

Fighters In The Long War



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Summary



- Why we have fighters
- Why UAVs are not the answer
- What fighters do
 - Classic and new missions
- How fighters do it
 - Aircraft characteristics
 - Weapons and equipment
- Stealth – an element of survivability
 - The three kinds of stealth
 - The price of LO
- Fighters as electronic platforms

The case for fighters

- What can...
 - Get anywhere in a 600 mile circle inside an hour?
 - Whether or not the locals are cooperating...
 - ID the good guys and the bad guys?
 - Place ordnance within 5-10 metres of the latter?



Not this...



...or this



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The case for fighters



- What can cover 600 miles, then
 - Launch a missile that will defeat the toughest air defenses
 - and fly through the President's window?
 - It's not one of these...
- And do self-escorted ISR?
 - Not one of these...



The case for fighters



- What are the longest-serving weapon systems?



Nancy Reagan christens USS Ticonderoga, 5/81



Aegis cruisers, decommissioned after 18 years in service



5,000-hour RNI AF F-16 – will serve until 2020

Why do aircraft last 30-plus years?

- Upgradable
- Technology insertion through electronics
- Technology insertion through weapons
- Mobile – don't have to be deployed/moving at all times

“No more manned fighters after JSF”



- Now a respectable meme
- Yes, UCAVs are here
 - Armed reconnaissance
 - Operational with Hellfire and LGB
 - Tested with AAMs (not successful)
- But permissive environment only
- Fast-jet, survivable UCAVs
 - Major programs under way
 - USN, Europe, UK, Russia
 - Offer advantages in range/payload
 - But only because they are subsonic
 - Can't do air to air
 - Can't do CAS
 - Persistent deep strike
 - Comparable to a subsonic attack aircraft



What fighters do...

- Classic fighter missions
 - Air combat
 - Homeland air defense
 - Deployed air defense
 - Counter-air & escort (air offense)
 - Air-to-surface
 - Strike and interdiction
 - Close air support
 - SEAD
 - Maritime strike
- Emerging missions
 - Air-to-ground
 - Non-traditional ISR
 - FAC-A, armed reconnaissance
 - DEAD



..and how they do it



- Characteristics

- Mobile
 - Rapidly deployable with support
 - Reach extended with COTS tankers
- Survivable
 - Self escort or mutual escort
 - Limited need for air defense cover
- Durable
 - Upgradeable
 - Modular structure
 - Many in-service fighters are 25-plus years old
 - Long-term investment



What kind of fighter?

- Survivable
 - Able to complete its mission in the face of likely threats
 - Able to survive even in adverse situations
- Affordable
 - Losing a fighter must not be losing a national asset
 - Smaller nations still want more than 20 jets
 - Enough airplanes to deploy and sustain at the same time
 - Affordable alongside airlift, tankers, AEW
 - Reasonable share of national defense resources
 - Acquisition, operational and sustainment/upgrades



What kind of fighter?



- An aircraft that can't be afforded is not effective
- Versatile
 - Adaptable *across missions*
 - Adaptable *through life*
- Versatility is the key to:
 - Long-term operational relevance
 - Long-term production, hence
 - Long-term development and support



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Air vehicle requirements



- Speed and agility
 - Driven by threat and survivability
 - Engagement control is the classic value
- Range
 - Expected theatre of operations
 - Deployment
 - Size/cost trade versus tanker requirements
- Payload
 - Weapon and equipment characteristics
 - Target sets and missions, e.g.
 - Persistent CAS (many small weapons)
 - Swing-role (AA, AG weapons in same loadout)
- Survivability
 - Because if it can't survive unescorted it is not a fighter



Survivability



- Elements of survivability have not changed
 - Speed, altitude, agility
 - Driven by air combat requirements
 - Agility close to pilot limits
 - Increasing sustained speed and height is expensive
 - Vulnerability
 - May be close to practical limit
 - Self-defense
 - Inherent quality of fighter versus attack aircraft
 - Situational awareness and weapons
 - Stand-off weapons
 - Valid for part of target set
 - RoE dependent
 - Prevent/delay detection, tracking or targeting
 - Electronic jamming
 - Reduce detectability
- Stealth or low observables (LO) is way to reduce detectability

Orthodox view of LO



- Traditional view
 - LO or not LO
 - LO has first shot, first kill
 - LO survives air threats
 - Non-LO cannot win
 - Non-LO is easily targeted
- This view is simplistic

JSF **Stealth Increases Survivability and Lethality**

Survivable Theater Access . . . *. . . With Increased Lethality*

4th Gen Fighter Can't Penetrate Air Defense

5th Gen Fighter Reduces Effectiveness of Air Defense

Stealth Gives 5th Fighter the Edge

4th Gen

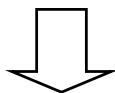
5th Gen

The graphic illustrates the advantages of stealth technology. It features a blue header with the JSF logo and the title 'Stealth Increases Survivability and Lethality'. Below the header, two green hexagonal areas represent theater access. The left area, labeled 'Survivable Theater Access . . .', shows a 4th Gen fighter (represented by a grey silhouette) attempting to penetrate a dense field of yellow circles representing air defenses. A red box below it states '4th Gen Fighter Can't Penetrate Air Defense'. The right area, labeled '. . . With Increased Lethality', shows a 5th Gen fighter (represented by a grey silhouette) penetrating the same field of air defenses. A blue box below it states '5th Gen Fighter Reduces Effectiveness of Air Defense'. To the right, a diagram compares the detection ranges of 4th and 5th Gen fighters. The 4th Gen fighter's detection range is shown as a wide yellow cone, while the 5th Gen fighter's detection range is shown as a much narrower blue cone. A blue box below this diagram states 'Stealth Gives 5th Fighter the Edge'. The background of the graphic is a large, semi-transparent image of a JSF fighter jet in flight.

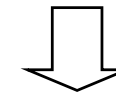
There are *three* kinds of LO



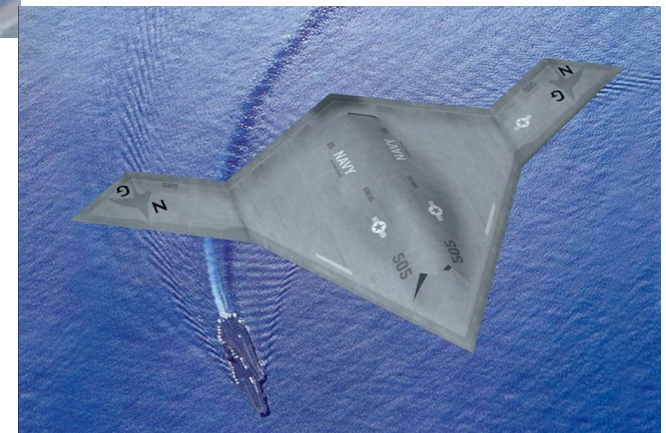
- Reduced RCS
 - Narrowband
 - Limited aspect
 - Synergistic with active jamming



- VLO
 - All RF bands
 - All aspect
 - Managed IR
 - Managed visual



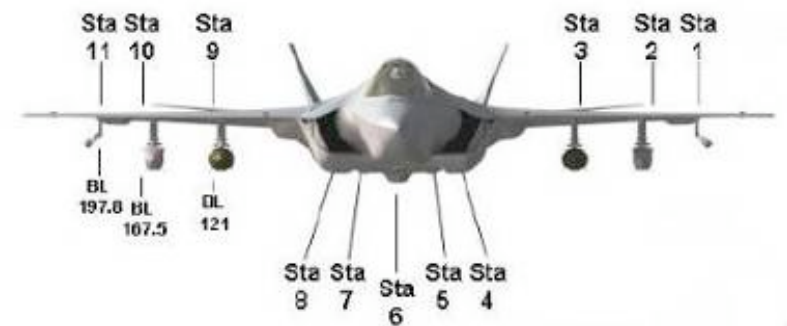
- LO
 - Wider bands
 - “Bow tie”
 - Lateral RCS peaks
 - No active jamming
 - Some variance within this group



LO is not free - 1



- F-35A and Typhoon
 - Similar installed thrust
 - Similar normal fuel loads
 - F-35A has 2 tonnes greater OEW
 - Typhoon has 17 per cent larger wing
 - Effective difference greater due to configuration
 - F-35A has no carriage flexibility in LO mode
 - Four stations in LO mode
 - Maximum of two offensive weapons (except SDB)
 - F-35A has less carriage flex in non-LO mode
 - No combat tanks in basic SDD
 - No one- or three-tank configurations
 - Only four heavy stations if more than two AMRAAMs carried



LO is not free - 2

- External fuel and loads are not all bad
 - Internal fuel volume adds cross-section (drag) and weight
 - External tanks not stressed for full envelope and 8000 h
 - Internal weapons not 100 per cent efficient
 - Bay volume much greater than weapon volume
 - External fuel is like staging in a rocket
- Other LO weight costs
 - Weight of RAM and RAS is still significant
 - Antennas/apertures large and heavy
- LO is largely fixed
 - Shape determines much of RCS
 - Upgrade would be major exercise
- Connectivity is a real issue
 - F-22-to-F-35 issue only just resolved



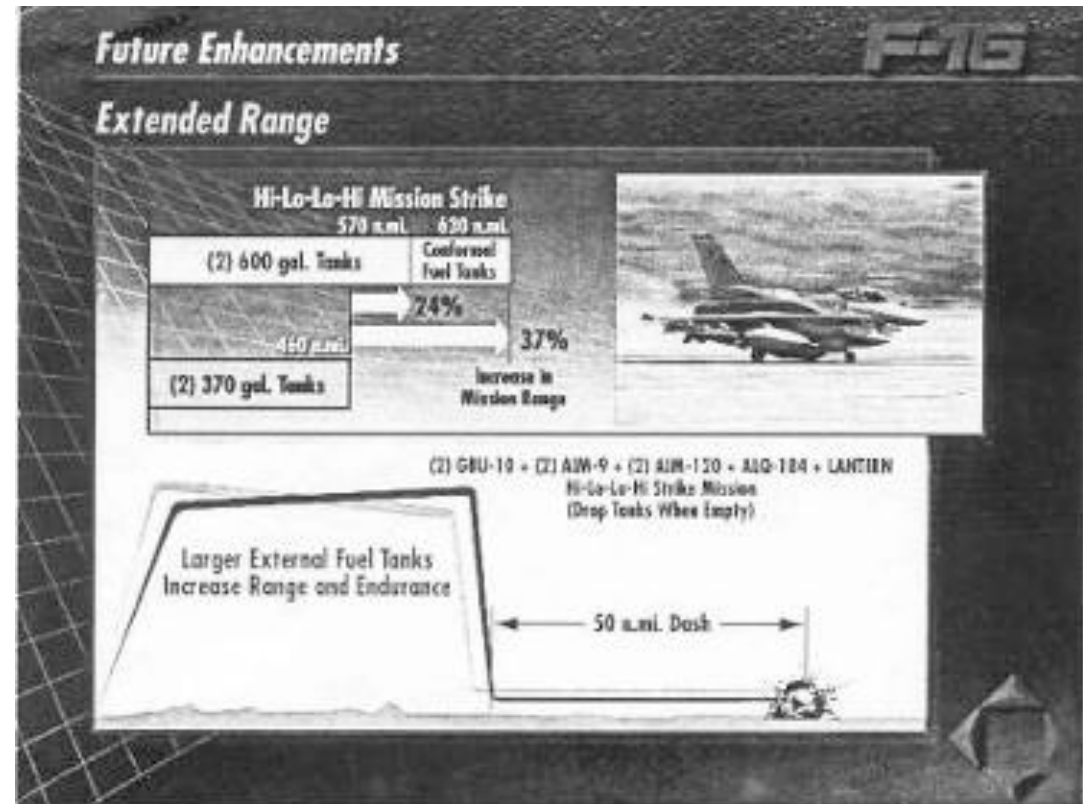
LO is not free - 3



- 1.5 X F-16 payload?

F-35A KPPs

- 600 nm hi-lo-hi
- 2 x 2000 lb JDAM
- 2 x AIM-120
- No SRAAMs
- External fuel is ferry-only
- Actual: 670 nm all-hi-alt





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Counter-LO

- No “stealth-killer” invented yet
- But many potential solutions
 - New radar
 - Track before detect, AESA, bistatic
 - Old radar
 - VHF, OTH-metric
 - Different RF systems
 - Passive location, passive bistatic
 - Combined & networked systems
 - VHF or OTH show AESA where to look
 - New systems
 - Better IR, active IR
- Take advantage of operational realities
 - Glints from weapon bay opening
 - How does an LO fighter transmit to the net?
 - HUMINT reports take-off
 - F-35 will have unique acoustic signature
- Likely that threat will improve faster than F-35 can be upgraded



Fighter lethality

- New attributes
 - Information platform
 - Targeting pods & AESA
 - Onboard data storage and datalinks
 - Weapon platform
 - Increasing diversity of weapons
 - From long-range standoff to ultra-precise, low-yield
 - AAM load-out - Multi-shot tactics are real



When the F-16 entered service...



This was the latest way to listen to disco



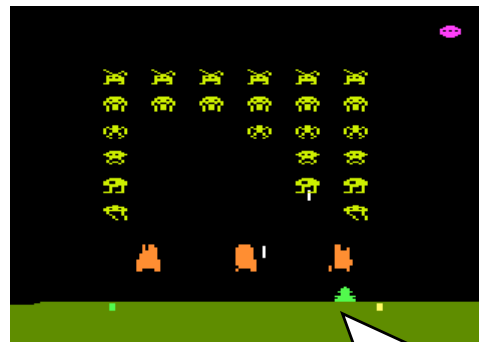
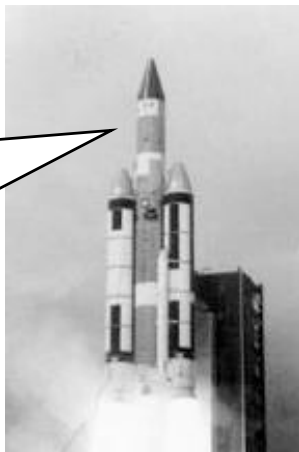
This was a cutting-edge accessory



This was very cool if you knew what it was for



There was a digital camera in **here**. But it was classified



Today's generals, vice-presidents and senior government officials were developing their combat skills with **this**



And **this** was a couple of years away...

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Targeting pods



- Instant precision bomber
 - New generation pods
 - Better IR range
 - ID quality
 - Better laser range
 - Designation and geolocation
 - Compatible with helmets
 - Available with datalinks
- Vital element of CAS
 - Receive/transmit imagery
 - Cue on to illuminated targets
 - Transmit imagery of target to JTAC
 - Confirm that you are looking at same target
- If you don't do CAS in 2009, you are a paperweight
- Easily extrapolated into a recce sensor



AESA



- A super radar
 - Air tracks
 - Interleaved modes
 - High performance
- But more than that
 - Jammer
 - ESM
 - Communications
- Price in process of crashing



Digital EW & Information



- Massive improvement in EW
 - Wideband
 - Weapons-grade accuracy
 - Target ID
 - Specific Emitter ID will come
 - Jamming and active cancellation
 - SEAD/DEAD
- Displays
 - Sensor fusion a reality
 - Crew can absorb more information
 - Long-range situational awareness
- Recording
 - Record video, select frame, transmit
 - Far less bandwidth than UAV



“The American navy is now so worried about Sorbstiya jamming their new APG-79 radar that they are introducing a new infrared tracker on the F/A-18E/F.”

Col. Grigory Medved, on AusAirpower

Return of the two-seater?



- The fighter cockpit can be an information hub
- Different philosophies
 - F-22, F-35 – no two-seater
 - Relatively expensive to do
 - F-22: primarily air-to-air, no EO or IR
 - F-35: reliance on very advanced displays
 - MiG-35
 - Two-seater standard; common forward fuselage
 - Rafale
 - French AF decided on majority two-seater force in 1990s
 - Super Hornet
 - Most Block 2s are two-seaters, including all RAAF jets
 - Typhoon, Gripen
 - Most two-seaters deployed as classic trainers
- How will this change as information flow increases?

Conclusions



- The fighter will survive
- Classic themes are still relevant
 - Air combat capability
 - Mobility and lethality
- Versatility is key
 - Effectiveness and usability across conflict spectrum
 - Longevity equals affordability
- Stealth is one element of survivability
- The fighter is a platform for many technologies