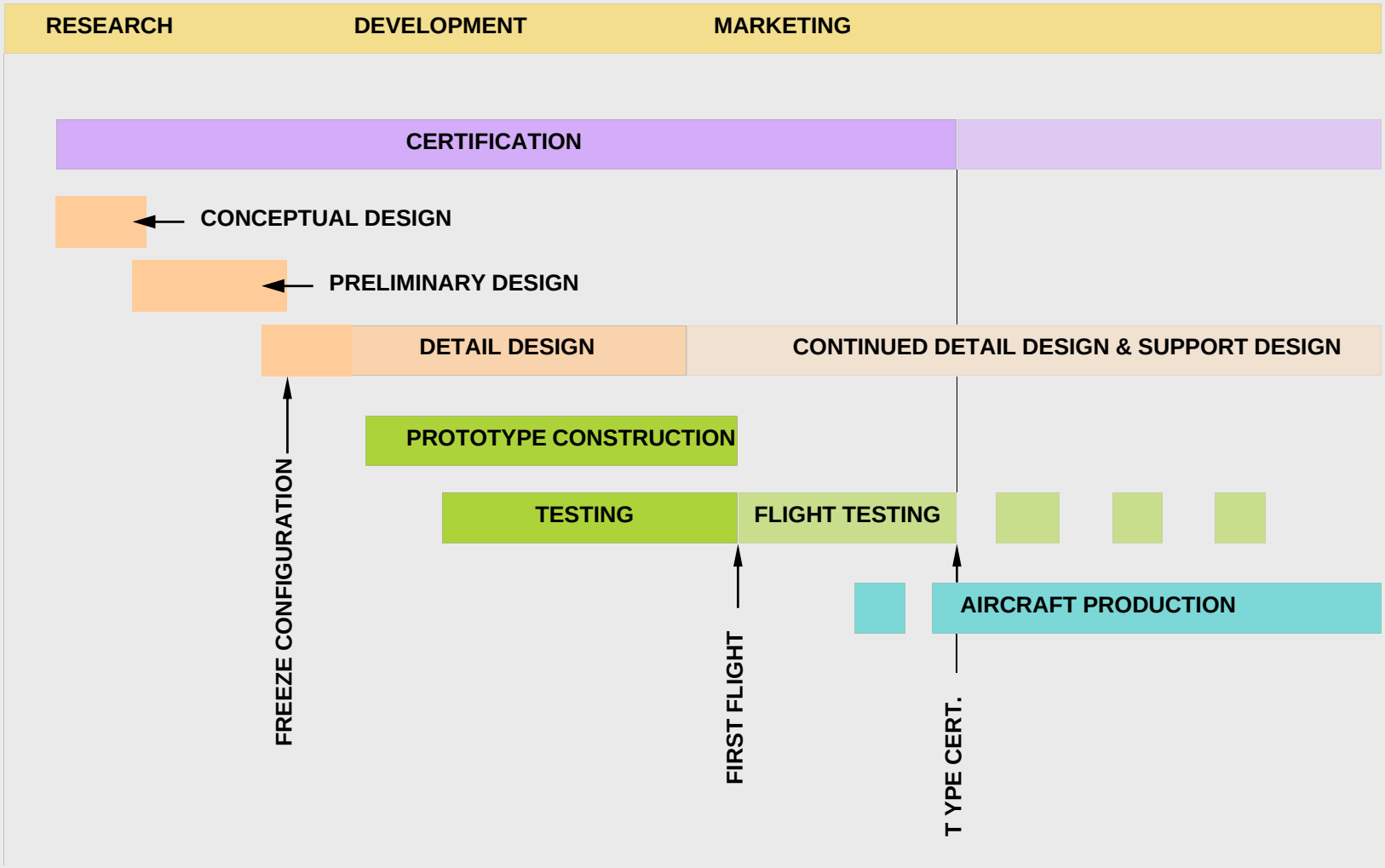
CASE STUDY: CERTIFICATION OF THE MISSION M212

presented by

Filip Lambert
Lambert Aircraft Engineering

RAeS Conference
Tue 23 Nov 2010

AIRCRAFT DESIGN AND DEVELOPMENT PROCESS



CERTIFICATION IS PART OF THE DESIGN & DEVELOPMENT PROCESS OF AN AIRCRAFT

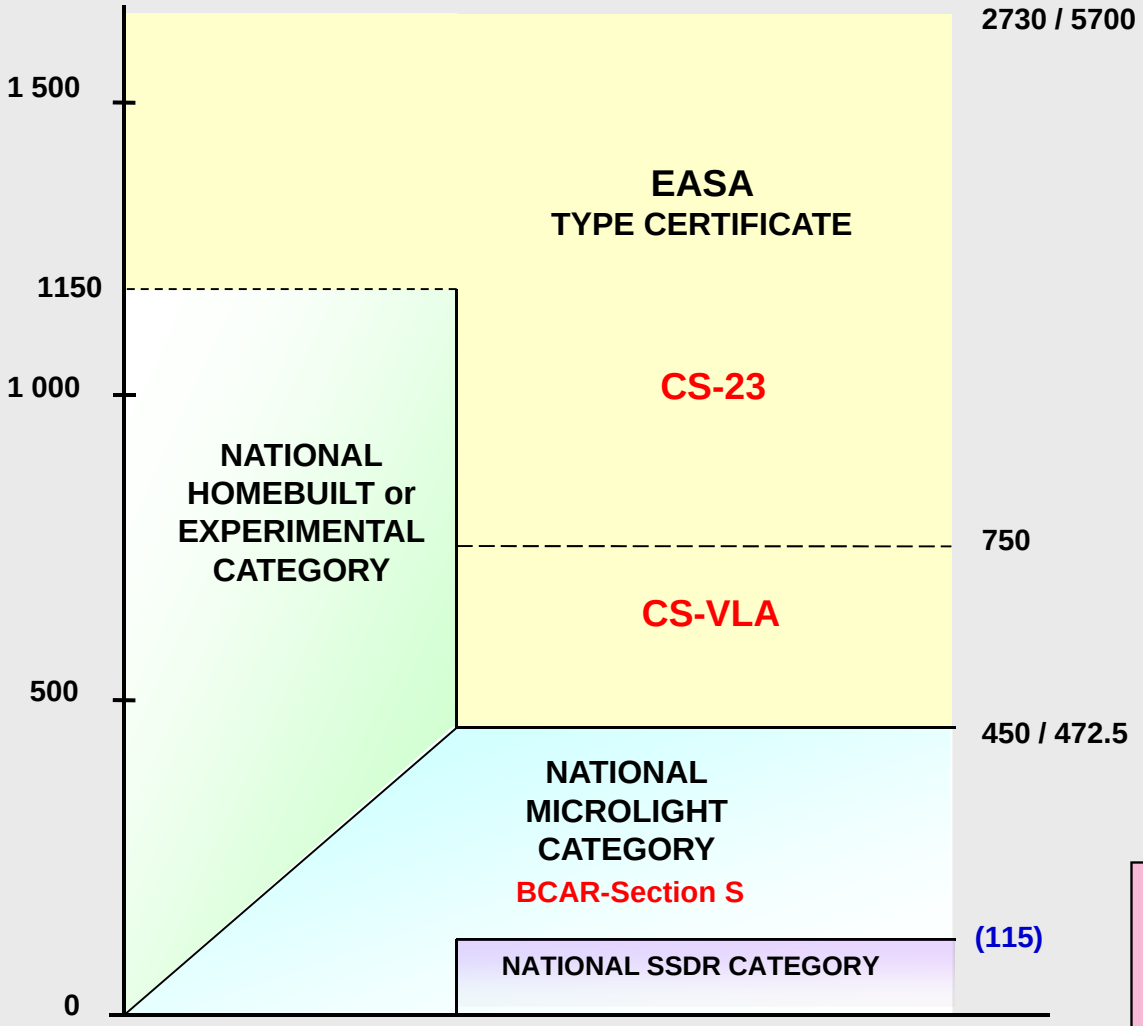
THE CERTIFICATION PROCESS SHOULD BE STARTED ON THE DAY THE DESIGN IS STARTED

PLAN THE DESIGN PROCESS
PLAN THE CERTIFICATION

<u>Crucial steps</u> to take at an early stage in the project:

- **→ Select an Airworthiness Standard**
- **→ Make a certification plan (roadmap)**
- **→ Arrange a meeting with your “certification office”**

AIRCRAFT CATEGORIES AND AIRWORTHINESS STANDARDS



FIXED WING AIRCRAFT

OTHER STANDARDS

CS-22: gliders
BCAR-T: autogyro's
CS-VLR: rotorcraft
CS-27: rotorcraft
……: lighter than air

CERTIFICATION

What is certification?

Certification is everything you undertake to demonstrate that the design (aircraft) complies with the applicable airworthiness standards

Where do you start?

- set up & maintain a compliance checklist and master data list for oversight & cross reference
- define how you will demonstrate compliance
- make reports which contain enough detailed information to cover the regulations and to allow a complete evaluation by the certification office

→ a report can be anything like:
- engineering analysis (e.g. loading actions, detail stressing)
- set of drawings
- test report (e.g. set up and results of a ground test)
- (manufacturing) process specification,
- …

CERTIFICATION (cont'd)

How do you demonstrate compliance?

FAA AC 23-24 defines the following *methods of compliance*:

(1) Flight Test (FT)
(2) Ground test (GT)
(3) Analysis (AN)
(4) Design (DE)
(5) Similarity (SI)
(6) Equivalent Level of Safety Finding (ELOS)
(7) Petition for Exemption (PExmpt)
(8) Not applicable (N/A)

In addition, consider *acceptable means of compliance*:

- AMC guidelines in appendix to some Airworthiness Standards
- some FAA ACs provide information on specific topics
- if no other guidance is available, make you own proposal to your certification office and come to an agreement

CASE STUDY - MISSION M212

Features:

- 4-seater low wing single engine aircraft, conventional configuration
- all-composite airframe, not pressurised
- 1150 kg MTOW
- 150-200 HP piston engine

Certification route:

- airworthiness standard: FAR-23 (JAR-23)
- certification office: PFA Engineering

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart C - Structure

§23.321 – §23.459 → substituted by Appendix A

means of compliance: combination of **Analysis** and **Ground Tests**

Structural Testing Program: test on a composite beam

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart C - Structure

§23.321 – §23.459 → substituted by Appendix A

means of compliance: combination of **Analysis** and **Ground Tests**

Structural Testing Program: wing test to ultimate load

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart C - Structure

§23.321 – §23.459 → substituted by Appendix A

means of compliance: combination of **Analysis** and **Ground Tests**

Structural Testing Program: control surface test

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart C - Structure

§23.321 – §23.459 → substituted by Appendix A

means of compliance: combination of **Analysis** and **Ground Tests**

Structural Testing Program: control system test

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart C - Structure

§23.471 – §23.499 (ground loads)

means of compliance: **Analysis**

Part 23, Subpart D – Design and Construction

§23.721 – §23.727 (landing gear)

means of compliance: combination of **Analysis** and **Similarity**

Mission M212: landing gear

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart C – Structure

§23.562 (emergency landing dynamic conditions)

means of compliance: **Petition for Exemption**

Justification for exemption:

§23.562 was only introducted ion 15 Aug. 1988 with Amdt. 36 of FAR 23, hence it is not applicable to any aircraft which received a Type Certificate prior to this date. An exemption for §23.562 would not be a compromise on the level of safety compared to the vast majority (>99%) of the world's light
aircraft fleet.

Part 23, Subpart D – Design and Construction

§23.867 (electrical bonding and lightning)

means of compliance: **Petition for Exemption**

Justification for exemption:

Under a Permit to fly, the aircraft is be limited to VFR Day conditions only.

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart D – Design and Construction

§23.629 (flutter)

means of compliance: **Ground test**

Ground vibration tests being prepared

CASE STUDY - MISSION M212 (cont'd)

Part 23, Subpart B – Flight

§23.21 - §23.253

means of compliance: **Flight test**

Flight test programme with Roger Bailey (Cranfield University)

A FEW DOs & DON'Ts

- → **Start the certification process on day 1**
- → **Work in a very organised way – it will avoid wasting time**
- → **Think first, then act – anticipation and preparation is most crucial**
- → **Don't sweep an ambiguity or concern under the carpet – it will grow and come back as a real problem**
- → **Don't cheat – be open and discuss problems**
- → **Don't be tempted to bend any rules of physics – you could end up with a bent airplane!**

That's all Folks!

thank you for your attention

enjoy the rest of the day

drive home carefully

see you back next time