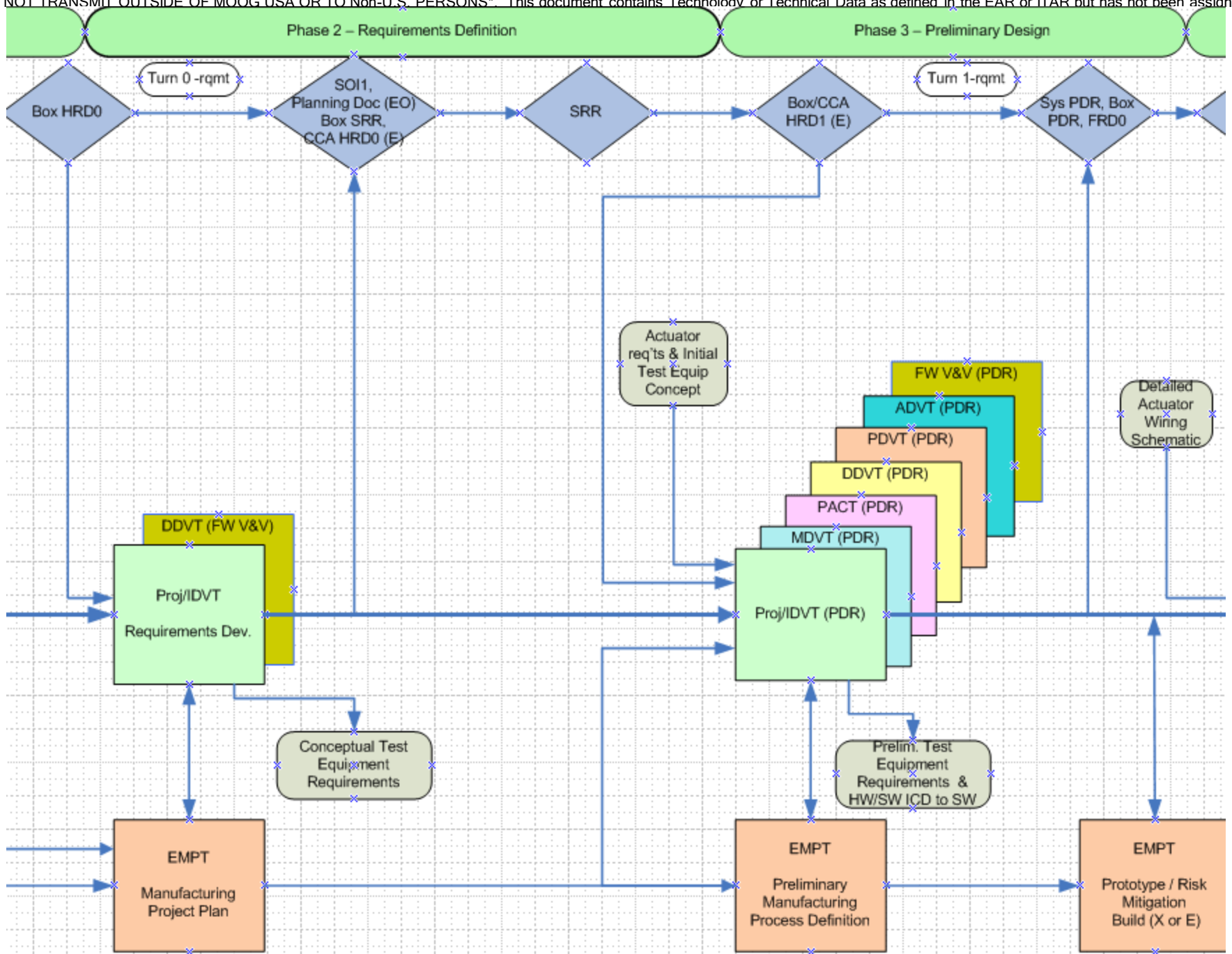# ACG Electronics Swimlane
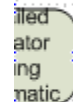## (Common Development Process)

Revised: January 21, 2014

Phase 0 – Concept Development	Phase 1 – Projects Planning

Revisions

PHAC0, HDP0,
HVP0, HCMP &
HPAP (E)

Box HRD0

Tu

EE - HW

Proj/IDVT

Concept
Development

Proposal
Baseline
Program Plan
Platform
Baseline

Proj/IDVT

Cert/Project Planning

R

Requ

Ma
P

Controlling
Document
6100-010-200

Phase 2 – Requirements Definition	Phase 3 – Preliminary Design

Box HRD0

Turn 0 -rqmt

SOI1,
Planning Doc (EO)
Box SRR,
CCA HRD0 (E)

SRR

Box/CCA
HRD1 (E)

Turn 1-rqmt

Sys PDR, Box
PDR, FRD0

Actuator
req'ts & Initial
Test Equip
Concept

FW V&V (PDR)

ADVT (PDR)

PDVT (PDR)

DDVT (PDR)

PACT (PDR)

MDVT (PDR)

Detailed
Actuator
Wiring
Schematic

DDVT (FW V&V)

Proj/IDVT

Requirements Dev.

Proj/IDVT (PDR)

Conceptual Test
Equipment
Requirements

Prelim. Test
Equipment
Requirements &
HW/SW ICD to SW

EMPT

Manufacturing
Project Plan

EMPT

Preliminary
Manufacturing
Process Definition

EMPT

Prototype / Risk
Mitigation
Build (X or E)

Revised: January 21, 2014

Phase 4 – Detailed Design	Phase 5 – Item build and ATP

Turn 2 -rqmt

Box/CCA HRD2 (EO)

Sys CDR Box CDR, FRD1, Box/CCA TRD

S0I2 Requirements, Design Data

Box/CCA ATP0

Box/CCA HRD3 (EO)

Turn 3 -rqmt

Turn 0 - Des

FW V&V (CDR)
ADVT (CDR)
PDVT (CDR)
DDVT (CDR)
PACT (CDR)
MDVT (CDR)

...iled ...ator ...ing ...matic

Proj/IDVT (CDR)

FW V&V (Test)
ADVT (Test)
PDVT (Test)
DDVT (Test)
PACT (Test)
MDVT(Test)

Motor Controller to Mech

Box Integation, ATP & Pre-Qual Risk Mitigation (IDVT)

Prototype Motor & Req'ts for Actuator Controller for Risk Mitigation to Mech

STE from Test, ATP SW & EMI SW builds from SW

HW fro... Mech f... EMC te... Docume... Certifi...

EMPT

Detailed Manufacturing Process Definition

...T

.../ Risk ...on ...or E)

EMPT

Dev HW build CCA / Box (E, EO) (Turn 0 HW)

Turn 0 - HW

Dev HW to Sys/SW/Mech for Integration

Revised: January 21, 2014

Phase 6 – System Integration and SOF

Phase 7 - Qualification

Box/CCA HRD4

Turn 4 -rqmt

Sys TRR FRD2, ATP 1

S0I3, Design Verification FRD3

Turn 1 – Des

FW V&V

PVDT (Design Turn)

DDVT (Design Turn)

PACT (Design Turn)

MDVT (Design Turn)

ADVT (Design Turn)

Problem reports

EMC/ SOF Test Support (IDVT)

Qual Problem reports

MDVT (Qual Sup't)

FW V&V

System EMC / Qual (IDVT)

ATP sk

IDV

HW from sys/ Mech for SOF EMC tests & TE Documentation/ Certification

HW from Sys/Mech for Qual EMC tests

Qual Item & EMC Report to Sys for Qual test & other box Qual results/report

SOF Item & EMC Report to Sys for SOF & other box SOF results & Integration Controller for motor

EMPT

SOF (EO) build CCA / Item

EMPT

Production Readiness, Qual builds (Turn 1 HW) EO

Turn 1 - HW

W to Mech ration

Revised: January 21, 2014

Phase 8 - Certification

SOI3, Design Verification FRD3

SOI4, Certification, FRD4

PRR

EIS Review

Turn 2 – Des

FW V&V

PVDT (Design Turn)

DDVT (Design Turn)

PACT (Design Turn)

MDVT (Design Turn)

ADVT (Design Turn)

IDVT (Design Turn)

FPY 92%

Design Engineering Leadership

n & ort to al test Qual port

Turn 2 - HW

Production HW build EO (Turn 2 HW)

Revised: January 21, 2014

Product Maturation / Entry Into Service

Sustainment

EIS Review

Product Maturation Review

Design Engineering

Product Maturation / EIS

Design Engineering

Sustainment

FPY ≈ 92%

FPY ≈ 99%

Design Engineering Leadership

Transfer to Product Engineering Leadership

Transfer to Operations Leadership

Turn 2 - HW

Production HW build EO (Turn 2 HW)

Electronics Manufacturing and Operations

Product Maturation / EIS

Electronics Manufacturing and Operations

Sustainment

Revised: January 21, 2014

EE Work Packages Summary

Phase	Work Package	
1 (1152 hrs)	Project Planning	IDVT WP1
2 (2712 hrs)	Requirements Definition	IDVT WP2
		DDVT WP3
	Manufacturing Project Planning	EMPT WP4
3 (6574 hrs)	Preliminary Design	IDVT WP5
		DDVT WP6
		Fwr V&V WP7
		ADVT WP8
		PDVT WP9
		PACT WP10
		MDVT WP11
	Preliminary Mfg Process Definition & Prototype/Risk Mitigation Build	EMPT WP12

Phase	Work Package	
4 (12462 hrs)	Detailed Design	IDVT WP13
		DDVT WP14
		Fwr V&V WP15
		ADVT WP16
		PDVT WP17
		PACT WP18
		MDVT WP19
	Detailed Mfg Process Definition	EMPT WP20
5 (6456 hrs)	Item Build and ATP	IDVT WP21
		DDVT WP22
		Fwr V&V WP23
		ADVT WP24
		PDVT WP25
		PACT WP26
		MDVT WP27
	Dev HW Build CCA/Item	EMPT WP28

Phase	Work Package	
6 (3650 hrs)	System Integration and SOF	IDVT WP29
		DDVT WP30
		Fwr V&V WP31
		ADVT WP32
		PDVT WP33
		PACT WP34
		MDVT WP35
	SOF Build CCA/Item	EMPT WP36
7 (2520 hrs)	Qualification	IDVT WP37
		Fwr V&V WP38
		MDVT WP39
	Production Readiness, Qual Builds	EMPT WP40
8 (3652 hrs)	Certification Support	IDVT WP41
		DDVT WP42
		ADVT WP43
		PDVT WP44
		Fwr V&V WP45
		PACT WP46
		MDVT WP47
	Production HW Build	EMPT WP48
	Product Maturation / EIS	IDVT WP49
		EMPT WP50
	Sustainment	IDVT WP51
		EMPT WP52

Legend:

IDVT	Item Design Verification and Test
DDVT	Digital Design Verification and Test
Fwr V&V	Firmware V&V
ADVT	Analog Design Verification and Test
PDVT	Power Design Verification and Test
PACT	Packaging Design Verification and Test
MDVT	Motor Design Verification and Test
EMPT	Electronics Manufacturing Process and Test

Assumptions – High Voltage EM Box with 90% Reuse, 6 Unique CCAs, DO-254 Level A design, Microprocessor and PLD, BLDC Motor design with reuse of magnetic design (pole/slot)

Phase 1 – Project Planning Work Package

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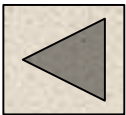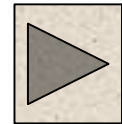
Project Planning – IDVT WP1

Inputs

Proposal Baseline
Proposal volumes (inc DTC)
Contract Spec & SOW
Electrical Engineering Budget
Platform Baseline/Templates
Org Project Standards
Planning Document Templates
Program Plan
Customer schedule/milestones
Program organization chart
Work Authorization (WO #)

Tasks / ETC

Planning
PHAC, HDP, HVP, SSMP, HPAP, HCMP,etc… (480)
Develop EE Risk Mitigation plan (32)
Create IP protection plan (24)
Plan for export compliance and licensing (24)
Manufacturing Concept Strategy(8)
Project Preparation
Create Integrated EE Schedule (44)
Create EE WBS and WP definition (40)
Update EE Program ETC (24)
Create Electrical IPT organization/plan (24)
Generate project data repository structure (18)
Design Requirements & Standards
Review deltas from proposal and award (24)
Review and update assumptions (28)
Define applicable design process std (32)
Kick-off
Identify IR&D / platform candidates and kick-off (30)
Other EE team support including trades (320)

Deliverables

1. Integrated EE Schedule / WBS / ETC – as required

2. Certification Planning Docs (E release):

   PHAC, HDP, HVP, HCMP, HPAP,SSMP

3. SDRL list / schedule – as required

4. EMC Control Plan – as required (E release)

Return to summary page
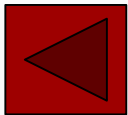
Resources (1152 hrs)
- Primary: EE Project/IDVT (352)
- Other EE teams (800)

Return to swimlane

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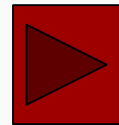
Phase 1 Exit Criteria

Phase 1 – Project Planning Work Package

1. ☐Complete, ☐N/A: Integrated EE Schedule / WBS / ETC – as required
2. ☐Complete, ☐N/A: Certification Planning Docs (E release):
   a. ☐Complete, ☐N/A: PHAC
   b. ☐Complete, ☐N/A: HDP
   c. ☐Complete, ☐N/A: HVP
   d. ☐Complete, ☐N/A: HCMP
   e. ☐Complete, ☐N/A: HPAP
   f. ☐Complete, ☐N/A: SSMP
3. ☐Complete, ☐N/A: SDRL list / schedule – as required
4. ☐Complete, ☐N/A: EMC Control Plan – as required (E release)
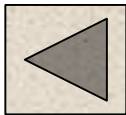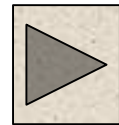
Phase 2 – Requirements Definition Work Packages

Return to summary page

Return to swimlane

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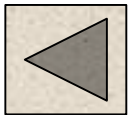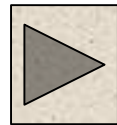
Requirements Definition – IDVT WP2

Inputs

Tasks / ETC

Deliverables

Requirement
Proposal volumes
Proposal HW assumptions
Proposal FW allocation assumptions
Customer Statement of Work
System Top Level Definition
Standards / Guidelines
Platform FEs
Design process standards
Trades with other swimlanes

Trade Studies
Other EE teams support including trades (600)
Generate conceptual Box HDD (120)
Define Box / CCA Architecture/technical approach (120)
• Platform reuse and development Items
• Partitioning & associated trade studies
• Reliability and safety allocations
Item Definition
Generate preliminary Box block diagrams (80)
Generate Grounding Scheme (40)
Define Box Hardware Requirements
  including derived requirements (240)
Generate Requirement trace matrix (120)
Create Product Structure Diag with PNs (28)
CCA Block Diagrams and HRDs (300, 300)
Baseline Requirements (16)
SRR Preparation (24)
Reviews/Project/Plans
Review requirements formally Int/Ext (48)
Requirements Peer Reviews (32)
EVMS Updates (32)
Create control plans - HV, EMC (100)
Collaborate Manufacturing Plan development (16)

1. Box Block Diagram
       project file (part of HRD)
2. Grounding approach
       project file (part of HRD)
3. ICD
       project file (part of HRD)
4. LRU HRD
       (E release) - prelim baseline in Doors
5. CCA HRDs
       as required (E release) – in Doors
6. Drawing Tree
       MRE document (E release)
7. Checklists / guidelines / templates
       distribution
8. DFX goals
       project memo
9. Control Plans – HV, EMC
       project memo

Return to summary page
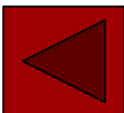
Resources (2216 hrs)
- Primary: IDVT/Proj (1316)
-Other EE *teams* (900)

Return to swimlane

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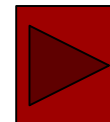
Requirements Definition – VnV (DDVT) WP3

Inputs

Tasks / ETC

Deliverables

Requirements
Board Requirement – HRD
Plans
V&V plans
PHAC, HVP, HDP, HPAP, HCMP
Guidelines / Standards
Requirement & Coding standard
Platform Functional Element – VHDL core

Preliminary PLD/Firmware definition
Identify the FEs / logic to be implemented in PLD (80)
Generate PLD high level block diagram (40)
Generate IO List (20)
Perform high level Timing analysis (80)
Update Planning Docs (80)
Create FRD0 (120)

1. PLD block diagram and IO List – project file
2. SOI 1 - audit results in clear case (as required)
3. FRD0 (DDVT activity) – E release
4. 5. Planning Doc's Released (EO)
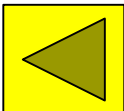
Resources (420 hours)
DDVT (420)

Return to summary page

Return to swimlane
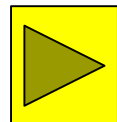
Phase 2 Exit Criteria

Phase 2 – Requirements Definition

☐Complete, ☐N/A: Box Block Diagram, project file (part of HRD)

☐Complete, ☐N/A: Grounding approach project file (part of HRD)

☐Complete, ☐N/A: ICD project file (part of HRD)

☐Complete, ☐N/A: LRU HRD (E release) - prelim baseline in Doors

☐Complete, ☐N/A: CCA HRDs as required (E release) – in Doors

☐Complete, ☐N/A: Drawing Tree MRE document (E release)

☐Complete, ☐N/A: Checklists / guidelines / templates distribution

☐Complete, ☐N/A: DFX goals project memo

☐Complete, ☐N/A: PLD block diagram and IO List – project file

☐Complete, ☐N/A: SOI 1 - audit results in clear case (as required)

☐Complete, ☐N/A: All Planning Doc's EO Released

☐Complete, ☐N/A: FRD0 (DDVT activity) – E release

☐Complete, ☐N/A: Control Plans (HV, EMC) - project memo
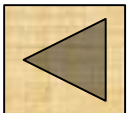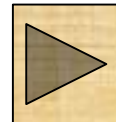
PH 3 – Preliminary Design Work Packages

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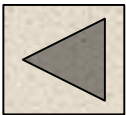
Return to swimlane
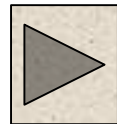
Preliminary Design – IDVT WP5

Inputs

Schedule
Program IMS & ETCs
Program data Item deliverables
Requirements
SRR actions
Updated Hardware Allocation
Box Requirement – HRD
HRD to CCA HRD RQMT Trace
Safety Requirements
Grounding approach
Plans
Manufacturing Plans EMCP1
V&V plans (PHAC, HVP, HDP)
Risk mitigation plan
DFX
DTC targets and DFMAT plans
Guidelines
Guidelines / Checklists
Platform Functional Elements

Tasks / ETC

Coordinate:
Box Block diagram, area, power estimates (60)
Source Control Drawings for Sensors, etc (120)
DFMAT, DTC and Obsolescence report (60)
Preliminary Box layout - fit, thermal (60)
Prototype / Risk mitigation testing (80)
Preparation of Data Items (80)
Box Reliability / FMEA analysis (40)
Auditing of guidelines / checklist (40)
Box PDR package (120)
Box BOM creation (40)
Peer Review with EMC and Subject MEs (40)
Box Design trades (80)

Lead project activities (120)
Develop Box Verification Matrix (40)
Update Box HRD (60)
Dev test plan (60)
Generate Box Test equipment requirements (40)
Support System PDR and Box PDR (40)

Resources (1180 hours)
-IDVT (1180)

Deliverables

1. Requirements - Box HRD update as required
    (E release) Doors REV
2. Requirements – Preliminary Compliance Matrix
    (with MOC defined) (E release)
3. Requirements - Box level requirements
    check list – clear case
4. Trade Study – if needed
    project memo
5. Peer Review documentation with SME
    project memo
6. Test Equipment req't document
    project memo
7. DFMAT review with MFG
    project memo
8. PDR review package – as required

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Revised: January 21, 2014

Preliminary Design – DDVT WP6

Inputs

Tasks / ETC

Deliverables

Requirements
Box Requirements - HRD
CCA Requirement – HRD
Plans
DTC targets and DFMAT plans
Grounding Approach
Risk Mitigation Plan
Program IMS & ETCs
Guidelines
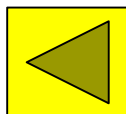Platform Functional Elements
Guidelines & Checklists

Design/Analysis
Generate Source Control Drawing as needed (40)
Generate Library models (60)
Generate Schematics (40, 60)
Generate BOM, DTC and Obsolescence report (60)
Perform PLD design activity (120)
Perform preliminary parts placement (80)
Perform Design Analysis / Sim – Stress, derating (80)
Update CCA HRD (80)
Reviews and other support
Prototype / Risk mitigation plan and testing (80/80)
Generate DFMAT compliance report (40)
Generate CCA Test equipment req't document (40)
Support Reliability / FMEA analysis (20)
Capture design data in repository (40)
Support Peer Review with EMC and SMEs (40)
Prepare PDR package (80)

1. Requirements - CCA HRD update as required (E release) Doors REV
2. Requirements – Preliminary Compliance Matrix (with MOC defined) (E release)
3. Trade Study, if needed – project memo
4. Area, power estimates, if needed – project memo
5. FRD1 REV update
6. Schematic Preliminary Peer review with SME – project memo
7. Schematic Preliminary (E release – if needed for prototype)
8. BOM, (E release – if needed for prototype)
9. BOM - DTC compliance & Obsolescence summary project memo
10. ABOM – long lead items if needed project memo or spread sheet
11. PDR review package – as required
12. PDR DDVT checklists

**Return to summary page**

Return to swimlane

Resources (1040 hours)
- DDVT (700 hrs)
- Components (120 hrs)
- PWB design (140 hrs)
- EE Tech (80 hrs)

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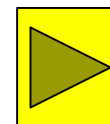
Preliminary Design – FW V&V WP7

Inputs

Tasks / ETC

Deliverables

Requirements
Box HRD
CCA HRD
Platform Functional Elements
Plans
DTC targets and DFMAT plans
Risk mitigation plan
V&V plans (PHAC, HVP, HDP)
Program IMS & ETCs
FRD0
Guidelines
Documentation requirements,
 templates, checklists

Requirement Reviews
Review released requirements (E-released) against check list (60)
Review preliminary test approach vs V&V plan (40)
Plans
Set Up V&V Data folders in Configuration Management System (40)
Analysis / Tracing / Procedures
Develop HVCP (60)
   Identify required test cases
   Identify required robustness testing
Estimate/allocate tool usage (40)
Work CCA tracing to PLD (80)

1. PDR review package, as required

**Return to
summary page**
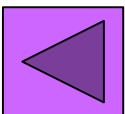
Resources (360 hours)
- DDVT (360)

**Return to
swimlane**

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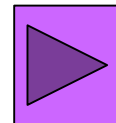
Preliminary Design – ADVT WP8

Inputs

Tasks / ETC

Deliverables

Requirements
Box Requirements - HRD
CCA Requirement – HRD
Plans
DTC targets and DFMAT plans
Grounding Approach
Risk Mitigation Plan
Program IMS & ETCs
Guidelines
Platform Functional Elements
Guidelines & Checklists

Design/Analysis
Perform Design trades (120)
Generate Schematics (100/60)
Generate CCA Block diagram, Area, power estimates (120)
Update CCA HRD (80)
Perform Design Analysis / simulation – Stress, derating (80)
Generate BOM, DTC and Obsolescence report (60)
Grounding Scheme (40)
Perform preliminary parts placement (80)
Generate Library models (60)
Generate Source Control Drawing as needed
Reviews and other support
Prototype / Risk mitigation plan and testing (80/80)
Generate DFMAT compliance summary (40)
Generate CCA Test equipment requirement (40)
Support Reliability / FMEA analysis (20)
Capture design data in repository (40)
Support Peer Review with EMC and SMEs (40)
Prepare PDR package (80)

1. Requirements - CCA HRD update as required (E release) Doors REV
2. Requirements – Prelim Compliance Matrix (with MOC defined) (E release)
3. Trade Study, if needed – project memo
4. Area, power estimates if needed – project memo
5. Schematic Preliminary Peer review with SME – project memo
6. Schematic Preliminary (E release – if needed for prototype)
7. BOM, (E release – if needed for prototype)
8. BOM - DTC compliance & Obsolescence Summary - project memo
9. ABOM – long lead items if needed project memo or spread sheet
10. PDR review package – as required
11. PDR ADVT checklists

Return to summary page
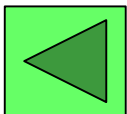
Resources (1220 hours)
- ADVT (880 hrs)
- Components (120 hrs)
- PWB design (140 hrs)
- EE Tech (80 hrs)

Return to swimlane

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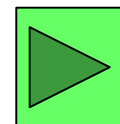
Preliminary Design – PDVT WP9

Inputs

Tasks / ETC

Deliverables

Requirements
Box Requirements - HRD
CCA Requirement – HRD
Plans
DTC targets and DFMAT plans
Grounding Approach
Risk Mitigation Plan
Program IMS & ETCs
High Voltage Control Plan
Guidelines
Platform Functional Elements
Guidelines & Checklists

Design/Analysis
Perform Design trades (120)
Generate CCA Block diagram, Area, power est (120)
Grounding Scheme (40)
Generate Source Control Drawing as needed
Magnetics Design (120)
Generate Library models (60)
Generate Schematics (100/60)
Generate BOM, DTC and Obsolescence report (60)
Perform preliminary parts placement (80)
Perform Design Analysis / sim – Stress, derating (80)
High Voltage Risk Identification (40)
Program High Voltage Guideline (20)
Update CCA HRD(80)
Generate CCA Test equipment requirements (40)
Reviews and other support
Prototype / Risk mitigation plan and testing (80/80)
Generate DFMAT compliance report (40)
Support Reliability / FMEA analysis (20)
Capture design data in repository (40)
Support Peer Review with EMC and SMEs (40)
Prepare PDR package (80)

1. Requirements - CCA HRD, update as required
   (E release) Doors REV
2. Requirements – Preliminary Compliance Matrix
   (with MOC defined) (E release)
3. Trade Study
   if needed – project memo
4. Area, power estimates
   if needed – project memo
5. Schematic Preliminary
   Peer review with SME – project memo
6. Schematic Preliminary
   (E release – if needed for prototype)
7. BOM
   (E release – if needed for prototype)
8. BOM - DTC compliance & Obsolescence summary
   project memo
9. ABOM – long lead items if needed
   project memo or spread sheet
10. High Voltage Guideline
11. PDR review package – as required
12. PDR PDVT checklists
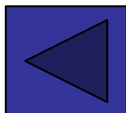
Resources (1220 hours)
- PDVT (880 hrs)
- Components (120 hrs)
- PWB design (140 hrs)
- EE Tech (80 hrs)

Return to summary page

Return to swimlane

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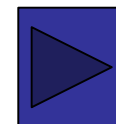
Preliminary Design – PACT WP10

Inputs

Tasks / ETC

Deliverables

Requirements
Box HRD including envelope
Mission Profiles
Board Requirements – # and type of cards
Plans
High voltage control plan
Risk mitigation plan
Grounding approach
Program IMS & ETCs
Guidelines
Board BOM as available
Board Power / Area Estimates
Platform Functional Elements (info only)
DTC targets and DFMAT plans

Design/Analysis
Perform Packaging Design trades (60)
Generate preliminary Box volume and weight estimates (60)
Generate Source Control Drawings (80)
Define Library models (connectors / or standard material) (40)
Generate BOM, DTC and Obsolescence report (connectors, screws, long lead Items) (80)
Generate drawing tree (20)
Prepare preliminary 3D model (80)
Perform Preliminary Design Analysis / simulation –Thermal, Vibe, fatigue, tolerance stack-up (120)
Generate DFMAT concept (20)
Support high voltage and separation rules (20)
Reviews and other support
Perform Peer Review with SMEs (40)
Prototype / Risk mitigation plan and testing (40)
Support Test equipment requirement doc for development testing (20)
Prepare PDR package (60)

1. Requirements – Box Level requirements check list – clear case
2. Trade Study – if needed Project Memo
3. BOM (E release – if needed for prototype)
4. ABOM – long lead items if needed project memo or spread sheet
5. Packaging - Preliminary 3D CAD model (no release)
6. Packaging - Preliminary board DXF to CAD (no release)
7. Packaging - Preliminary Assembly Drawing (E release)
8. Packaging - Peer Review with SME project memo
9. Preliminary Design analysis / Simulation - Thermal, Vib, Fatigue, Tolerance stack up
10. PDR review package – as required
11. PDR PACT checklists

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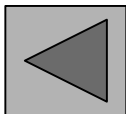
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Resources (740 hours)
PACT (740)

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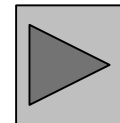
Preliminary Design – MDVT WP10

Inputs

Tasks / ETC

Deliverables

Requirements
Motor Platform
Torque-Speed-Power
Rtt/Ltt, Kt/Ke,
Inertia, peak acceleration
Min/Max Voltage/Current
Commutation/Sensor Type
Cable length, Environmental
DTC targets and DFMAT plans
Plans
Risk mitigation plan
Grounding approach
Program IMS & ETCs
Guidelines
 DTC, DFMAT Requirements
 Motor platform elements

Design/Analysis
Cost, weight, envelope, performance trades (60)
Prelim. magnetic and performance analysis (140)
Prelim Assembly Design/ Modeling (50)
Prelim Stress Analysis (20)
Components supplier selection (10)
Components design/modeling (40/10)
Component drafting drawings (20/10)
Prototype Motor Design (80/80)

Reviews and other support
HV / Corona mitigation plan (10)
Plan and prepare for Prototype Motor Test from platform (40/80)
Prepare PDR package (60/20)

1. Prelim. Top-level Assembly drawings – E released
2. Prelim. Motor Envelope
3. Prelim. Stator and Rotor Dims & weight
4. Prelim. Motor Design Data
5. Prelim Performance Analysis
6. Prelim Thermal analysis
7. Prelim. Stress analysis
8. Mechanical Components Design
9. Peer review Documentation (project)
10. Motor PDR package (project)
11. Prototype Motor BOM and detailed drawings as required (E release)
12. PDR MDVT checklists

Resources (730 hrs)
-Motor design (530 hrs)
-Drafting (120 hrs)
-Technician (80 hrs)

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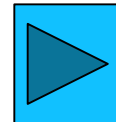
Phase 3 Exit Criteria

Phase 3 – Preliminary Design

1. ☐Complete, ☐N/A: Requirements - Box HRD update as required (E release) Doors REV

2. ☐Complete, ☐N/A: Requirements – Preliminary Compliance Matrix (with MOC defined) (E release)

3. ☐Complete, ☐N/A: Requirements - Box level requirements check list – clear case

4. ☐Complete, ☐N/A: Trade Study – if needed, project memo

5. ☐Complete, ☐N/A: Peer Review documentation with SME, project memo

6. ☐Complete, ☐N/A: Test Equipment req't document, project memo

7. ☐Complete, ☐N/A: DFMAT review with MFG, project memo

8. ☐Complete, ☐N/A: Requirements - CCA HRD, update as required (E release) Doors REV

9. ☐Complete, ☐N/A: Area, power estimates if needed – project memo

10. ☐Complete, ☐N/A: Schematic Preliminary Peer review with SME – project memo

Phase 3 Exit Criteria

Phase 3 – Preliminary Design, cont…

11. ☐Complete, ☐N/A: Schematic Preliminary (E release – if needed for prototype)

12. ☐Complete, ☐N/A: BOM (E release – if needed for prototype)

13. ☐Complete, ☐N/A: BOM - DTC compliance & Obsolescence summary, project memo

14. ☐Complete, ☐N/A: ABOM – long lead items if needed, project memo or spread sheet

15. ☐Complete, ☐N/A: FRD1 REV update

16. ☐Complete, ☐N/A: Packaging - Preliminary 3D CAD model, (no release)

17. ☐Complete, ☐N/A: Packaging - Preliminary board DXF to CAD, (no release)

18. ☐Complete, ☐N/A: Packaging - Preliminary Assembly Drawing, (E release)

19. ☐Complete, ☐N/A: Packaging – Preliminary Analysis – Thermal, Vib, Fatigue,up

20. ☐Complete, ☐N/A: Packaging - Peer Review with SME, project memo

21. ☐Complete, ☐N/A: PDR review package – as required
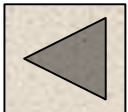
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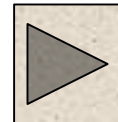
Phase 3 Exit Criteria

Phase 3 – Preliminary Design, cont…

21. ☐Complete, ☐N/A: Prelim. Top-level Assembly drawings – E released
22. ☐Complete, ☐N/A: Prelim. Motor Envelope
23. ☐Complete, ☐N/A: Prelim. Stator and Rotor Dims & weight
24. ☐Complete, ☐N/A: Prelim. Motor Design Data
25. ☐Complete, ☐N/A: Prelim Performance Analysis
26. ☐Complete, ☐N/A: Prelim Thermal analysis
27. ☐Complete, ☐N/A: Prelim. Stress analysis
28. ☐Complete, ☐N/A: Mechanical Components Design
29. ☐Complete, ☐N/A: Peer review Documentation (project)
30. ☐Complete, ☐N/A: Motor PDR package (project)
31. ☐Complete, ☐N/A: Prototype Motor BOM and detailed drawings as required (E release)
32. ☐Complete, ☐N/A: High Voltage Guideline (E release)
33. ☐Complete, ☐N/A: PDR Design Checklists completed
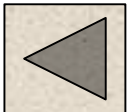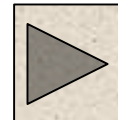
Phase 4 – Detail Design Work Packages

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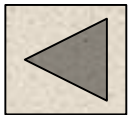
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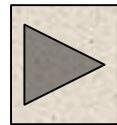
Detailed Design – IDVT WP13

Inputs

Project
Program IMS & ETCs
Program data Box deliverables
Trade Study Results
Plans
Supply Chain Plan
V&V plans (PHAC, HVP, HDP)
DTC targets and DFMAT plans
Risk mitigation plan
HALT/HASS Plan
Updated Material Plan
Requirements
Updated Hardware Allocation
Updated Box Requirement – HRD
HRD to CCA HRD Reqt's Trace
EMCP

Return to summary page

Tasks / ETC

Project
Lead activities (60)
Finalize BOM and DTC (40)
Supply chain support (40)
DFMAT compliance report (40)
Support preparation of data items (80)
Complete box EMC control plan (80)
Requirements
Finalize Box Block Diagram (80)
Finalize Box requirements (160)
Finalize Test Equipment requirements (60)
Design Support / Reviews
Area and power estimates (40)
Ensure completion of Box layout, fit, Thermal, Weight (24)
Complete box verification matrix (160)
Perform peer reviews with EMC and SME's (60)
Prepare box CDR package (80)
Support CDR (30)
Drawings
Box – top level drawing (30)
Source control drawings for Sensors (80)
Test
Complete prototype risk mitigation testing (160)
Dev test plans, ATP,SOF, Qual (240)

Deliverables

1. Design trade study – if needed – project memo
2. Estimate - Area, power - if needed project memo
3. Block diagram (Box and Card) MRE document (EO release)
4. Requirement - Box HRD (EO release) REV Doors - clear case
5. Requirement - Pin Assignments (ICD / Box pins) spread sheet – project file
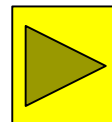6. Requirement derived justification link in Doors – clear case
7. Requirement tracing and review check list clear case
8. CDR review package – as required
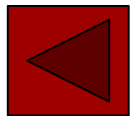
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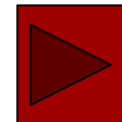
Resources
-IDVT (1544)

Revised: January 21, 2014

Detailed Design – DDVT WP14

Inputs

Requirements
Box Requirement - HRD
CCA Req't Document - HRD
Firmware Requirements - FRD
Preliminary Design Documentation
Preliminary design data & Documents
Risk mitigation test results
Plans
V&V plans (PHAC, HVP, HDP)
DTC targets and DFMAT plans
Guidelines & Checklists
Program IMS & ETCs

Tasks

Requirements
Finalize block diagram (80)
Update CCA HRD and FRD (120)
Design
Finalize schematic (240)
Firmware design (360)
Test Benches (120)
Generate EDP (40)
Perform board layout / trace route (360)
Analysis
Finalize Design Analysis, Stress, Timing, Signal integrity (320)
Support Reliability / FMEA analysis (40)
Functional/post-route Simulation (160)
Generate requirement to design compliance matrix (160)
Components
Finalize BOM, DTC and Obsolescence (80)
Generate library models as needed (40)
Test
Generate board test requirements (240)
Finalize prototype risk testing (120)
Reviews / Reports
Schematic, layout and tracing routing review (80)
Update DMFAT compliance report (40)
Prepare CDR package (60)
Generate SDRL documents (60)
Prepare design doc – HDD (160)

Deliverables

1. Design trade study – if needed
    project memo
2. Estimate - Area, power if needed
    project memo
3. Block diagram (CCA)
    MRE document (EO release)
4. Requirement CCA card HRD – if needed
    (EO release) REV Doors – clear case
5. Requirement FRD2 REV, (EO release) – clear case
6. Schematic Peer Review
    project memo – results of review with SME
7. Schematic checklist data base in team center
    error report completed and resolved – team center
    E release until built – EO release prior to qual
8. Board layout guidelines for each CCA (EDP)
    team center
9. Board layout Peer Review, part place and trace routing
    checklist – project file
10. BOM - (E release – EO release prior to qual)
11. BOM - DTC compliance and Obsolescence report
    memo or spread sheet
12. Analysis (initial / final after qual) –
    Derating / signal integrity/ timing analysis
    project file / clear case
13. Test Procedure (E release)
14. CDR review package – as required
15. PLD Design – PLD source code
    Captured in Clear case
16. Requirement derived justification - link
    in Doors clear case
17. CDR DDVT checklists

Return to summary page

Resources :
 - DDVT (2240 hrs)
 - Components (120 hrs)
 - PWB design (360 hrs)
 - EE Tech (120 hrs)

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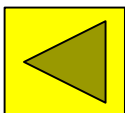
Detailed Design – PLD VnV WP15

Inputs

Tasks

Deliverables

Requirement
Preliminary FRD
Plans
HVP
Preliminary HVCP
Standards
VHDL standards
Check lists (HVCP, TB, HVR)
Design / Models
DUT
Models

Procedure/Test Bench
Generate HVTCP (320 hrs)
Generate/update Test Benches (320 hrs)
Analysis / Simulation
Initial Functional Simulation (320 hrs)
Identifying failures (if any) and analysis (40)
Timing simulation for Typ, Min, Max (320 hrs)
Reviews / Reports
HVCP Peer review & updates (120 hrs)
TB Peer review & updates (120 Hrs)
Generate HVR for simulations (120 hrs)
RQMT clarification based on simulation failure (80)
Hardware Verification Report / Analysis for
    Simulation (160 hrs)
Problem Report / CR (80 hrs)

1. Requirement derived justification Review - link
      in Doors clear case
2. Requirement tracing and review check list
          clear case
3. PLD source code review checklist –
          Clear Case
4. PLD source code traceability –
          Clear Case
5. Functional test Benches
          Captured in Clear Case
6. Functional PLD and post route simulation
          results captured in project file

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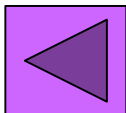
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Resources :
 DDVT (2000 hrs)

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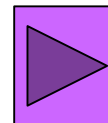
Detailed Design – ADVT WP16

Inputs

Requirements
Box Requirement - HRD
CCA Req't Document - HRD
Preliminary Design Documents
Preliminary design data & doc's
Risk mitigation test results
Plans
DTC targets and DFMAT plans
Guidelines & Checklists
Program IMS & ETCs

Tasks

Requirements
Finalize CCA Block diagram, Area, power estimates (60)
Update CCA HRD (40)
Generate Requirement to Design Compliance Matrix (40)
Design
Finalize Schematics (120)
Generate Board layout guidelines (EDP) (60)
Finalize parts placement (80)
Perform Board Layout (240)
Analysis
Finalize Design Analysis / sim – Stress, derating, HV (40)
Support Reliability / FMEA analysis (20)
Components
Generate Library models as needed (20)
Finalize BOM and scrub for PPL (40)
DTC and Obsolescence report (40)
Test
Prototype / Risk mitigation plan and testing (80)
Generate Board Test Requirement for V&V (40)
Reviews / Reports
Update DFMAT compliance report (40)
Preliminary Board Design Document – HDD (60)
Perform Peer Review including EMI and SMEs (20)
Prepare CDR package (40)
Generate SDRL documents (40)

Deliverables

1. Design trade study – if needed, project memo
2. Estimate - Area, power if needed, project memo
3. Block diagram (Card), MRE document (EO release)
4. Requirement CCA card HRD – if needed
      (EO release) REV Doors – clear case
5. Schematic Peer Review –
      project memo – results of review with SME
6. Schematic checklist
      error report completed and resolved – team center
7. Schematic
      (E release until built – EO release prior to qual)
      data base in team center
8. Board layout guidelines for each CCA
      (EDP) – team center
9. Board layout Peer Review, part placement and trace
      routing checklist – project file
10. CCA assembly drawing
      (E release until built – EO release prior to qual)
11. BOM –
       (E release until built – EO release prior to qual)
12. Analysis (initial / final after qual) – Sensitivity and
      Derating, project memo
13. Test Procedure (E release)
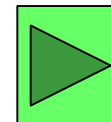14. CDR review package – as required
15. ADVT CDR checklist

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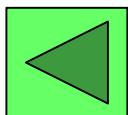
Resources :
 - ADVT (620 hrs)
- Components (100 hrs)
- PWB design (320 hrs)
- EE Tech (80 hrs)

Revised: January 21, 2014

Detailed Design – PDVT WP17

Inputs

Requirements
Box Requirement - HRD
CCA Requirement – HRD
Design Documentation
Preliminary design data & doc's
Risk mitigation test results
Plans
DTC targets and DFMAT plans
Guidelines & Checklists
High Voltage Control Plan
Program IMS & ETCs

Tasks

Requirements
Finalize block diagram (80)
Update CCA HRD (120)
Design
Finalize schematic (240)
Magnetic design (360)
Generate EDP (40)
Perform board layout / trace route (360)
Analysis
Finalize Design Analysis, Stress, Loop Stability (320)
Support Reliability / FMEA analysis (40)
Generate requirement to design compliance matrix (160)
2D&3D HV analysis (HV) (120/60)
Components
Finalize BOM, DTC and Obsolescence (80)
Generate library models as needed (40)
Test
Finalize prototype risk testing (120)
Reviews / Reports
Schematic, layout and tracing routing review (80)
Update DMFAT compliance report (40)
Prepare CDR package (60)
Generate SDRL documents (60)
Prepare design doc – HDD (160)

Deliverables

1. Design trade study – if needed, project memo
2. Estimate - Area, power if needed, project memo
3. Block diagram (Card), MRE document (EO release)
4. Requirement CCA card HRD – if needed (EO release) REV Doors – clear case
5. Schematic Peer Review – project memo – results of review with SME
6. Schematic checklist error report completed and resolved – team center
7. Schematic (E release until built – EO release prior to qual) data base in team center
8. Board layout guidelines for each CCA, (EDP) – team center
9. Board layout Peer Review, part placement and trace routing checklist – project file
10. CCA assembly drawing (E release until built – EO release prior to qual)
11. BOM – (E release until built – EO release prior to qual)
12. Analysis (initial / final after qual) – Sensitivity and Derating, project memo
13. Test Procedure (E release)
14. CDR review package – as required
15. 2D & 3D HV Analysis Report – (E-Release)
16. PDVT CDR Checklist

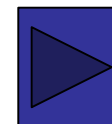## Return to summary page
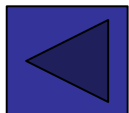
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Resources :
- PDVT (1880)
- Components (120)
- PWB design (360)
- PACT (60)
- EE Tech (120)

Revised: January 21, 2014

Detailed Design – PACT WP18

Inputs

Tasks

Deliverables

Requirements
Mission Profiles
High voltage control plan
Updated HRD and CCA HRDs
Design Documentation
Preliminary design data &
documentation
Risk Mitigation test results
Plans
Updated DTC and DFMAT
Updated Program IMS & ETCs
Guidelines & Checklists

Requirements
Support Detail ICD – Box / CCA pin-outs, I/O
  specification, interconnect definition (8)
Design
Detail packaging design (240)
Analysis
Finalize board level thermal, structural,
  mechanical tolerance, clearance analysis (80)
Finalize Box level thermal, structural, mechanical
  tolerance, 2D&3D clearance sup't (360)
Components / Drawings
Finalize MBS BOM, Part, cable, assembly &
  installation dwgs (160)
Support library models as needed (connectors, etc)
(24)
Test
Complete risk reduction testing (80)
Reviews / Reports
Detail power / area / weight estimates (80)
Peer Reviews with SME's (20)
CDR preparation (40)

1. Design trade study – if needed
       project memo
2. Box - Top Level Assembly Drawing
       E release until built – EO release prior to qual
       data base in team center
3. Box - Drawing (3 D exploded view – PDF format
       models and drawings in team center
4. Box - Installation Drawing
       E release until built – EO release after customer approval
       data base in team center
5. Box - Drawing - torque definitions
       data base in team center
6. Box - Detailed Size/volume, weight report
       memo or power point
7. Box - Peer Review — results of review with SME
       project memo, project file
8. Box - Packaging check list / standards
       project file
9. Analysis (initial / final after qual) – Thermal /
       Vib / Mech Tol report project file
10. CDR review package – as required
11. PACT CDR Checklist

Resources
- PACT (1092)

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summary page**

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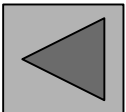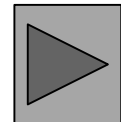
Detail Design – MDVT WP19

Inputs

Tasks / ETC

Deliverables

Requirement Updates
Torque-Speed-Power
Rtt/Ltt, Kt/Ke,
Inertia, peak acceleration
Min/Max Voltage/Current
Commutation/Sensor Type
Cable length, Environmental
DTC targets and DFMAT plans
Design Documentation
Design data and analysis
Prototype test results
Plans
DTC, DFMAT

Requirements
Requirement updates (40)
Design
Detailed Assembly Design/Modeling (60/16)
Design to Cost (DTC) Analysis/Monitoring (40)
Analysis
Finalize weight estimates (20)
Finalize Component Sizing (20)
Finalize Component Design Modeling (40)
Finalize Design & Performance Analysis (180)
Finalize definition of High Voltage Manufacturing processes (24)
Components / Drawings
EO Release Drawings (20/20)
Drawing Reviews/Approvals (20/40)
Detailed Installation Drawing (16/8)
Detailed Component Drawings (40/60)
Test
Performance verification prototype motor (24/100)
A & T Worksheet Reviews/Approvals (20)
Risk Mitigation including HV & Report (20)
Reviews / Reports
CDR Preparation and Follow-up Actions & CDR (40/20)

1. Prototype Motor Test Results – Project Memo
2. Detailed Installation Drawings (EO)
3. Detailed Interface Control Documents (EO)
4. Detailed Design Drawings (Team Center)
5. Detailed Part Lists (BOM's) (Team Center)
6. Detailed 3-D Envelope Model (Team Center)
7. Detailed Weights – Project Memo
8. Detailed Performance Analysis – Project Memo
9. DTC Analysis summary – Project Memo
10. MDVT CDR checklist

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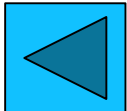
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Resources (848)
- Motor design (584 hrs)
-Drafting (164 hrs)
-Technician (100 hrs)

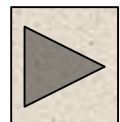**Revised: January 21, 2014**
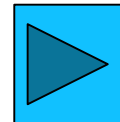
Phase 4 Exit Criteria

Phase 4 – Detailed Design

1. ☐Complete, ☐N/A: Block diagram (Box and Card) MRE document (EO release)

2. ☐Complete, ☐N/A: Requirement - Box HRD (EO release) REV Doors - clear case

3. ☐Complete, ☐N/A: Requirement - Pin Assignments (ICD / Box pins) spread sheet – project file

4. ☐Complete, ☐N/A: Requirement derived justification, link in Doors – clear case

5. ☐Complete, ☐N/A: Requirement tracing and review check list, clear case

6. ☐Complete, ☐N/A: Design trade study – if needed, project memo

7. ☐Complete, ☐N/A: Estimate - Area, power if needed, project memo

8. ☐Complete, ☐N/A: PLD source code review checklist – Clear Case

9. ☐Complete, ☐N/A: PLD source code traceability – Clear Case

10. ☐Complete, ☐N/A: Functional test Benches, Captured in Clear Case

11. ☐Complete, ☐N/A: Functional PLD and post route simulation results, captured in project file

12. ☐Complete, ☐N/A: Requirement CCA card HRD – if needed (EO release) REV Doors – clear case

13. ☐Complete, ☐N/A: Requirement FRD2 REV, (EO release) – clear case

14. ☐Complete, ☐N/A: PLD Design – PLD source code, Captured in Clear case

15. ☐Complete, ☐N/A: Schematic Peer Review – project memo – results of review with SME

16. ☐Complete, ☐N/A: Schematic checklist, error report completed and resolved – team center

17. ☐Complete, ☐N/A: Analysis (initial / final after qual) – Derating / signal integrity/ timing analysis
project file / clear case

18. ☐Complete, ☐N/A: Detailed Installation Drawings (EO)

19. ☐Complete, ☐N/A: Detailed Interface Control Documents (EO)

20. ☐Complete, ☐N/A: Detailed Design Drawings (Team Center)

21. ☐Complete, ☐N/A: Detailed Part Lists (BOM's) (Team Center)

22. ☐Complete, ☐N/A: Schematic (E release until built – EO release prior to qual), data base in team center

23. ☐Complete, ☐N/A: Board layout guidelines for each CCA, (EDP) – team center
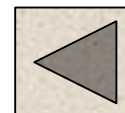
Phase 4 Exit Criteria

**Phase 4 – Detailed Design, cont…**

24. ☐Complete, ☐N/A: Board layout Peer Review, part placement and trace routing checklist – project file

25. ☐Complete, ☐N/A: CCA assembly drawing (E release until built – EO release prior to qual)

26. ☐Complete, ☐N/A: Box - Top Level Assembly Drawing, E release until built – EO release prior to qual, data base in team center

27. ☐Complete, ☐N/A: Box - Drawing (3 D exploded view – PDF format, models and drawings in team center

28. ☐Complete, ☐N/A: Box - Installation Drawing, E release until built – EO release after customer approval, data base in team center

29. ☐Complete, ☐N/A: Box - Drawing - torque definitions, data base in team center

30. ☐Complete, ☐N/A: Box - Detailed Size/volume, weight report, memo or power point

31. ☐Complete, ☐N/A: Box - Peer Review — results of review with SME, project memo, project file

32. ☐Complete, ☐N/A: Box - Packaging check list / standards, project file

33. ☐Complete, ☐N/A: BOM – (E release until built – EO release prior to qual)

34. ☐Complete, ☐N/A: Analysis (initial / final after qual) – Sensitivity and Derating, project memo

35. ☐Complete, ☐N/A: Test Procedure (E release)

36. ☐Complete, ☐N/A: CDR review package – as required

37. ☐Complete, ☐N/A: BOM - DTC compliance and Obsolescence report memo or spread sheet

38. ☐Complete, ☐N/A: Detailed 3-D Envelope Model (Team Center)

39. ☐Complete, ☐N/A: Detailed Performance Analysis – Thermal, Vib, Fatigue, Stack up Project Memo

40. ☐Complete, ☐N/A: DTC Analysis summary – Project Memo

41. ☐Complete, ☐N/A: Detailed Weights – Project Memo

42. ☐Complete, ☐N/A: 2D& 3D HV Analysis Report – (E Release)

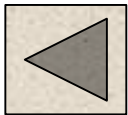43. ☐Complete, ☐N/A: CDR Design Checklists completed
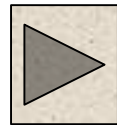
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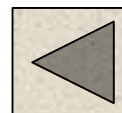
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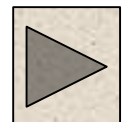
Phase 5 – Item Build and Test Work Packages

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summary page**

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Item Build and Test – IDVT WP21

Inputs

Design Data
 CCA Gerber files
 Box Req't & Design Doc – HRD & HDD
 Board req't & Design Doc - CCA HRD & HDD
 FW Req't & Design Doc - FDD & FRD
 PLD Code
 Released Schem's, BOM, CCA & box Assy's
Plans
 EMCP (Electronics Manu Control Plan)
 Program IMS&ETC
 DTC target/actuals and DFMAT plans
 Risk mitigation plan
Hardware/other
 Assembled CCAs, & Chassis
 CCA/Box Devel Test equipment & Test SW
 ATP SW & EMC SW
 CCA/Box Development test plan
 Lab equip for test and troubleshooting

Tasks / ETC

Build
Box build / procurement activities (100)
Documents
Box compliance and verification matrix (240)
Box test procedure – ATP and ATP limits (240)
SOF Box test procedure – SOF ATP (120)
PQ (power quality) and ROF (Risk of fire) procedures (40)
HALT / HASS procedure (80)
BOX / System EMC test procedure (120)
Generate design changes and rework instructions (40)
Create PR for requirement changes (60)
Test
Box HW integration of CCA's (240)
Box ATP (120)
HALT and HASS testing (160)
Box integration into the high level system (80)
Risk mitigation testing, EMC, Temp, Vib, ALT, humidity, water, Icing (160)
Reviews / Reports
Support SOI#2 (40)

Resources (hrs)
- IDVT (1840)

Deliverables

1. Document Box ATP / Preliminary Limits (E release with box test software)
2. Document Test results project file - data spread sheet or memo
3. Document Test coverage and test limits project file
4. Document SOF ATP (E release)
5. Box / System SOF EMC test procedure (E release)
6. HALT / HASS procedure – if required (E Release)
7. PQ procedure (E Release)
8. ROF procedure (E Release)

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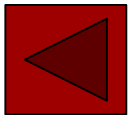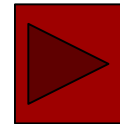
Item Build and Test – DDVT WP22

Inputs

Design Data
 CCA Gerber files
 Box Req't & Design Doc – HRD & HDD
 Board req't & Design Doc - CCA HRD &HDD
 Released Schem's, BOM, CCA & box Assy's
 PLD code

Plans
 Program IMS & ETCs
 CCA DTC target/actuals and DFMAT plans
 Test concept / Risk mitigation plan

Hardware
 Assembled CCAs
 CCA/Box Devel Test equipment & Test SW
 CCA/Box Development test plan
 Lab equipment for test and troubleshooting

Tasks / ETC

Build
Support CCA procurement and build activities
 (40/5/10)
Documents
Develop CCA test procedure (80/20)
Generate design changes, support generation of
 rework instructions, retest, & update the design
 drawings (80/5/10/10)
CCA test coverage analysis as appropriate (80)
Test and Integrate
Test CCA, document results and update test
 procedure as required (120)
Perform robustness (environmental, voltage,
 frequency, etc) tests as appropriate (80/40)
Risk testing prior to formal qual (40)
Support integration of CCA into Box (80)

Deliverables

1. Document Test results
        project file - spread sheet or memo
2. Document Test coverage and test limits
        project file
3. Risk Mitigation test report – if needed
        project memo
4. Successful completion of SOI #2
        audit summary in clear case
5. Board test procedure document
        E Release
6. PLD design – PLD source code, E release
7. Functional test benches
        updated and captured in Clear Case
8. Functional PLD simulation / post route
        results captured in project file/clear case

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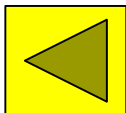
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Resources :
 - DDVT (600 hrs)
 - Components (10 hrs)
 - PWB design (10 hrs)
 - EE Tech (80 hrs)

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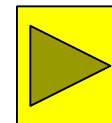
Item Build and Test – FW V&V WP23

Inputs

Requirements
Box Req't & Design Doc – HRD & HDD
Board req't & Design Doc - CCA HRD & HDD
FW Req't & Design Doc - FDD & FRD
Design Documentation
PLD Code
Released Schem's, BOM, CCA & box Assy's
CCA Gerber files
Hardware
Assembled CCAs, & Chassis
CCA/Box Devel Test equipment & Test SW
CCA/Box Development test plan
Lab equipment for test and troubleshooting
Plans
Program IMS & ETCs
PHAC
HVP
HVTP

Tasks / ETC

Procedure/Test Bench
Update test procedures/test benches, as required (200)
Analysis/Simulation
Perform code simulation (min/max/typ) (160)
Perform elemental analysis (160)
Reviews
Update requirement checklists (40)
Complete HVTCP/HVR checklist (80)
Peer review of test results & simulations [HVR] (120)
Prepare for SOI#2 (80)
PLD Test
Perform Do254 V & V tests (prototype testing used for credit), document results (360)
Documentation
Update compliance matrix with test results (40)
Create and resolve PR (80)

Deliverables

1. Successful completion of SOI #2 audit summary in clear case
2. PLD design – PLD source code tracing Stored in Clear Case/DOORS
3. Functional/Verification test benches updated -captured in Clear Case
4. Functional PLD and Post Route simulation results captured in project file And captured in Clear Case

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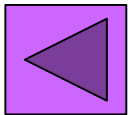
Resources (hrs)
- DDVT (1560)

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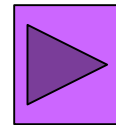
Item Build and Test – ADVT WP24

Inputs

Tasks / ETC

Deliverables

Design Data
 CCA Gerber files
 Box Req't & Design Doc – HRD & HDD
 Board req't & Design Doc - CCA HRD &HDD
 Released Schem's, BOM, CCA & box Assy's
Hardware
 Assembled CCAs
 CCA/Box Devel Test equipment & Test SW
 CCA/Box Development test plan
 Lab equipment for test and troubleshooting
Plans
 Program IMS & ETCs
 CCA DTC target/actuals and DFMAT plans
 CCA test concept / Risk mitigation plan

Build
 Support CCA build / procurement activities (40/5/10)
Documents
 Develop CCA test procedure (60/10)
 Generate design changes, support generation of rework instructions,
  retest, & update the design drawings (80/5/10/10)
 CCA test coverage analysis as appropriate (60)
Integrate/Test
 Test CCA, document results and update test procedure as required (80)
 Perform robustness (environmental, voltage, frequency, etc) tests
  as appropriate (80/40)
 Risk Testing prior to formal qual (40)
 Support CCA integration into Box (40)

1. Document Test results
      project file -spread sheet or memo
2. Document Test coverage and test limits
      project file
3. Risk Mitigation test report – if needed
      project memo
4. Board test procedure document
      (E Release)

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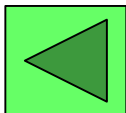
Resources :
 - ADVT (440 hrs)
 - Components (10 hrs)
 - PWB design (10 hrs)
 - EE Tech (70 hrs)

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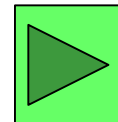
Item Build and Test – PDVT WP25

Inputs

Tasks / ETC

Deliverables

Design Data
 CCA Gerber files
 Box Req't & Design Doc – HRD & HDD
 Board req't & Design Doc - CCA HRD &HDD
 Released Schem's, BOM, CCA & box Assy's
Plans
 Program IMS & ETCs
 CCA DTC target/actuals and DFMAT plans
 Test concept / Risk mitigation plan
Hardware
 Assembled CCAs
 CCA/Box Devel Test equipment & Test SW
 CCA/Box Development test plan
 Lab equipment for test & troubleshooting

Build
  Support CCA build / procurement activities (40/5/10)
Documents
 Develop CCA test procedure (60/10)
Generate design changes, support generation of rework instructions,
 retest, & update the design drawings (80/5/10/10)
 CCA test coverage analysis as appropriate (60)
Test and Integrate
Test CCA (120/80)
Document CCA test results
Update test procedure as required (80)
Perform robustness / risk mitigation testing as appropriate (80/40
(environmental, voltage, frequency, etc.)
CCA Integration into Box (40)
Perform PWB, CCA, Component, Assy, & Box Level HV altitude
 tests (200/200)

1.Document Test results project file –
    spread sheet or memo
1.Document Test coverage and test limits
    project file
2.Risk Mitigation test report – if needed
    project memo
3.Board test procedure document
    (E Release)
4.   HV Altitude test reports (E Release)

Return to summary page
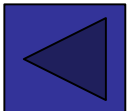
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Resources :
 - PDVT (760 hrs)
 - Components (10 hrs)
 - PWB design (10 hrs)
 - EE Tech (350 hrs)

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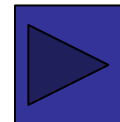
Item Build and Test – PACT WP26

Inputs

Tasks / ETC

Deliverables

Design Data
  Box Req't & Design Doc – HRD & HDD
  Assembled CCAs, & Chassis
Plans
  Risk mitigation plan
  Box DTC Target/actuals
  Program IMS & ETCs
Hardware
  Assembled Box

Build
Support Box build / procurement activities (40)
Perform fit check (40/40)
Documents
Generate design changes (24)
Generate design changes, support generation of rework instructions, retest, & update the design drawings (80/10)
Create PR for requirement changes that require design modification and resolve (20)
Update DFMAT Document (40)
Test and Integrate
Support risk mitigation test including thermal, vibration, Fit Check, weight, Sealing, etc…as appropriate (80)

1. Fit check – Project Memo
2. Thermal survey – Project Memo
3. Initial vibe – Project Memo

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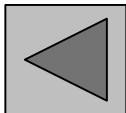
Resources (hrs)
-PACT (344)
-EE Tech (50 hrs)

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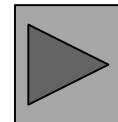
Item Build and Test – MDVT WP27

Inputs

Tasks / ETC

Deliverables

Design Data
 Detailed Installation Drawings
 Detailed Interface Control Docs
 Detailed 3-D Envelope Model
 Detailed Performance Analysis
 Detailed Design Drawings
 Detailed Part Lists (BOM's)
Plans
 Risk mitigation plan
 Box DTC Target/actuals
 Program IMS & ETCs
Hardware
 Assembled Motor

Build
 Support MRB Activity (30/20)
 Support Fabrication Process (50/10)
 Support Fabrication of Hardware (50/10/20)
Documents
 Design to Cost (DTC) Analysis/Monitoring (20)
 Document test results (10/20)
 Develop Motor ATP if required (40)
Test / Integration
 Perform Motor testing (10/40)
 Perform Risk Mitigation testing (10/40)
 Perform Motor Environmental testing if required (10/40)

1. Motor ATP if required (E Release)
2. DTC Actuals – Project Memo
3. Test Results – Project Memo

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Resources (hrs)
- Motor design (230 hrs)
- Drafting (40 hrs)
- Technician (160 hrs)

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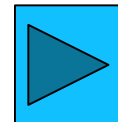
Phase 5 Exit Criteria

Phase 5 – Item Build & Test

1. ☐Complete, ☐N/A: Document Box ATP (E release with box test software)

2. ☐Complete, ☐N/A: Document Test results, project file - data spread sheet or memo

3. ☐Complete, ☐N/A: Document Test coverage and test limits, project file

4. ☐Complete, ☐N/A: Document SOF ATP (E release)

5. ☐Complete, ☐N/A: Box / System SOF EMC test procedure (E release)

6. ☐Complete, ☐N/A: HALT / HASS procedure – if required (E Release)

7. ☐Complete, ☐N/A: Successful completion of SOI #2, audit summary in clear case

8. ☐Complete, ☐N/A: PLD design – PLD source code tracing, E released

9. ☐Complete, ☐N/A: Functional test benches updated -captured in Clear Case

Phase 5 Exit Criteria

Phase 5 – Item Build & Test, cont…

10. ☐Complete, ☐N/A: Functional PLD and Post Route simulation results captured in project file and captured in Clear Case

11. ☐Complete, ☐N/A: PLD design – PLD source code review and tracing review, Clear Case/DOORS

12. ☐Complete, ☐N/A: Risk Mitigation test report – if needed, project memo

13. ☐Complete, ☐N/A: Board test procedure document (E Release)

14. ☐Complete, ☐N/A: Fit check – Project Memo

15. ☐Complete, ☐N/A: Thermal survey – Project Memo

16. ☐Complete, ☐N/A: Initial vibe – Project Memo

17. ☐Complete, ☐N/A: Board test procedure document E Release

18. ☐Complete, ☐N/A: Motor ATP if required (E Release)

19. ☐Complete, ☐N/A: DTC Actuals – Project Memo

20. ☐Complete, ☐N/A: Test Results – Project Memo

21. ☐Complete, ☐N/A: High Voltage / Altitude Test Reports (E Release)

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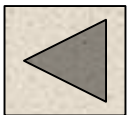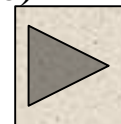
Phase 6 – System Integration and SOF Work Packages

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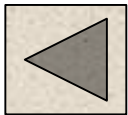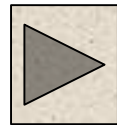
System Integration and SOF – EMC/SOF Test Support [IDVT] WP29

Inputs

Design Documentation
Test Procedures, including EMC Test Procedure
Problem reports from previous Phase
DFMAT Document

Hardware
Hardware from System/Mechanical for SOF & EMC Tests
Test Equipment and Test SW
from System Test and SW groups
SOF CCA/Box Build Hardware
Integrated Box from Build & Test

Tasks / ETC

Test
Perform box integration testing
Perform SOF testing

Reviews
Lead SOF readiness reviews
Create and Maintain problem reports
Evaluate rest results vs requirements
Support Box conformity – if needed

Documents
Update ATP – as needed
Support completion of QTP
Update DFMAT
Update HRD, as required (40)

Deliverables

1. Problem reports under configuration control
        clear quest
2. Updated ATP /Limits Justification – as required
        EO release - REV
3. SOF EMC test procedure
        EO release
4. SOF EMC Test report
        SDRL
5. SOF Environmental qual test procedure
        EO release
6. SOF Environmental qual test report
        SDRL
7. DFx (M,A,T) at Box level report
        project memo
8. Updated HRD, EO release new REV

Return to summary page
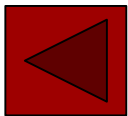
Resources (hrs)
- IDVT (600)

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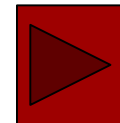
System Integration and SOF – Design Turn [DDVT] WP30

Inputs

Requirements

Design requirements updates causing Design turns in CCAs

Design Documentation

Updated Hardware Allocation from System **Hardware**
SOF CCA Build Hardware
Integrated Box from Build & Test

Tasks / ETC

Test
Support SOF testing as required
Reviews
Support System review and validation of changes (60)
Support peer review of test results
Hold CCA PRR (60)
Documents
Create, update and resolve Problem reports (120)
Update design documentation:
    schematics, BOM, timing analysis, simulation, derating,
    updated requirements (120)
Update CCA Test Procedure, as necessary (40)
Update FRD, as required (40)
Update HRD, as required (40)
Generate PLD Programming Files (FCI) (40)

Deliverables

1. Problem reports under configuration ctrl
        clear quest
2. Updated CCA schematic – as required
        – EO release for qual
3. Update CCA BOM – as required
        – EO release for qual
4. Update CCA Assembly Drawing – as required
        – EO release for qual
5. Updated HRD & FRD EO release new REV
6. DFx (M,A,T) at Box level report
        review project memo with MFG WP
7. PLD Design –PLD Source code
        EO released / clear case
8. PLD FCI – EO Release

Return to summary page
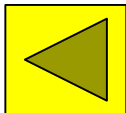
Resources (hrs)
- DDVT (480)

Return to swimlane

Revised: January 21, 2014
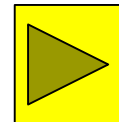
System Integration and SOF – Design Turn [FW V&V] WP31

Inputs

Requirements

Design requirements updates causing Design turns in CCAs

Design Documentation

Updated Hardware Allocation from System **Hardware**
SOF CCA Build Hardware
Integrated Box from Build & Test

Tasks / ETC

Test Procedures
Update HVTCP & Test Benches, as needed (40)
Reviews
Create and Maintain Problem reports (60)
Review elemental analysis vs source code (40)
Review code tracing – prepare checklist (200)
Review simulation results (40)
Analysis
Finalize elemental analysis (80)
Perform code post route simulation (80)
Test
Perform PLD tests, document results (80)
Establish verification environment (20)
Perform TRR prior to formal run for score (20)
Documentation
Prepare problem reports (40)
Update FW programming procedure, as necessary (40)

Resources (hrs)
- DDVT (640)

Deliverables

1. Problem reports under configuration control
   clear quest
2. PLD Design – PLD source code
   EO released
   Clear case
3. Code review and tracing checklist
   Clear case
4. Functional PLD and post route simulation results
   captured in project file
5. PLD Elemental Analysis Report
6. FW V&V TRR Checklist
7. Updated FRD,TB & Test Cases developed
   update through cert phase - clear case

Return to summary page
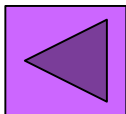
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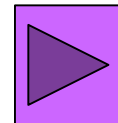
System Integration and SOF – Design Turn [ADVT] WP32

Inputs

Requirements

Design requirements updates causing
Design turns in CCAs

Design Documentation

Updated Hardware Allocation from
System **Hardware**
SOF CCA Build Hardware
Integrated Box from Build & Test

Tasks / ETC

Test
Support SOF testing as required
Reviews
Support System review and validation of changes (60)
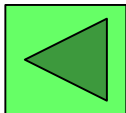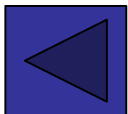Support peer review of test results
Hold CCA PRR (60)
Documents
Create, update and resolve Problem reports (120)
Update design documentation:
    schematics, BOM, analysis, simulation, derating,
    updated requirements (120)
Update CCA Test Procedure, as necessary (40)
Update HRD, as required (40)

Deliverables

1. Problem reports under configuration control
    clear quest
2. Updated CCA schematic – as required
    – EO release for qual
3. Update CCA BOM – as required
    – EO release for qual
4. Update CCA Assembly Drawing – as required
    – EO release for qual
5. DFx (M,A,T) at Box level report
    review project memo with MFG WP
6. Updated HRD, EO release new REV

Return to summary page

Return to swimlane

Resources (hrs)
- ADVT (440)

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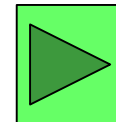
System Integration and SOF – Design Turn [PDVT] WP33

Inputs

Requirements

Design requirements updates causing Design turns in CCAs

Design Documentation

Updated Hardware Allocation from System **Hardware**
SOF CCA Build Hardware
Integrated Box from Build & Test

Tasks / ETC

Test
Support SOF testing as required
Reviews
Support System review and validation of changes (60)
Support peer review of test results
Hold CCA PRR (60)
Documents
Create, update and resolve Problem reports (120)
Update design documentation:
   schematics, BOM, stability and transient analysis, derating,
   updated requirements (120)
Update CCA Test Procedure, as necessary (40)
Update HRD, as required (40)
Update 2D & 3D HV analysis (40/40)
Update PWB, CCA, Component, Assy, & Box Level HV altitude tests
  (40/40)

Deliverables

1. Problem reports under configuration control clear quest
2.   Updated CCA schematic – as required
      – EO release for qual
3.   Update CCA BOM – as required
      – EO release for qual
4. Update CCA Assembly Drawing – as required
      – EO release for qual
5. DFx (M,A,T) at Box level report
      review project memo with MFG WP
6. Updated HRD, EO release new REV
7. Updated 2D & 3D HV analyses – as required (E Release)
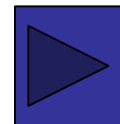8. Updated HV Altitude test reports – as required (E Release)

Return to summary page

Return to swimlane

Resources (hrs)
- PDVT (520)
- PACT (40)
- EE Tech (40)

Revised: January 21, 2014

System Integration and SOF – Design Turn [PACT] WP34

Inputs

Tasks / ETC

Deliverables

Requirements
SOF environmental test procedure
Design requirements updates

Design Documentation
Test data from previous phase
Design changes from previous phase

Hardware
Integrated Box from Build & Test

Test
Support SOF testing as required
Reviews
Support System review and validation of changes (60)
Support peer review of test results
Support Chassis PRR (60)
Documents
Create, update and resolve Problem reports (120)
Update design documentation:
   chassis drawing, update thermal and vib analysis
   updated requirements (120)

1.SOF Environmental qual test report
     Support SDRL
2.DFx (M,A,T) at Box level report
     review project memo with MFG WP

**Return to
summary page**
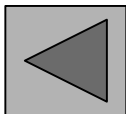
Resources (hrs)
- PACT (360)

**Return to
swimlane**
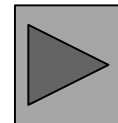
System Integration and SOF – Design Turn [MDVT] WP35

Inputs

Requirements
SOF environmental test procedure
Design requirements updates for Motor

Design Documentation
Test data from previous phase
Design changes from previous phase

Hardware
SOF Motor Build

Tasks / ETC

Test
Support Motor/Actuator SOF testing (10)
Reviews
Support SOF readiness review (4)
Hold Motor PRR (40)
Evaluate design requirements updates (24)
Support System validation of changes (32)
Documentation
Create and Maintain Problem reports (16)
Update Motor design documentation (8)
Update Motor requirements as needed (4)
Update Motor ATP, as necessary (40)

Deliverables

1. Problem reports under configuration control clear quest
2. Updated Motor Req'ts Doc
3. Updated Motor ATP (EO)
4. Updated Motor documentation (EO)
5. Production Readiness Review complete

Return to summary page

Resources (hrs)
- MDVT (320)

Return to swimlane

**Revised: January 21, 2014**
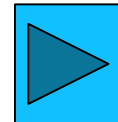
Phase 6 Exit Criteria

Phase 6 – System Integration & SOF

1. ☐Complete, ☐N/A: Problem reports under configuration control, clear quest

2. ☐Complete, ☐N/A: Updated ATP – as required, EO release - REV

3. ☐Complete, ☐N/A: SOF EMC test procedure, EO release

4. ☐Complete, ☐N/A: SOF EMC Test report SDRL

5. ☐Complete, ☐N/A: SOF Environmental qual test procedure, EO release

6. ☐Complete, ☐N/A: SOF Environmental qual test report, SDRL

7. ☐Complete, ☐N/A: DFx (M,A,T) at Box level report, project memo

8. ☐Complete, ☐N/A: Updated HRD & FRD, EO release new REV

9. ☐Complete, ☐N/A: Updated CCA schematic – as required – EO release for qual

10. ☐Complete, ☐N/A: DFx (M,A,T) at Box level report review project memo with MFG WP

11. ☐Complete, ☐N/A: FW V&V TRR Checklist

12. ☐Complete, ☐N/A: DFx (M,A,T) at Box level report review project memo with MFG WP

13. ☐Complete, ☐N/A: Updated Motor Req'ts Doc
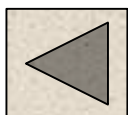
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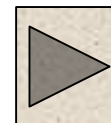
Phase 6 Exit Criteria

Phase 6 – System Integration & SOF, cont…

14. ☐Complete, ☐N/A: Update CCA BOM – as required – EO release for qual

15. ☐Complete, ☐N/A: Update CCA Assembly Drawing – as required – EO release for qual

16. ☐Complete, ☐N/A: PLD Design –PLD Source code, EO released / clear case

17. ☐Complete, ☐N/A: PLD FCI – EO Release

18. ☐Complete, ☐N/A: SOF Environmental qual test report, Support SDRL

19. ☐Complete, ☐N/A: Code review and tracing checklist, Clear case

20. ☐Complete, ☐N/A: Functional PLD and post route simulation results, captured in project file

21. ☐Complete, ☐N/A: PLD Elemental Analysis Report

22. ☐Complete, ☐N/A: Updated FRD,TB & Test Cases developed, update through cert phase - clear case

23. ☐Complete, ☐N/A: Updated Motor ATP (EO)

24. ☐Complete, ☐N/A: Updated Motor documentation (EO)

25. ☐Complete, ☐N/A: Production Readiness Review complete

26. ☐Complete, ☐N/A: Update 2D & 3D HV Clearance Reports – (E Release)

27. ☐Complete, ☐N/A: Update High Voltage / Altitude Test Reports (E Release)
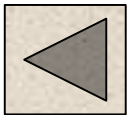
28. ☐Complete, ☐N/A: Design checklists completed
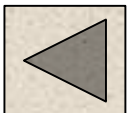
Phase 7 – Qualification Work Packages

Revised: January 21, 2014
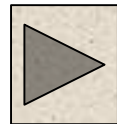
Qualification Phase – System EMC/Qual [IDVT] WP37

Inputs

Requirements

ATP

QTP

Design Documentation

SOF results / modifications

Hardware

Qualification HW

Qualification SW (as required)

Test Equipment / test cables

Tasks / ETC

Procedures
Prepare/review EMC and Environmental test procedures (200)
Schedule test labs(40)
Update ATP, as needed (40)
Update compliance (verification) trace matrix (80)
Reviews
Coordinate/Support review and insure test setup is ready (40)
Prepare readiness review checklist(20)
Create and Maintain problem reports
Test
Support EMC and Environmental testing (40)
Power Quality testing (40)
Evaluate Qual test results (40)
Support / Document Design modifications as needed(40)
Test Reports
Prepare Environmental & EMC test reports(160)
Review and approve qualification test reports (40)
Submit reports for review/signoff(20)
Problem Reports
Create and Maintain Problem reports as needed (40)
Conduct Box PR (40)
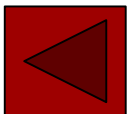
Resources (hrs)
- IDVT (880)

Deliverables

1. Problem reports configured – clear quest

1. EMC Qualification test procedure – EO released

1. EMC Qualification Test Report - SDRL

2. Environmental Qualification Test Procedure - EO released

3. Environmental Qualification Test Report - SDRL

4. Power Quality Test Report as required SDRL

5. LRU requirements update- Doors update - REV

6. Updated ATP - EO Released - REV

7. Verification Trace Matrix evidence in Doors or spreadsheet

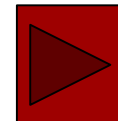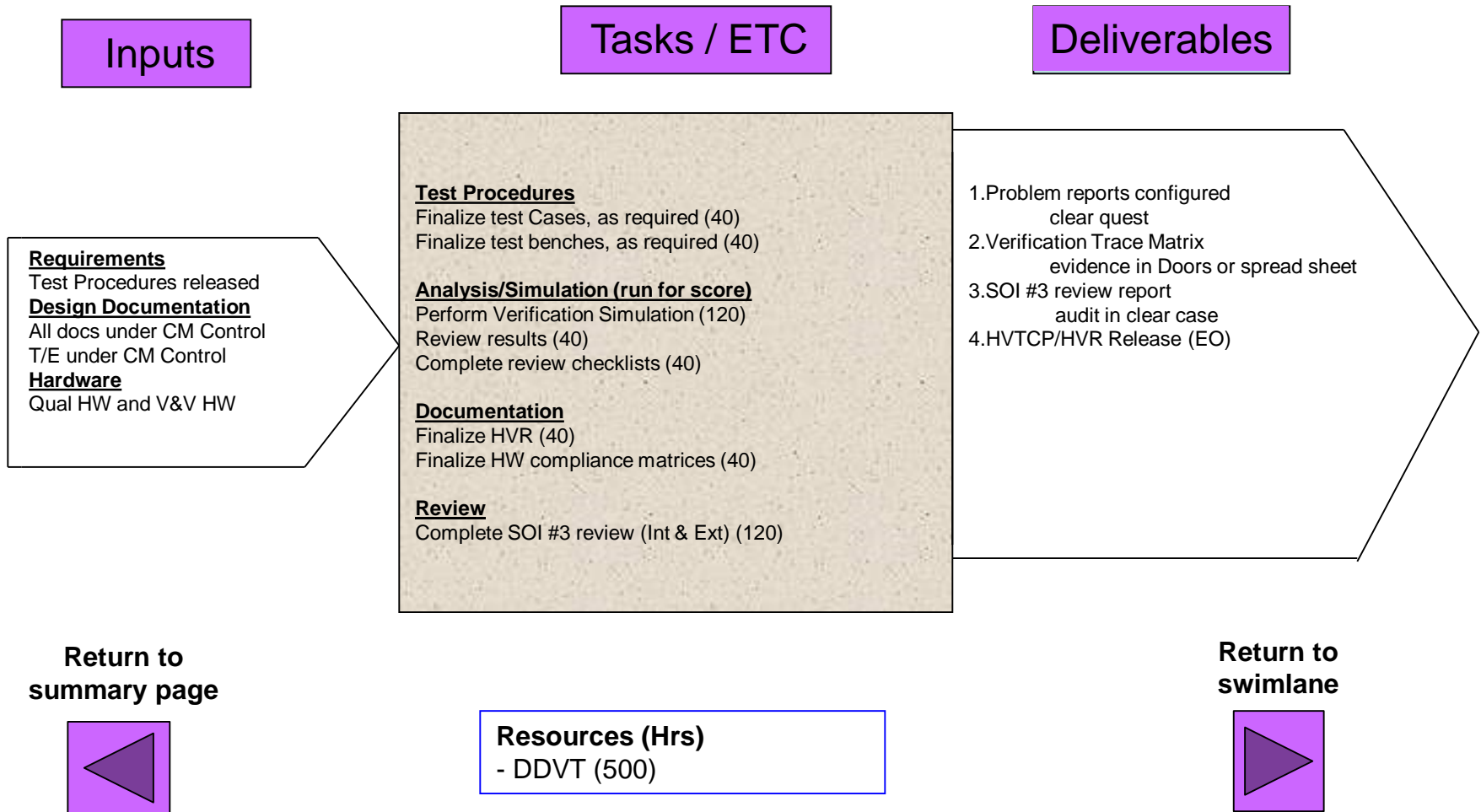8. DFx(M,A,T) at Box level summary memo MFG WP

Revised: January 21, 2014

Qualification Phase - FW VnV Work Package WP38

Inputs

Tasks / ETC

Deliverables

Requirements
Test Procedures released
Design Documentation
All docs under CM Control
T/E under CM Control
Hardware
Qual HW and V&V HW

Test Procedures
Finalize test Cases, as required (40)
Finalize test benches, as required (40)

Analysis/Simulation (run for score)
Perform Verification Simulation (120)
Review results (40)
Complete review checklists (40)

Documentation
Finalize HVR (40)
Finalize HW compliance matrices (40)

Review
Complete SOI #3 review (Int & Ext) (120)

1.Problem reports configured
     clear quest
2.Verification Trace Matrix
       evidence in Doors or spread sheet
3.SOI #3 review report
        audit in clear case
4.HVTCP/HVR Release (EO)

**Return to
summary page**

**Return to
swimlane**

Resources (Hrs)
- DDVT (500)

Revised: January 21, 2014

Qualification – Qual Support [MDVT] WP39

Inputs

Requirements

Updated Motor Req'ts Doc

Updated ATP (EO)

Design Documentation

Problem reports under configuration

Updated Motor documentation (EO)

Production Readiness Review complete

Tasks / ETC

Documentation
Update ATP Motor/Actuator, as needed (Actuator support only) (40)
Update Motor Req'ts Doc (40)
Update Motor documentation (80)
Update compliance matrix (16)
Reviews
Conduct Motor PRR (40)
Prepare readiness review checklist(20)
Test
Support System Qualification Testing (40)
Evaluate Qualification test results and feedback design change requirements to Motors and/or Drive electronics (60)

Problem Reports

Create and resolve Problem reports (40)

Deliverables

1. Resolved Problem reports
2. Updated ATP Motor/Actuator, as needed (Actuator support only
3. Update Motor Req's Doc
4. Updated Motor Documentation (EO)

Return to summary page

Resources (hrs)
- MDVT (340)

Return to swimlane

Revised: January 21, 2014
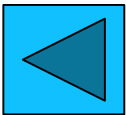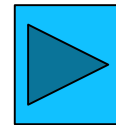
Phase 7 Exit Criteria

Phase 7 – Qualification

1. ☐Complete, ☐N/A: Problem reports configured - clear quest

2. ☐Complete, ☐N/A: EMC Qualification test procedure - EO released

3. ☐Complete, ☐N/A: EMC Qualification Test Report - SDRL

4. ☐Complete, ☐N/A: Environmental Qualification Test Procedure - EO released

5. ☐Complete, ☐N/A: Environmental Qualification Test Report - SDRL

6. ☐Complete, ☐N/A: Power Quality Test Report as required SDRL

7. ☐Complete, ☐N/A: LRU requirements update- Doors update - REV

8. ☐Complete, ☐N/A: Updated ATP - EO Released - REV

9. ☐Complete, ☐N/A: Verification Trace Matrix evidence in Doors or spreadsheet

10. ☐Complete, ☐N/A: DFx(M,A,T) at Box level summary memo MFG WP

11. ☐Complete, ☐N/A: Verification Trace Matrix, evidence in Doors or spread sheet

12. ☐Complete, ☐N/A: SOI #3 review report, audit in clear case

13. ☐Complete, ☐N/A: HVTCP/HVR Release (EO)

14. ☐Complete, ☐N/A: Resolved Problem reports

15. ☐Complete, ☐N/A: Updated ATP Motor/Actuator, as needed (Actuator support only)

16. ☐Complete, ☐N/A: Update Motor Req's Doc

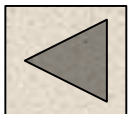17. ☐Complete, ☐N/A: Updated Motor Documentation (EO)

Revised: January 21, 2014
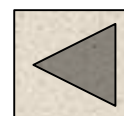
Phase 8 – Certification Work Packages

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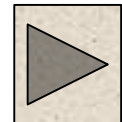
Certification Phase – Design Turn [IDVT] WP41

Inputs

Tasks / ETC

Deliverables

Problem Reports
V+V actions / issues
Blue / Red label problem list

Qualification Data
Environmental test issues
EMI test issues

DFX Inputs
Manufacturability DFX inputs
DTC updates

Requirements
CCA design requirements updates

Procedures
Prepare Environmental test procedure (40)
Schedule test lab (40)
Prepare EMI test procedure (40)
Schedule test lab (40)
QBS (Qual By Similarity) reports as required (40)
Review
Coordinate / support readiness review (40)
Prepare readiness review checklist (40)
Create and Maintain problem reports
Test Report
Prepare Environmental test report (40)
Submit report for review / signoff (40)
Prepare EMI test report (40)
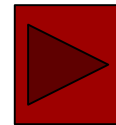Submit report for review / signoff (40)

1. Problem reports closed or deferred – clear quest
2. Successful transition of design to production evidence that PRR Checklist is complete and actions are closed (Project Memo)

Return to summary page
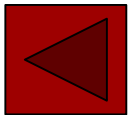
Resources (hrs)
- DDVT (440)

Return to swimlane

Certification Phase – Design Turn [DDVT] WP42

Inputs

Tasks / ETC

Deliverables

Problem Reports
V+V actions / issues
Blue / Red label problem list

Qualification Data
Environmental test issues
EMI test issues

DFX Inputs
Manufacturability DFX inputs
DTC updates

Requirements
CCA design requirements updates

Requirements
Update requirements / block diagrams – as required (40)
Update compliance matrix / HVR (40)
Design Changes
Evaluate design and manufacturability DFX inputs (40)
Evaluate Qual changes and incorporate (40)
Update Schematic / BOM (40)
Update Analysis (performance / Timing / Simulation) (40)
Update part placement and trace routing instructions (40)
Update design documentation / description (40)
Update CCA Test Procedure, as necessary (40)
PWB Updates
Review part placement changes (40)
Review trace routing changes (40)
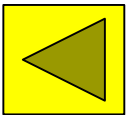**Problem Reports**
Close out all PRR actions (40)
Production
Support production Hardware Build / readiness review (40)

1. Problem reports closed or deferred - clear quest
2. HW accomplishments summary (EO)
3. Successful SOI #4 review audit report in clear case
4. Updated CCA Drawing Package, EO release
   a) Schematic
   b) BOM
   c) Assembly Drawing
5. Updated CCA Test Procedure
6. Updated Analysis, Project Memo

Return to summary page

Resources (hrs)
- ADVT (520)

Return to swimlane

Revised: January 21, 2014
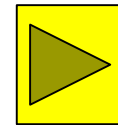
Certification Phase – Design Turn [ADVT] WP43

Inputs

Tasks / ETC

Deliverables

Problem Reports
V+V actions / issues
Blue / Red label problem list

Qualification Data
Environmental test issues
EMI test issues

DFX Inputs
Manufacturability DFX inputs
DTC updates

Requirements
CCA design requirements updates

Requirements
Update requirements – as required (40)
Update compliance matrix / HVR (40)

Design Changes
Evaluate design and manufacturability DFX inputs (40)
Evaluate Qual changes and incorporate (40)
Update Schematic / BOM (40)
Update Analysis (performance / Stress) (40)
Update part placement and trace routing instructions (40)
Update design documentation / description (40)
Update CCA Test Procedure, as necessary (40)
Peer Review changes (40)
PWB Updates
Review part placement changes (40)
Review trace routing changes (40)

Problem Reports
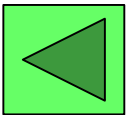Close out all PRR actions (40)
Production
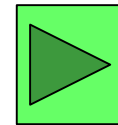Support production Hardware Build / readiness review (40)

1. Updated CCA Drawing Package, EO release
   a) Schematic
   b) BOM
   c) Assembly Drawing
2. Updated CCA Test Procedure
3. Updated Analysis, Project Memo

Return to summary page

Resources (hrs)
- ADVT (560)

Return to swimlane

Revised: January 21, 2014

Certification Phase – Design Turn [PDVT] WP44

Inputs

Tasks / ETC

Deliverables

Problem Reports
V+V actions / issues
Blue / Red label problem list
Power Quality Inputs

Qualification Data
Environmental test issues
EMI test issues

DFX Inputs
Manufacturability DFX inputs
DTC updates

Requirements
CCA design requirements updates

Requirements
Update requirements – as required (40)
Update compliance matrix / HVR (40)
Insure that CCA is compatible with Aircraft capability and has been verified. (40)
Insure power requirements compatible with SW / FW (40)
Design Changes
Evaluate design and manufacturability DFX inputs (40)
Evaluate Qual changes and incorporate (40)
Update Schematic / BOM (40)
Update Analysis (performance / Stress) (40)
Update part placement and trace routing instructions (40)
Update design documentation / description (40)
Update CCA Test Procedure, as necessary (40)
Update 2D & 3D HV analysis (40/40)
Update PWB, CCA, Component, Assy, & Box Level HV altitude tests (40/40)
PWB Updates
Review part placement changes (40)
Review trace routing changes (40)
Problem Reports
Close out all PRR actions (40)
Production
Support production Hardware Build / readiness review (40)

1. Updated CCA Drawing Package, EO release
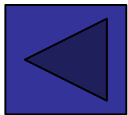   a) Schematic
   b) BOM
   c) Assembly Drawing
2. Updated CCA Test Procedure
3. Updated Analysis, Project Memo
4. Updated 2D & 3D HV analyses – as required (E Release)
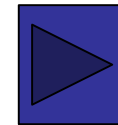5. Updated HV Altitude test reports - as required (E Release)

Return to summary page

◀

Return to swimlane

▶

Resources (hrs)
- PDVT (680)
- PACT (40)
- EE Tech (40)

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Certification Phase – Design Turn [FW V&V] WP45

Inputs

Tasks / ETC

Deliverables

Requirements

Design requirements updates causing Design turns in FW

Hardware

Qual CCA Build Hardware

Qual Firmware

Integrated Box from Qual

Documentation
Prepare HAS (160)
Review HAS and complete checklist (60)
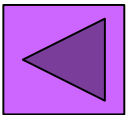**Problem Reports**
Review and Update Problem reports (60)
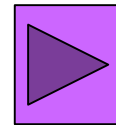**Audits**
Support SOI #4 review (80)

1. Problem reports Closed or Deferred
   clear quest
2. HW accomplishment summary
   EO Release
3. Successful SOI #4 review
   audit report in clear case

Return to summary page

Resources (hrs)
- DDVT (360)

Return to swimlane

Revised: January 21, 2014

Certification Phase – Design Turn [PACT] WP46

Inputs

Hardware

Qual CCA Build Hardware

Integrated Box from Qual

DFX Inputs

Manufacturability inputs for final design spin

Requirements

Design requirements updates causing Design turns

Tasks / ETC

Design Changes
Evaluate design and manufacturability requirements updates for best implementation in hardware (40)
Update design documentation: drawings, BOM, analysis, simulation, etc… for updated requirements (120)
Support System validation of changes (40)
Problem Reports
Create and Maintain Problem reports (40)
Production
Closeout Box PRR actions (40)
Update Box ATP, as necessary (40)
Support initial production Hardware Build (40)
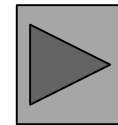
Deliverables

1. Updated Drawings & Models, EO release
    1. BOM
    2. Assembly Drawing
    3. Chassis
    4. Mechanical Subassemblies
2. Updated Analysis, Project Memo

Return to summary page

Resources (hrs)
- PACT (360)

Return to swimlane

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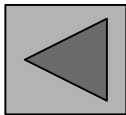
Certification – Qual Support [MDVT] WP47

Inputs

Problem Reports

Problem reports under configuration

DFX Inputs

Production Readiness Review complete

Requirements

Updated Motor Req'ts Doc

Updated ATP (EO)

Updated Motor documentation (EO)

Tasks / ETC

Test

Support System Qualification Testing (40)

Design Changes

Update Motor Req'ts Doc (40)

Update Motor documentation (80)

Evaluate Qualification test results and feedback design change requirements to Motors and/or Drive electronics (60)

Update ATP Motor/Actuator, as needed (Actuator support only) (40)

Problem Reports

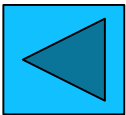Create and resolve Problem reports (40)

Production

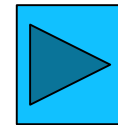Conduct Motor PRR (40)

Deliverables

1. Resolved Problem reports

2. Updated ATP Motor/Actuator, as needed (Actuator support only)

3. Motor PRR Complete

4. Updated Motor Req'ts Doc

5. Updated Motor documentation (EO)

Return to summary page

Resources (hrs)
- MDVT (340)

Return to swimlane
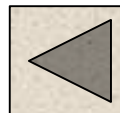
Revised: January 21, 2014

Phase 8 Exit Criteria

Phase 8 – Certification

1. ☐Complete, ☐N/A: Problem reports closed or deferred – clear quest

2. ☐Complete, ☐N/A: Successful transition of design to production evidence that PRR Checklist is complete and actions are closed (Project Memo)

3. ☐Complete, ☐N/A: HW accomplishments summary (EO)

4. ☐Complete, ☐N/A: Successful SOI #4 review audit report in clear case

5. ☐Complete, ☐N/A: Updated CCA Drawing Package, EO release

   a.   ☐Complete, ☐N/A: Schematic

   b.   ☐Complete, ☐N/A: BOM

   c.   ☐Complete, ☐N/A: Assembly Drawing

6. ☐Complete, ☐N/A: Updated CCA Test Procedure

7. ☐Complete, ☐N/A: Updated Analysis, Project Memo

8. ☐Complete, ☐N/A: Updated Drawings & Models, EO release

   a.   ☐Complete, ☐N/A: BOM

   b.   ☐Complete, ☐N/A: Assembly Drawing

   c.   ☐Complete, ☐N/A: Chassis

   d.   ☒Complete, ☐N/A: Mechanical Subassemblies

9. ☐Complete, ☐N/A: Updated Analysis, Project Memo

10. ☐Complete, ☐N/A: Resolved Problem reports

11. ☐Complete, ☐N/A: Updated ATP Motor/Actuator, as needed (Actuator support only)

12. ☐Complete, ☐N/A: Motor PRR Complete

13. ☐Complete, ☐N/A: Updated Motor Req'ts Doc

14. ☐Complete, ☐N/A: Updated Motor documentation (EO)

15. ☐Complete, ☐N/A: Update 2D & 3D HV Clearance Reports - (E Release)

16. ☐Complete, ☐N/A   Update High Voltage / Altitude Test Reports (E Release)

17. ☐Complete, ☐N/A   Design review checklists

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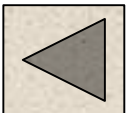
Product Maturation/EIS and Sustainment Work Packages

**Return to
summary page**

**Return to
swimlane**

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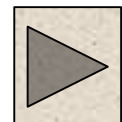
Design Engineering – Product Maturation/EIS (FPY > 92%) WP49

Inputs

Tasks / ETC

Deliverables

Manufacturing Data

FPY (supply chain, CCA, Box)

Product cost data

NC history

RURs

Parametric ATP Data

Supplier quality rating

Supply chain sourcing strategies

Program/Design Data

Customer demands (design change, new features, etc)

Obsolescence Status, Errata

Fielded MTBUR, DMC

Lead Tasks

Conduct EIS Review (entry event when FPY > 92%)

Program Reviews (Moog with Moog customers)

Lead RCCAs as required.

Develop solutions to design problems

Actively work to reduce NCs and improve FPY

Review ATP Limits with respect to FPY, NCs and parametric data and make changes as appropriate

Lead Cost/Product/Process improvement initiatives as required

Lead Delta Qualification/Certification, QBS, etc activities as required

Create and Maintain problem reports

Support Tasks

CRB Support

Drawing, BOM, ATP, HASS, etc updates as required

Review supplier performance data as required

Support Reliability Testing activities (i.e. ongoing Proof of HASS, etc)

Support Supply Chain transitions as required

Review Parametric test data for shifts and out of family trends

1. Refresh Strategy
2. Support Weekly Manufacturing-Design meetings
3. Updated drawings, BOMs, ATP, HASS, ATP Limits, etc as required
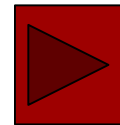4. Delta Qual documents as required

Return to summary page
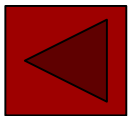
Resources (hrs)
- Project/IDVT (100% LOE)

Return to swimlane

Design Engineering – Sustainment (FPY > 99%) WP51

Inputs

Tasks / ETC

Deliverables

Manufacturing Data

FPY (supply chain, CCA, Box)

Product cost data

NC history

RURs

Parametric ATP Data

Supplier quality rating

Supply chain sourcing strategies

Program/Design Data

Customer demands (design change, new features, etc)

Obsolescence Status, Errata

Fielded MTBUR, DMC

Support Tasks

CRB Support

Program Reviews (Moog with Moog customers)

Support RCCAs as required

Develop Refresh Strategy working with Program team, customer and manufacturing engineering

Cost/Product/Process improvement initiatives as required

Drawing, BOM, ATP, HASS, etc updates as required

Delta Qualification/Certification, QBS, etc activities as required

Support Reliability Testing activities (i.e. ongoing Proof of HASS, etc)

Support Supply Chain transitions as required

Review Parametric test data for shifts and out of family trends

Review ATP Limits with respect to FPY, NCs and parametric data and make changes as appropriate
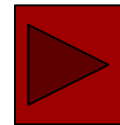
Create and Maintain problem reports

1. Refresh Strategy
2. Support Weekly Manufacturing-Design meetings
3. Updated drawings, BOMs, ATP, HASS, ATP Limits, etc as required
4. Delta Qual documents as required
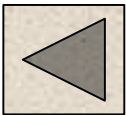
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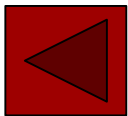
Resources (hrs)
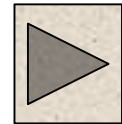- Project/IDVT (25% LOE)

Return to swimlane

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Phase 1 – MFG
Work Packages

**Return to
summary page**

**Return to
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Revised: January 21, 2014

Requirements Definition - Mfg Project Plan WP4

Inputs

Tasks / ETC

Deliverables

Requirements
Spec/SOW
Box HRD
Proposal Baseline
DTC Targets
Schedule
Updated quantities and milestones
Plans
Quality flow down
Proposal EMCP0
Cert/Project Plan
Preliminary product structure

Project Preparation
Review Proposal Baseline including budgets (8)
Review product relative to platforms for synergy (4)
Review plan for magnetic sourcing (4)
Review plan for cable assemblies sourcing (4)
Review plan for mechanicals including box (8)
Design Requirements & Standards
Capabilities gap analysis
(capacity, equipment, processes, materials, etc) (8)
Review DTC targets versus plan/actuals (8)
Defined prototype and production build locations
Update EMCP1 (32)

1. DTC feedback to project team
2. EMCP1(MFG plan)

Return to summary page
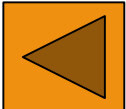
Resources (hrs)
-Operations Lead (28)
-Prod/Proc Engineering (32)
-Supply Chain (16)
-76 hours total

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Phase 3 – MFG
Work Packages

**Return to
summary page**

**Return to
swimlane**

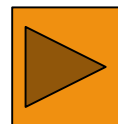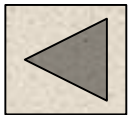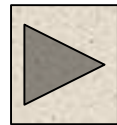# Preliminary Design – Prelim. Mfg process definition WP12

Inputs

Tasks / ETC

Deliverables

Requirements
Preliminary CCA Design Info
Updated quantities and
  milestones
Updated Box HRD
Plans
EMCP1
Revised project plan/scope changes
DFX
Revised DTC Targets

Requirement Reviews
Review preliminary block diagrams /allocations (24)
Review preliminary BOM and schematics(32)
Review preliminary Box design (24)
Plans
Updated EMCP2 (32)
Review risk management plan (16)
Review DTC targets versus plan/actuals (16)
DFX
Conduct DFx (M,A,T) reviews (40)

1. DFx (M,A,T) at Box level summary
2. DFx (M,A,T) at CCA level summary
3. Process flow diagram
4. DTC feedback to project team
5. EMCP2

**Return to
summary page**
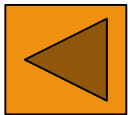
**Return to
swimlane**

Resources (hrs)
-Operations Lead (36)
-Prod/Proc Engineering (128)
-Supply Chain (20)
-184 hours total

Revised: January 21, 2014

Preliminary Design – Prototype/Risk Mitigation Build

Inputs

Requirements
Preliminary CCA Design Info
CCA Risk Build data as required
Updated quantities and
  milestones
PDR materials
Plans
EMCP2
Revised project plan/scope changes
DFX
Revised DTC targets

Tasks / ETC

Requirement Reviews
Review preliminary design box and CCA (80)
Plans
Updated and released EMCP3 (24)
Refine AWs, TWs if required to support product and
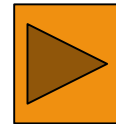 process engineering per EMCP (180)
DFX
Review DTC targets versus plan/actuals (16)
Conduct DFx (M,A,T) reviews (80)

Deliverables

1. DFx (M,A,T) at Box level summary
2. DFx (M,A,T) at CCA level summary
3. AWs and TWs if required
4. Prototype/risk mitigation CCAs, as required
5. Product/Process/Ops PDR materials
6. DTC feedback to project team
7. EMCP3

Return to summary page
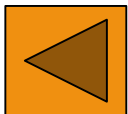
Resources (hrs)
-Operations Lead (24)
-Prod/Proc Engineering (340)
-Supply Chain (16)
-380 hours total

Return to swimlane

Revised: January 21, 2014

Phase 4 – MFG Work Packages

Revised: January 21, 2014
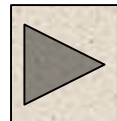
Detailed Design - Mfg Process definition WP20

Inputs

Tasks / ETC

Deliverables

Project
Revised project plan
  / scope changes
Plans
EMCP3
Latest AW, TW
Requirements
CCA TRDs
Detailed Design Package
Revised DTC Targets
Special test Reqs (HASS, etc)

Design Support / Reviews
Review detailed drawings box and CCA (120)
Review DTC targets versus plan/actuals (32)
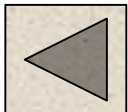Review TRD (Test Requirement Docs) (32)
Drawings
Update EMCP4 (24)
Refine AW with CEM Process Engineering (160)
Refine TW with CEM Product Engineering (160)
Production
Visit CCA CEM and audit per strategy (300)

1. MFG - DFMAT – Peer review with MFG
        project memo / action resolution
2. MFG - EMCP4 (MFG plan update)
3. CDR review package – as required

Return to summary page
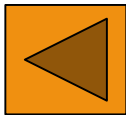
Return to swimlane

Resources (hrs)
-Operations Lead (40)
-Prod/Proc Engineering (748)
-Supply Chain (40)
-828 hours total

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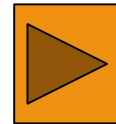
Phase 5 – MFG
Work Packages

**Return to
summary page**
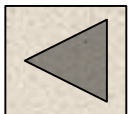
**Return to
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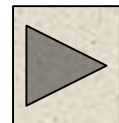
Item Build & Test – Dev HW Build CCA/Item WP28

Inputs

Tasks / ETC

Deliverables

Design Data/Requirements
CCA Dev Test Procedure
Released PLD code
Box ATP test requirements
Box ATP limits justification
Box ATP
Plans
EMCP4
Revised project plan/scope changes
Latest AW, TW
Revised DTC Targets
Hardware/other
POB hardware, tooling
CCA Dev Test Fixtures

Build
Liaison with CEM (120)
Update box and CCA AWs & TWs if required (200)
Conduct POB and report (280)
Documents
Update EMCP5 (8)
Test
Support box and CCA Test Procedures as required (200)
Support Des Engineering testing (24)
Reviews / Reports
Validate DTC actuals (40)
Review DTC targets versus plan/actuals (24)
Support MRB (120)

1. DFx (M,A,T) at Box level summary
2. DFx (M,A,T) at CCA level summary
3. Hardware CCA (turn0), QTY based on project need
4. Hardware box (turn0), Qty based on project need
5. Updated AW, TW if required
6. Proof of build report – Project memo
7. DTC feedback to project team - Project memo
8. EMCP5

Return to summary page
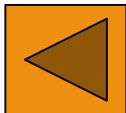
Return to swimlane

Resources (hrs)
-Operations Lead (80)
-Prod/Proc Engineering (856)
-Supply Chain (80)
-1016 hours total

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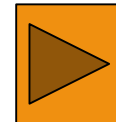
Phase 6 – MFG
Work Packages

Return to summary page

Return to swimlane

Revised: January 21, 2014

System Integration and SOF – SOF Build CCA/Item WP36

Inputs

Requirements
Revised project plan/scope changes
Revised DTC Targets
Design Documentation
EMCP5
Latest AW, TW
POB report from turn0 hwr

Tasks / ETC

Test
Support Des Engineering testing (30)

Reviews
Support MRB (60)

Documents
Updated EMCP6 (16)

Production
Update box and CCA AWs (turn0 hardware plus cuts and jumper) & TWs as required (80)
Liaison with CEM (160)
Review DTC targets versus plan/actuals (24)

Deliverables

1. SOF LRU build
         QTY based on project
2. DFx (M,A,T) at Box level report
         project memo
3. EMCP6

Return to summary page

Resources (hrs)
-Operations Lead (16)
-Prod/Proc Engineering (338)
-Supply Chain (16)
-370 hours total

Return to swimlane

Revised: January 21, 2014

Phase 7 – MFG
Work Packages

Revised: January 21, 2014

Qualification Phase – Production Readiness Qual Builds WP40

Inputs

Tasks / ETC

Deliverables

Design Documentation
SOF design and BOM update
Assembly Drawings
Plans
Revised project plan/scope changes
Revised DTC Targets

Qualification Build
Liaison with CEM (320)
Update box and CCA AWs & TWs if required (100)
Coordinate cable builds (80)
Production Readiness Review
Support box and CCA Test Procedures as required (180)
Support DTC targets versus plan/actuals (40)
Support MRB (120)
Plans
Updated EMCP7 (16)
Reviews
DFX reviews (24)

1. Qualification LRU's
   QTY based on project
2. DFx (M,A,T) at Box level summary
   memo MFG WP
3. EMCP7

Return to summary page

Resources (hrs)
-Operations Lead (-)
-Prod/Proc Engineering (-)
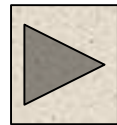-Supply Chain (-)
-880 hours total
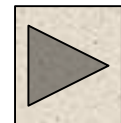
Return to swimlane

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Phase 8 – MFG
Work Packages

**Return to
summary page**
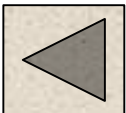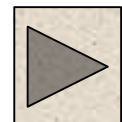
**Return to
swimlane**

Certification Phase – Production Hardware Build WP48

Inputs

Reports
POB report from turn1 hwr

Project
Revised project plan/scope changes

DFX Inputs
Revised DTC Targets

Requirements
EMCP7
Latest AW, TW

Tasks / ETC

Production
Liaison with CEM (240)
Develop plan for production (120)
Develop plan for sustaining engineering (40)
Reviews
Review DTC targets versus plan/actuals (16)
Support MRB (120)
Plans
Update EMCP8 (16)

Deliverables

1. Successful transition of design to production
2. Product engineers are trained
3. Documentation to support build/test - released
4. Updated AW, TW if required MFG
5. EMCP8

Return to summary page

Return to swimlane

Resources (hrs)
-Operations Lead (24)
-Prod/Proc Engineering (512)
-Supply Chain (16)
-552 hours total

Revised: January 21, 2014

Product Maturation/EIS and Sustainment Work Packages

Revised: January 21, 2014

Manufacturing Engineering – Product Maturation/EIS (FPY > 92%) WP50

Inputs

Tasks / ETC

Deliverables

Manufacturing Data
FPY (supply chain, CCA, Box)
Product cost data
NC history
RURs
Parametric ATP Data
Supplier quality rating
Supply chain sourcing strategies

Program/Design Data
Customer demands (design change, new features, etc)
Obsolescence Status, Errata
Fielded MTBUR, DMC

Support Tasks
Develop Plan for Every Part (P4EP)
CRB support
Supplier performance review meetings
Support RCCAs as required
Create and Maintain problem reports

Process Data
Process parametric data from CCA and Box ATP
Lead test equipment maintenance and upgrade activities

1. Generate Incident Database
2. Generate parametric data summary
3. Lead weekly Manufacturing-Design meeting 'Product Yield Top Concerns'
4. Conduct Monthly Manufacturing Review meeting with LRU team (FPY, NC, on Hold, cost, etc)
5. Update TW, AW as required

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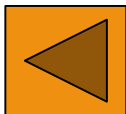
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Resources (hrs)
-Product/Proc Eng (50%/25% LOE)
-Supply Chain (25% LOE)
-QE (5% LOE)

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Manufacturing Engineering – Sustainment (FPY > 99% WP52

Inputs

Tasks / ETC

Deliverables

Manufacturing Data
FPY (supply chain, CCA, Box)
Product cost data
NC history
RURs
Parametric ATP Data
Supplier quality rating
Supply chain sourcing strategies
Program/Design Data
Customer demands (design change, new features, etc)
Obsolescence Status, Errata
Fielded MTBUR, DMC

Lead Tasks
Conduct Product Maturation Entry Review (entry event when FPY > 99%)
Lead RCCAs as required
Create and Maintain problem reports

Support Tasks
CRB support
Supplier performance review meetings

Process Data
Process parametric data from CCA and Box ATP
Lead test equipment maintenance and upgrade activities

1. Maintain Incident Database
2. Maintain parametric data summary
3. Lead weekly Manufacturing-Design meeting 'Product Yield Top Concerns'
4. Conduct Monthly Manufacturing Review meeting with LRU team (FPY, NC, on Hold, cost, etc)
5. Update TW, AW as required

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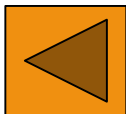
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Resources (hrs)
-Product/Proc Eng (25%/10% LOE)
-Supply Chain (10% LOE)
-QE (5% LOE)

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Acronyms

A	
ADVT	Analog Design Verification and Test
ATP	Acceptance Test Procedure
ALT	Altitude
AW	Assembly Worksheet
ABOM	Advanced Bill of Material
A&T	Assembly & Test

B	
BOM	Bill Of Materials
BLDC	Brushless Direct Current

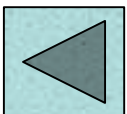| C	
CCA	Circuit Card Assembly
CDR	Critical Design Review
CR	Change Request
CM	Configuration Management
CERT	Certification
CEM	Contract Electronics Manufacturer

D	
DDVT	Digital Design Verification and Test
DFx (M,A,T)	Design for x where x can be Manufacturing, Cost, Assembly and Test, etc
DTC	Design To Cost
DFMAT	Design for Manufacturability, Assembly and Test
DUT	Device Under Test
DEV	Development
DMC	Direct Maintenance Cost
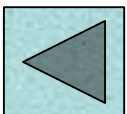
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Acronyms (continued)

E	
EE	Electrical Engineering
EMPT	Electronics Manufacturing Process and Test
EDP	Electronics Design Plan (Special Instructions used for PWB Layout definition)
EO	Engineering Order: form and procedure for implementing design changes
EMC	Electromagnetic Compliance (Compatibility)
EMI	Electromagnetic Interference
EM	Electro-Mechanical
ETC	Estimate To Complete
EVMS	Earned Value Management System
EMCP	Electronics Manufacture Control Plan
F	
FCI	Firmware Configuration Index
FRD	Firmware Requirements Document
FW V&V	Firmware Verification and Validation
FEs	Functional Elements
FMEA	Failure Mode Effects Analysis
FDD	Firmware Design Drawing
FW	Firmware

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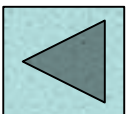
Acronyms (continued)

H	
HALT	Highly Accelerated Life Test
HAS	Hardware Accomplishment Summary
HASS	Highly Accelerated Stress Screens
HCMP	Hardware Configuration Management Plan
HDP	Hardware Development Plan
HDD	Hardware Description Document
HEPG	Hardware Engineering Process Group
HVP	Hardware Verification Plan
HRD	Hardware Requirements Document
HW	Hardware
HV	High Voltage
HVR	Hardware Verification Report
HVCP	Hardware Verification Cases and Procedures
HVS	Hardware Verification Standards
HVTCP	Hardware Verification Test Cases and Procedures
HVTP	Hardware Verification Test Procedures
HCMP	Hardware Configuration Management Plan
HPAP	Hardware Process Assurance Plan
HRS	Hardware Requirements Specification

I	
ICD	Interface Control Diagram
IDVT	Item Design Verification Test
IP	Intellectual Property
IPT	Integrated Product Teams
IR&D	Internal Research and Development
IO	Input /Output
IMS	Integrated Master Schedule

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Acronyms (continued)

K	
Kt/Ke	Torque constant (Kt)/Voltage constant (Ke)

L	
LRU	Line Replaceable Unit

M	
MDVT	Motor Design Verification and Test
MECH	Mechanical
MOC	Means of Compliance
MBS	Moog Business System
MRB	Material Review Board
MFG	Manufacturing
ME	Mechanical Engineering
MTBUR	Mean Time Between Unscheduled Removal

P	
PHAC	Plan for Hardware Aspects of Certification
PLD	Programmable Logic Device
PRB	Program Review Board
PACT	Packaging Design Verification and Test
PDVT	Power Design Verification and Test
PDR	Preliminary Design Review
PRR	Production Readiness Review
PN	Part Number
PWB	Printed Wire Board
PPL	Preferred Parts List
PR	Problem Report
POB	Proof of Build
PROD	Production
PROC	Procedure

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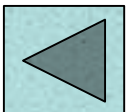
Acronyms (continued)

Q	
QA	Quality Assurance
QUAL	Qualification
QTP	Qualification Test Procedure
QTY	Quality
R	
RQMT	Requirement
REV	Revision
Rtt/Ltt	Terminal to Terminal Resistance and Inductance
S	
SOF	Safety Of Flight
SOI	State of Involvement
SDRL	Subcontractor Data Requirement List
SRR	System Requirements Review
SW	Software
STE	Standard Test Equipment
SYS	System
SME	Subject Matter Expert
SOW	Statement Of Work
SSMP	System Safety Management Plan
SPEC	Specification

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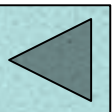
Acronyms (continued)

T	
TRD	Test Requirements Document
TRR	Test Readiness Review
TB	Test Bench
TEMP	Temperature
TWs	Test Worksheet
TE	Test Equipment
V	
V&V	Verification and Validation
VHDL	Very High-level Design Language
VIB	Vibration
W	
WP	Work Package
WO	Work Order
WBS	Work Breakdown Structure

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