



Australian Government  
Department of Defence  
Capability Acquisition and  
Sustainment Group

# Australian F-35A Joint Strike Fighter Airworthiness and Engineering Management System



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F-35A Chief Engineer



# Scope

- Brief overview of F-35A design
- Outline development, test and evaluation activities
- Development and implementation of the F-35A airworthiness and Engineering Management System for the entire Air System (not just the air vehicle).



Au-1 and Au-2

# F-35 Design Overview



# F-35 Variants

## F-35C

Probe and Drogue  
Refueling (Basket)

Strengthened  
Landing Gear  
and Tailhook

Wingfold and  
Ailerons Added

Probe and Drogue  
Refueling (Basket)

Lift Fan

Roll Posts

Centerline  
Gun Pod  
with 25mm Gun

Larger Wing and  
Horizontal Tail Area

## F-35A

In-Flight Refueling  
Receptacle

Internal  
25mm 4-Barrel  
Gatling Gun

3-Bearing  
Swivel Nozzle

## F-35B

# F-35A Comparison



**F-35A**

Length	51.4 ft
Span	35 ft
Wing Area	460 ft <sup>2</sup>
Internal Fuel	<b><u>18,342 lb</u></b>



**F/A-18C**

Length	56 ft
Span	37.4 ft
Wing Area	400 ft <sup>2</sup>
Internal Fuel	<b><u>10,800 lb</u></b>



**F/A-18F**

Length	60.38 ft
Span	42 ft
Wing Area	500 ft <sup>2</sup>
Internal Fuel	<b><u>13,760 lb</u></b>



# Fighter Evolution

Capability

## The Evolution of Stealth

• Air-to-Ground Only at Night

• High and Fast

• All Stealth – 24/7/365



**5th Gen Integration of Stealth and Fighter Evolution = Quantum Leap**

# One Type Replaces Many

## US and UK



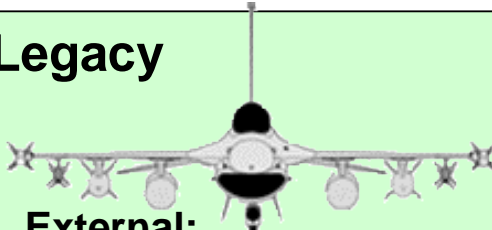
**F-35  
Joint  
Strike  
Fighter**

## International



# Cleaner Configuration

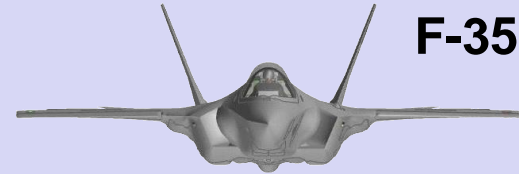
## Legacy



### External:

- Fuel
- Weapons
- EOTS
- Countermeasures
- ECM Electronics
- Tailhook

## F-35



### Internal:



- |                   |                               |
|-------------------|-------------------------------|
| • Fuel            | • Distributed Aperture System |
| • Weapons         | • Integrated ECM Apertures    |
| • EOTS            | • Signature Integration       |
| • Countermeasures | • Integrated Subsystems       |
| • ECM Electronics |                               |
| • Tailhook        |                               |



# Highly-integrated, software-intensive Air System

- 5<sup>th</sup> Gen fighter aircraft derive a majority of their capability / functionality from software
  - F-4 was estimated to generate 8% of its capability from software
  - F-35 is estimated to generate 90% of its capability from software
- Over 30 million source lines of code are planned for the JSF Air System
  - Air Vehicle (8.4M) – Vehicle Systems, Mission Systems, Prognostics & Health Management (PHM)
  - Ground Support System (22.5M) – Autonomic Logistics Information System (ALIS), Off-Board Mission Support (OMS), Training Systems
  - Air Vehicle and Ground Support System are interdependent

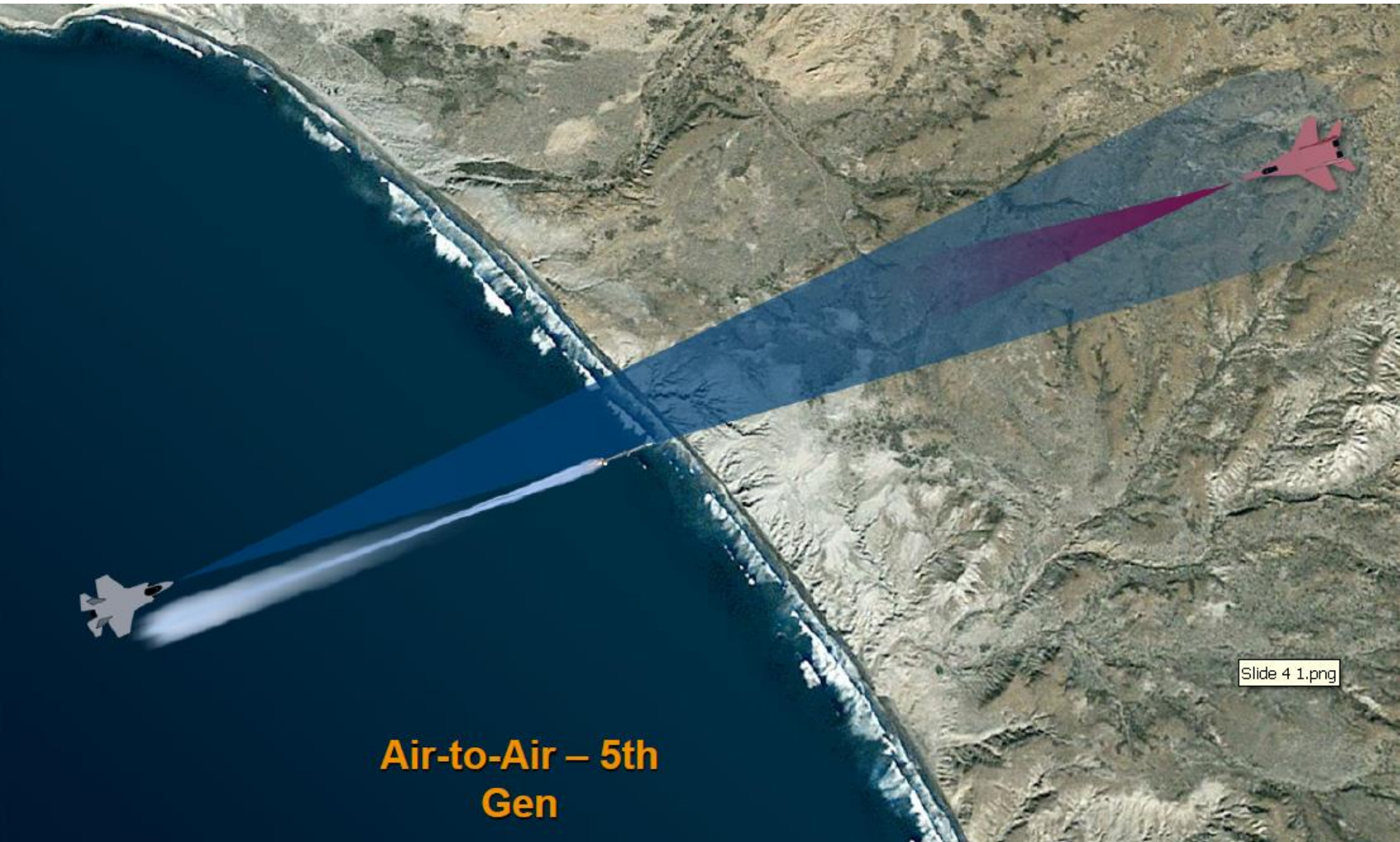
# F-35 Redefines Multirole Aircraft



**Air-to-Air – 4th Gen**



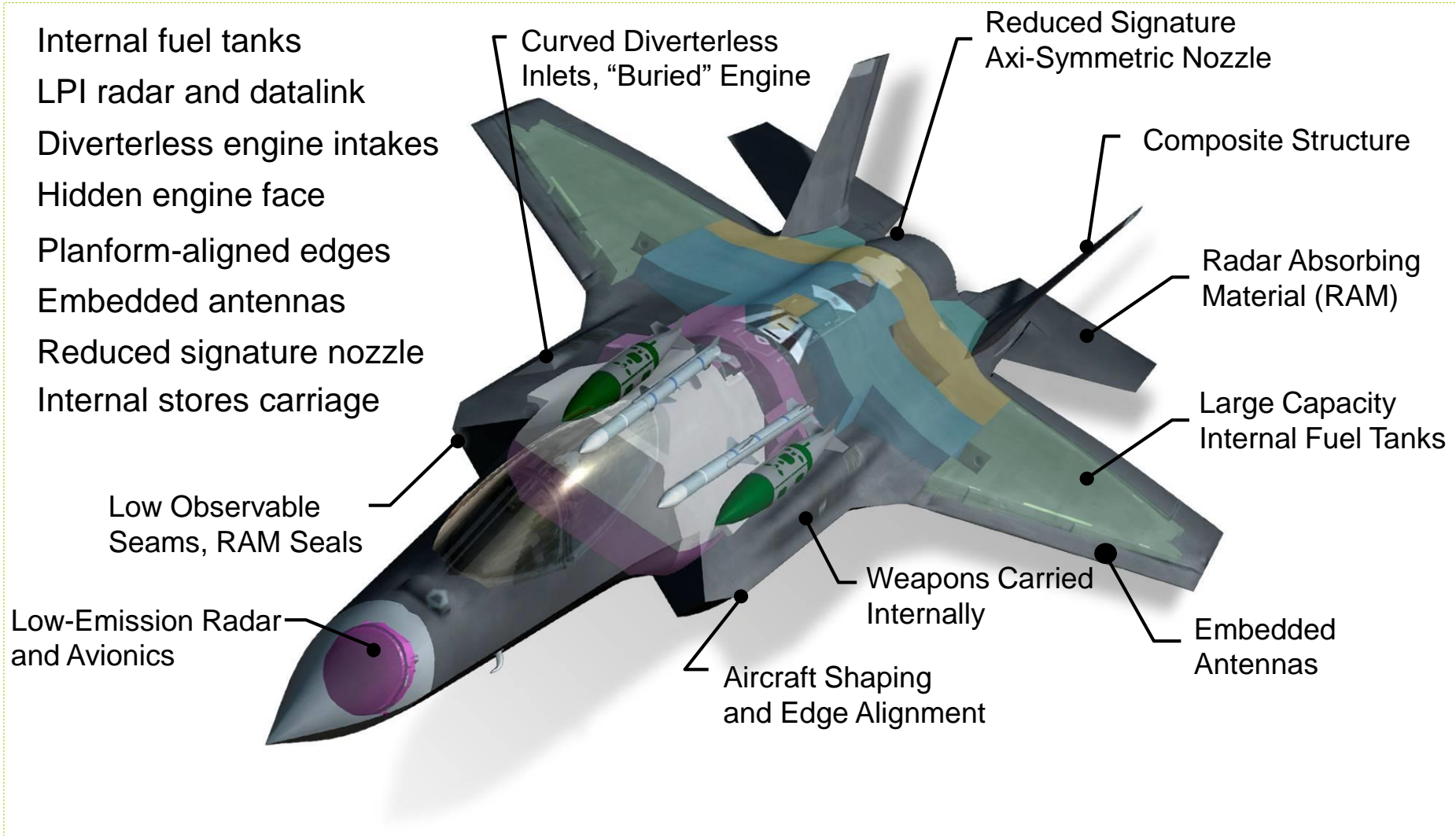
# F-35 Redefines Multirole Aircraft



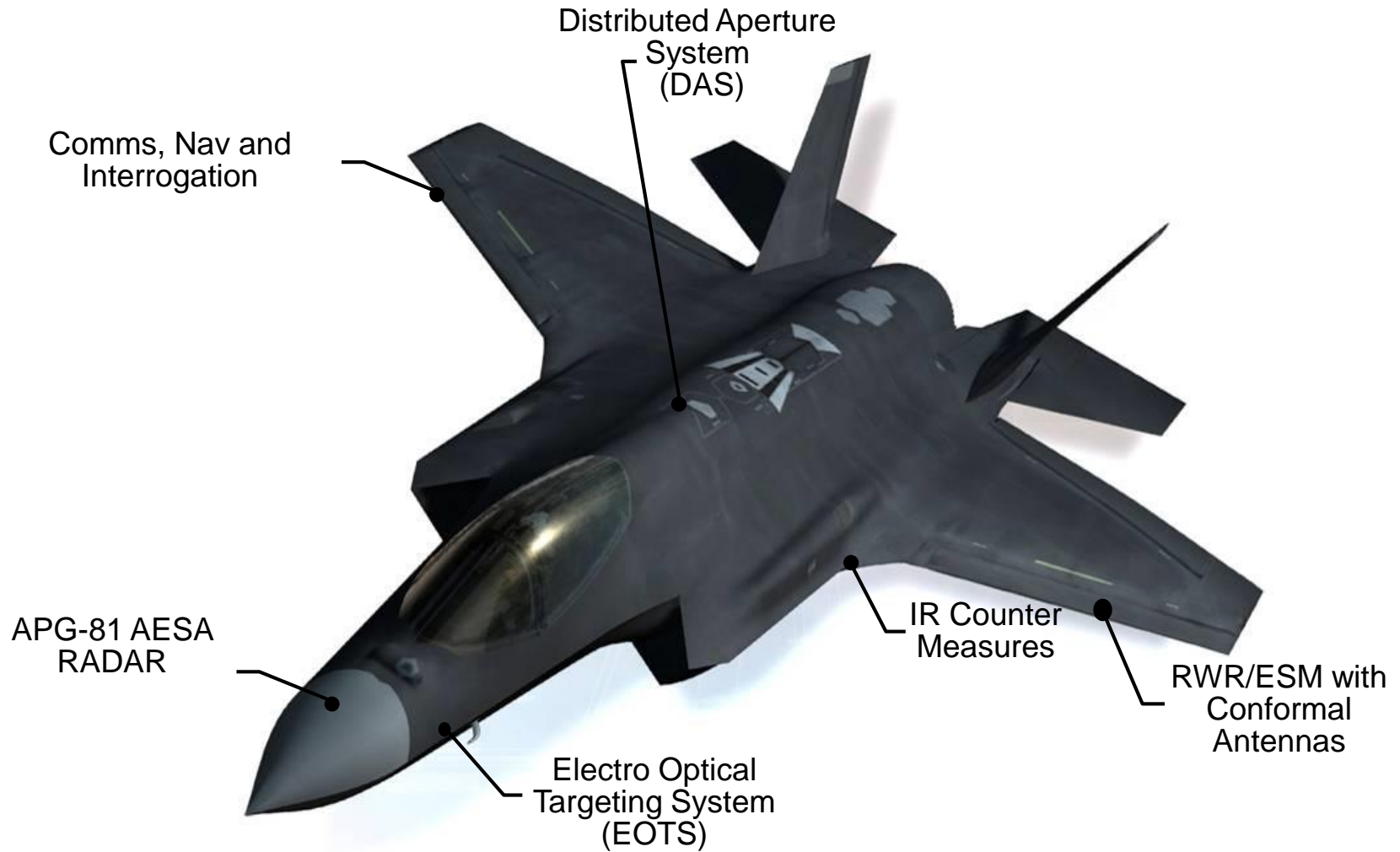
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**Air-to-Air – 5th  
Gen**

# F-35A Low Observable (LO) design features



# F-35A Sensor Fusion – Key Sensors

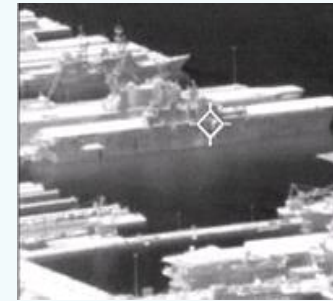
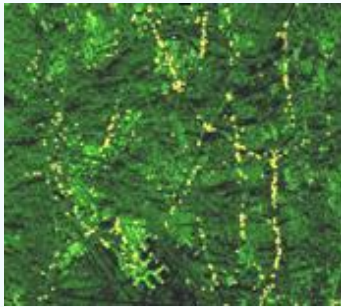




# F-35A Sensor Fusion

## F-35A Multi-Spectral Sensors

- Radar
- Electro-Optical Targeting System (EOTS)
- Electro-Optical Distributed Aperture System (EO DAS)
- Electronic Warfare System
- Identification Friend or Foe (IFF) Interrogators
- Data Links



### Sensor Inputs

## Sensor Fusion

- Determine Where the Entity Is
- Determine Who the Entity Is
- Conduct Track Needs Assessment
- Task Sensors for Additional Information
- Provide Track Information to Pilot and Weapons

Automatic Sensor  
Tasking Cues Best  
Sensor for the Job

Provide Weapons  
Quality Tracks



Situational Awareness and Targeting  
Information Presented to Pilot



# F-35A Design

- Stealth technology
- Advanced sensors and weapons,
- Networking and data fusion capabilities

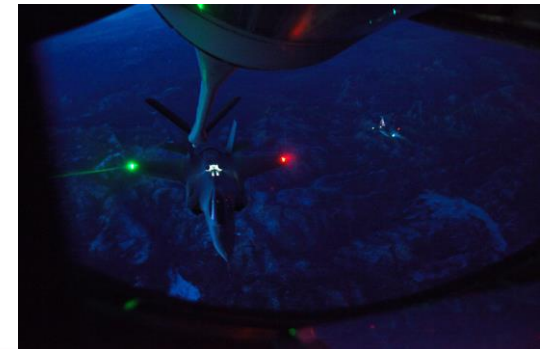


# Development, Test and Evaluation



# Development, Test and Evaluation

- Structured to provide accurate, timely, and essential information to decision makers.
- Evaluate system performance.
- Identify deficiencies (technical or operational) for resolution.



# Development, Test and Evaluation

- F-35 T&E effort divided into two areas:
  - **Verification and Test** concerned with broad range of testing and simulation as well as the verification, validation and accreditation of modelling, inspection, simulation and test results. V&T consists of Developmental Test & Evaluation and Operational Test and Evaluation.
  - **Flight Test** is a subset of V&T and serves as the ultimate air system level verification methodology.





# Development, Test and Evaluation

- Australia included in US T&E at the Joint Operational Test Team at Edwards AFB
- Australian V&V to focus on unique aspects
  - Ability of logistics system to support missions in Australia
  - Workforce sizing and skills
  - Integration with Australian IT systems
  - Adequacy of Australian training system
- Australian IOC decision to be based on US T&E and Australian V&V evidence

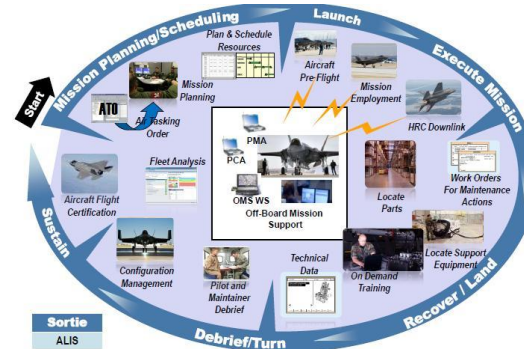
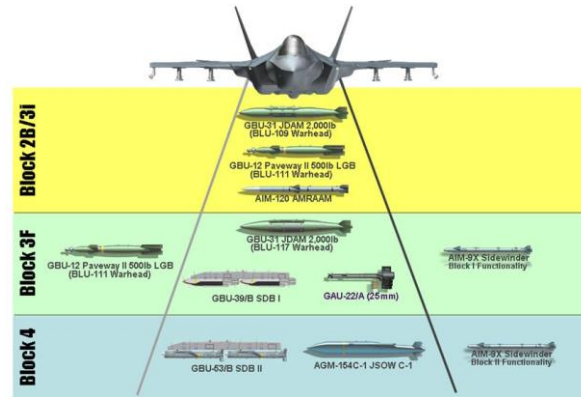
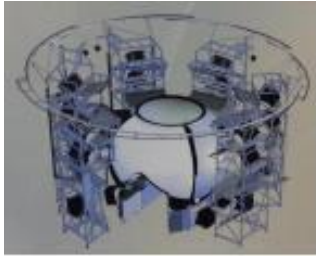


# F-35A Airworthiness and Engineering Management System



# F-35A Airworthiness and Engineering Management System

## F-35A Air System



# F-35A Airworthiness and Engineering Management System

- Context and the opportunity
  - DASR alignment ongoing
  - Defence Registered F-35As in USA
  - ACSPO not yet established
  - Acquisition Engineering Team responsible for:
    - Application for AU F-35A Military Type Certificate
    - Continuing Airworthiness due diligence for jets in USA
  - Assisting ACG/ACTO/ACSPO with developing the prioritised set of procedures and processes
  - Consider a framework that covers airworthiness and non-airworthiness functions across the entire Air System

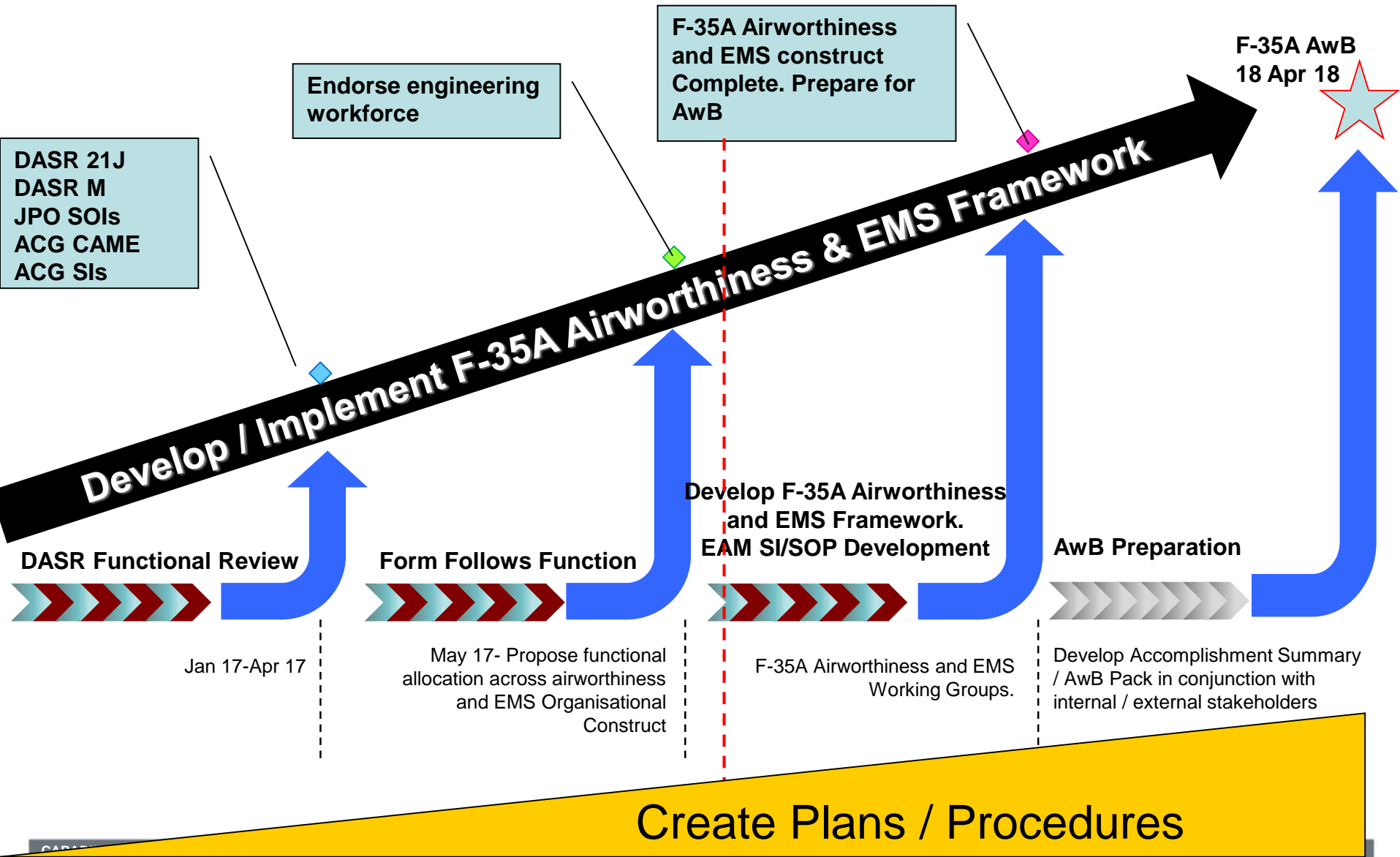
# F-35A Airworthiness and Engineering Management System

- Once in an Engineer's lifetime opportunity to define, develop and implement a new EMS and airworthiness framework.
- It all started with a CONOPS, including stakeholder engagement strategy
- Defined the requirements (i.e airworthiness / non-airworthiness / best practice engineering management etc)
- Functional Review, in consultation with Air Force
- Form follows Function to influence organisation Workforce Design
- Set up 21J / CAMO/ 145 Approvals
- Create and validate minimum set of processes across ACG, ACTO, EMU, OBISC, ITC and US based engineers





# Implementation Approach



# JSF Division Engineering Team



CAPABILITY ACQUISITION AND SUSTAINMENT GROUP – JOINT STRIKE FIGHTER DIVISION

# CPP Engineers

- Washington DC and Fort Worth
- Must Continue Over LOT
- PTC-1 PML remain at Luke AFB

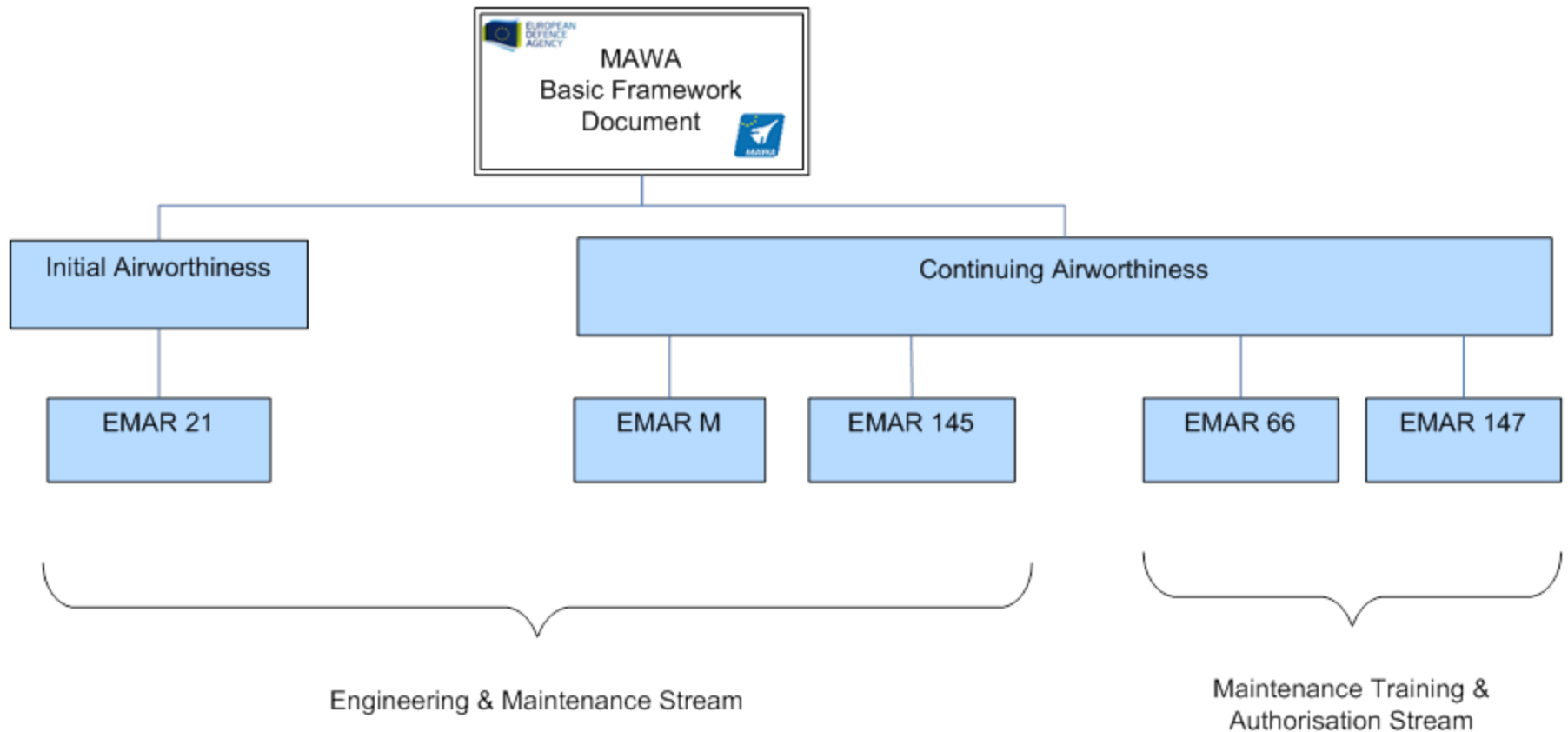
AU Class Desk (WGCDR)  
AU Designated Airworthiness Agent (SQNLDR)

2 x Service Representatives (SQNLDR and FLTLT)

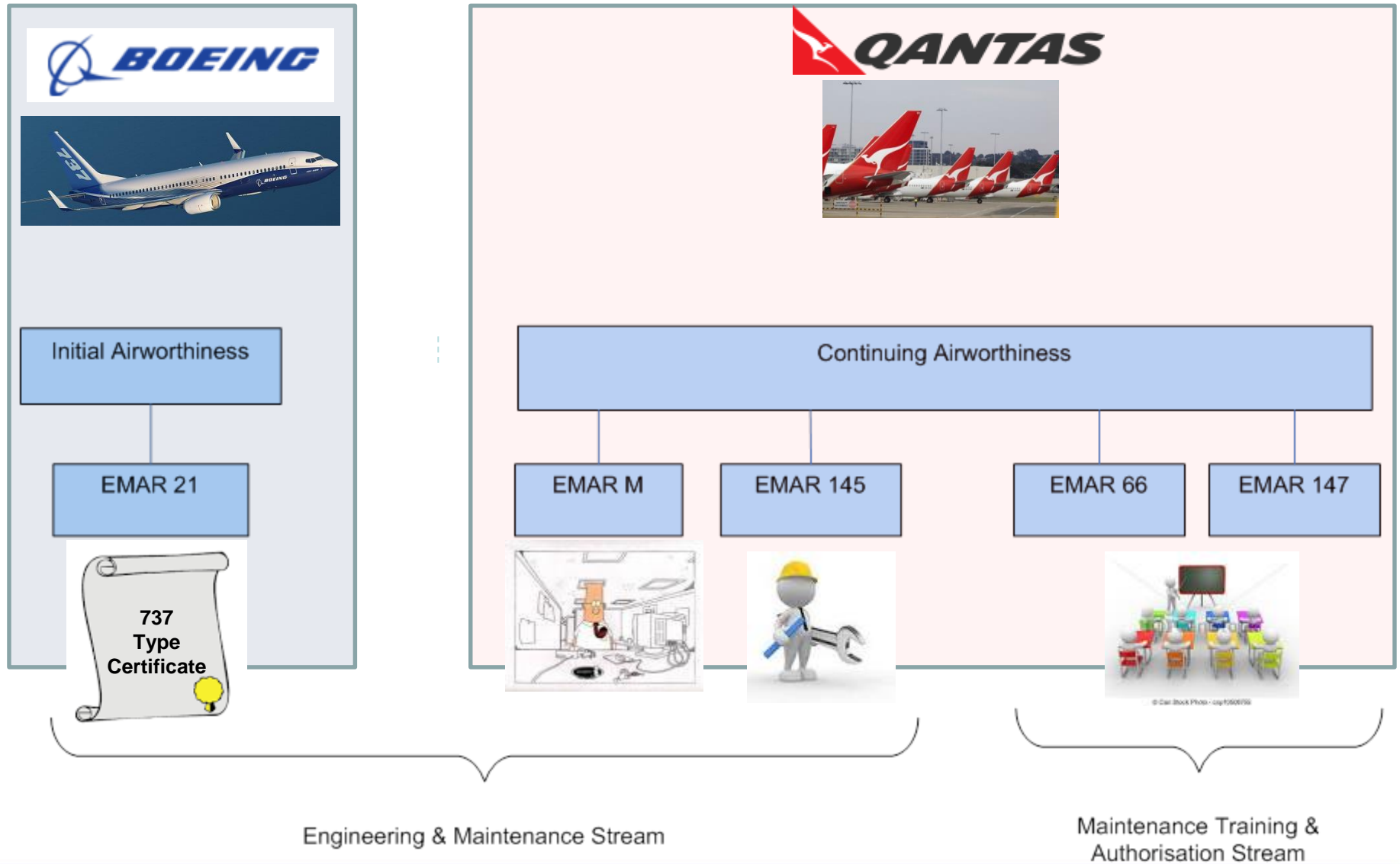
1 x PTC-1 PML (SQNLDR)



# Basic EMAR Structure

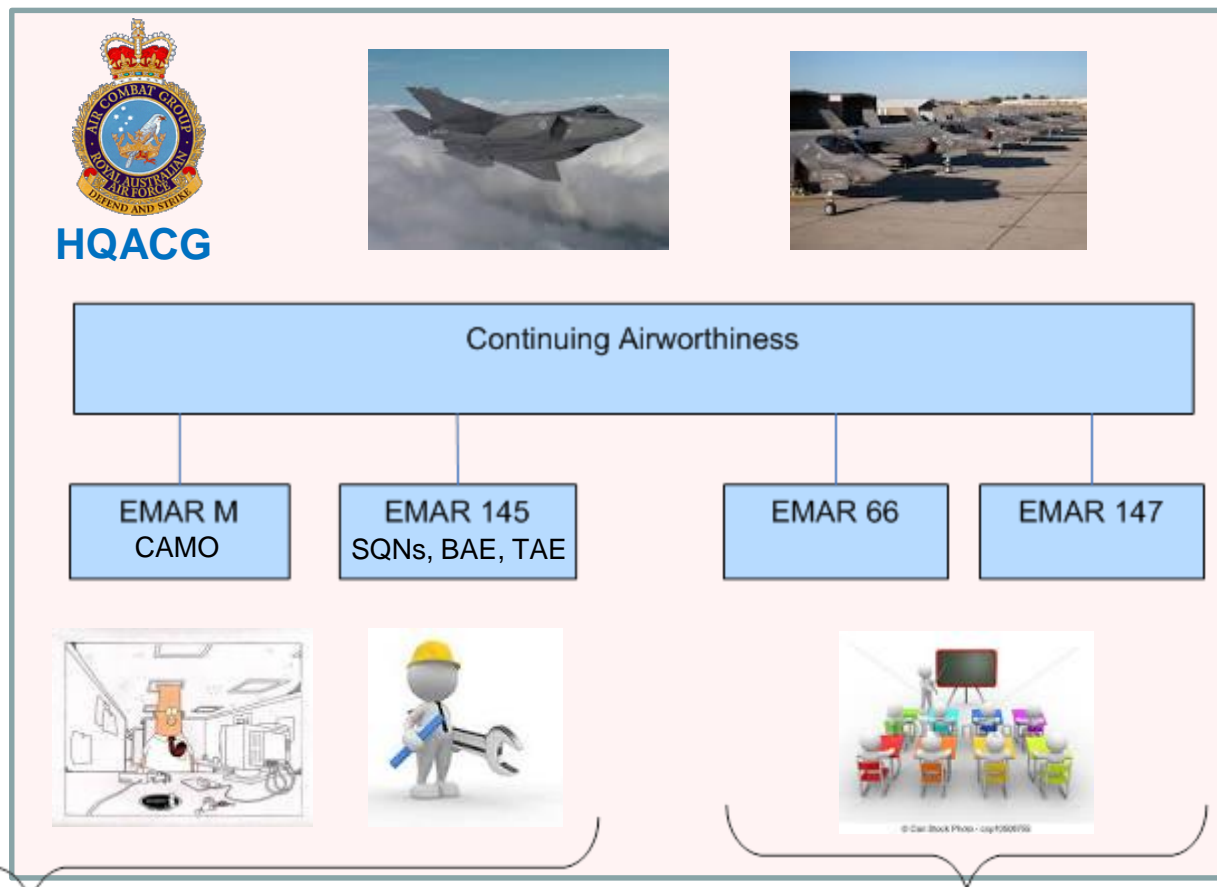
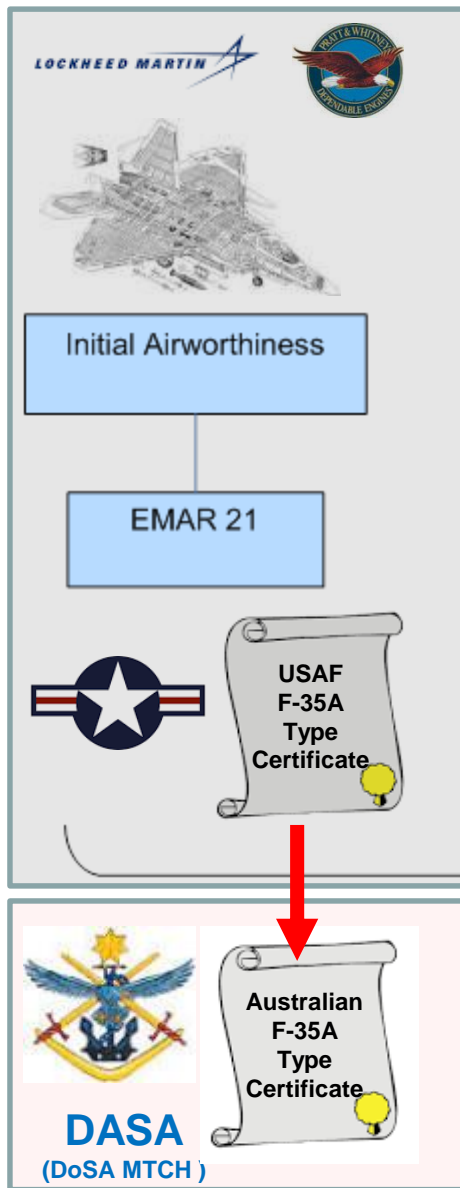


# Civil Analogy





# Australian F-35A Context





# JPO Military Design Organisation

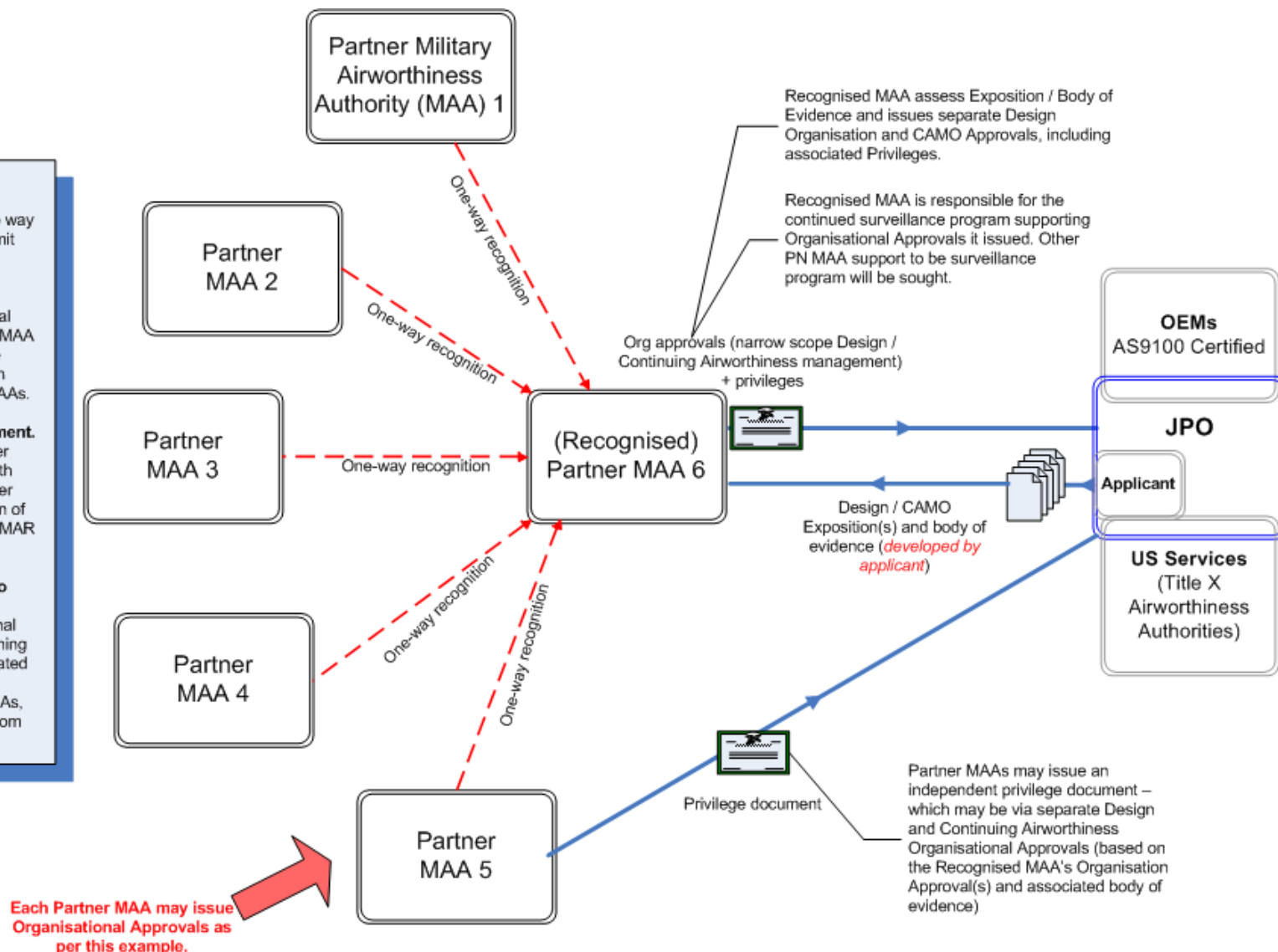
**Clarification**

**Recognition.** Only one way is required (does not limit potential for shared surveillance)

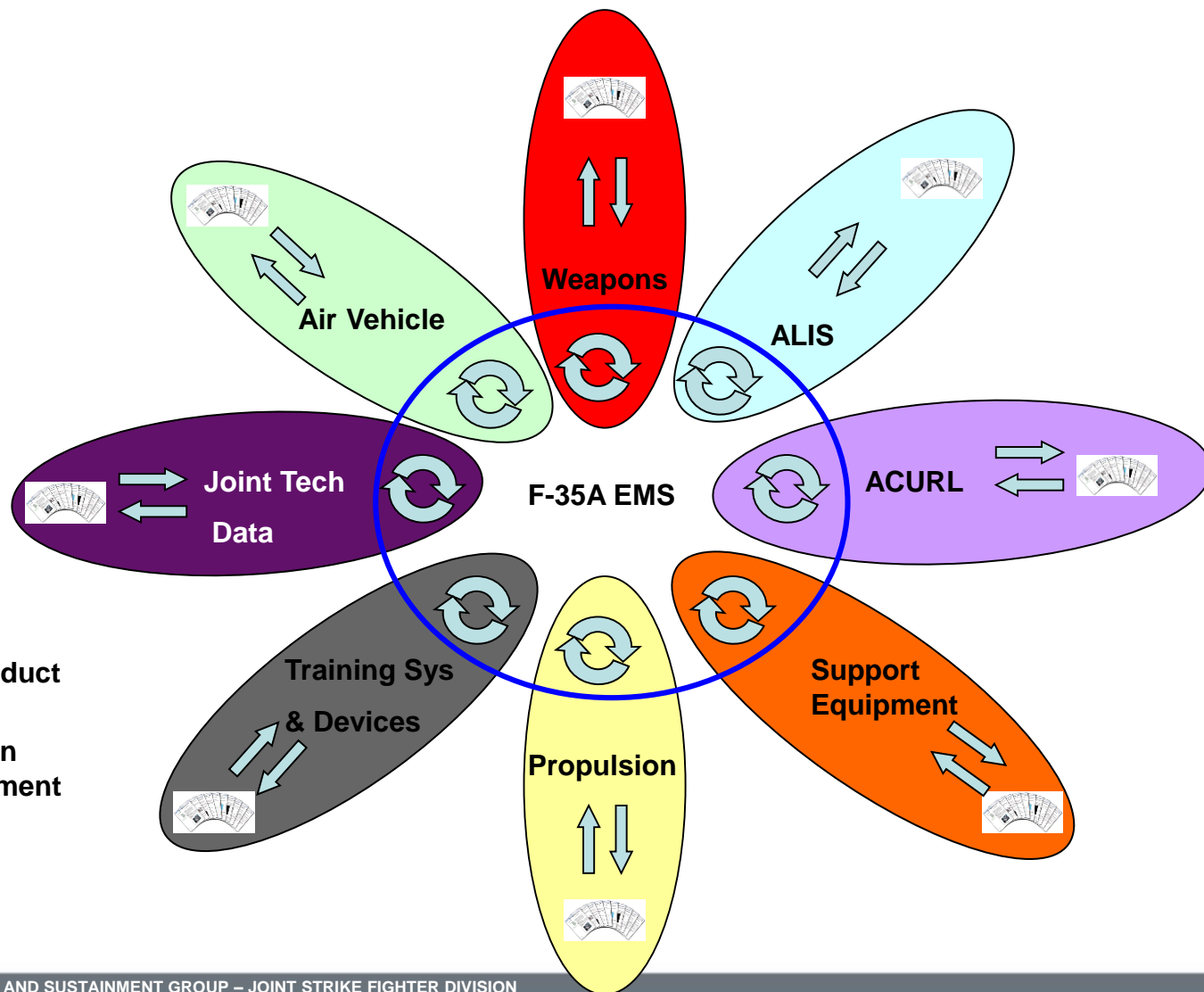
For broader international objectives, the Partner MAA 6 is expected to pursue Mutual Recognition with participating Partner MAAs.

**Partner MAA engagement.** The Recognised Partner MAA will collaborate with other interested Partner MAAs during finalisation of Org approval scope / EMAR tailoring

**Information transfer to other Partner MAAs.** Sharing of Organisational Approval and underpinning expositions and associated Body of Evidence to be provided to Partner MAAs, subject to agreement from the applicant (JPO).



# F-35A Airworthiness and Engineering Management System



# Summary





Questions?

