when approaching a turn, slow down to avoid unnecessary braking and nose tire scrubbing.

When possible, avoid using brakes during a turn. If braking is necessary during a turn, brake the outside wheels first. If additional power is required during a turn, use the engine on the outside of the turn. Attempt to roll out of a turn if possible prior to stopping to relieve tire twisting stresses.

The distance from the pilots’ seats to the main gear (approximately 56 feet) requires an overshoot of the centerline on all turns. For visual reference, taxi with the centerline under the pilots’ seats in order to maintain nosewheel on centerline (refer to – Aircraft General Section).

Any time the airplane is stopped the parking brake should be set.

If delays are encountered during icing conditions, apply procedures in Supplementary section.

Fuel consumption during taxi is approximately 30 pounds per minute.

<u>Taxi - Use Of Thrust</u>

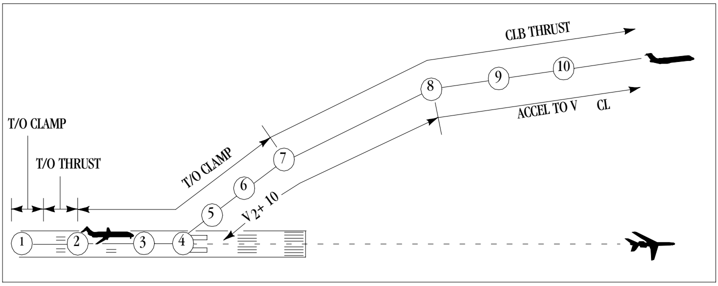
Unless the airplane is very heavy or headed uphill, use momentary application of minimum thrust required to initiate movement. Do not use excessive thrust without ground crewman clearance in order to avoid possible personnel injury or equipment damage. After airplane is moving, idle power may cause acceleration. Control taxi speed with intermittent braking.

NOTE

> Throttles should be moved forward slowly to commence taxi with as little power as necessary to preclude damage to fixed facilities or ground support equipment.

TAKEOFF

Normal Takeoff



1. When airplane is aligned on runway and cleared for takeoff, PF advances throttles and confirms symmetrical thrust. PF calls: “AUTO FLIGHT, SET TAKEOFF POWER.” PNF pushes AUTO FLIGHT switch, observes ATS OFF disappears from FMA ALT window, and T/O THRUST replaces T/O CLAMP. PNF observes the throttles advance to proper EPR setting/N_1 indication and responds: “POWER SET.” PF maintains directional control with rudder pedals. Captain keeps hand on the throttles.
2. At 80 KIAS, PNF verifies T/O CLAMP has returned to FMA altitude window and calls “80 KNOTS.” If throttles fail to clamp, PNF will call “NO CLAMP.” PF verifies airspeed and T/O CLAMP annunciated and responds “CHECK.”
3. PNF calls “V_1.” PF places both hands on the control wheel (if PF is First Officer, both hands will already be on the control wheel; if Captain, he will move them to the control wheel at this time).
4. PNF calls “V_R.” PF smoothly rotates at approximately 2.5°/sec to attain V_2 + 10 at 35 feet AGL. PNF calls “V_2.”
5. At positive rate of climb and V_2, PNF calls “POSITIVE RATE.” PF calls “GEAR UP.” PNF moves gear handle to UP and repeats “GEAR UP.” PF follows the flight director command bars which maintain V_2+10 and set heading.

6. At or above 500 feet AGL, PF calls “AUTO FLIGHT.” PNF pushes AUTO FLIGHT switch to engage the autopilot and repeats “AUTO FLIGHT” when engaged.

   At or above 400 feet AGL, PF normally calls “PROF.” PNF pushes the PROF button which will cause thrust reduction and acceleration to automatically occur on FMS schedule. In this event, do not accomplish steps 7 and 8.

   NOTES

   Setting PROF will be the normal procedure for standard departures. For non-standard departures, use the altitude select knob and speed select knob to comply with SID or ATC clearance.

   When at or above 500 feet AGL, for most takeoffs, the PF will call “AUTOFLIGHT, PROF,” together as a single callout.

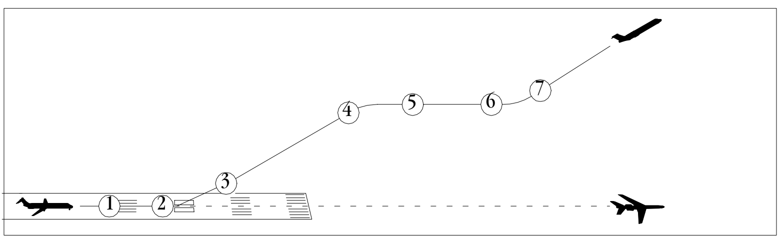
7. At or above 400 feet AGL, if not using PROF, the PF states “SET ALTITUDE” and he/she or the PNF pulls the altitude select knob on the FCP. Confirm CLB THRUST on Display Units after reaching 1500 feet. Usually the PF will state “AUTOFLIGHT, SET ALTITUDE” together as a single callout if planning to engage the autopilot.

   NOTE

   Pulling the ALTITUDE select knob below CLB THRUST altitude will change T/O CLAMP to T/O THRUST and enable thrust reduction at CLB THRUST altitude. If above CLB THRUST altitude, pulling the ALTITUDE select knob will cause thrust to reduce to CLB THRUST.

8. At acceleration altitude (3000 feet above airport elevation or initial level off), pull the airspeed select knob or set FMS speed to initiate acceleration. Verify 250 PITCH in FMA speed window, a pitch decrease and an airspeed increase. Monitor acceleration, and vertical and horizontal navigation.
9. At acceleration altitude and flap retract speed, PF calls “FLAPS UP.” PNF verifies airplane is at or above flap retract speed and moves FLAP/SLAT handle to 0/EXT and repeats “FLAPS UP.”
10. At slat retract speed, PF calls “SLATS RETRACT.” PNF verifies airplane at or above slat retract speed and moves FLAP/SLAT handle to UP/RET and repeats “SLATS RETRACT.” Call for and accomplish the CLIMB checklist.

Engine Failure Takeoff



NOTE

EO ACCEL altitude must be edited to 800 feet AGL.

1. If engine fire/failure occurs after V1, maintain directional control and continue the takeoff. PNF will call “ENGINE FAILURE” or “ENGINE FIRE” as appropriate.
2. At VR, rotate smoothly at approximately 2.5° per second to attain V2 at 35 feet AGL. Use rudder to maintain directional control with wings level and follow the Flight Director command bars.

NOTES

Initial pitch target is 12-15° nose-up depending on the gross weight.

If engine failure occurs prior to attaining V_2, the pitch bar will command the aircraft to accelerate to and maintain V_2. If engine failure occurs between V_2 and V_2+10, the pitch bar will maintain that airspeed. If airspeed is above V_2+10, the pitch bar will command the aircraft to reduce to V_2+10 and maintain that airspeed until reaching acceleration height.

3. At positive rate of climb and V_2, PNF calls “POSITIVE RATE.” PF calls “GEAR UP.” PNF moves landing gear handle to up and repeats “GEAR UP.”

NOTE

AUTO FLIGHT may be engaged above 500 feet AGL. Parallel rudder will be engaged in the T/O mode. Parallel rudder will revert to series rudder with a change in the roll mode or when slats are retracted. PF should be prepared to maintain rudder position before disengaging parallel rudders.

When an engine failure occurs, both MCDUs will revert to the PERF page with “CONFIRM ENG OUT” and “CLEAR” prompts. FMS engine out computations and guidance will not become active until “CONFIRM” prompt has been selected. Once “CONFIRM” has been selected, the FMS will level off at the EO ACCEL altitude; or if the aircraft is already above the EO ACCEL altitude (but below the ALL ENG ACCEL ALT), the FMS will command a new level off altitude.

NOTE

For an engine fire warning, the ENG OUT mode key must be selected on the MCDU.

The PF will verify the failure and call “CONFIRM ENGINE OUT.” The PNF will select the CONFIRM prompt on the MCDU and call “CONFIRM.”

4. When the aircraft levels off at the EO ACCEL ALT, V3 (final segment climb speed) becomes the active FMS speed target. The aircraft will remain in ALT HOLD until V3 speed is reached.

   While in T/O mode, setting PROF at or above 400 AGL will result in vertical profile guidance and speed schedule occurring automatically on FMS schedule. If PROF is used, do not accomplish steps 4A and 7.

4A. At EO ACCEL altitude, PF calls “SET V3.” PNF sets speed and pulls airspeed select knob.

NOTES

> Pulling the airspeed select knob will initiate a pitch reduction. Do not pull the airspeed select knob below EO ACCEL altitude.
>
> With no loss of thrust (i.e. engine fire), pulling the airspeed select knob will initiate a smaller pitch reduction and acceleration to the speed shown in the FCP airspeed window. Retarding the affected throttle to idle will further reduce the pitch to an engine out profile.

5. At flap retract speed, PF calls “FLAPS UP”. PNF moves flap/slat handle to 0/EXT and repeats “FLAPS UP.”
6. At slat retract speed, PF calls “SLATS RETRACT.” PNF moves flap/slat handle to UP/RET and repeats “SLATS RETRACT.” Follow Pitch Guidance to continue climb to safe operating altitude.

NOTE

> If the autopilot is engaged, retracting the slats or changing heading will take the rudder out of parallel operation. Ensure that you are holding the rudders with foot pressure prior to retracting slats or changing heading.

7. Upon reaching V3 with clean configuration, PF calls “SET ALTITUDE.”

Other considerations for the Captain include:

-Do not continue a long distance from the landing airport.

-Declare an emergency and request equipment.

-Request a straight out Missed Approach from ATC.

-Brief the #1 flight attendant (TEST).

- •• **T** - Type of emergency --- special instruction?
- •• **E** - Evacuatin ... will it be necessary?
- •• **S** - Signals ... for brace and evacuation?
- •• **T** - Time ... available for preparation?

-Notify dispatch, time permitting.

-Brief the PNF not to give you more than 25 landing flaps and when to take the trim out during the landing.

Engine Fire Takeoff

An engine fire warning at or after V_1, is handled in a manner similar to an engine failure.

- Silence the warning bell.
- Fly the takeoff profile as described for an engine failure.

NOTE

For an engine fire warning, the ENG OUT mode key must be selected on the MCDU.

- After flap/slat retraction, and reaching V_3 speed, or if conditions require earlier action, identify, then confirm the specific engine with the other crew member, call for the fire fighting procedure (“Fight the Fire”) and Engine Fire/Damage/Separation checklist.

<u>Fire Fighting Procedure</u>

The fire fighting procedure should be done in a deliberate manner. Since bleed air ducts are the primary cause of engine fire warnings, it is recommended that the pilot doing the fire fighting procedure pause after the throttle is retarded until the engine unspools. If the fire warning still exists, place the Fuel Switch to OFF and pause again until the engine decelerates to windmill speed. If the fire warning still exists, pull the Engine Fire Handle and discharge the agent. At the Captain's discretion, the procedure is complete at any point in the checklist when the fire warning no longer exists.

Rejected Takeoff

The decision to reject or to continue a takeoff cannot be considered lightly. Statistics indicate that the success of a rejected takeoff become less probable as speed increases. Because the result of a rejected takeoff improperly executed may be catastrophic, THE DECISION TO REJECT WILL BE MADE AND EXECUTED BY THE CAPTAIN.

When deciding whether to continue or reject a takeoff, consider some of the reasons why high speed aborts are often unsuccessful:

- As the airplane approaches V_1, the acceleration is three to five knots per second. Even if an engine fails, the airplane will continue to accelerate until action is taken to stop.
- Only limited time is allowed for recognition of the problem, deciding on the appropriate response, and converting that decision into action.

Prior to 80 knots, the takeoff should be discontinued for a ENGINE FAILURE, ENGINE FIRE, or activation of a MASTER CAUTION light.

V_1 is the Takeoff Decision Speed in case of an engine failure. It provides an indication of the stopping performance available. Some malfunctions may not require a rejected takeoff at speeds approaching V_1 if flight performance is not affected. Other malfunctions may compromise the ability of the airplane to stop. In the case of blown tires, for example, stopping performance will not be predictable. Therefore, AS THE AIRPLANE APPROACHES V_1, THE TAKEOFF SHOULD NOT BE REJECTED UNLESS THERE IS SERIOUS DOUBT THAT THE AIRPLANE WILL FLY.

Regardless of which pilot is flying, the Captain will keep his hand on the throttles until “V_1” is called during takeoff. He should be continuously evaluating the progress of the takeoff until the airplane is committed to flight. Prior to V_1, If the Captain decides to reject the takeoff, he will call out “ABORT” and simultaneously:

CAPTAIN	FIRST OFFICER
Retard throttle to idle and apply maximum braking. **NOTE** Below 60 knots, autothrottle will not disengage unless it's done manually. Apply reverse thrust and ensure ground spoiler deployment. **NOTE** Ground spoilers should deploy automatically with thrust reverser actuation. If the spoilers fail to deploy, deploy manually. Maintain directional control with rudder pedals and apply slight forward pressure on control column. **CAUTION** **Should directional control become a problem while in reverse thrust, reduce reverse thrust to reverse idle (or forward idle thrust if required), regain directional control and re-apply reverse thrust as necessary.**	If possible, for brake cooling, note the abort speed. Advise PF of thrust reverser deployment by calling "REVERSE" when they depict green. If SPOILER lever does not move aft or does not remain at EXT position, PNF call "NO SPOILERS." Captain moves lever aft to full extend position.
Maintain braking, reverse thrust and ground spoiler deployment until a safe stip is assured. Evaluate situation and take appropriate action. Use PA to advise passengers (see below).	Call out "80 KNOTS." At taxi speed or after stopping, advise tower of rejected takeoff and of any assistance required.

When advising passengers and crew on the PA, use the following statements (per the FOM).

If evacuation is not required:

> "**ATTENTION! THIS IS THE CAPTAIN, REMAIN SEATED, REMAIN SEATED**."

If evacuation is required, preface the command with which exit to use, i.e.:

> "**RIGHT SIDE, RIGHT SIDE, EVACUATE, EVACUATE**," or
> "**ALL EXITS, ALL EXITS, EVACUATE, EVACUATE**."

Other considerations for the Captain include:

- If evacuation is required, perform the evacuation checklist.
- Taxiing clear of the active runway.
- Taxiing or having the airplane towed to a suitable parking area.
- Whether parking brakes should be used.
- Whether fire fighting assistance is needed.
- Whether the APU should be started and the engines shut down.
- Evaluating the situation to determine whether evacuation might still be required.
- Advising ramp control to restrict personnel from the landing gear area, cautioning them regarding chocking, servicing, etc.
- If another takeoff is planned, review ESTIMATED BRAKE COOLING TIME in the PERFORMANCE section.

DESCENT

Normal Descent

During descent, the PF and the PNF will call out the altitude upon going through the last 1,000 ft level prior to the assigned level.

During enroute descent, the PF and the PNF will call out the actual altimeter setting approaching Transition Level, as a reminder to reset altimeters.

Descent from cruise altitude is normally made in the clean configuration with throttles at idle and should be used whenever operating conditions permit, as it saves time and fuel.

The following rule-of-thumb has been found workable in determining the DME distance at which to begin a normal descent.

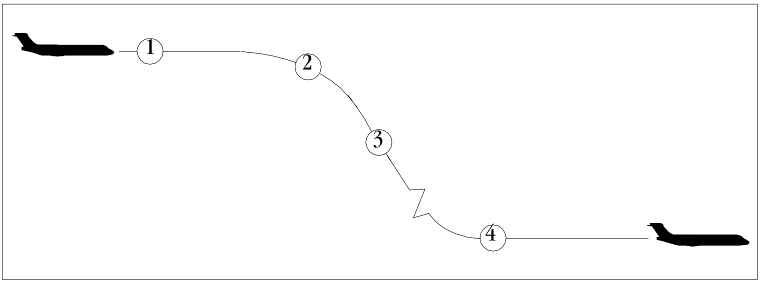
Altitude (in 1,000's of ft) x 3 = DME distance to start descent.

EXAMPLE

- Cruise Flight Altitude 31,000 ft.
- DME Transmitter on Field.

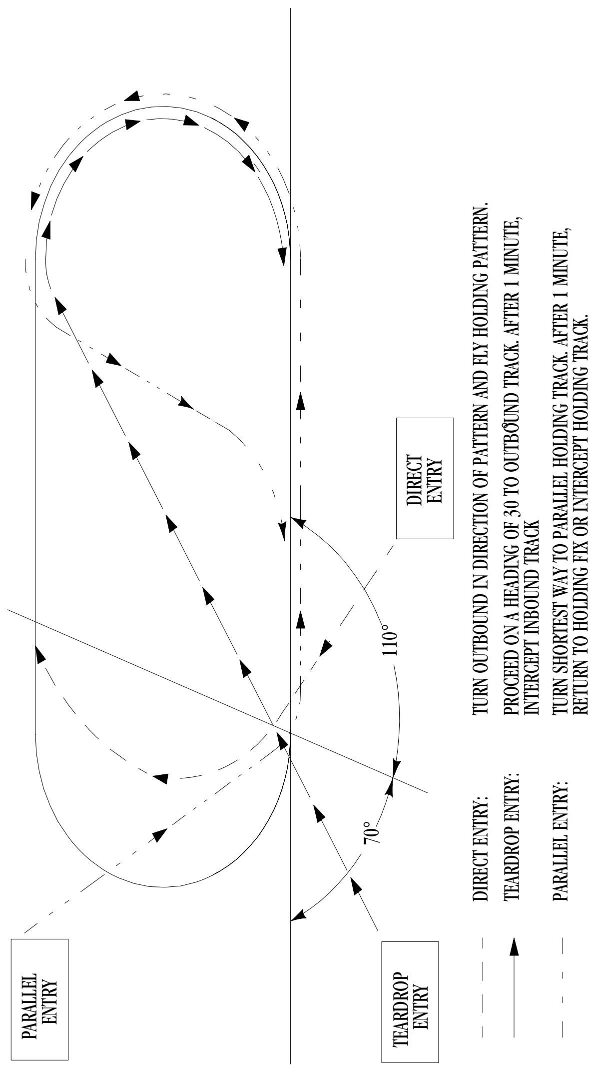
Cruise Altitude	31 (000)
	X 3
Start Descent at	93 DME

Emergency Descent



1. PF calls “EMERGENCY DESCENT CHECKLIST.” Commences descent, limiting pitch to 10 degrees nose down. If desired, a 30 degree banked turn may be initiated. PNF completes EMERGENCY DESCENT checklist.
2. PF adjusts IAS/Mach to maintain 320 KIAS/.80. If structural integrity is in doubt, recommended speed is 270 KIAS/.70M.
3. PF monitors FMA for ALT CAP. Verify descent below 14,000 feet or minimum safe altitude, whichever is higher.
   If a lower altitude is desired receive approval from ATC.
4. Level flight.

HOLDING



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Altitudes or Flight Levels	Maximum Holding Speed	Still Air Outbound Timing
Above 14,000 feet	265*	1.5 minute
Above 6000 feet, up to and including 14,000 feet	230* (210 where published)	1 minute
6000 feet or below	200*	1 minute

* Unless restricted to a lower speed.

If FMS is used for holding, FMS calculates bank angle. Reduce to holding speed within 3 minutes prior to initially crossing the fix. If holding is anticipated, request to slow to holding speed early to conserve fuel. If the holding pattern is programmed into the FMS, the FMS will slow the aircraft to computed holding speed prior to entering holding.

For maximum fuel economy, hold at flaps up/slats retract minimum maneuvering speed. If flaps up/slats retract minimum maneuvering speed exceeds maximum holding pattern airspeed, use minimum slat/flap setting which meets speed restriction.

Compensate for known effect of wind except when turning. Once established in holding pattern, drift correction angle can be determined along inbound course. On outbound leg of 1-minute patterns, inbound drift correction should be tripled and applied to outbound course. Size of pattern is governed by inbound times.

Outbound timing begins over or abeam of the fix, whichever is later. If the abeam position cannot be determined, start timing when turn to outbound heading is completed.

APPROACHES

NOTE

The various approaches have the PF stating "PRESET and SET SPEED/ALTITUDE/ HEADING." Either pilot can set the speed/ altitude/heading. The altitude and heading will normally be set by the PF if it is an autopilot approach, and by the PNF if it is a hand flown approach.

AirTran Approach Speeds Defined

Calm wind approaches will be flown using the following guidelines:

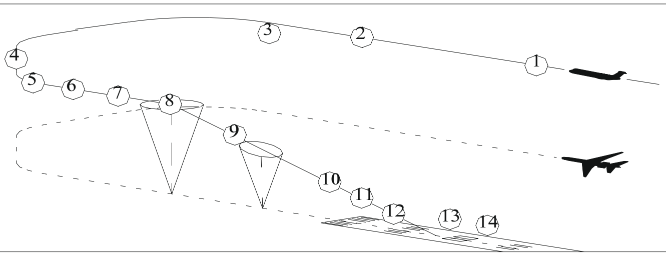
VREF	absolute minimum speed
VREF + 5	TARGET SPEED
VREF + 10	Maximum acceptable while correcting to TARGET speed.

Wind add-ons (1/2 Headwind + Gusts) will be added to VREF and will not exceed VREF + 20 KTS.

Add-ons for headwinds will be bled off crossing the runway threshold.

Add-ons for gusts will be applied until touchdown.

ILS Approach (FD Only) (With Or Without FMS NAV)



1. IN-RANGE checklist completed. Flap/slat handle at UP/RET. Speed - minimum maneuvering to 250 KIAS. Both flight directors on, autopilot on or off, and autothrottles on.

2. Commence speed reduction as desired. PF calls "SLATS EXTEND, SET SPEED 190." PNF repeats and complies with command.
3. PF calls "FLAPS 18, SET SPEED 160." PNF repeats and complies with command.

NOTE

The PNF will use the APPR mode on his NAV display until LOC has been captured. At that time he will have the option to return to MAP for the approach.

4. On intercept heading and after being cleared for ILS approach, PF calls "APPR/LAND." PNF pushes APPR/LAND button and calls "APPR/LAND ARMED."

NOTE

FMS NAV, if engaged for lateral navigation before the final approach course, will disengage at LOC capture.

5. Following localizer capture, PNF states "LOCALIZER CAPTURE" PF states "PRESET MISSED APPROACH HEADING."
6. At glideslope alive, PNF states "GLIDESLOPE ALIVE." PF calls "GEAR DOWN, LANDING CHECKLIST." PNF repeats command and moves landing gear handle to DOWN and initiates the LANDING CHECKLIST.
7. At approximately one dot below glideslope, the PF calls "FLAPS 25, SET SPEED." The PNF repeats the command, moves the flap/slat handle to 25, and sets speed to footer + 5. When ATC requirements dictate a quick approach, this step may be omitted.
8. Approaching glideslope, PF calls "FLAPS 40, SET SPEED." PNF repeats command, moves flap/slat handle to 40, and sets speed to VAPP.
9. Upon glideslope capture, PNF calls "GLIDESLOPE CAPTURE." PF states "PRESET MISSED APPROACH ALTITUDE."
10. After passing 1500 feet AGL + 10 seconds and successful completion of the dual land test, the altitude window will change to AUTOLAND (green) or APPR ONLY (white) and the roll window will be LOC (green).

NOTES

Depending on equipment status, AUTOLAND (green) or APPR ONLY (white) may appear in the altitude window. There are no restrictions to CAT I operations with either AUTOLAND or APPR ONLY.

With AUTOLAND or APPR ONLY displayed on the FMA, the approach may only be disarmed by pushing GA switch.

At 100 feet AGL, with APPR ONLY, the autopilot automatically kicks off.

At the 1,000 feet Voice Warning, PNF calls, “MISSED APPROACH SET.” Ensure heading and altitude are set for missed approach.

NOTE

At Decision Height, perform manual landing procedure or execute manual missed approach as required.

11. At 150 feet AGL with autopilot ON and in AUTOLAND, ALIGN (green) annunciates in the FMA roll window, and a runway alignment maneuver occurs to remove existing crab angle. ALIGN may or may not appear if in APPR ONLY.

12/13/14. Apply reverse thrust and ensure adequate braking is applied. Application of reverse thrust will disconnect ATS.

NOTES

Maximum reverse thrust should be selected without delay. Reversers will not deploy until nosewheel touchdown. There should be no effort to delay lowering the nosewheel to the runway; aerodynamic braking is ineffective and not a recommended decelerating technique.

Additional Comments for an Engine Out ILS

Procedures for a single engine ILS approach are the same as a normal ILS, except landing flaps are limited to FLAPS 25. Read and accomplish the appropriate NON-NORMAL checklists to prepare the aircraft and crew for the approach.

Normally, the approach will be flown with autopilot and autothrottles on.

If manually flying the approach, remain constantly aware of the relationship between engine thrust and rudder trim. It is important that the aircraft remain in trim with wings level due to the lateral control asymmetry and resulting turning tendency. When thrust is changed, re-trim the rudder. Approach the glide path at approach speed (VREF 25 + 5 KIAS). If speed is high, the tendency is to be fast for a long period after glide slope capture resulting in large thrust reductions to correct. Trim and power settings will change as glide slope is captured. Make the necessary corrections as early as possible to stabilize the aircraft on the ILS in a trimmed condition. Once established, only minimum changes should be required.

NOTE

In training and for SIC Proficiency Checks, FOs will fly One Engine ILS Approaches. On the line, only the Captain will make an actual One Engine ILS Approach and landing.

CAT II ILS Approach

TBD

TBD

TBD

TBD

TBD

TBD

TBD

TBD

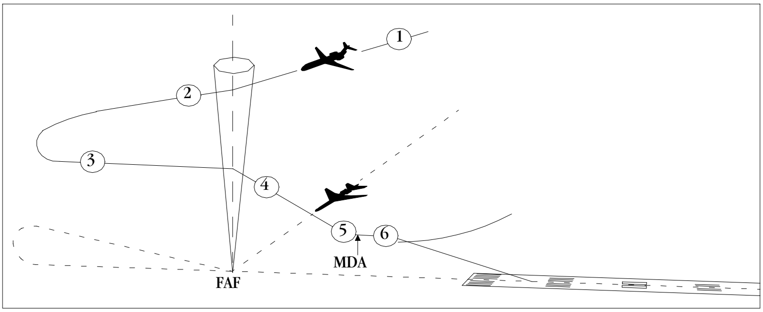
Landing and Rollout

TBD

TBD

TBD

VOR or RNAV Approach



NOTES

During a VOR approach, the PF will make the approach in the VOR (raw data) mode. The PNF will remain in MAP (minimum range) during the approach.

If FMS NAV is used, either the flight director must be on, or the autopilot must be engaged, or both.

If the "UNABLE RNP" alert is displayed or FMS/ Autopilot or FMS/Flight Director disengagement occurs prior to MDA, and suitable visual reference is available, the pilot may continue the approach. If suitable visual reference has not been established, discontinue the approach and perform go-around. An "UNABLE RNP" alert does not preclude the pilot selection of another approved means of navigation to continue the approach.

1. IN-RANGE checklist completed. Flap/slat handle set to 0/EXT, speed 190, both flight directors on, autopilot on or off, and autothrottles on.

2. Commence speed reduction as desired. PF calls, “FLAPS 18, SET SPEED 160.” PNF repeats and complies with the command.
3. PNF calls “COURSE CAPTURE.” PF states “PRESET MISSED APPROACH HEADING.”

NOTE

During some approaches, the heading select knob will need to be used during the final portion of the approach. In these cases, the missed approach heading will not be preset.

Prior to the FAF:

- PF calls for “GEAR DOWN, LANDING CHECKLIST.”
- PNF repeats command and moves landing gear handle to DOWN and initiates LANDING CHECKLIST.
- PF then calls “FLAPS 25, SET SPEED”.
- PNF repeats command, moves Flap/Slat handle to 25, and sets speed to footer + 5 for Flaps 25. PF then calls “FLAPS 40, SET SPEED”.
- PNF repeats command, moves Flap/Slat handle to 40, and sets speed to VAPP.
- PF calls “PRESET MDA”
- PNF repeats command and presets MDA.

4. At FAF PNF will call “FAF”, ALTITUDE “______”, “TIME NOTED.” Start timing and depart the FAF at VAPP. PF calls “VERTICAL SPEED _________ DOWN.”

NOTE

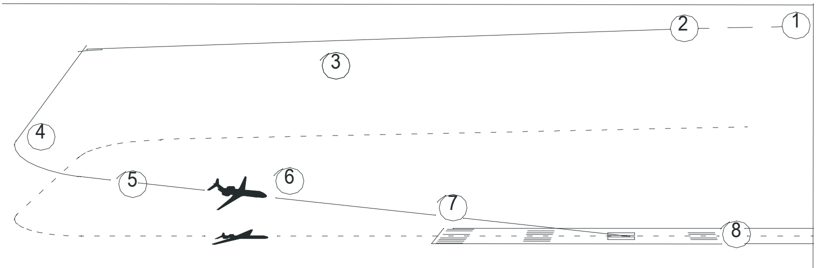
Descents to MDA may be accomplished with Vertical Speed (V/S) or Flight Path Angle (FPA).

5. After arriving at the MDA, PNF presets the missed approach altitude.
6. At the missed approach point, PNF makes appropriate call, PF either executes a manual landing or a manual go-around.

NOTE

Procedures for a single engine VOR approach are the same, except landing flaps are limited to FLAPS 25.

Localizer (LOC) Approach (FD Only Or Auto Flight Engaged) (With Or Without FMS Nav)



NOTE

The PNF will use the APPR mode on his NAV display until the LOC has been captured. At that time he will have the option to return to MAP for the approach.

1. IN-RANGE checklist completed. Flap/slat handle at UP/RET. Speed - minimum maneuvering to 250 KIAS. Both flight directors on, autopilot on or off, and autothrottles on.
2. Commence speed reduction as desired. PF calls "SLATS EXTEND, SET SPEED 190." PNF repeats and complies with the command.
3. PF calls "FLAPS 18, SET SPEED 160." PNF repeats and complies with the command.
4. On intercept heading and cleared for approach, select the LOC ONLY prompt on the NAV RAD page and observe LOC ARMED (white) in the upper portion of FMA roll window.

5. At localizer capture, PNF calls “LOCALIZER CAPTURE.” PF calls “PRESET MISSED APPROACH HEADING.” PNF presets missed approach heading.

   Prior to the FAF:

- PF calls for “GEAR DOWN, LANDING CHECKLIST.”
- PNF repeats command and moves landing gear handle to DOWN and initiates LANDING CHECKLIST.
- PF then calls “FLAPS 25, SET SPEED”.
- PNF repeats command, moves Flap/Slat handle to 25, and sets speed to footer + 5 for Flaps 25. PF then calls “FLAPS 40, SET SPEED”.
- PNF repeats command, moves Flap/Slat handle to 40, and sets speed to VAPP.
- PF calls “PRESET MDA”
- PNF repeats command and presets MDA.

6. At the FAF the PNF calls “FAF”, ALTITUDE “______”, “TIME NOTED.” Start timing and depart the FAF at VAPP. PF calls “VERTICAL SPEED _________ DOWN”.

NOTE

Descents to MDA may be accomplished with Vertical Speed (V/S) or Flight Path Angle (FPA).

   After arriving at the MDA, PNF presets the missed approach altitude.

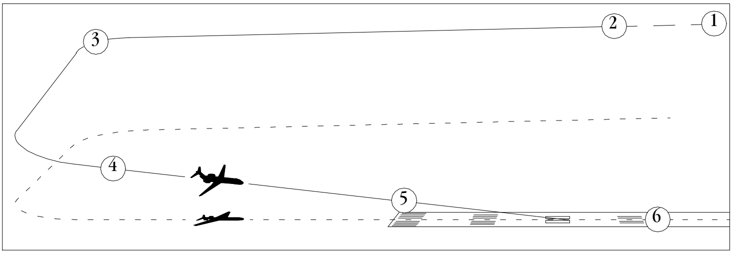
   At the missed approach point, PNF makes appropriate call, PF either executes a maual landing or a manual go-around.

7. Cross threshold at approximately 50 feet AGL.
8. See LANDING portion in this section for explanation of landing aircraft.

NOTE

Procedures for a single engine localizer approach are the same, except landing flaps are limited to FLAPS 25.

No Flap/No Slat Approach



1. Appropriate checklists complete, VMIN + 5 for configuration. Flight director, autopilot and autothrottles may be engaged if available. Autothrottles must be disconnected prior to landing.

NOTE

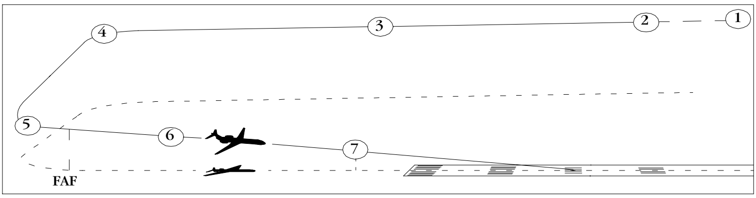
> Reduce gross weight to lowest practicable and land on longest available runway with consideration given to runway conditions such as dry, wet or crosswind factor.

2. Fly wider than normal downwind at traffic pattern altitude. PF calls “GEAR DOWN, LANDING CHECKLIST” and maintains VMIN + 5. PNF repeats command, moves landing gear handle to DOWN, and completes the LANDING CHECKLIST.
3. Delay base turn to provide longer than normal final.
4. When stabilized on final approach course, PF calls “SET SPEED” and disconnects autopilot. Use autothrottles to fly the approach at VREF + 5. PNF sets speed. Fly a normal glideslope. At 500 feet AGL, PNF calls “500 FEET.”
5. Cross threshold at approximately 50 feet AGL. Disconnect autothrottles prior to 50 feet AGL or upon approaching threshold. Aim for touchdown target of 1000 feet from approach end of runway. Fly airplane onto runway and do not attempt to achieve a smooth touchdown.
6. On touchdown, lower nose gear to runway and immediately apply full reverse thrust and brakes as required. Adequate directional control can be maintained by rudder until approximately 60 knots.

CAUTION

With no hydraulic pressure, set parking brakes prior to coming out of idle reverse thrust. Do not attempt to taxi.

Visual Approach



1. Appropriate checklists completed. Flap/slat handle set to 0/EXT, set speed to 190 knots.
2. After entering downwind, PF calls "FLAPS 18, SET SPEED 160 KNOTS." PNF repeats command and moves flap/slat handle to 18° and SETS SPEED.
3. At traffic pattern altitude (normally 1500 ft AGL or higher) and abeam end of runway, start timing and disengage autopilot.
4. Turn base at approximately 45 seconds past abeam end of runway. PF calls, "GEAR DOWN, LANDING CHECKLIST." PNF repeats command and moves landing gear handle to down and initiates LANDING checklist.

   PF begins normal descent when required and calls, "FLAPS 25, SET SPEED." PNF repeats command, moves flap/slat handle to 25, and SETS SPEED to footer + 5.
5. PF flying calls "FLAPS 40, SET SPEED" by 1000 feet AGL. PNF repeats command, moves flap/slat handle to 40, and SETS SPEED to VAPP.
6. When stabilized on final and at 500 feet AGL, PNF calls "500 FEET."
7. Cross threshold at approximately 50 feet AGL. Aim for touchdown target of 1000 feet from approach end of runway.

Approach Characteristics And Techniques

Flight Path Angle Approach

When an approach using constant Flight Path Angle (FPA) descent is desired,

1. Set level offs (either intermediate and/or MDA) and timer as necessary prior to commencing approach. Approaching the Final Approach Fix (FAF), verify V/S-FPA display window indicates FPA.

NOTE

> Pushing the V/S-FPA changeover button permits alternate selection of vertical speed or flight path angle.

2. Preset next desired altitude.
3. Passing final approach fix, rotate pitch wheel on flight control panel until desired flight path angle is displayed in adjacent window.

NOTE

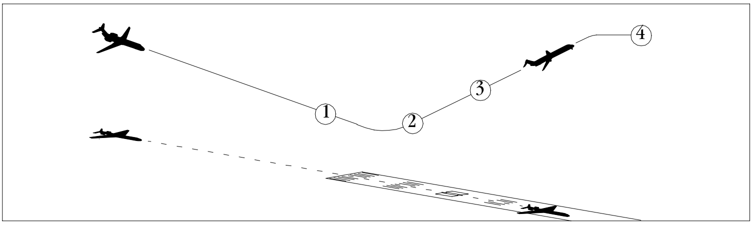
> Rotation of the pitch wheel will select the displayed flight path angle and cause the preset altitude bug to become a solid selected bowtie bug indicating the auto flight system will capture the preset altitude.

4. Verify FMA altitude control window displays FPA.
5. Verify correct autopilot and/or flight director response.

Approach At 140 Knots Or Less

If VAPP is 140 knots or less and RA or DH is set to 50 feet or less, the aural warning “MINIMUMS” is inhibited. If it is desired to set RA or DH to less than 50 feet, manually set a VAPP sufficiently high to keep airspeed above 140 knots during flare.

GO-AROUND



WARNING

If reverse thrust is initiated, a full stop landing must be made.

NOTE

Autopilot must be disconnected for a go around.

1. PF pushes GA button and advances thottles to GA thrust. Simultaneously increase pitch to FD pitch command to establish climb and airspeed (20° pitch maximum) and call “GO-AROUND POWER, FLAPS 18.” PNF repeats command, verifies go-around thrust is set and moves flap/slat handle to 18.
2. When positive rate is established and verified, the PNF will call “POSITIVE RATE.” The PF will call “GEAR UP.” PNF repeats command and moves landing gear handle to UP. and verifies missed approach altitude, and airspeed have been preset.
3. PF will call “Set FCP, MAP, NAV” directs PNF to ensure proper FCP setup. PNF repeats and follows commands (NAV will be selected if the published missed approach is to be flown.)

NOTES

Commanded airspeed during climb will be V_{MIN} + 5 for 18 flaps or indicated airspeed when GA button was pushed, whichever is higher.

Altitude capture will automatically cancel pitch mode, and airplane will accelerate to speed in FMA window.

NOTE

If in a bank when GA button is pushed, AFS will roll wings level. As Bank Angle comes through 3°, AFS will hold heading that exists at that time.

4. Maintain commanded airspeed until reaching clearance altitude. Flaps/slats may be left extended if required. If proceeding to a holding fix, the recommended configuration is slats and 190 KIAS. PF calls for CLIMB CHECKLIST.

NOTE

Do not exceed 200 KIAS at or below 2,500 feet above the surface within 4 NM of the primary airport of Class D airspace (has operational control tower).

INOPERATIVE STABILIZER APPROACH AND GO-AROUND

An inoperative stabilizer may be suspected when the stabilizer trim indicator does not respond to electric trim inputs. Verification of this condition should be made by application of the steps described in the Non-Normal Section of this manual. Fly a normal pattern, using standard maneuvering speeds for each flap setting.

High elevator forces may be required. The extent of this out-of-trim condition will vary, depending upon the airspeed at the time the problem occurred. The higher the airspeed was at the time the stabilizer became inoperative, the greater the elevator force required for landing. The physical effort involved can be reduced by delaying speed reduction and flap extension. However, if delayed too long, a speed control problem will develop during the final approach. Plan to be “in-the-slot”, and on target airspeed no later than passing 500 ft on final approach. The physical exertion required will seem to be less if both pilots apply elevator control force during the approach.

Plan to make a normal touchdown at the 1,000 ft point. Do not “hold-off' to reduce speed. Follow normal after-touchdown procedures. Do not over control on flare or “ballooning” will result.

In case a Go-Around becomes necessary:

- Advance throttles to go-around power and rotate to stop descent.
- After PNF states "POSITIVE RATE," PF states "GEAR UP." PNF repeats the "GEAR UP" command and places the Gear up.
- Climb to Obstruction Clearance Altitude at VMIN + 15 for 18 flaps (10 knots faster than normal Go Around).
- Continue the climb at a reduced angle to allow airspeed to increase.
- Retract flaps using standard speeds.
- At 1,500 ft. set climb thrust.

LANDING

Crosswind for Landing

The maximum demonstrated crosswind component for takeoff and landing is 30 knots reported wind at the 50 foot height.

Touchdown

The desired touchdown point is 1,000 feet from the end of the runway threshold. Touchdown should occur within 500 feet of the desired touchdown point. Bleed off the wind gradient factor add-on by the threshold and reduce the airspeed to bug plus the gust factor. Height of the airplane over the threshold should be approximately 50 ft.

Autothrottles should be used for all landings and will begin to retard after passing 30 feet AGL.

Initiate flare at approximately 20 ft. wheel height with a slight rotation of 2 to 3 degrees to slow sink rate. As ground effect increases, there is a slight pitch down tendency. Maintain attitude with slight back pressure to touchdown. Reduce thrust to idle. Because of the effectiveness of the elevators, care must be taken to avoid ballooning.

Do not hold aircraft off in an attempt to achieve a smooth landing. Holding aircraft off to achieve a smooth landing may result in a long touchdown, unusually heavy breaking, a higher pitch attitude and reduced tail clearance.

After touchdown, monitor ground spoiler deployment. Lower nosewheel to runway, and if auto ground spoilers do not fully deploy, manually deploy spoilers.

Rollout

As nosewheel is lowered to the runway, deploy reversers simultaneously. For a normal landing, at 80 KIAS, smoothly move reverse levers to be at reverse idle by 60 knots. At 60 KIAS, move reverse levers to forward idle unless additional reverse is required.

NOTE

To reduce chances of FOD ingestion, thrust reversers should be stowed by 40 knots whenever possible. Thrust reversers should be stowed by entry onto a High Speed Taxiway.

WARNING

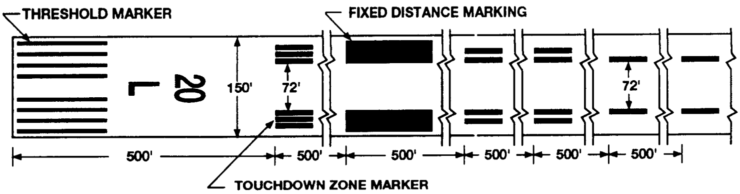
After reverse thrust is initiated, a full stop landing must be made.

NOTES

Refer to the Normal Section for additional information on landing procedures.

If directional control becomes a problem while in reverse thrust, reduce reverse thrust on both engines and, if necessary, return engines to forward thrust. Do not use differential reverse thrust. Apply brakes smoothly with moderate to firm steady pressure. Use differential braking as needed. Hold control column forward and keep wings level. When landing on long dry runways, delay brake application whenever possible until airplane has decelerated to less than 100 KTS.

Do not attempt to turn off of a slippery runway until speed is reduced sufficiently to turn without skidding. When landing on wet slippery runways, it is recommended that the airplane be flown onto the runway to avoid floating and hydroplaning.



ALL WEATHER RUNWAY

Landing Considerations

Pulling the nose up and allowing the airplane to float on its ground cushion is not an acceptable procedure for the following reasons:

The airplane will decelerate faster on the ground than in the air.

Runway and stopping distance is wasted at rates of more than 200 feet per second at normal approach speeds.

As the nose is pulled up, more time is required to land the nosewheel, delaying the stopping procedure. The trailing edge of the outboard flaps is nearer to the runway, and the maximum allowable bank angle is reduced.

In the event of a bounced landing, hold or re-establish a normal landing attitude. Add thrust as necessary to control the rate of descent. Do not push over as this may cause a second bounce and possibly damage the nose gear.

Procedures For Landing On Slippery, Wet, Or Icy Runways

The following procedures are the result of thorough investigation of the capabilities and limitations of the aircraft's stopping systems, the environmental problems associated with runway clutter and the stopping distance that is required.

Approach

The approach speed should be as low as possible commensurate with landing conditions. Setting the proper speed additives to account for prevailing approach conditions is very important and provides adequate safety margin for both the approach and the landing roll.

Plan to touch down 1,000 feet beyond the threshold. This provides adequate protection against landing short and leaves maximum runway ahead for making the stop.

Flare and Touchdown

The landing flare should be performed so that touchdown is moderately firm. Fly the airplane onto the runway.

NOTE

> Icy or wet runways can affect proper auto spoiler operation. Pilot Not Flying should ensure extension and hold the handle aft, if necessary.

Rollout

On a limited length, wet runway, apply maximum braking, allowing full benefit of the anti-skid system.

If hydroplaning conditions develop, the use of reverse thrust may be the most effective deceleration means available to the pilot. However, improper use of reverse on wet slippery runways can be critical to directional control, especially during crosswind conditions.

Do not attempt to turn off of a slippery runway until speed is reduced sufficiently to turn without skidding.

GPWS WARNING PROCEDURES

GPWS - General

Under certain conditions of flight where immediate visual reference to surrounding terrain is not available, prompt and decisive action is required for an enhanced ground proximity warning system (EGPWS) alert.

CAUTION

Do not ignore short duration warnings. Take immediate and aggressive action.

Activation Of EGPWS Warning

Flight crews should become familiar with the following sequence of actions and use them immediately and aggressively upon activation of an aural or visual EGPWS warning.

Thrust –

Disengage the autothrottles and aggressively apply necessary thrust to ensure adequate airplane performance. Use emergency over-rated-thrust (maximum N1) to avoid imminent ground contact.

NOTE

If engine emergency over-rated-thrust (maximum N1) is used, an airplane log book entry is required.

Autopilot –

Disengage autopilot.

Pitch –

Immediately rotate the airplane at a rate of 3° per second (similar to a normal takeoff rotation rate) to 20° pitch attitude.

Trade airspeed for climb performance. If necessary to prevent ground contact, continue to increase pitch attitude until stick shaker actuates. In this situation, consider use of engine overboost by moving throttles to their mechanical limits.

Although there are no pitch limitations in emergency situations, caution must be exercised to keep from maintaining pitch attitudes that result in continuous actuation of stick shaker.

Speed Brakes –

Retract speed brakes (if extended).

Flight Director –

Turn off flight director or disregard commands.

Level wings to assure maximum airplane performance.

Do not change gear or flap configuration until terrain separation is assured. Monitor radio altimeter for sustained or increasing terrain separation.

After EGPWS warning ceases, continue climb to published minimum safe altitude.

STEEP TURNS

The following section explains how to set up and perform a steep turn in training.

1. Stabilize airplane at 250 knots with autopilot and autothrottles - in trim.
2. Turn off flight director.
3. Set heading bug for 180° left or right turn. (Ask PNF for 15° lead call for rollout.)
4. Note N1 power setting and degrees of pitch for level flight.
5. Turn off autopilot and autothrottles.
6. Slowly roll into turn and passing 30° bank, add approx. 5% N1 and +1° pitch.
7. Lock in on 45° bank and concentrate on constant pitch.
8. Vertical Velocity is first indication of altitude deviation - keep it zeroed.
9. Roll out, power back, and maintain altitude.
10. Turn on autopilot, autothrottles and flight director.

APPROACHES TO STALLS

Approaches to stalls and recoveries are performed during training.

Stall recovery should always be initiated with the first indication of an approaching stall, such as:

- Rapid decrease of airspeed below bug setting.
- Rapid decrease of climb rate during takeoff or go-around.
- Rapid increase of sink rate during approach.
- Stick shaker or buffet.

In stall recovery, it should be emphasized to minimize altitude loss. In an emergency situation, positive climb performance and maneuver margins still exist at or near stick shaker. Intermittent stick shaker is the upper limit of usable pitch attitude and adequate maneuver and stall margins are still maintained.

The aircraft will be configured as you would expect with that type of stall. One approach to stall will be performed in a 20° banked turn. For the following stalls, the instructor will call for the set-up (asterisked items). Trim to Vmin on all stalls.

Clean Stall

1. * Set speed 190 KIAS and set heading - stabilize.
2. * Autoflight paddles off and idle power.
3. Follow pitch bar, maintain altitude.
4. Recover (through the gate) “MAX POWER, SLATS EXTEND”.
5. Maintain altitude, follow flight director, reduce power to maintain 190 KIAS.

Departure/Approach Stall

1. * Flaps 18° or 13°, set speed 160 KIAS.
2. * Set bank angle to 20° on FCP. * Preset heading for 270° left or right turn.
3. * Autoflight paddles off and set throttles to 50% N1.
4. Set heading, start turn, follow flight director.
5. Recover (through the gate) “MAX POWER, HEADING HOLD”.
6. Roll wings level, maintain alt, follow flight director, reduce power to maintain 160 KIAS.

Landing Stall

1. * Landing gear down.
2. * Flaps 40, set approach speed (Vref)
3. * Autoflight paddles off and set throttles 50% N1.
4. Recover (through the gate), “MAX POWER”.
5. Maintain altitude, follow flight director, reduce power to maintain Vref + 5 KIAS.

Clean Up (After last stall, maneuver is finished. Instructor directed clean up.)

1. Go-around power.
2. Flaps 18.
3. Gear up.
4. Flaps up.
5. Slats retract.
6. Autoflight paddles on.
7. Reset FADEC.
8. Autoflight on.
9. Set speed 250 KIAS, HDG ____, ALT ____.
10. Bank angle to Auto.

ACCEPTABLE PERFORMANCE GUIDELINES

Course Completion

The performance standards that are required for course completion are detailed in the FAA's Airline Transport Pilot and Type Rating Practical Test Standard (FAA'S-8081 or as amended).

Briefings For Training Flights/Simulator Periods

A briefing is to be conducted before each flight/simulator period and is to include discussions of all maneuvers, normal, and non-normal procedures to be accomplished during the period. The first briefing period must include crew duties, checklists, engine starts and taxi. Each period will be followed by a critique.

Guidelines

The following is a list of selected maneuvers from the Airline Transport Pilot and Type Rating Practical Test Standards. This list is not intended to be all-inclusive. It is intended that instructors use it as a guide. If any question regarding customer performance arises concerning a maneuver or procedure not listed in this manual, the instructor should refer to the appropriate practical test standard.

Steep Turns

Bank Angle:	45 degrees +/- 5 degrees
Altitude:	+/-100 feet
Airspeed:	+/-10 knots
Heading:	+/-10 degrees of assigned rollout (specified heading)

Approach to Stall

Initiates recovery at first indication. Recovers to reference airspeed, altitude, and heading, allowing only the minimum loss or deviation

Departure, Enroute, Holding, and Arrival

Altitude:	+/-100 feet
Airspeed:	Maintains airspeed within +/- 10 knots

Heading:	+/- 10 degrees
Radials, Courses, and Bearings:	Accurately tracks

Precision Instrument Approaches (ILS/MLS)

Initial Approach

Airspeed:	+/-10 knots
Heading:	+/-5 degrees
Radials:	Accurately tracks
Courses:	Accurately tracks
Bearings:	Accurately tracks

Final Approach

Localizer/Glide slope:	Allows no more than 1/4 scale deflection at DH (1/2 dot)
Airspeed:	+/-5 knots of desired
Decision Height (DH)	Initiates missed approach immediately when the required visual reference is not distinctly visible and identifiable (FAR 91.175) or Transition to a normal landing approach when the aircraft is continuously in a position from which a descent to a landing on the runway of intended landing area can be made at a normal rate of descent usingnormal maneuvers

Non Precision Instrument Approaches (VOR/LOC)

Initial Approach

Altitude:	+/-100 feet
Airspeed:	+/-5 knots
Heading:	+/-5 degrees of desired HDG
Radials:	Accurately tracks
Courses:	Accurately tracks
Bearings:	Accurately tracks

Final Approach

Airspeed:	+/-5 knots of desired airspeed
Heading:	+/- 5 degrees of desired HDG
CDI:	Allows less than 1/4-scale needle deflection (1/2 dot)
RMI:	+/- 5 degrees of desired BRG
Descent:	Establishes a rate of descent that will ensure arrival at the MDA with the aircraft continuously in a position from which a descent to a landing in the touchdown zone or area can be made at a normal rate using normal maneuvers
MDA	Maintains, when reached, within +50/-0 feet to the missed approach point (MAP)

Missed Approach

Execute when the required visual references for the intended runway are not distinctly visible and identifiable at the missed approach point (MAP)

Airspeed:	+/-5 knots
Altitude:	+/-100 feet
Heading:	+/-5 degrees
Courses:	Accurately tracks
Radials:	Accurately tracks
Bearings:	Accurately tracks

Engine Failure - At VI

Identification:	Correctly identifies, verifies, and secures the malfunctioning powerplant following the prescribed checklist
Aircraft Control:	Maintains positive aircraft control
Airspeed:	+/- 5 knots of desired airspeed
Heading:	Maintains runway heading +/- 5 degrees
Initial Climb Airspeed:	Maintains desired airspeed +/- 5 knots

Engine Failure - In Cruise

Identification:	Correctly identifies, verifies, and secures the malfunctioning powerplant following the prescribed checklist
Aircraft Control:	Maintains positive aircraft control
Drift-Down Altitude:	+/- 100 feet
Heading:	+/- 10 degrees
Airspeed:	+/- 10 knots

Landing Traffic Pattern (Normal or Engine Inoperative)

Altitude:	+/- 100 feet
Heading:	+/- 5 degrees
Airspeed:	+/-10 knots

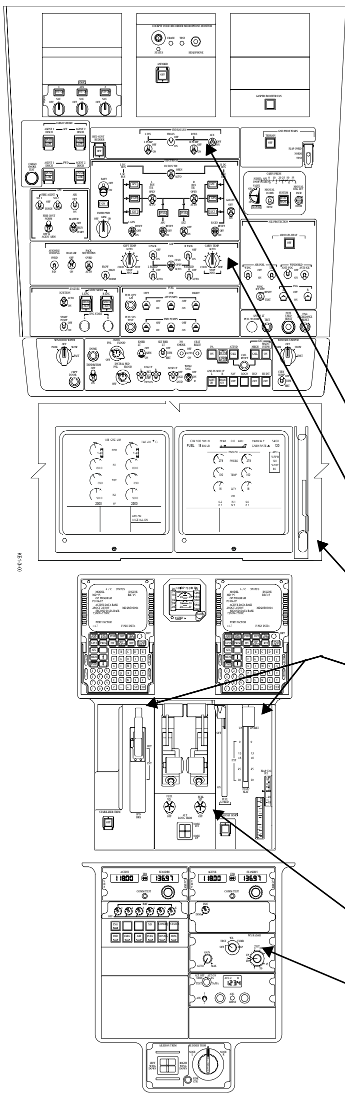
Final Approach (Normal or Engine Inoperative)

Maintains a stabilized descent angle and the recommended approach airspeed, with gust factor applied, + 5 knots.

Touches down smoothly beyond and within +/- 500 feet of a specified point, with no drift and the airplane's longitudinal axis aligned with the runway centerline

Normal And Non-Normal Procedures

A level of knowledge of the aircraft operational procedures such that the crew member will be able to demonstrate operation of the aircraft and aircraft systems in the operational environment in accordance with the applicable operating instructions.



COCKPIT SAFETY INSPECTION

1. **Logbook (not shown)**
2. **Circuit Breakers (not shown)**
3. **Cockpit Equipment (not shown)**

   Fire Axe
   Life Vests (3)
   Escape Ropes
   QRH, MEL/CDL, Runway Anal Manual
   Oxygen Cylinder (Crew)
   Protective Breathing Equipment
   Gear Pins (3)
   Fire Extinguisher

4. **Aft Overhead Panel (not shown)**

   Ground Service Electrical - As Required
   O2 Pressure - Green Band
   Eng Fire Warning - all loops on BOTH
   Cargo Smoke - both on NORM

5. **Hydraulics Control Panel**

   AUX and TRANS pump switches are off.

6. **Air Control Panel**

   Verify L and R PACK switches are off.

7. **Gear Handle**

   Verify Gear Handle is down.

8. **SPD BRK and FLAP/SLAT Handle.**

   Verify SPB BRK lever is in full forward and DISARMED position.

   FLAP/SLAT handle should be UP. If not, confirm no maintenance work in progress. Retract ONLY after clearing the area.

   If the lever is up, but the FLAP/SLATS have drooped, ensure area is clear before appllying hydraulic pressure.

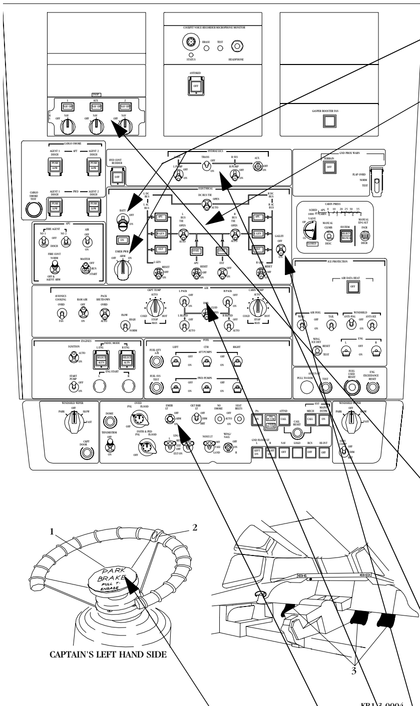
9. **FUEL Switches**

   Verify engine FUEL switches are OFF.

10. **WX RADAR Panel**

    Verify weather radar mode selector is OFF.

PRELIMINARY COCKPIT PREPARATION



1. Emergency Power Switch/Battery Switch

EMER PWR - OFF. BATT switch ON & rotated 90 degrees.

2. Establishing Electrical Power

DC BUS TIE, L & R BUS TIE switches - AUTO.

L GEN, APU and R GEN switches - ON.

If Ext Pwr Available. Move Ext Pwr Switch to ON & GROUND SERVICE ELEC Switch OFF.

External Power not available, start APU as follows:

EMER PWR Switch - ON.

Accomplish FIRE TEST.

START PUMP - ON.

APU AIR - OFF & FIRE CONT - NORM. APU MASTER switch to START and release to RUN.

NOTES

APU start delayed up to approx 40 seconds for inlet door.

APU bleed air inhibited for 2 min after start is initiated.

When APU power established, move EMER PWR to OFF, select a right fuel tank pump ON & move START PUMP switch OFF.

3. IRS Initialization

Rotate IRS Mode Selectors to NAV

- Access A/C Status Page. Verify active data base is current.

- MCDU F-PLAN INIT– Enter Company Route or From/To
- Enter appropriate data and initialize.

NOTE: Do not move airplane while IRU's are aligning.

4. HYDRAULICS Control Panel

WARNING

Ensure area clear before applying hyd pressure.

HYD cue. Hyd AUX - ON (right hyd pres normal). Hyd TRANS - ON, (left hyd pres normal). Confirm HYD CONT RUDDER switch light is out.

After exterior inspection, turn TRANS & AUX switches off.

5. GALLEY Power

Verify GALLEY Power ON.

6. Air Control Panel - Air Conditioning (if needed)

ISOL switch OPEN.

APU AIR switch to ON

L & R PACK Switches to AUTO

Rotate CKPT TEMP to AUTO

7. EMER LT Switch

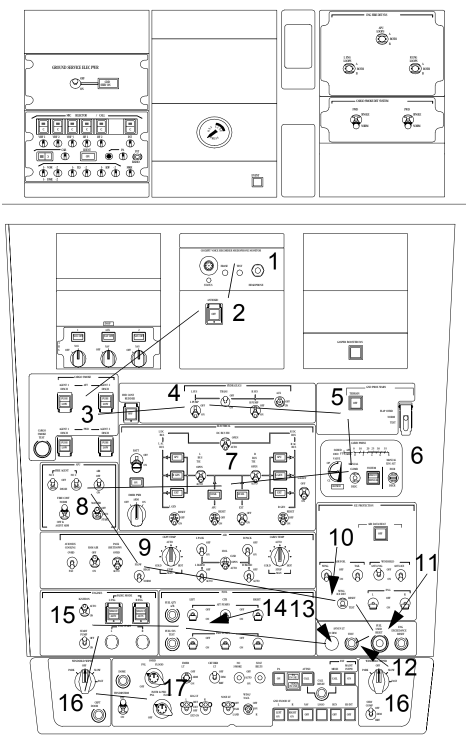
EMER LT switch ON, check emerg light in cockpit. EMER LT switch ARM -- emerg light extinguishes.

NOTE

Limit EMER LT ON to a max of 1 minute.

8. Parking Brake

FINAL COCKPIT PREPARATION (PAGE 1)



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1. Cockpit Voice Recorder

Push TEST -- STATUS light on for 1 sec.

Plug headset - steady tone when TEST.

2. ANTI-SKID Switch Light

ANTI-SKID OFF switch light extinguished.

3. CARGO SMOKE Panel- Perform test.

Push and hold test switch.

Voice alert: “CARGO SMOKE”

Visual alerts: Master Warning Lights, 4 “PUSH” lights, 3 EAD (level 2) alerts.

CARGO SMOKE TEST PASS on EAD.

4. Hydraulics - Ensure Trans and Aux pumps are off.

5. GPWS Control Panel (Enhanced GPWS)

Perform GPWS test .

Verify TERRAIN OVRD switch extinguished & guard down. Ensure TERRAIN is displayed in right corner of Pilot’s NDs, Rotate WX/TERR knob on Glareshield CCW. Push GPWS TEST switch. Check verbal and aural indicators.

6. CABIN PRESS Panel - check.

7. ELECTRICAL Panel/Emergency Power

Emerg Power Test.

8. APU Panel

APU power as required.

9. AIR Control Panel

Turn on as required.

10. ICE PROTECTION Control Panel

Perform tests and set up panel.

11. FUEL USED RESET Button

Push FUEL RESET - ensure counters zero.

12. Annunciator/Digital Lights

Test all annunciator/warning/caution lights.

13. PULL TO DIM Switch - Desired position.

14. FUEL Control Panel

Test pumps.

15. ENGINES Control Panel

L and R FADEC MODE lights extinguished.

IGNITION - AUTO. Start Pump - OFF.

16. Windshield Wipers (Both)

Verify wipers are parked.

17. Exterior/Interior Lights

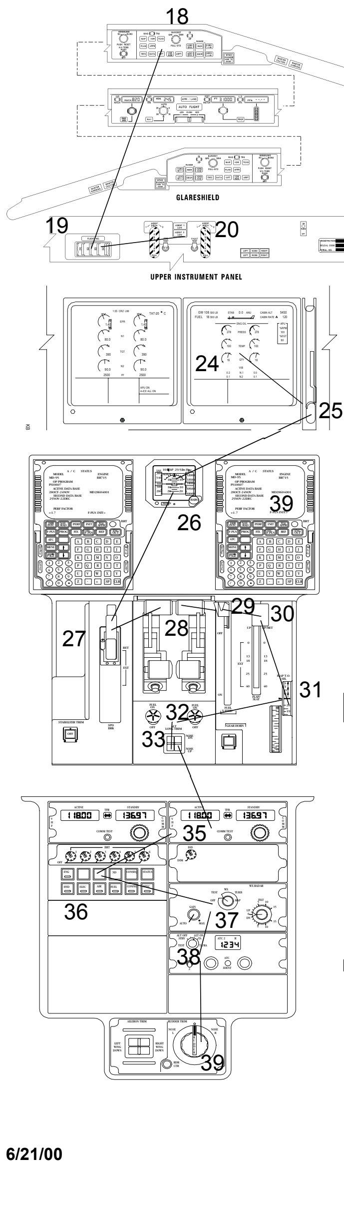
SEAT BELT/ NO SMOKE lights - ON.

NAV light - ON.

LOGO light - as required.

Check standy compass.

FINAL COCKPIT PREPARATION (PAGE 2)



18. EIS

Perform preflight and ensure control panel is properly set up.

19. FLIGHT NO. Indicator

Rotate thumbwheels on FLIGHT NO. to current flight number.

20. Engine/APU Fire Test

If not previously done, accomplish FIRE TEST.

21. Oxygen Mask/Interphone (Not Shown)

Perform Oxygen system and interphone system test.

22. Audio Control Panel (Not Shown)

Set audio control panel as desired.

23. Source Input Select Panel (Not Shown)

Verify EIS SOURCE is vertical. All lights on panel extinguished.

24. Display Units

Display units powered and appropriate indications present.

25. Gear Warning/Brake Pressure

Perform and observe Gear Warning Test.

Verify brake pressure indications are normal.

26. Integrated Standby Instrument System (ISIS)

Adjust display intensity. No red X displayed. ATT FAIL not displayed. Altimeter setting in “in HG” window agrees with current altimeter. Attitude indicator is aligned.

27. SPD BRK Lever

Verify SPD BRK lever is in full forward and DISARMED position.

28. Takeoff Warning/Throttles

Move both throttles full forward to the gate and observe takeoff visual warnings are displayed and takeoff aural warning sounds.

29. FUEL X FEED Lever

Verify FUEL X FEED lever is in OFF.

30. FLAP/SLAT Handle

Verify FLAPS/SLAT handle is UP/RET.

31. FLAP T.O. SELector

Verify FLAP T.O. SELector is in STOW.

32. FUEL Switches

Verify both engine FUEL switches are OFF.

33. Stabilizer

Perform test if first flight of day.

34. Control Column (not shown)

Check with 20-30 pounds of force.

35. VHF COMM Panels (Both)

Verify comm radios are checked and set for taxi & takeoff.

36. System Display Control Panel (SDCP)

Push STATUS cue switch & review all items on STATUS page.

Push ENG cue switch.

37. Weather Radar

Test weather radar system.

38. Transponder/TCAS

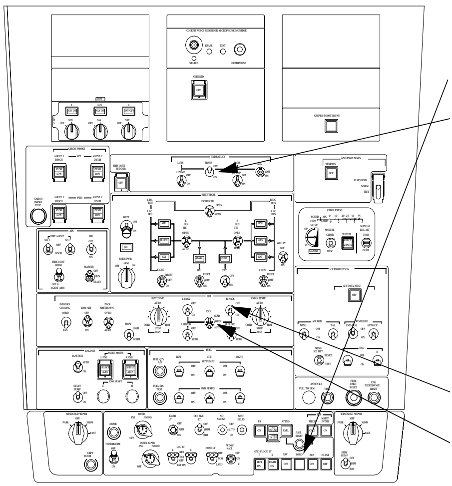
Select 1 or 2 with ATC switch andTEST.

FD -- RA recommended vert speed. ND -- 4 threat level symbols. Aural messages “TCAS SYSTEM TEST” and “TCAS SYSTEM TEST PASS” sounds.

39. Rudder/Aileron Trim

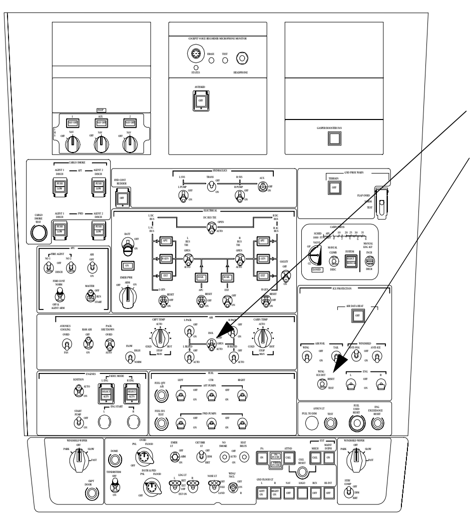
Verify RUDDER TRIM and AILERON TRIM are set to zero.

40. FMS - Verify flight plan and computed values (not shown).



BEFORE ENGINE START FLOW (Below the Line)

1. **STATUS PAGE -** check
2. **BEACON Light**
   Verify ON
3. **HYDRAULICS Control Panel**
   AUX/TRANS pump switches ON.
4. **Parking Brake** (not shown)
   On or off based on requirements.
5. **Papers and Logbook** (not shown)
   Confirm papers and logbook are on board.
6. **FMS and V-Speeds** (not shown)
   Enter/check appropriate data, V-Speeds and stab trim.
7. **Flap T.O SELector.**
   Stow or rotate to desired setting.
8. **Shoulder Harness** (not shown)
   Verify On
9. **Pack Switches**
   Verify OFF
10. **ISOL Switch**
    Verify OPEN



BEFORE TAXI CHECKLIST

1. **AIR Control Panel**
   PACK & ISOL Switches - AUTO.
2. **ICE PROTECTION Control Panel**
   Engine/air foil anti-ice - as required.

NOTES

Icing can occur on ground when:

- OAT is 10°C (50°F) or below, and
- Visible moisture is present or,
- Operating where slush/standing water may impinge & freeze on ext surfaces.

Icing in flight when:

- TAT is 10°C (50°F) or below, and
- Visible moisture is present, or
- Ice is built up on windshield wiper or other visible portions of the airplane.

3. **Door Lights(on EAD - not shown)**
   Verify all door lights are out.

BEFORE TAKEOFF TO THE LINE

1. APU AIR and Master Switches
Verify APU air switch to OFF. If APU is not being used for electric power verify APU is shut down. (can be delayed at Captain's discretion).

2. Flt Controls/Brake Temp
Select Config synoptic. Verify spoiler full deflection when control wheel full left & right. Elev boxes corespond to wheel movement. Rudder boxes correspond to rudder pedal movement. Brakes less than 170C.

3. Flap/Slat Handle
Verify TO Sel indicates planned setting, PFD shows setting, and handle in desired takeoff setting.

4. Fuel Quantity
Recheck to ensure required dispatch fuel on board.

5. Trim Controls
Determine/set Horizontal Sab setting from FMS. Verify aileron and rudder centered.

6. Spoilers (not shown)

Arm Spoilers

7. Takeoff Briefing

Confirm proper runway set. PF briefs takeoff in accordance with FOM.

8. FCP (not shown)

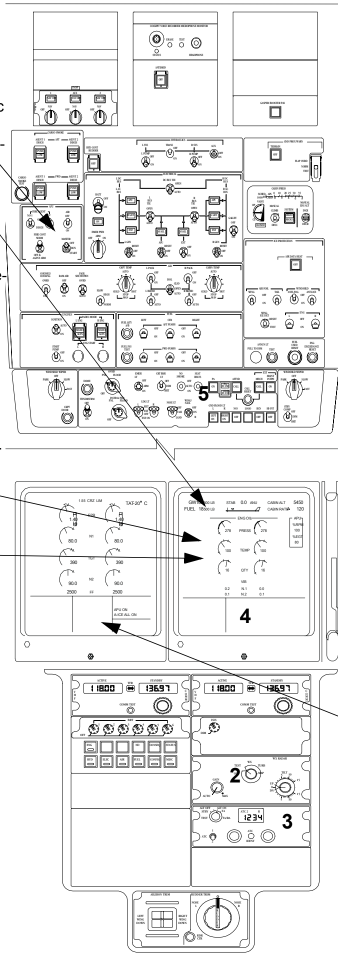
Verify speed, heading, and altitude are set as required.

9. Altimeter (not shown)

Set and cross-check altimeters.

9. Cabin Secure

Ensure flight attendants have given cabin secure.



BEFORE TAKEOFF BELOW THE LINE

The following items are accomplished when cleared unto the runway, just prior to takeoff.

1. Flight Attendant (F/A) Signal (not shown)

Notify Flight Attendants to be seated for departure.

2. Weather Radar

Turn weather radar to ON and adjust for departure. (if required)

3. Transponder

Rotate mode selector to TA/RA.

4. EAD

Review EAD for alerts and reminder messages and green box.

5. Landing/Exterior Light

Upon being cleared for takeoff, move L and R LDG LT switches to EXT ON, NOSE LT switch to LAND, push GND FLOOD lights to ON, and push STROBE light switch to ON.

6. EAD

Review EAD for alerts, reminder messages and green box.

INITIAL CLIMB

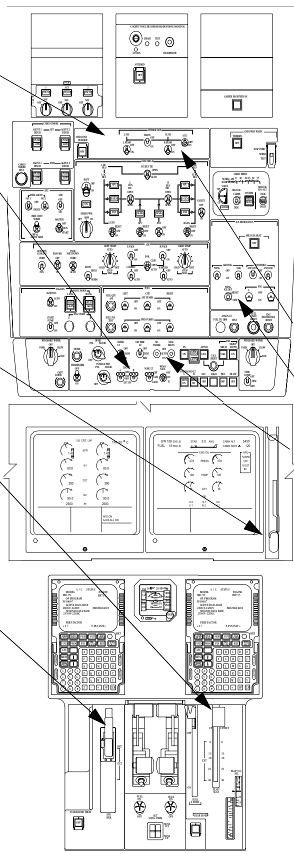
1. Hydraulic AUX/TRANS Pumps
Switches OFF.

2. Landing and Exterior Lights
Retract and OFF at Captain’s discretion.

3. Landing Gear
Handle up.

4. Flaps/Slats
Up/Retract on speed.
When checking for up and retracted ensure dial a flap is stowed.

5. Spoilers
OFF/Disarm



IN RANGE

1. FMS
Insert and verify arrival and approach data.

2. DH/MDA
Set for Approach

3. Landing Data and Briefing
ATIS/Crew Briefing

4. Hydraulic AUX/TRANS Pumps
Switches ON.

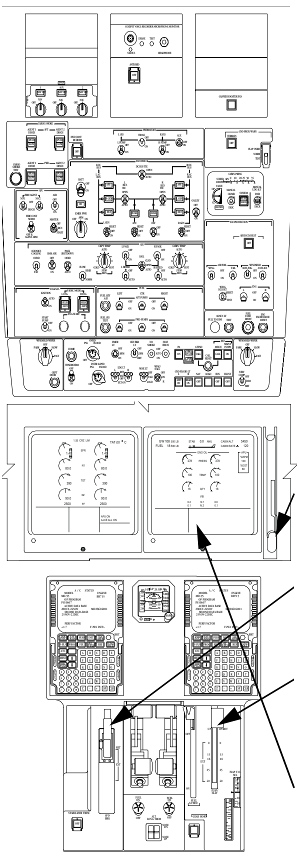
5. Ice Protection Switches
Ensure Ice Protection systems properly set for descent.

6. NO SMOKE/SEAT BELT
Seat Belt switch ON at Captain’s discretion.

7. Shoulder Harness (Not Shown)
Ensue shoulder harnesses are on.

8. Altimeters
Set at transition level and cross-check.

LANDING FLOW



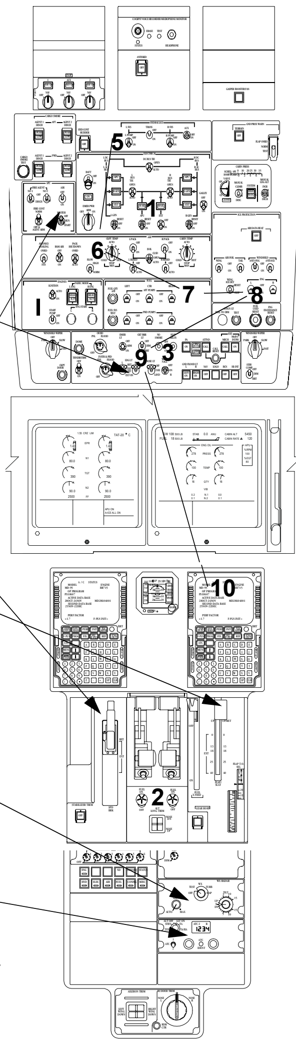
1. F/A Signal
Given.

2. LANDING GEAR
Gear handle down - check 3 green lights.

3. SPOILERS
ARMED

4. FLAPS
Set flaps to landing position.

5. EAD
Check alerts, reminder messages, and green box.



AFTER LANDING

A. Landing and Exterior Lights
Nose light taxi, others, as required.

B. Spoilers
Forward and Disarm.

C. Flaps.
18 degrees.

D. APU
Start.

E. Weather Radar
OFF.

F. Transponder.
Standby

G. Flaps/Slats
Raise just prior to entering gate.

PARKING

(Shown by numbers)

1. APU/EXT Power
Verify APU or External Pwr ON.

2. Fuel Switches
Turn fuel switches OFF.

3. Seat Belt Switch
Off.

4. Parking Brake (not shown)
Set as required. Coordinate with the ground crew.

5. Hydraulic AUX/TRANS Pump Switches
OFF.

6. Air Conditioning
Set.

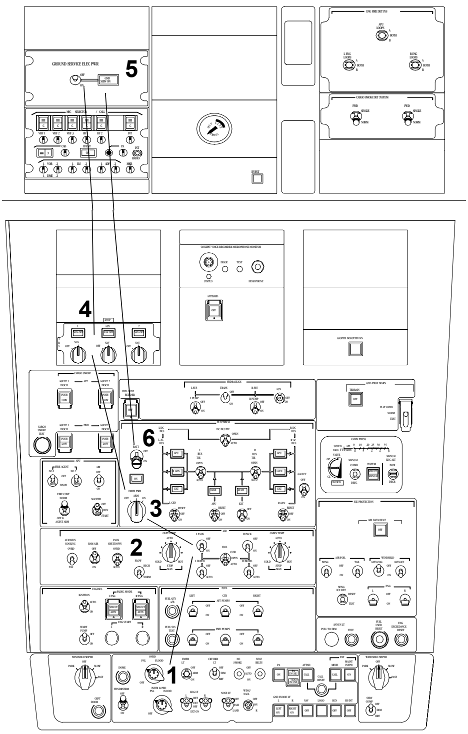
7. Fuel Control Panel
Boost pumps off except for APU supply.

8. Ice Protection Control Switches
OFF

9. Exterior Lights
All OFF. Nav lights as required.

10. SCP Status Page
Review for discrepancies.

TERMINATING



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1. **CABIN EMERGENCY LIGHTS** - OFF

2. **PACK SWITCHES** - OFF

3. **EMERGENCY POWER SELECTOR** - OFF

4. **IRS** - OFF

5. **GROUND SERVICE POWER** - AS REQUIRED

6 **BATTERY SWITCH** - AS REQUIRED