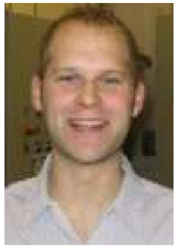
Introduction to AVDASI

Staff

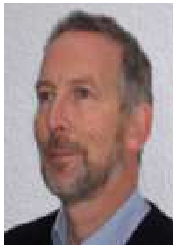


Dr. Steve Burrow, Unit director.

Teaching; Aircraft systems

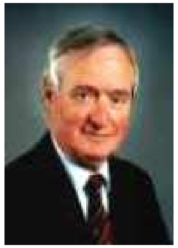
Prof. Fabrizio Scarpa.

Teaching; Fixed wing aircraft design; flight control



Mr. Pete Bunnis.

Teaching; Rotary wing aircraft; Gliders



Mr. Sandy Mitchell.

Teaching; Propulsion; Design history

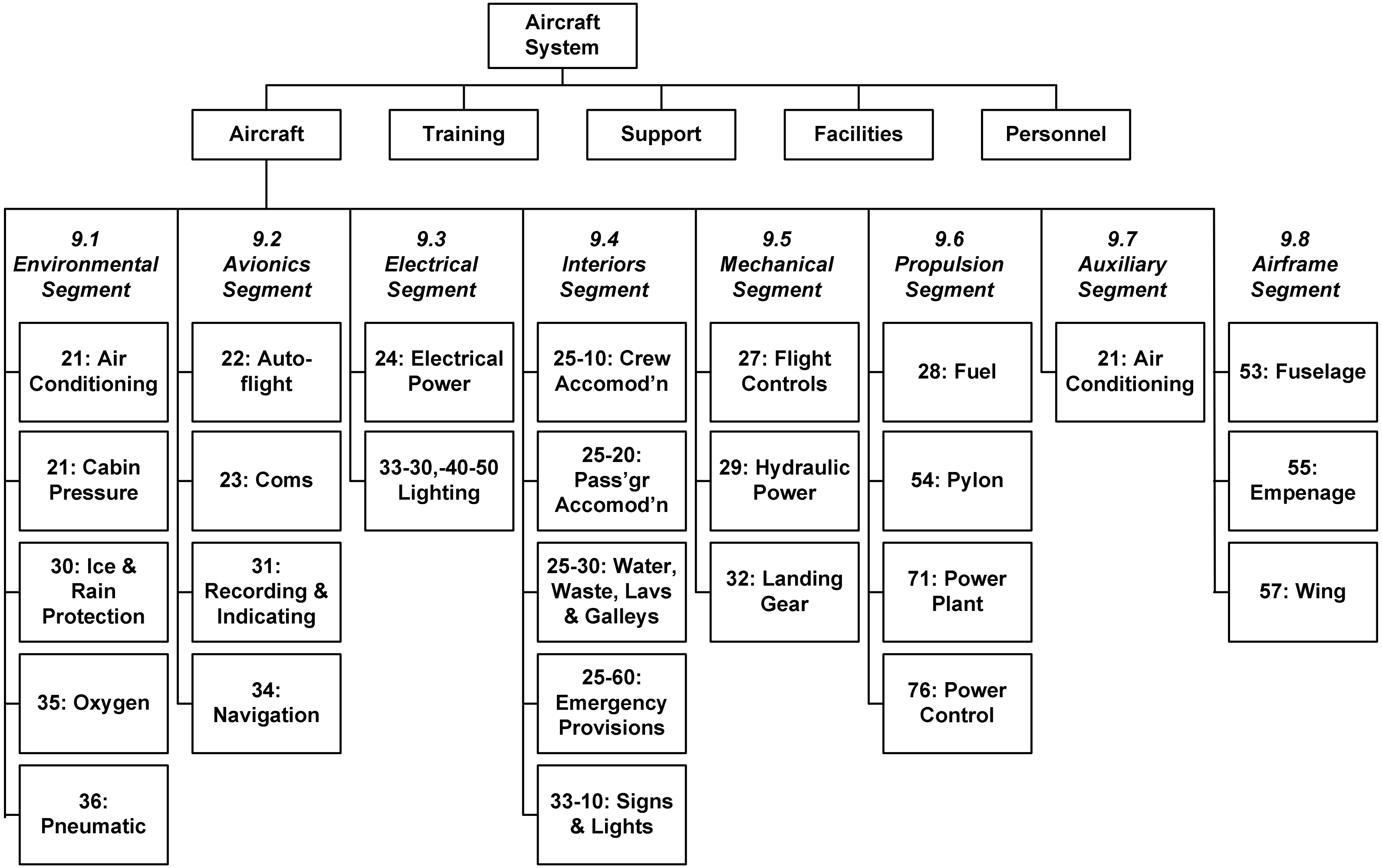
What is AVDASI 1?

- AVDASI 1 introduces the design of, and components that make up, modern aerospace vehicles.

- It is ‘top down’ – we will start with aircraft and describe design and systems

- Knowledge based – we aim to broaden your knowledge of aircraft.

Air Transport Association (ATA) Chapters



From the outside: Design Morphology

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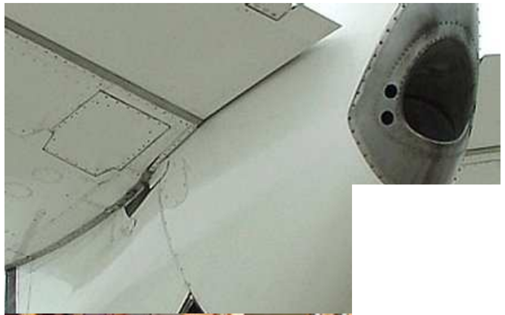
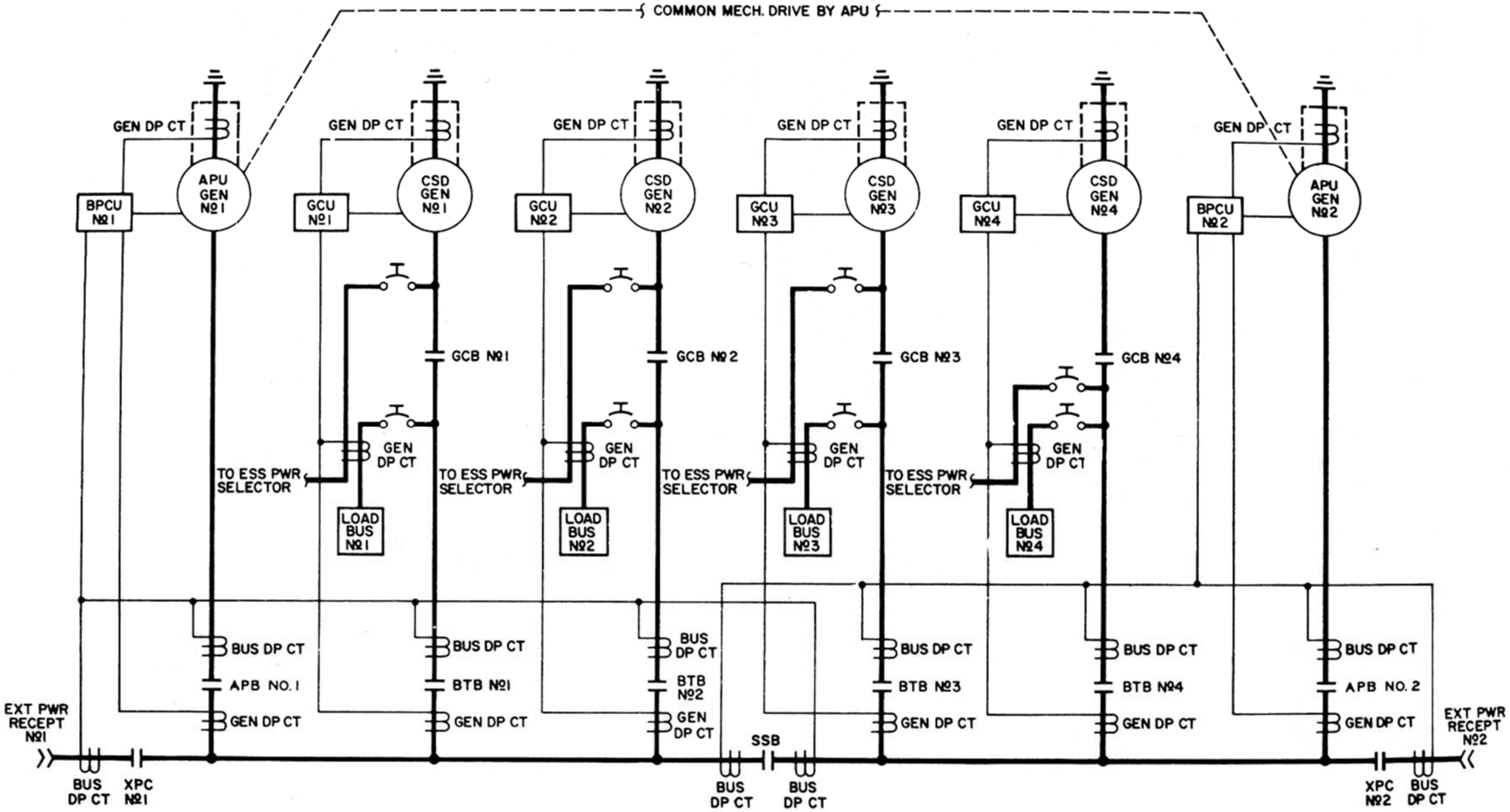
Under the skin: Components and Systems



Components and Systems

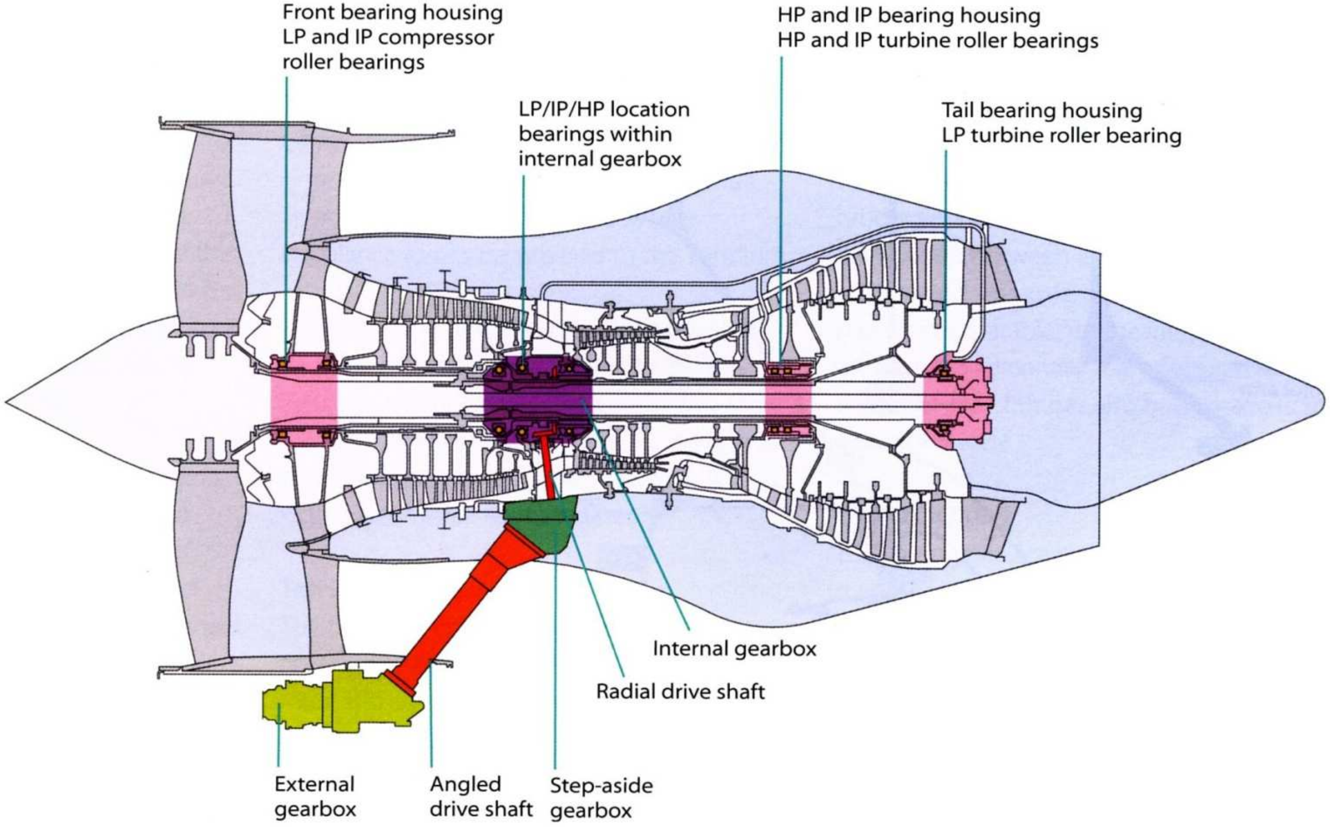
Electrical power



AC SYSTEM SINGLE-LINE DIAGRAM

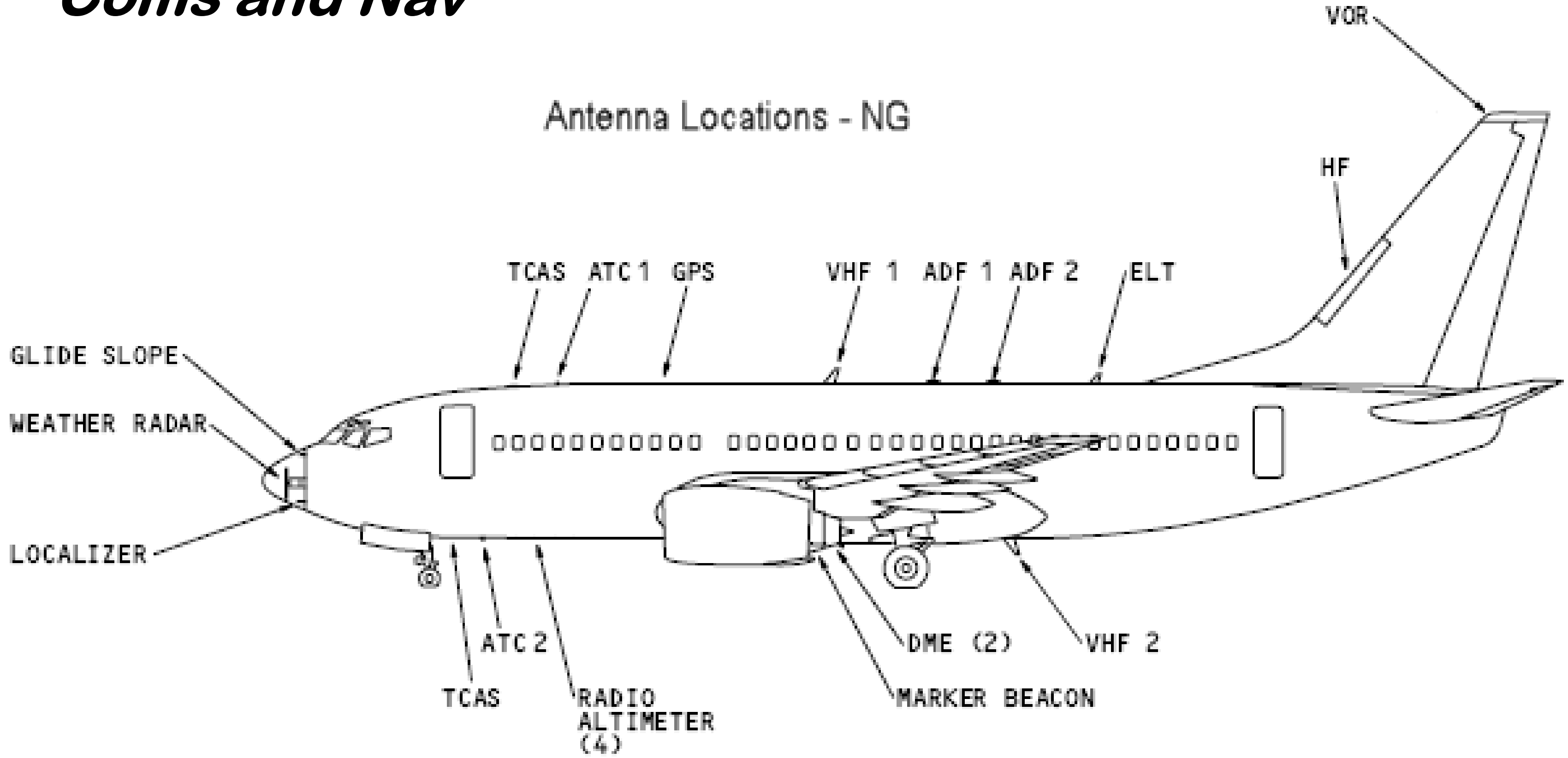
Components and Systems

Engines



Components and Systems

Coms and Nav



Environmental impact

- Lectures by Jeff Jupp
  - Previous chairman of the RAeS 'Greener by design' committee

  - Sources of problems
  - Aircraft design to reduce pollution
  - Alternative fuels

Lecture series content (by topic)

WK	Lecture	Date	Time/Location	Title	Lecturer
1	1	26-Sep	10-11am G12 MOTT, Physics bld	Introduction to AVDASI	Steve Burrow
	2	28-Sep	10-11am 1.1S Peel, Geog. Sci.	History of aircraft design	Sandy Mitchell
2	3	03-Oct	10-11am G12 MOTT, Physics bld	System Safety	Steve Burrow
	4	05-Oct	10-11am 1.1S Peel, Geog. Sci.	Gliders	Pete Bunniss
3	5	10-Oct	10-11am G12 MOTT, Physics bld	Aerospace Radio and Comms	Steve Burrow
	6	12-Oct	10-11am 1.1S Peel, Geog. Sci.	Flixed wing design 1	Fabrizio Scarpa
4	7	17-Oct	10-11am G12 MOTT, Physics bld	Flixed wing design 2	Fabrizio Scarpa
	8	19-Oct	10-11am 1.1S Peel, Geog. Sci.	On Board Navigation Systems	Steve Burrow
5	9	24-Oct	10-11am G12 MOTT, Physics bld	Aircraft Design for Reduced Env. Impact	Jeff Jupp
	10	26-Oct	10-11am 1.1S Peel, Geog. Sci.	Alternative fuels	Jeff Jupp
6	11	31-Oct	10-11am G12 MOTT, Physics bld	Off Board Navigation Systems	Steve Burrow
	12	02-Nov	10-11am 1.1S Peel, Geog. Sci.	Rotary wing aircraft 1	Pete Bunniss
7	13	07-Nov	10-11am G12 MOTT, Physics bld	Flight Deck Displays	Steve Burrow
	14	09-Nov	10-11am 1.1S Peel, Geog. Sci.	HUD, FLIR and night vision	Steve Burrow
8	RW	14-Nov	RW		
	RW	16-Nov	RW		
9	15	21-Nov	10-11am G12 MOTT, Physics bld	Hydraulic and Pneumatic power	Steve Burrow
	16	23-Nov	10-11am 1.1S Peel, Geog. Sci.	Electrical Power Systems 1	Steve Burrow
10	17	28-Nov	10-11am G12 MOTT, Physics bld	Propulsion 1	Sandy Mitchell
	18	30-Nov	10-11am 1.1S Peel, Geog. Sci.	Rotary wing aircraft 2	Pete Bunniss
11	19	05-Dec	10-11am G12 MOTT, Physics bld	Electrical Power Systems 2	Steve Burrow
	20	07-Dec	10-11am 1.1S Peel, Geog. Sci.	Computing and data buses / fuel	Steve Burrow
12	21	12-Dec	10-11am G12 MOTT, Physics bld	Propulsion 2	Sandy Mitchell
	22	14-Dec	10-11am 1.1S Peel, Geog. Sci.	SPARE	

Assessment

- Summer Exam (100% of final mark)
  - Will be multiple choice and short answer format
- Compulsory flight simulator exercise

Introduction to simulators

- 6 flight simulators available on BLADE mezzanine in Queens Building

- You have a chance to do a 1 hour introductory exercise
  - Work in pairs – choose the person next to you.
  - Flying a glider and Cessna work through a series of exercises designed to introduce some of the fundamental concepts.
  - At the end of the exercise you will have filled the worksheet which you can hand in to me.


Pilot PC
Pilot PC
Pilot PC

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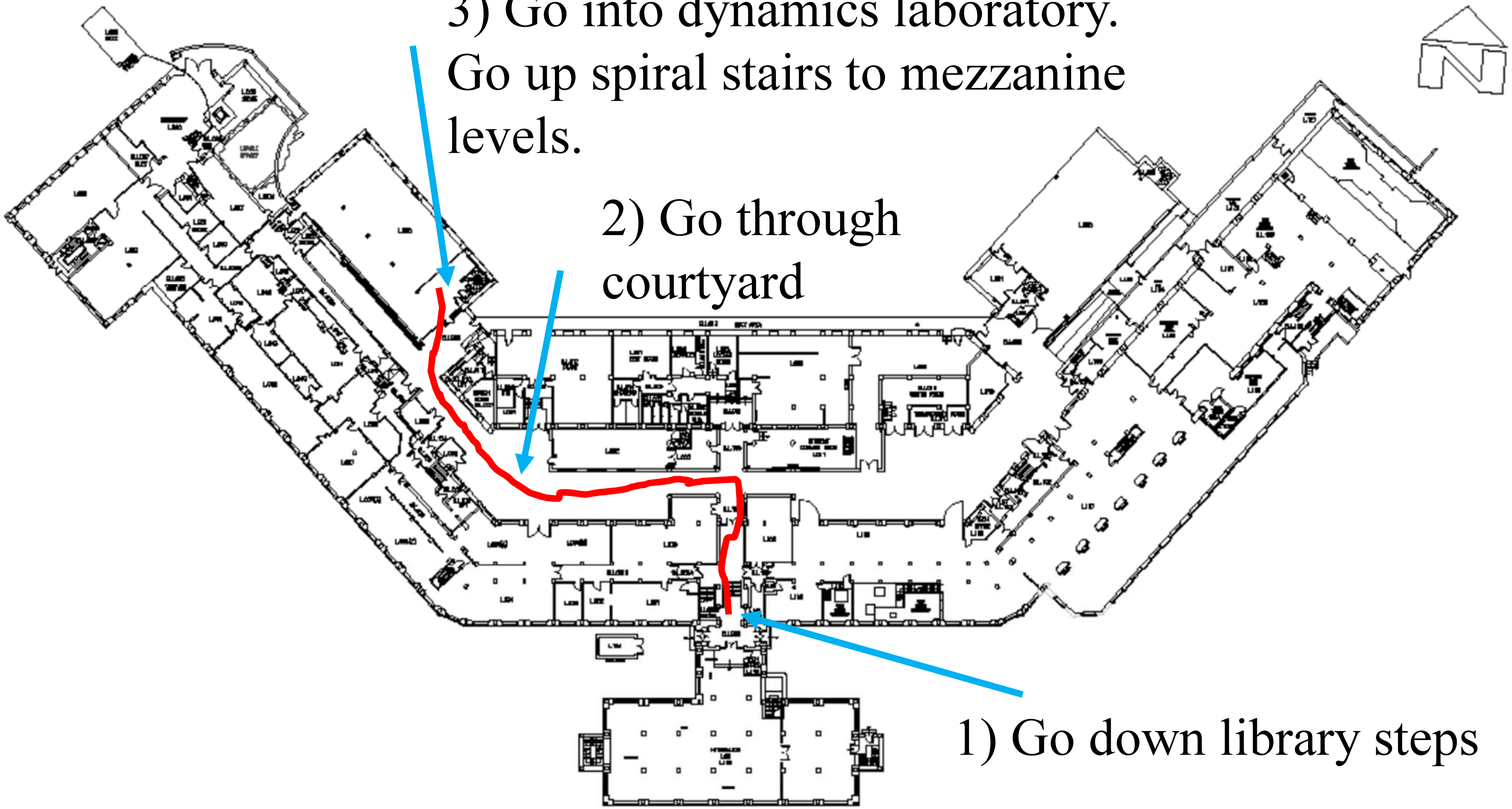
How to get there



How to book

- On each simulator there will be a booking sheet covering this term in two hour long slots.
- Book your slot ahead by writing in your name or alternatively just turn up and see if any are free.

Example questions

When did the first successful, manned, rotary-winged aircraft fly?

A) 1932

B) 1923

C) 1913

D) 1931

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Example questions

Which of these statements best defines ‘integrity’ in an aerospace context?

A) the attribute of a system or an item indicating that it can be relied upon to work correctly on demand

B) the probability that a system or an item is in a functioning state at a given point in time

C) the inability of an item to perform its intended function

D) freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment

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General info

- *10 credit points = 100 hours work*
  - Use the library and the internet to supplement lectures
- Lecture slides and support materials will be available on blackboard.
- It is intended that you attend lectures and supplement the power-point notes with your own.

General info

- Course is a framework for knowledge that is easily available to you.
- Use online resources to follow up aspects which spark your interest.
- This unit is different to almost every other you will study – it is broad learning. Think about how you revise for the exam.

A bit on Systems

Systems Engineering?

There are many different definitions of ‘Systems’ and ‘Systems Engineering’

“ **I.** An organized or connected group of objects.

1. A set or assemblage of things connected, associated, or interdependent, so as to form a complex unity; a whole composed of parts in orderly arrangement according to some scheme or plan; rarely applied to a simple or small assemblage of things…..” (OED)

Systems Engineering?

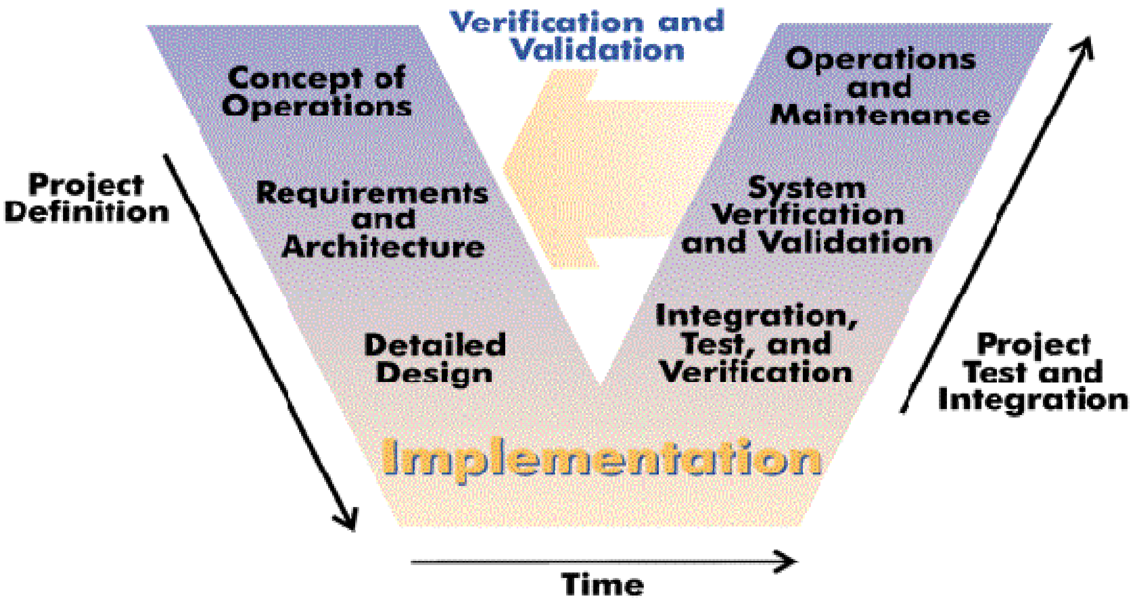
- During your degree you will hear Systems Engineering many times….
- It could be in reference to a technique or process used to design or manage or deliver a product or service. Sometimes called *‘soft-systems’*
- Or it might refer to a connection of physical components. Sometimes called *‘hard-systems*’

compare – hardware/software

Systems Engineering?

- This can be confusing – check the context

- In the aircraft design lectures of this series we will mention soft systems type processes……



Systems Engineering?

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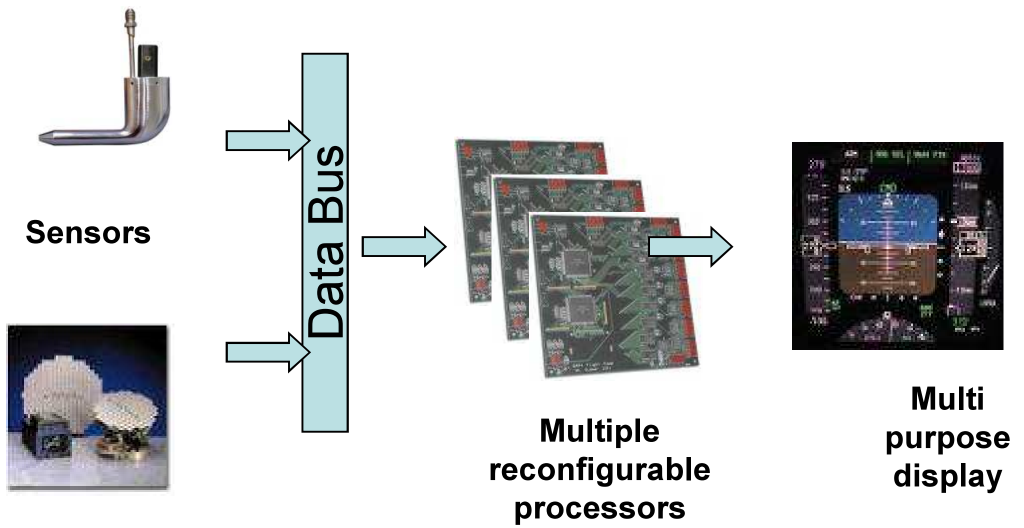
- ….but the majority of systems we will look at will be hard systems……



What single concept underlies everything we do?

- ***SAFETY!***

Severity classification

Minor effect
Slight increase in crew workload.
Slight reduction in safety margins.
Physical effects, but no injury to occupants A reportable occurrence only.

Major effect
Significant reduction in safety margins or functional capabilities.
Significant increase in crew workload or in conditions impairing crew efficiency.
Some injury to occupants.

Hazardous effect
Large reduction in safety margins or functional capabilities.
Higher workload or physical distress, such that the crew could not be relied upon to perform tasks accurately or completely.
Serious injury to, or death of, a relatively small proportion of the occupants.

Catastrophic effect
All failure conditions which would prevent continued flight and landing.
Consequence is probably a multi-fatal accident and/or loss of the aircraft.

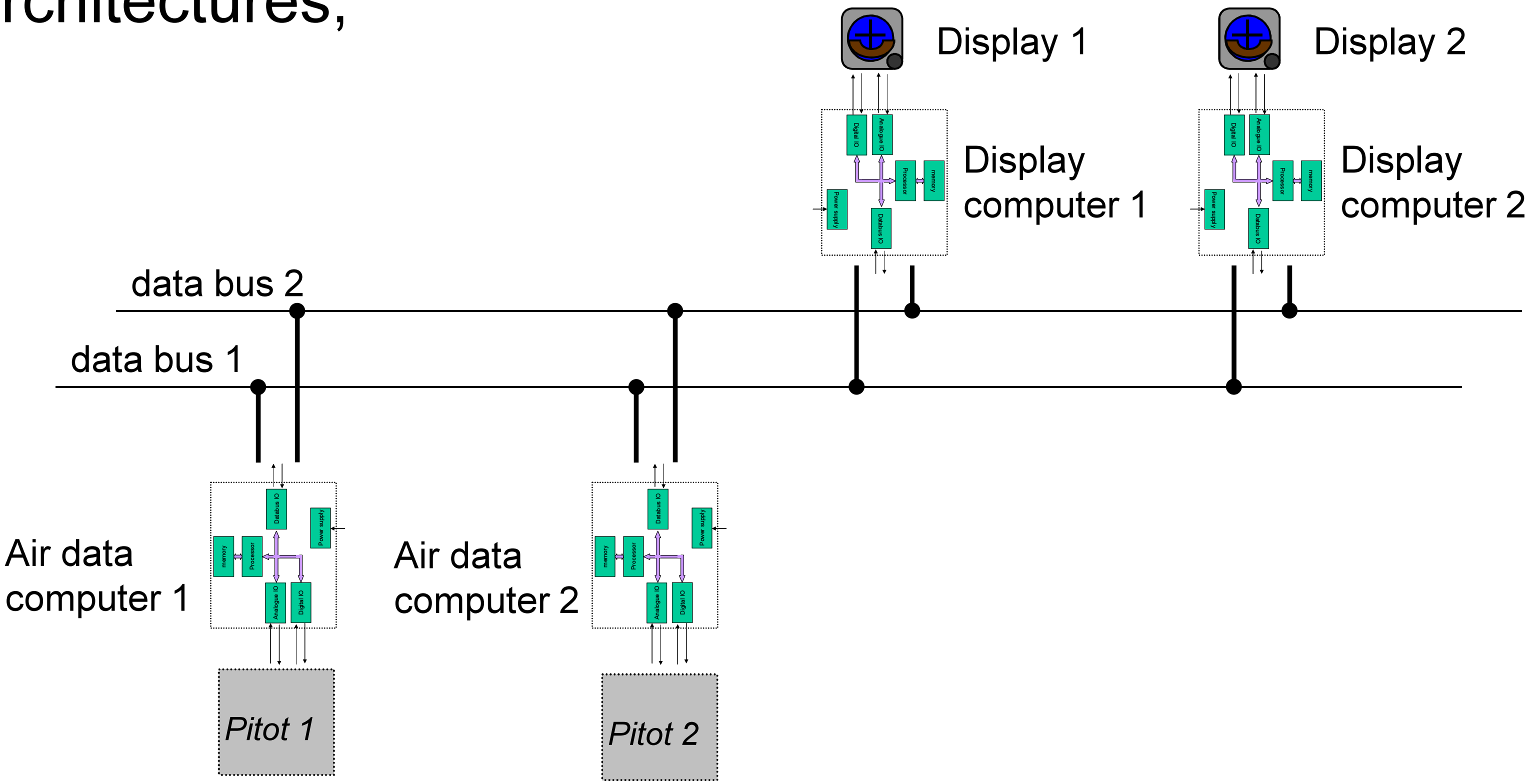
Aerospace System Safety

- JAR (Joint Airworthiness Requirements) 25 defines the acceptable likelihoods of the failure conditions

Severity	***Probability***	***Analysis***
Minor	Reasonably probable	1 x10^{-3} per flight hour
Major	Remote	1 x10^{-5} per flight hour
Hazardous	Extremely remote	1 x10^{-7} per flight hour
Catastrophic	Extremely improbable	1 x10^{-9} per flight hour

Redundancy

- Because most systems cannot meet the safety requirements on their own they are used in redundant architectures;



Redundancy

- Systems from air data to the hydraulics feature redundancy – it is why it is good to have more than just one big engine…
- Systems which might cause catastrophic effects – e.g. flight control, often have triplex redundancy.
- Often dissimilar hardware and/or software is used in redundant systems – this can help with systematic failures

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