



ITEA System of Systems Engineering Workshop
Reducing Risk in 2020

T&E Range Options & Tools
January 29, 2015

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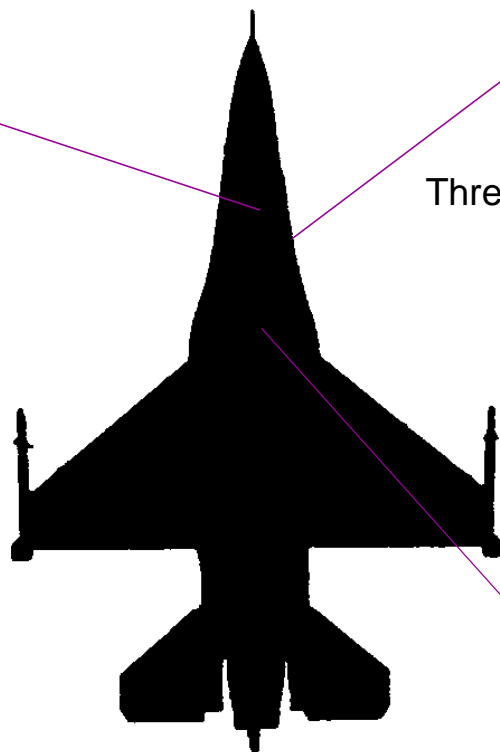


Cyber Attack Surfaces (c. 1980)

Notional 3rd Generation Aircraft

**NAVIGATION
& LANDING**
Pulsed-Doppler Radar
TACAN
Navigation PODS

**THREAT WARNING
& TARGETING**
Targeting System PODS
ECM PODS
Threat & Radar Warning Systems (RWR)



VOICE
UHF / VHF
Radios

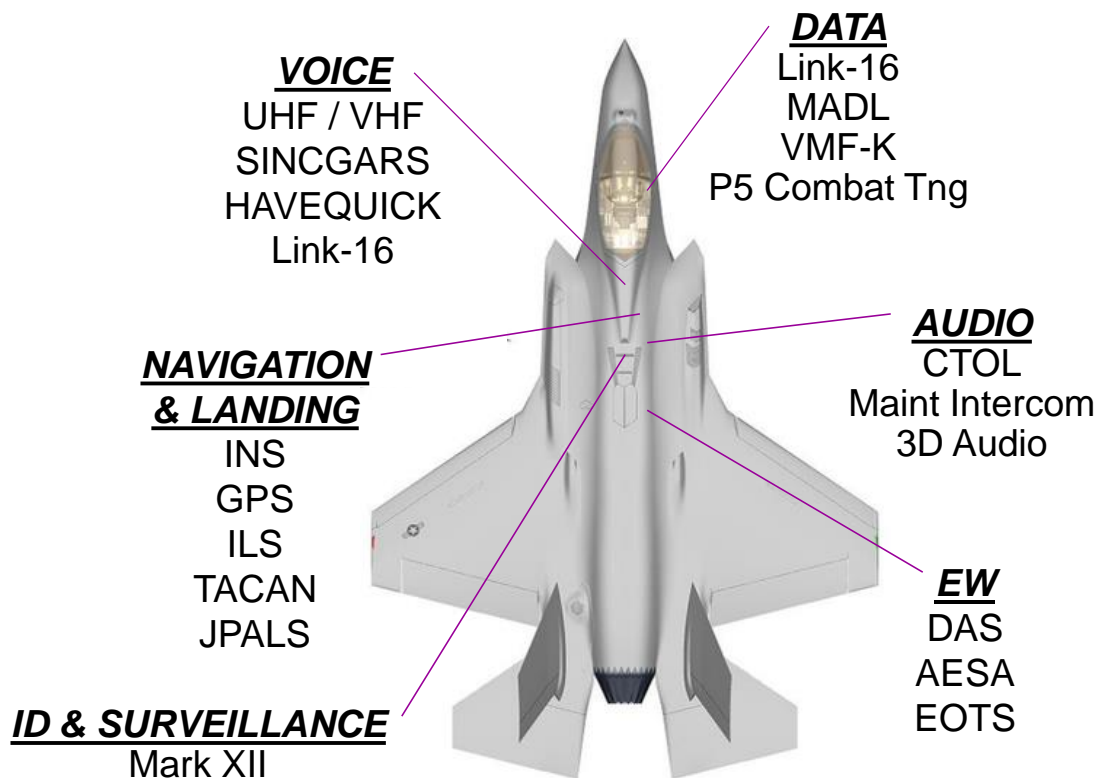
Attack Surface: A system's exposure to reachable and exploitable cyber vulnerabilities

Source: SANS Attack Surface Problem: <http://www.sans.edu/research/security-laboratory/article/did-attack-surface>



Cyber Attack Surfaces (c. 2015)

Notional 5th Generation Aircraft



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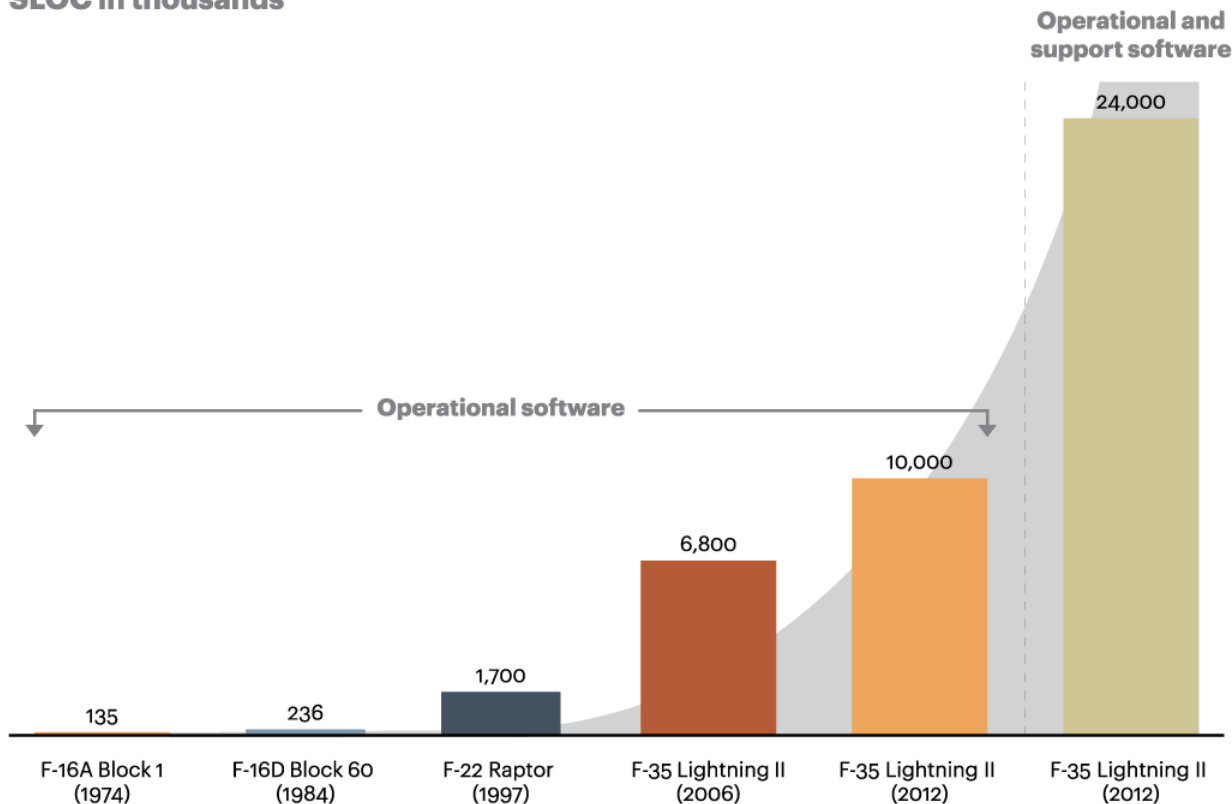


SLOC Increase in Avionics Software (1974-2012)



The number of source lines of code (SLOC) has exploded in avionics software

SLOC in thousands



Notes: SLOC for F-16 and F-22 are at first operational flight. F-35 SLOC figures are from first test flight and current estimates/sources.

Sources: P. Judas and L.E. Prokop, "A historical compilation of software metrics with applicability to NASA's Orion spacecraft flight software sizing," Innovations in Systems and Software Engineering, vol. 7 issue 3, September 2011. p. 161-170; Andrea Shalal-Esa, "Pentagon focused on resolving F-35 software issues," Reuters, March 2012; Robert N. Charette, "F-35 Program Continues to Struggle with Software," IEEE Spectrum, September 2012



Dr. Jeff McNeil



- **Professor, Clemson University College of Business and Behavioral Sciences**
- **US Marine Corps Reserve Colonel and career intelligence officer**
 - Currently Cyberspace Plans officer for US Pacific Command
 - Recent billets include Intelligence Plans and Operations Officer for Marine Forces Pacific and Central Commands, Joint Concept Development and Experimentation Deputy Director for International Engagement, US Strategic Command Assessment Officer
- **22 years serving across government, industry, and academia**
- **14 years as a Principal Investigator for Scientific Research Corporation in support of various T&E projects, to include Cyberspace Threat Analysis for the T&E Threat Resource Activity (TETRA)**
- **PhD in International Studies with a focus on International Conflict and Cooperation in Cyberspace**



Dr. Joseph W. Nichols



- **Technical Advisor for Flight Test and Evaluation, Air Force Test Center, Edwards Air Force Base, CA**
 - Senior technical advisor to the AFTC Commander regarding health and suitability of airframe, avionics, installed propulsion, and electronic warfare flight and supporting ground test capability across AFTC's test ranges and facilities valued at more than \$31 billion, including 116 aircraft and 164 ground test facilities
 - Establishes flight test and evaluation technical policy and procedures, and provides technical expertise and direction to the AFTC work force
 - Formulates testing approaches to assure scientific validity, effectiveness and efficiency in accomplishing ground and flight tests
 - Represents the center on the Air Force Materiel Command Engineering Council, the Executive Committee of the Range Commanders Council, and the Spectrum Stewardship Senior Steering Group.
- **Retired from the Air Force as a colonel, after 26 yrs**
- **PhD in Mechanical Engineering**



Mr. AJ Pathmanathan



- **Joint Mission Environment Test Capability (JMETC) Deputy PM for Engineering, Test Resource Management Center (TRMC)**
 - Responsible for all technical aspects of the JMETC distributed testing infrastructure as well as the JMETC Cyber T&E Support, Network Engineering, Information Assurance, and Event Support teams
 - While at TRMC, he has also served as the Technical Director for the National Cyber Range and as the Executing Agent for the T&E/S&T Program's Cyber Test Technology Area
- **Previously served at U.S. Army Redstone Test Center (RTC) as both Network Architect and Director of the High Performance Computing (HPC) Center**
- **BS in Electrical Engineering, Auburn University**



Mr. Scott M. Lewandowski



- **Chief Cyber Scientist, National Cyber Range**
- **President and Principal Engineer for The Wynstone Group, Inc.**
 - Boutique consulting firm providing specialized information dominance expertise to military, intelligence community, law enforcement, government, and commercial customers
 - Provides end-to-end test and evaluation support of offensive, defensive, and intelligence-related hardware and software systems, from initial test concept development through post-test results analysis and reporting
 - Has served as principal evaluator of many Title 10 and Title 50 systems; has provided testimony and guidance to senior-level policymakers in the Executive Office of the President; the Departments of State, Defense, and Treasury; and the US Congress
- **Previously Technical Staff in the Information Systems Technology Group at MIT Lincoln Laboratory**
- **ScM, Computer Science and AB, Computer Science & Business Econ. *magna cum laude*, Brown University**