F-35 Lightning II

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F-35 Program Norway

This briefing and Presentation is for Information only.
Agenda

• Norway and NATO
  – Geopolitics
• F-35 Program Norway - Status
• F-35 capabilities
  – Performance
  – Sensors
  – Stealth
  – Communications
  – The office
  – 5th gen operations
Norway and geopolitics

• Geopolitical position
• History
  – Pre WW II:
    • Neutral in peace
    • Alliance (UK) in war
  – Post WW II:
    • Alliance - NATO/USA
    • UN
  – Pre - / Post 1960
Norway and NATO

• Why NATO is important?
  – Small country – Big neighbor
  – Relatively small military force
  – The security provider!
  – NATO Strategy
    • GWOT
    • Local surroundings

• Future challenges – Arctic changes
  – Polar Ice melting
  – Marine Resources
  – Minerals
  – Petroleum
  – Transpolar transport routes
F-35 Lightning II

F-35 Program Norway
F-35 Program Norway

• Future Combat Aircraft Program
  – Started 1999
• Joint Strike Fighter Program – Partner 2001
• Conceptual solution
  – Rafale, Eurofighter, Gripen, F-35
• Selection process 2008
  – Eurofighter, Gripen, F-35
• F-35 Acquisition
  – 48 + 4
  – 10 already approved by the Government
  – Delivery: 2015 – 2024
  – IOC - 2019
Level of ambition

- The combat Aircraft shall be able to safeguard national interests and tasks in all aspects of conflict, including high-intensive war, as well as producing a squadron sized element according to NATO requirements.

- Multirole combat aircraft being able to operate in:
  - **Counter Air:**
    - Offensive Counter Air - OCA (SWP, ESC, SEAD)
    - Defensive Counter Air - DCA (CAP, INT)
  - **Anti-Surface:**
    - Air Interdict - AI
    - Close Air Support - CAS / Urban CAS
    - Destruction of Enemy Air Defenses - DEAD
    - Anti-Surface Warfare - ASUW
  - **Support missions:**
    - Air Policing
    - Armed Recce,
    - Electronic Warfare - EW (ESM, EA, SEAD)
    - Combat search and Rescue - CSAR
    - Battle Damage Assessment - BDA/BDI
    - Surveillance - (ISR)
  - **Strategic operations:**
    - Effects towards enemy Centers Of Gravity
The RNoAF needs:

- Multi-/swing-role combat aircraft
- Air-to-Air and Air-to-Surface roles.
- Interoperability
  - National
  - NATO
- Autonomous operations
- Flexibility
  - Future threats, tasks, intensity level
- Performance – equal or better than F-16
- War fighting capabilities above and beyond what the current F-16 may offer
- Cost-effective regarding maintenance, support and training
F-35 Lightning II

F-35 performance and capabilities
# F-35 vs F-16

<table>
<thead>
<tr>
<th></th>
<th>F-35A (CTOL) Config. 240A-4.7</th>
<th>F-16 A/B BI15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radar Signature</td>
<td>Stealth</td>
<td>4th gen</td>
</tr>
<tr>
<td>Height (ft)</td>
<td>14.2</td>
<td>15.6</td>
</tr>
<tr>
<td>Length (ft)</td>
<td>51.4</td>
<td>49.7</td>
</tr>
<tr>
<td>Span (ft)</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>Wing Area (sq. ft)</td>
<td>460</td>
<td>300</td>
</tr>
<tr>
<td>Weight Empty (approx)</td>
<td>29,500 lb</td>
<td>17,500 lb</td>
</tr>
<tr>
<td>Internal Fuel (approx)</td>
<td>18,500 lb</td>
<td>7,200 lb</td>
</tr>
<tr>
<td>Weapons Payload</td>
<td>18,000 lb</td>
<td>10,500 lb approx *</td>
</tr>
<tr>
<td>Maximum Weight</td>
<td>70,000 lb class</td>
<td>35,000 lb class</td>
</tr>
<tr>
<td>Engine (one per A/C)</td>
<td>F135-PW-F100</td>
<td>F100-PW-220E</td>
</tr>
<tr>
<td>Engine Thrust (Mil/Max)*</td>
<td>24,000 lb / 40,000 lb</td>
<td>- / 24,000 lb</td>
</tr>
<tr>
<td>Speed</td>
<td>Mach 1.6</td>
<td>Mach 2.05 *</td>
</tr>
<tr>
<td>Mission Radius (KPP)</td>
<td>590 nm (USAF profile)</td>
<td>450 nm (USAF profile)</td>
</tr>
</tbody>
</table>

**Representative Stores Carriage**
- **CTOL**: 4 Internal Hardpoints, 7 External Hardpoints
- **STOVL**: Internal and External Weapons Carriage
- **CV**: 10

**Abbreviations**
- **CTOL** = Conventional Takeoff and Landing
- **STOVL** = Short Takeoff/Vertical Landing
- **CV** = Carrier Variant
Combat -/Surveillance Radius

728 nm – surveillance radius
590 nm – Combat radius
Target Detection, Track, Classification and Identification

F-35 is Autonomous, Long Range and All Weather-Capable
APG-81 Advanced Electronically Scanned Array Radar

Near Precision Adverse Weather Self-Targeting Capability With Enhanced with ATC for Target Recognition
Legacy AC SAR Maps

Legacy Resolution
Low Resolution SAR Maps

Low Resolution
Medium Resolution SAR Maps
High Resolution SAR Maps

High Resolution
SAR Maps

Legacy Resolution

JSF APG-81 Resolution
Precise Alignment of GMTI Targets on SAR Map

- Moving Targets
- Bridge
- Boats

GMTI Superimposed on SAR Map for Target Context
APG-81 Provides Increased Search Volume and Track Accuracy in Air-to-Air

Enhanced Search Range and Performance Advantage over Legacy
Electronic Support Measure (ESM)

ESM Capabilities Support Enhanced Passive SA, and Suppression & Destruction of Enemy Air Defenses Capabilities
Electro Optical Targeting System Operational Capabilities

- Internally Mounted
- Long Range, High Resolution
- NAVFLIR, Targeting FLIR, IRST Functions
- Digital Continuous Zoom

The Advanced EOTS Provides Passive Multi-Spectral A/A and A/G Capabilities As Well as Enhanced A/G Target ID Capability
Distributed Aperture System (DAS)

DAS Sensors

DAS Sensor

DAS Window Panel

IRCM

RFCM

SAIRST

Spherical Coverage

Missile Warning

NavFLIR on HMD

STOVL Auto Land & Pilot Landing Aid

SAM Launch Point Report

BDI - Explosion Detection

DAS Sensors

DAS Sensor
Advanced Stealth Must Be Designed-In

Internal Fuel Tanks
Fixed Array Radar
Engine Inlets
Full Line-of-Sight Blockage
Aligned Edges
Embedded Antennas
Reduced Signature Nozzles
Internal Stores Carriage

Curved Diverterless Inlets, “Buried” Engine
Reduced Signature Nozzle
Composite Structure
Radar Absorbing Material (RAM)
Large Capacity Internal Fuel Tanks
Embedded Antennas
Weapons Carried Internally
Aircraft Shaping and Edge Alignment

Low Observable Seams, RAM Seals
Low-Emission Radar and Avionics

Fundamental 5TH Design Features Can Not Be Retrofitted
Ready for combat

All internal!

- Air-to-Air missiles
- Additional fuel
- Targeting pod
- Jammer
- Additional fuel
- Precition guided munitions
- Air-to-Air missiles
General – IR Technology

- Low Observable Asymmetric Nozzle (LOAN)
  - geometrical shaping
  - an advanced cooling system
  - special coatings on internal and external structures.

- Results
  - Reduced IR signature
  - Increased life of the nozzle divergent flaps
  - significant maintenance cost savings.
General - Reduced IR signature

- No afterburner
- Longer exhaust pipe - even out exhaust and reduce “hot spot”
- Masking by aircraft structure
- Mixing the exhaust with cold air before it exits the aircraft.
  - From fan section
  - Ambient cooling air
F-35 Communication

**Voice Comms**
- Line of Sight VHF/UHF
  - 30-400 MHz AM/FM
  - Clear/Secure Voice
- HAVEQUICK
- SINCGARS

**Link-16**
- VMF
- MADL
- Voice

**C2ISR Platforms (Link 16)**
- EW Platforms
- MADL
- VMF

**Digital Aided CAS**
Variable Message Format (VMF)
- Position Reporting
- CAS Mission Execution [Striker]
  - Check-In / On-Station
  - Target Designation
- CAS Mission Control [FAC(A)]
  - CAS Request
  - 9-Line / Targets
  - Terminal Control
- Mission Effectiveness Reporting
- Still Imagery
- Free Text

**Air-to-Air & Air-to-Surface**
Link-16
- Position & Status Reporting
- Mission Assignments
- Air / Surface / Land Tracks
- Air / Surface Target Reports
- Engagement Status
- Threat Warning / EW Info
- Still Imagery
- Free text
- Voice

**Not an all inclusive list of Link 16 and VMF OPFACs**
- JTAC – Joint Terminal Attack Controller
- MADL - Multifunction Advanced Data Link

**Platforms**
- C2/CAOC
- E-2
- Aegis
- CVN
- LHD
- F-22
- F-15
- F/A-18
- F-16
- F/A-18
- A-10
- Rotary Wing
- Patriot

**Ground Forces**
- JTAC

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Integrated and Fused Mission Systems

Full Spherical Coverage by Distributed Aperture System (DAS)

Electro-Optical Targeting System

Active Electronically Scanned Array (AESA)

Radar Provides Near Perfect Situational Awareness

Data Links
Helmet-Mounted Display

Presents Critical Flight and Mission Systems Information in the Pilot’s Field-of-View

Throttle and Side Stick

Provides Pilot-Configurable Head-Down Display with Mission and Subsystem Specific Information

Mark 16 Seat (Martin Baker)

Allows Pilot To “Fly and Fight,” Controlling Critical Avionics and Weapons Functions Without Having To Remove His Hands

Panoramic Cockpit Display

The office
Operations with 5th Gen fighters

3rd + 4th gen systems
- High threat level
- Dependent on support
  - Standoff Jammers
  - SEAD
  - Decoys
  - Counter Air
  - Etc

5th Gen - Stealth (LO)
- Able to avoid or take out potential threats
- Direct attack is possible
- Alone or in coordination with others

Short Range SAM/AAA
SAM Range
Airborne Interceptor
Multi-role combat aircraft for Norway

5th gen capabilities

- VLO Stealth
- F-16/F-18-like performance
- Integrated sensors – sensor fusion
- Network based operations
- Advanced logistics

Air to Air

Air to Surface

Electronic warfare

Future NTISR capabilities

Situational awareness and VLO Stealth = Operational flexibility
The Revolution Begins