



F-35 JSF Collaborative Software Development

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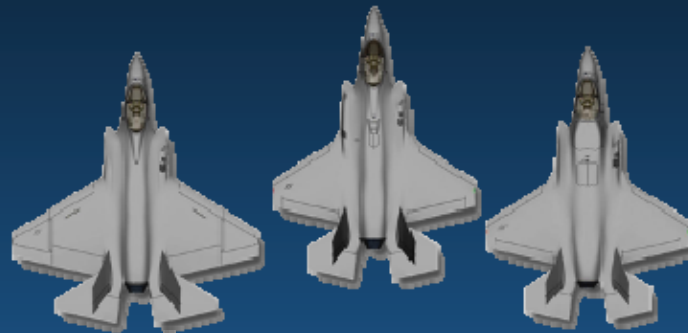
JSF – Many Programs in One



Interoperability



CTOL



P&W F135 GE/RR F136



3 Services



8 International Partners



2 Security Cooperation Participants



Global Sustainment

Domestic / International Suppliers



Autonomic Logistics



3 Flight Test Facilities



Training Facilities

Team JSF

LM Aero

NGC

BAES





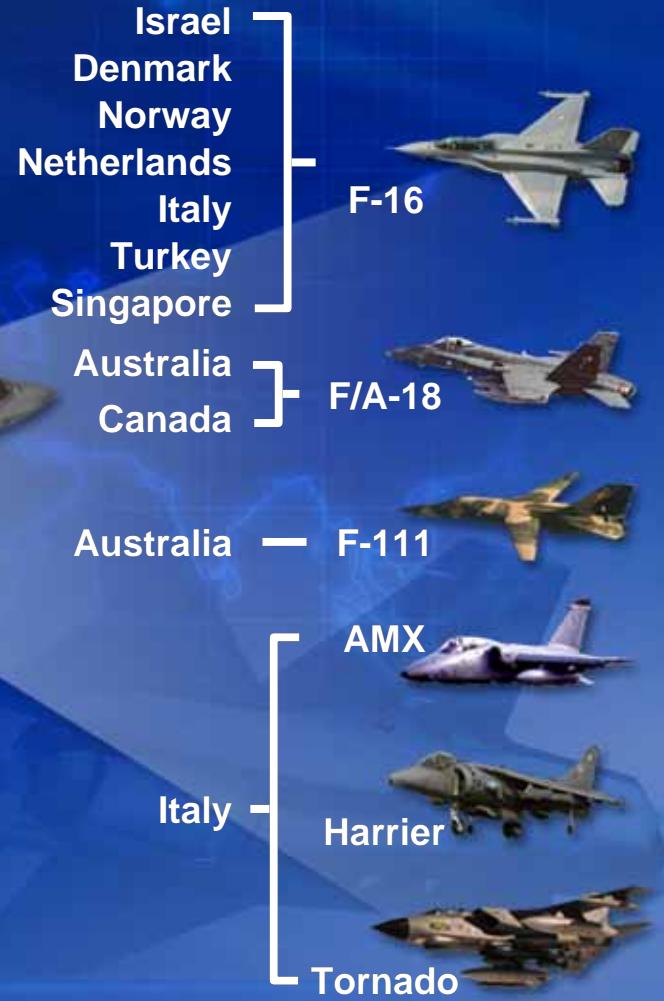
JSF Enables True Joint / Coalition Operations

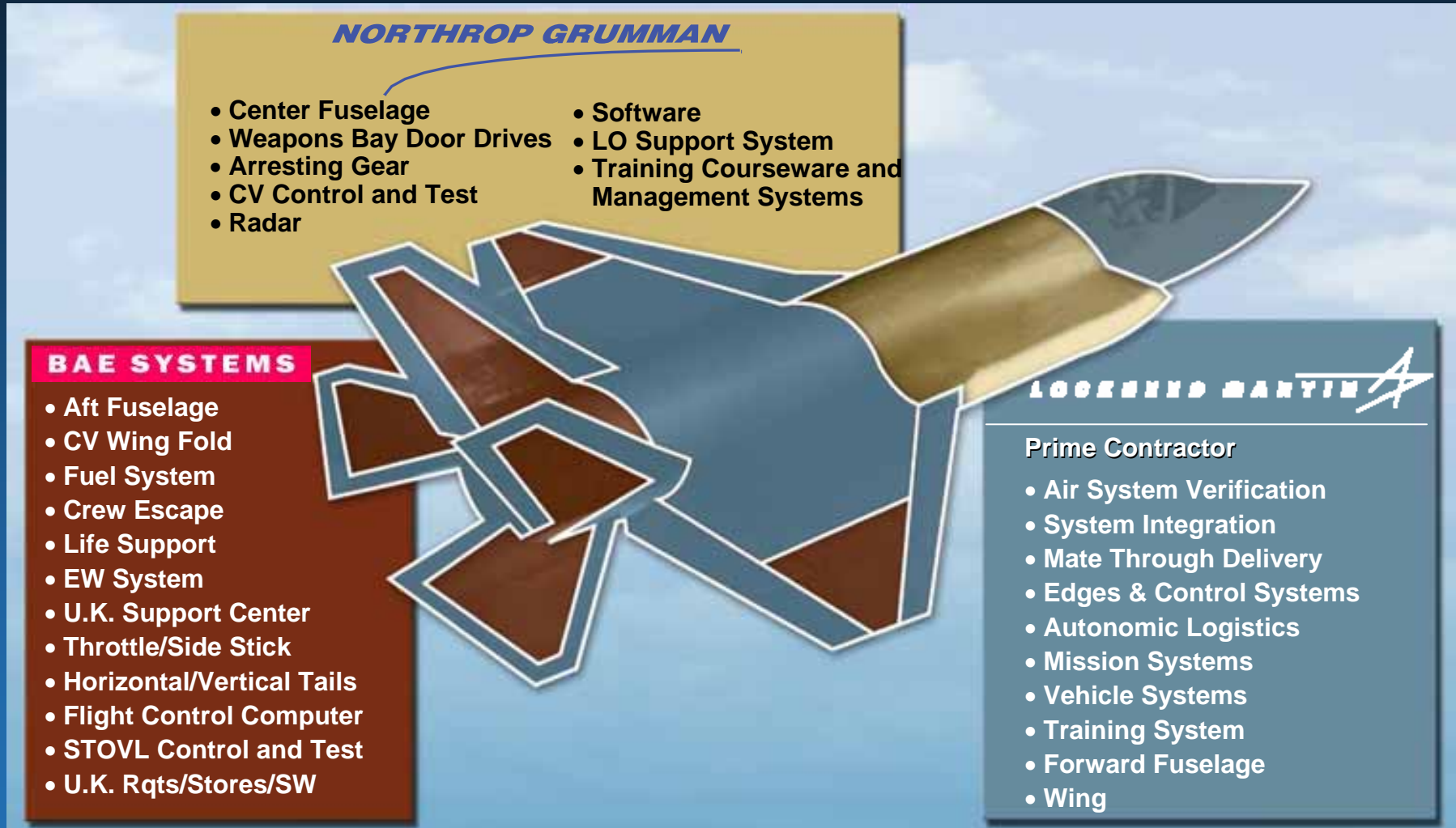


Domestic and UK

International

**F-35
Joint
Strike
Fighter**





A Highly Integrated Best Value Team



JSF Software Team

About the products . . .



- We build large, complex software systems
 - Long life spans
 - 19 MSLOC across multinational sites – over 60 on-aircraft computers
 - Safety and Mission Critical Software
 - COTS and legacy reuse



Application types

- On-aircraft
- Lab simulations
- User training
- Aircraft logistics



Multi-Service

- Common SW
- Vehicle-specific SW

Multi-National

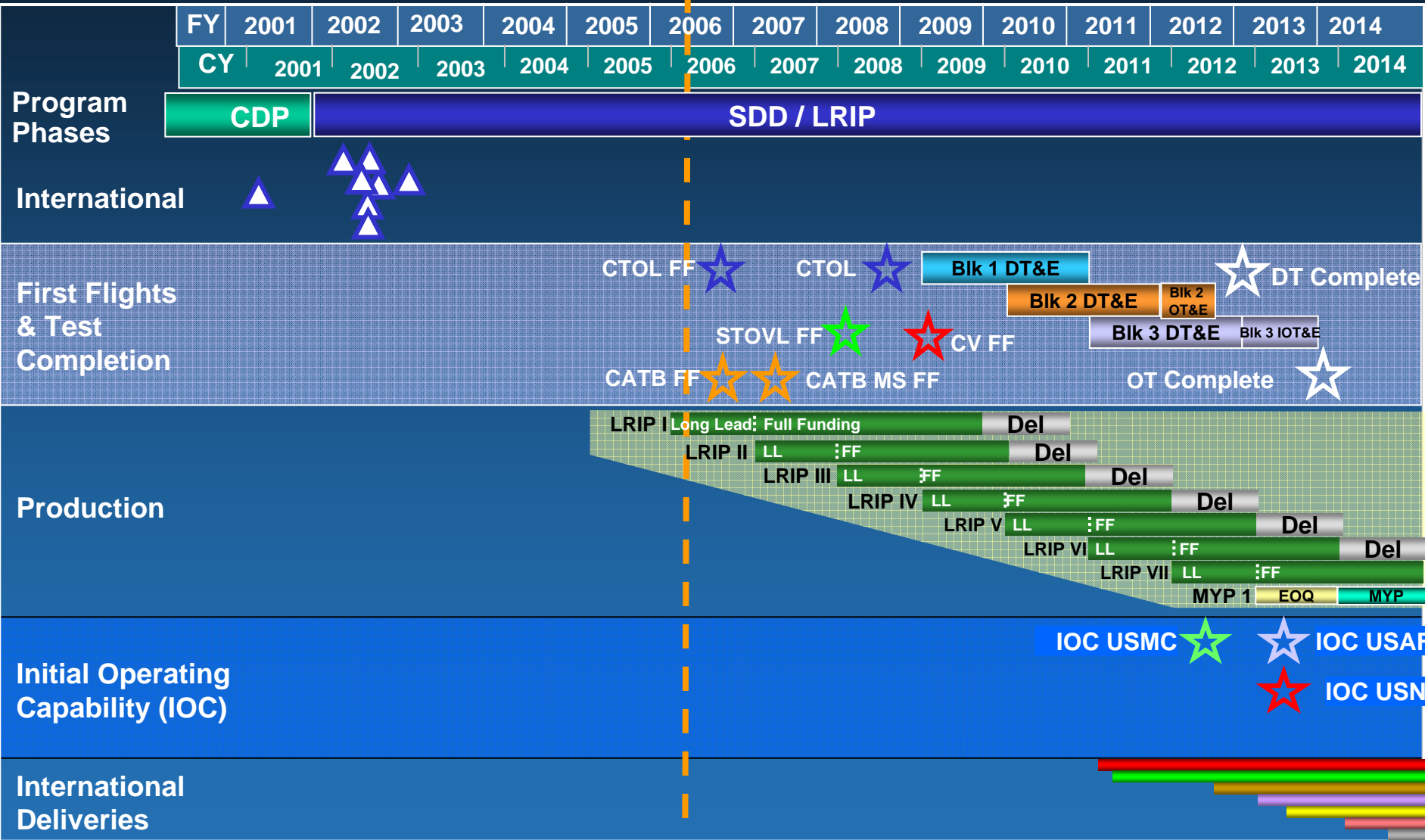
- Customer-specific SW



F-35 Schedule Through Initial Operations Capability (IOC)



Time Now

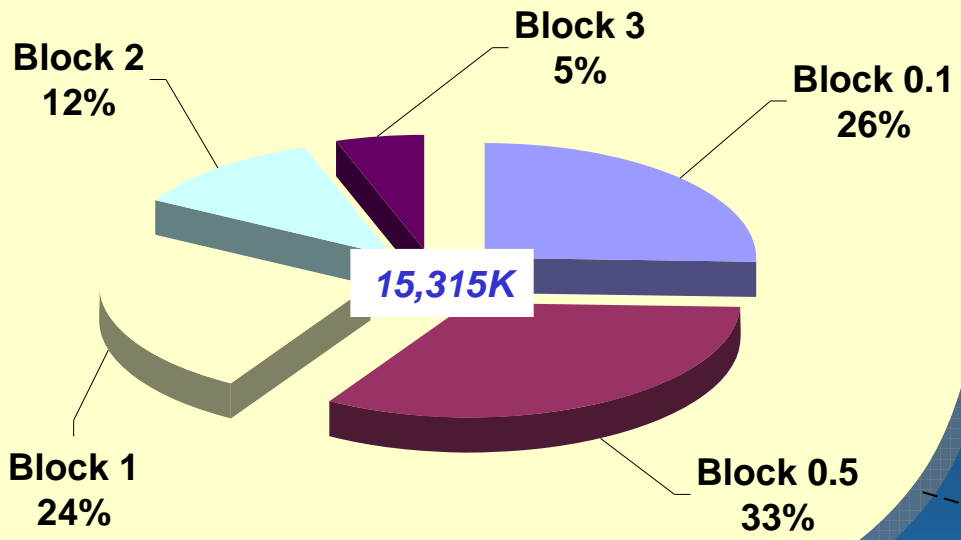




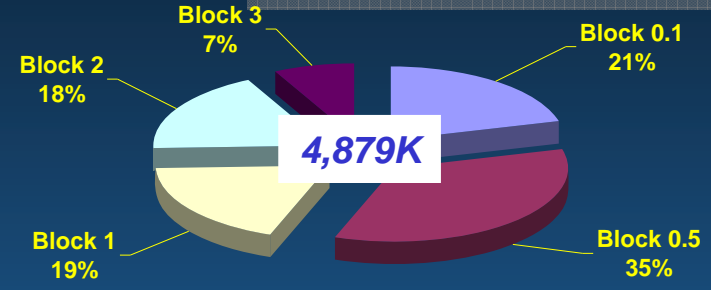
Deliveries Spread Over Blocks



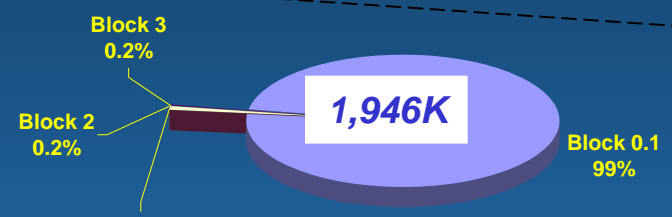
All Deliverable Software (by Block)



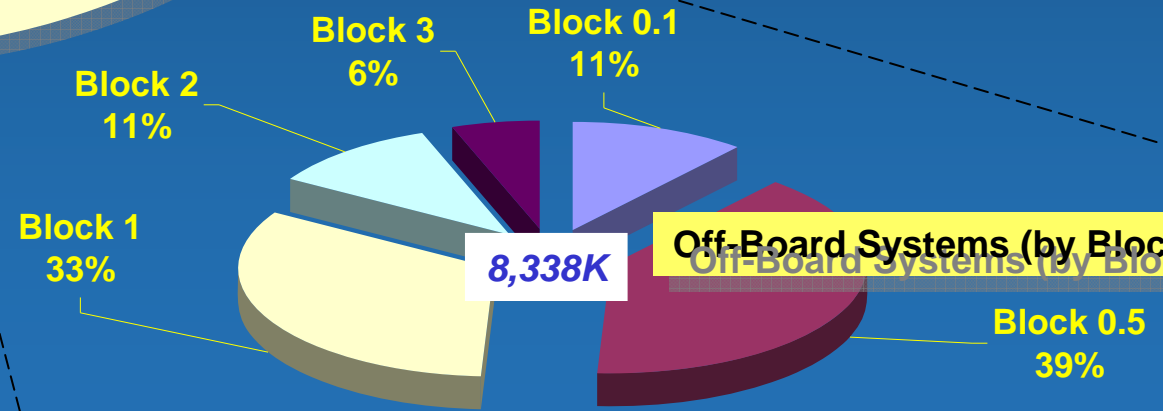
Mission Systems/WI (by Block)



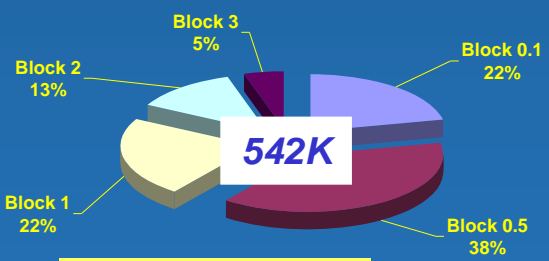
Vehicle Systems (by Block)



Off-Board Systems (by Block)



PHM (by Block)





- The JSF Software Development Organization is large and complex

- *Multi-Company & International*

- Partners & Suppliers
- The sun never sets on JSF software development

- *Collaborative software development*

- We have moved from an era of specialization to an era of collaboration
- We recognize the power of the JSF team

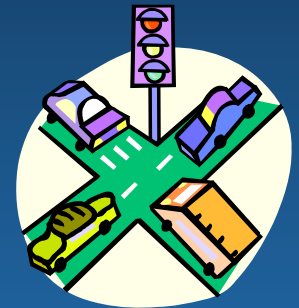


- *What is software collaboration to JSF?*

- An essential core set of tools and processes defined and refined
- Processes, plans, and requirements are defined, communicated, & controlled
- Detailed technical schedules are established and maintained
- Software quality goals are established, communicated, and actively managed
- These are to allow us to leverage off of each team's demonstrated strengths



- **Quantitative Software Metrics are tracked by each team (monthly)**
 - *Thresholds are used to indicate if actions need to be taken by the individual software team*
 - *Stoplights are rolled up and analyzed for lingering and/or systemic issues*
- **Provides an excellent method of identifying issues**
 - *Process definition & tool usage*
 - *Team training & performance*
- **Areas of improvement have been in re-work estimation and defect prediction**
- **Active area of focus is using defect prevention techniques to meet cost challenge targets**





- The JSF Software Team produces safety critical software that will be deployed world-wide
 - *US & International safety assurance is critical*
 - *The JSF approach - aircraft level hazards are explicitly linked to hardware and software components*
 - *Hazards allocated to*
 - Software products are closed through verification
 - Software processes are closed via evidence of compliance with process requirements
 - *The MathWorks has worked to ensure that generated C code is safety compliant*
- JSF software team recently published a C++ Safety Critical coding standard (with Bjarne Stroustrup)
 - *This is now public domain and being implemented by industry tools*





F-35 JSF Software

Our Common Strategic Direction . . .



- **Common process, tools, and requirements are defined with the specific intent of**
 - *Allowing each teammate to help us achieve success*



- **Our collaborative vision of the JSF software team extends to those developing our vital tools – specific goals include**
 - *Integration with UML & test coverage tools*
 - *Expansion into new domains and C++ code generation*
 - *Automated checking of compliance to standards*



F-35 JSF Software

In summary ...



- The JSF software team enterprise is a world-wide alignment of focused expertise
- The JSF software team is progressing the state of the industry through leading processes and infusion of critical tools
- JSF is committed to using the latest tools and techniques to develop its software products
- Collaborative Engineering is working to provide the best value for the JSF program
- JSF is positively motivating and influencing software quality

