F-35 Lightning II Missionized Gun System Status

Presented by:

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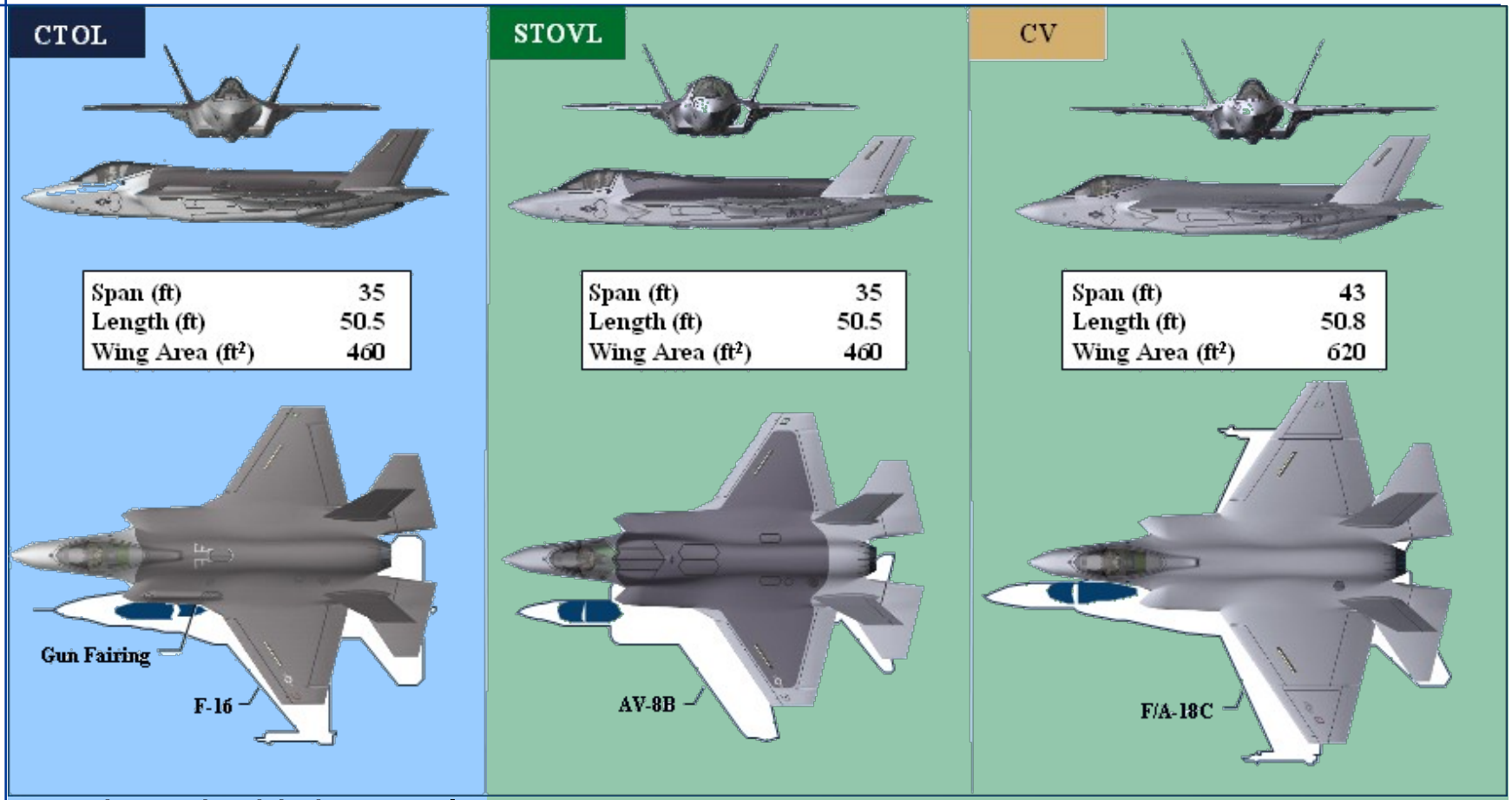
Presentation Outline

- System Overview
- Program Status
  - ↗ Qualification Efforts
  - ↗ SDD Delivery Status
  - ↗ Support Equipment Design
- Path Forward

JSF Multi-Service Design



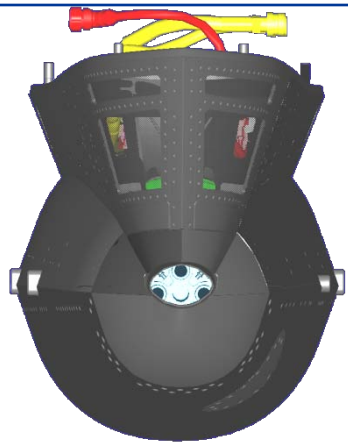
Equipped with internal gun system

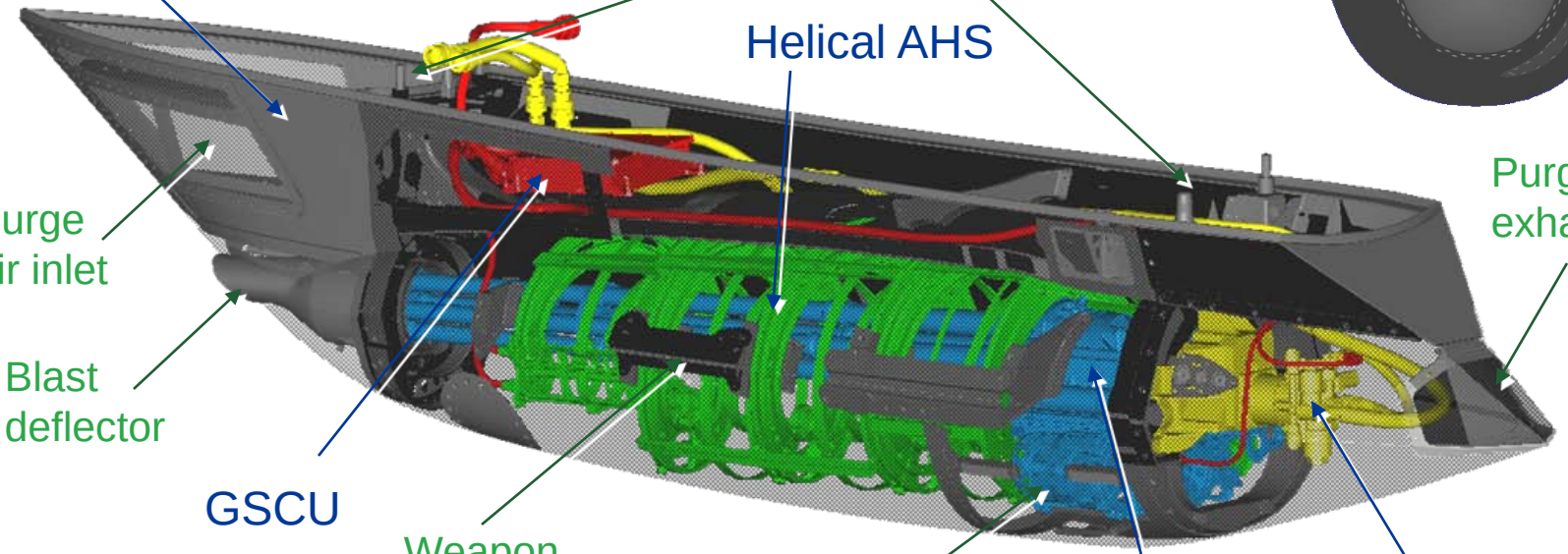
Equipped with Missionized Gun System

Missionized Gun System (MGS) Key Features

- 5 primary assemblies
  - Pod – composite monocoque structure designed and fabricated by Terma of Denmark
  - Gun System Control Unit (GSCU) supplied by Hamilton Sundstrand and software that controls system function
  - AHS - 220-rnd helical linear linkless ammunition handling system.
  - Hydraulic system - 4000-psi system composed of hydraulic lines/hoses, priority valve, and drive (dual sourced to Parker and Triumph)
  - GAU-22A Gatling gun - 3000 spm, 25-mm, 4-barrel, reverse clearing, GAU-12U derivative
- Dispersion - 5 milliradians diameter, 80 percent circle
- 1017 lb fully loaded
- 27” wide, 32” high, 146” long

MGS Key Components



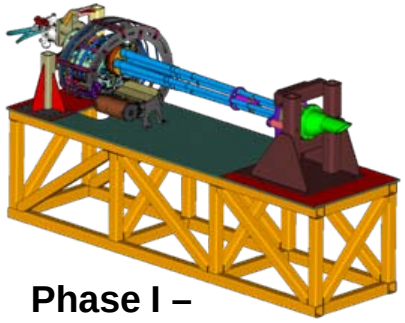


Upcoming Program Milestones

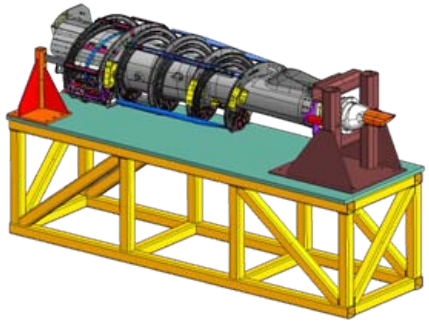
- Qualification complete - June 2010
- Deliver System Development & Demonstration (SDD) systems 2 & 3 – May & July 2010 respectively
- Execute Low Rate Initial Production (LRIP) contracts
  - ↗ Two – 3 STOVL systems, August 2011
  - ↗ Three – 4 STOVL systems, December 2011
  - ↗ Four - 7 STOVL & 2 CV systems, June 2012
- Support equipment
  - ↗ Qualification – June to August 2010
  - ↗ Deliver – August 2010

Engineering Test

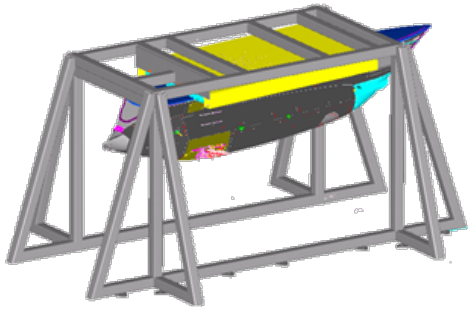
- Engineering testing was completed May 2009
  - Three phases shown below
  - 13,503 rounds fired, 1,575 rounds cycled
  - Successful system integration



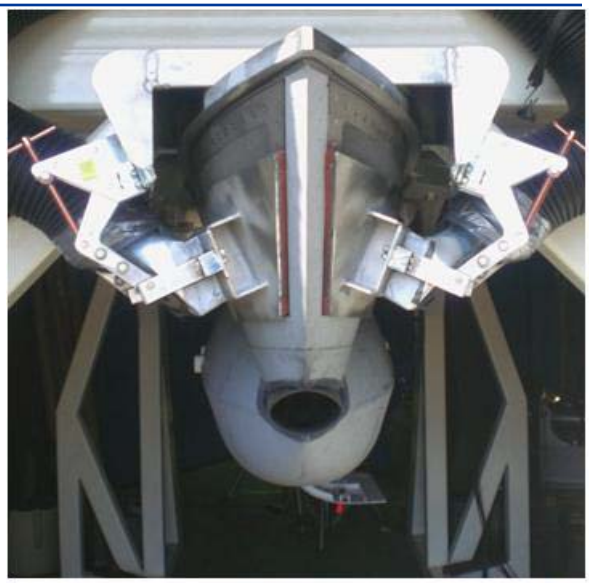
Phase I – gun only



Phase II – gun system

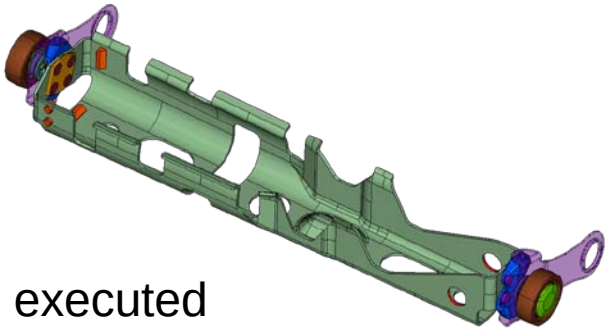


Phase III - MGS



Engineering Test - Video

Engineering Testing – Resulting Design Improvements



- Carrier Durability
  - Premature failure of the carrier was caused by high loads experienced at the gun handoff area.
  - A rigorous design and evaluation phase were executed
    - FEM, bench top, and system testing at ambient and extreme cold.
  - No issues have arisen during qualification testing.

- Hydraulic Fluid Temperature
  - The system is designed to meet performance requirements with warm hydraulic fluid.
  - System level cold tests highlighted a sensitivity to continuous purge air flow.
  - Insulation was added to the fixed and flexible supply lines to mitigate the fluid heat loss.

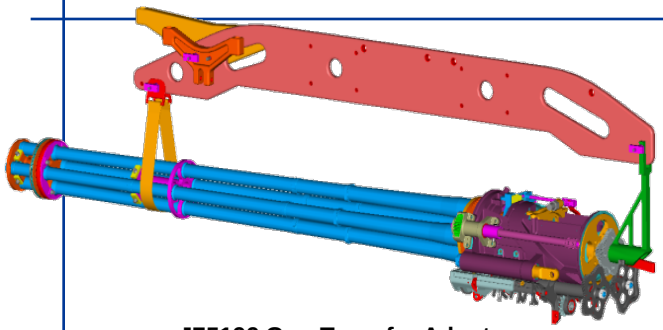
Ground Vibration Test

- MGS was installed on aircraft 2BF:003 at LM Aero for ground vibration testing in July 2009
- The MGS fit perfectly and no issues with the gun system were identified!

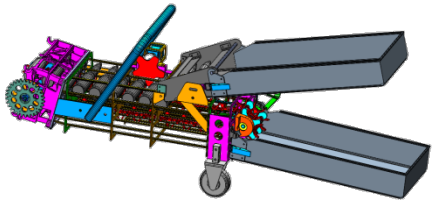
Qualification Test Status

- Testing began with the foundation of fully qualified sub-system components (GSCU, hydraulic drives, and sensors)
  - Pod structure underwent a series of risk reduction tests, including limit load tests and a 36,000 round equivalent gun fire vibration test.
- Specialty tests include
  - High/low delta pressure
  - Hot and cold testing
  - 220-rnd fire out
  - Interrupted bursts
  - Gun gas measurement

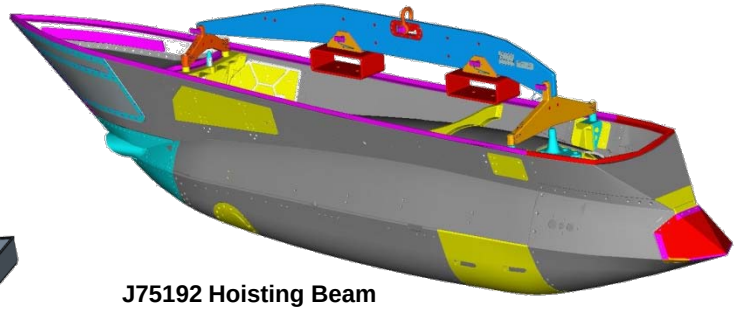
Support Equipment Design



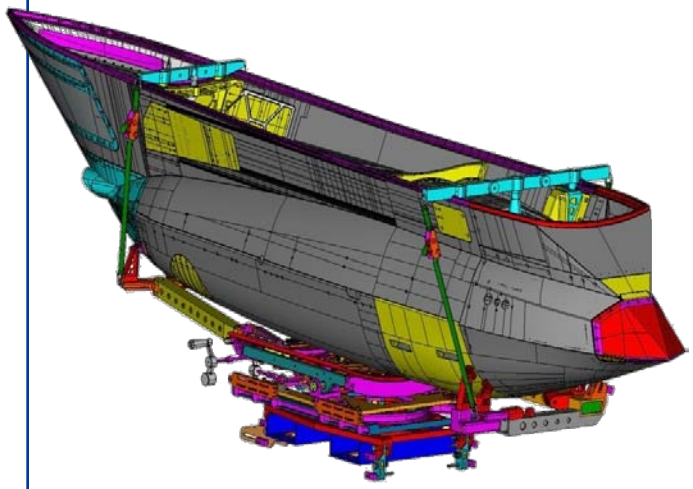
J75199 Gun Transfer Adapter



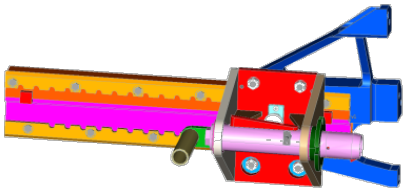
J75208 Ammunition Loader



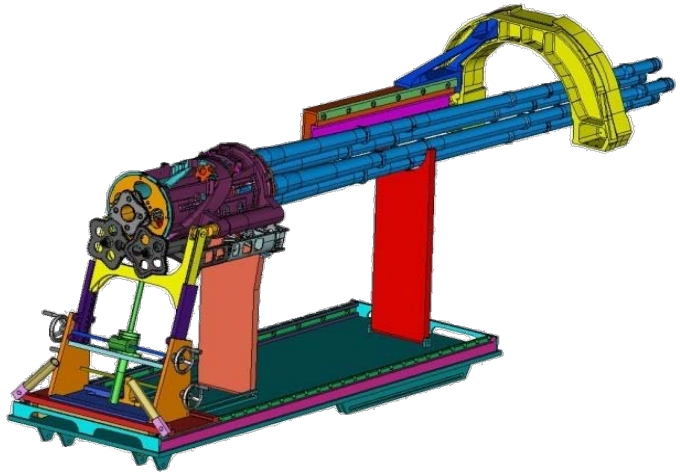
J75192 Hoisting Beam



J75189 Ground Handling Adapter



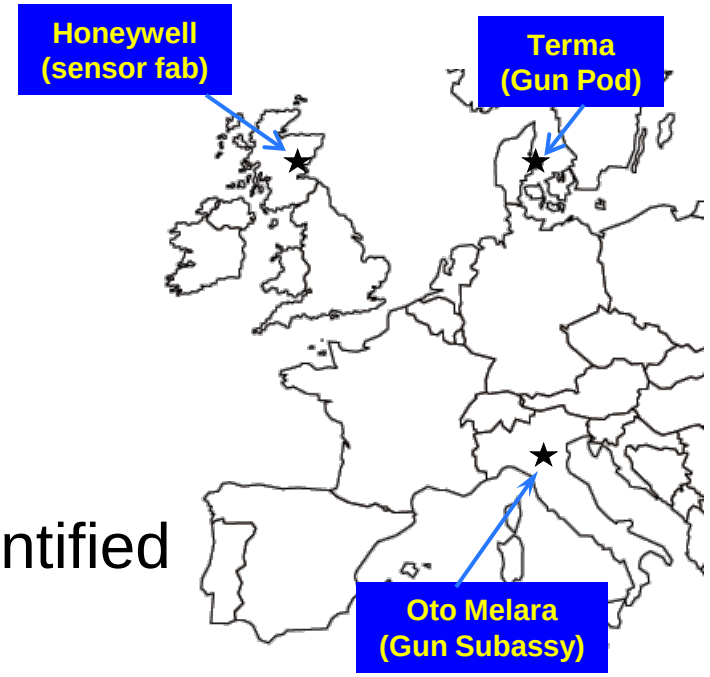
J75196 Mount Rail



J75197 Gun Mount Adapter

Key Program Successes

- Leveraged Content
  - ↗ Numerous efficiencies have been realized by heavily leveraging CTOL components, experiences, and infrastructure.
    - Gun is 85% common
    - GSCU is identical
    - Hydrives are identical
    - Sensors are identical
    - Support assets and experience
- Demonstrated system reliability
- Significant international content
- AC fit up with no MGS issues identified



MGS Path Forward

- Complete MGS qualification
- Deliver non-firing MGS for weapons loader training to LM Aero
- Deliver SDD MGS 2 and 3 to LM Aero
- Negotiate future and execute awarded LRIP contracts

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