



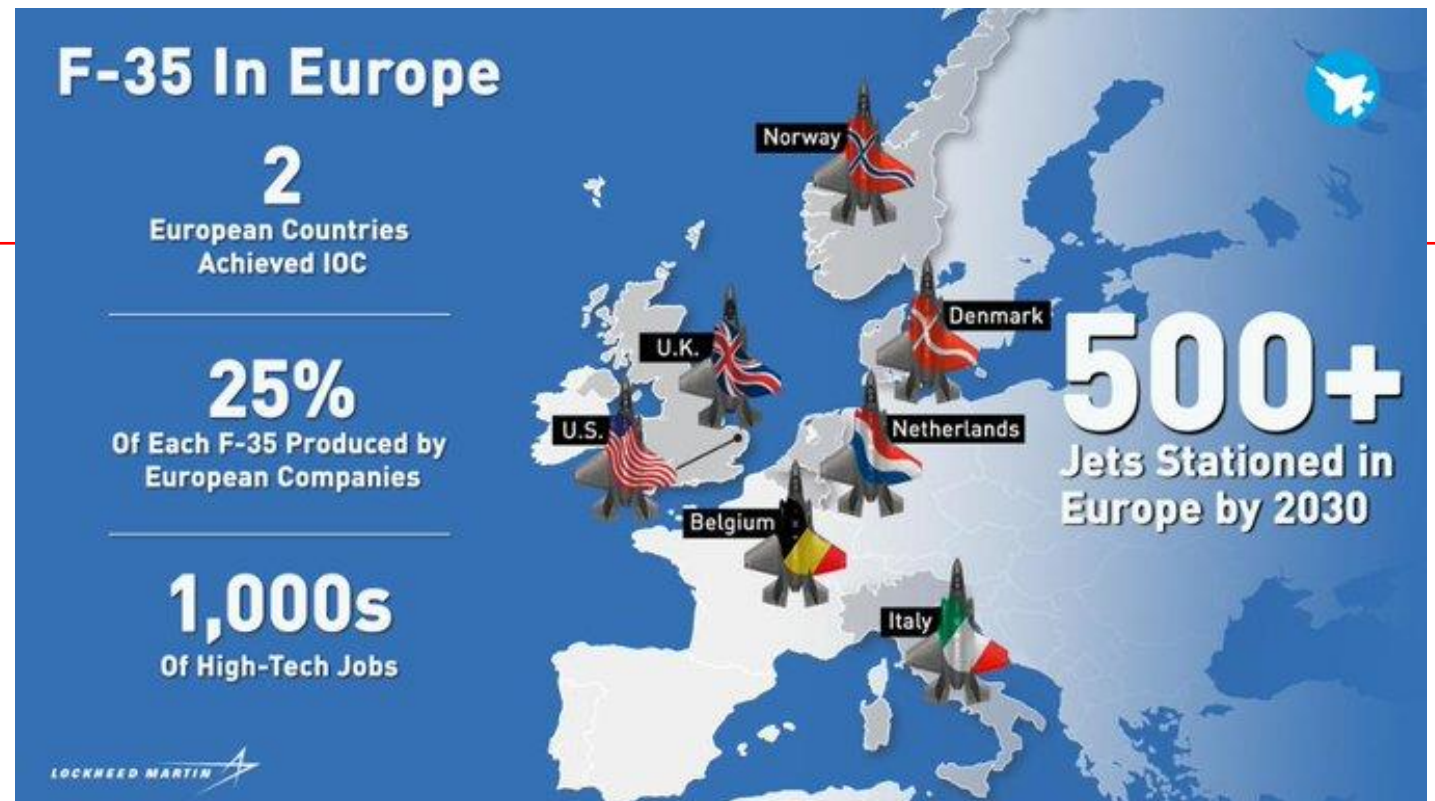
# *“What F-35 can teach us about global software delivery for impact”*

*Prof Kate Gill  
FRAES, FIET*



# F-35 Overview

- Working across 12 political systems, with over 990+ aircraft operational worldwide, the F35 is a 5th Generation military aircraft which delivers impact through data.
- Keeping all the software intensive systems flying, through obsolescence, repair, new technology and upgrade is a configuration and logistical challenge.
- In late 2019, the US F35 Joint Project Office embraced agile software delivery to reduce software cycle times from 18 months to 6 weeks.
- This presentation covers the story of that time



## Global Enterprise

Australia	Israel	United Kingdom
Belgium	Italy	United States
Canada	Japan	
Czech Republic	Netherlands	
Denmark	Norway	
Finland	Poland	
Germany	Republic of Korea	
Greece	Switzerland	



# F-35 LIGHTNING II

NORTHROP GRUMMAN | BAE SYSTEMS | PRATT & WHITNEY

LOCKHEED MARTIN

## Program at a Glance

The F-35 is the most advanced node in 21st Century Security using its advanced sensors and connectivity to ensure those we serve stay ahead of threats through integrated capabilities fit for the mission.



990+

Aircraft Delivered



842,000+

Flight Hours



44

Bases Worldwide



2,430+

Pilots

16,065+

Maintainers

### Fast Facts

Download a PDF of our latest stats updated every month.

Download

<https://www.f35.com/f35/about/fast-facts.html>

## Germany Program of Record



Program of Record

35



Aircraft Variant

F-35A

**2022:** Germany  
Letter of Offer and  
Acceptance for 32  
aircraft signed

**2023:** Breaking  
Ground for F-35  
Integrated Assembly  
Line in Germany



✈ Büchel Air Base

# Software Evolution (1971 onwards)

## 1971 - 2018

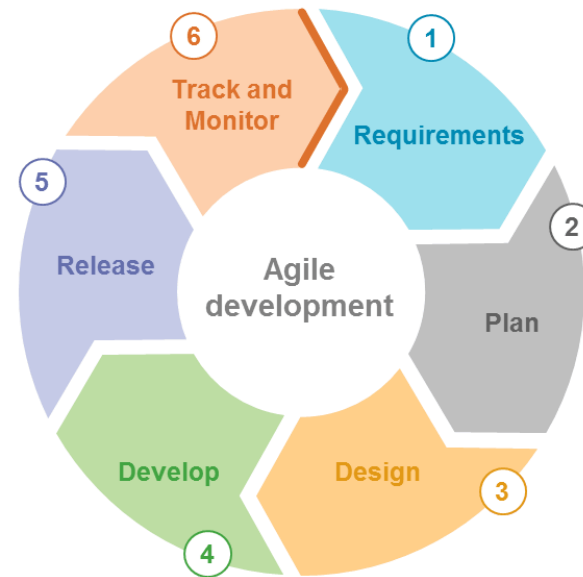
System Development and Demonstration (SDD) – waterfall software development

## Q1 2018 Onwards

At the end of SDD, the F35 project transitioned to model driven architecture (MBSE), product line engineering implemented to enable common trunk for all variants, automated systems build and agile prototypes. During this transition, the software delivery was also known as Continuous Capability Development and Delivery (C2D2) and then Block 4 delivery

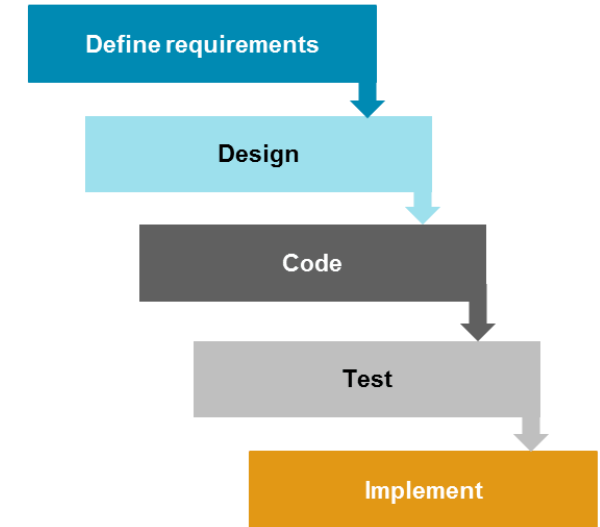
**C2D2 Vision= 2 fleet wide release per year available to all users, containing development and sustainment software for all configurations**

### Agile



- Continuous cycles
- Small, high-functioning, collaborative teams
- Flexible/continuous evolution
- Customer involvement

### Waterfall



- Sequential/linear stages
- Upfront planning and in-depth documentation
- Best for simple, unchanging projects
- Close project manager involvement

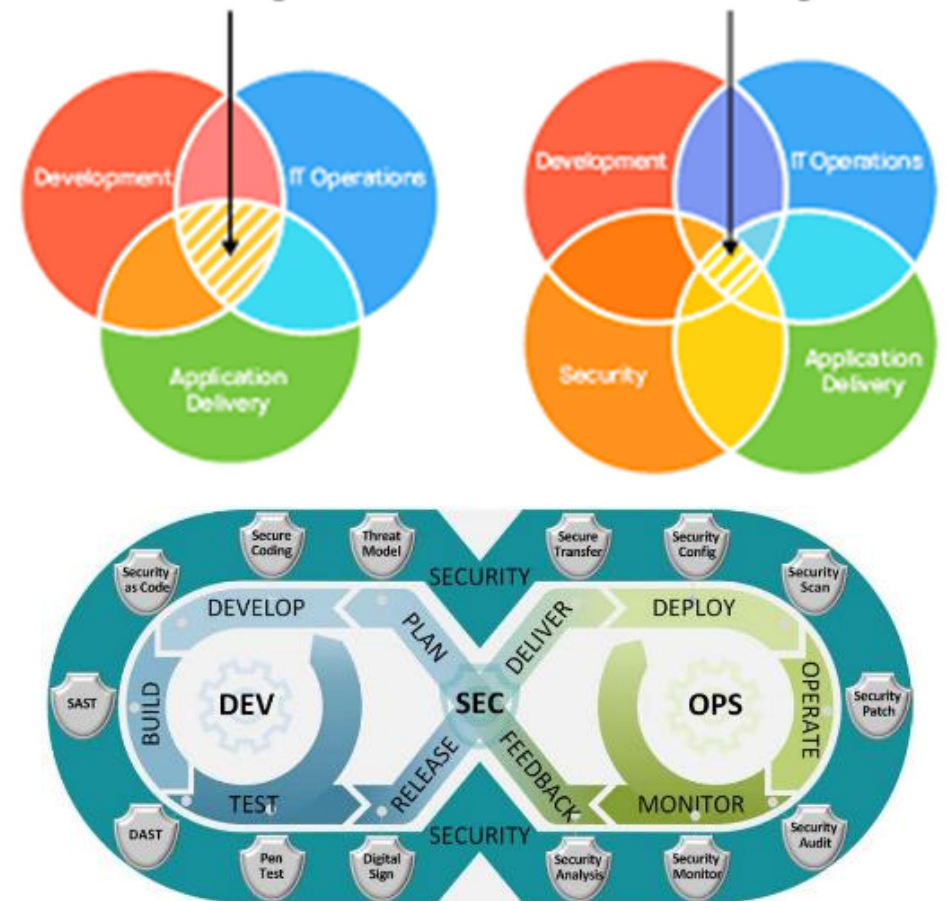


# DevOps and Agile

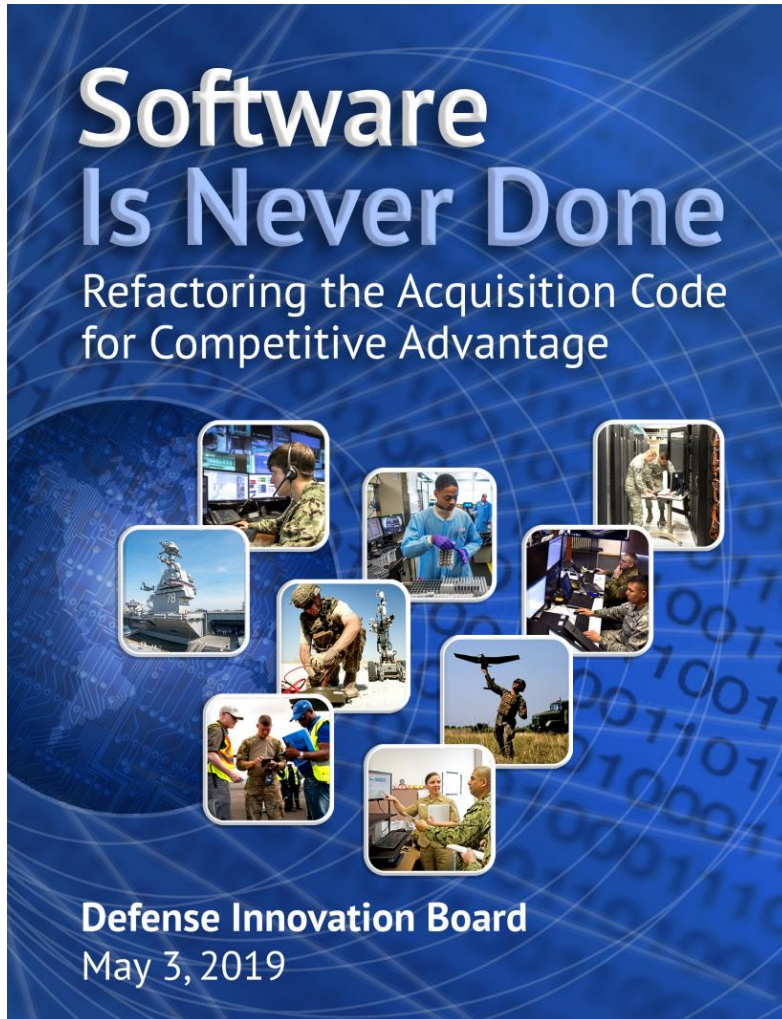
## Definitions

- DevOps is a set of practices that combines software development and IT operations. It aims to shorten the systems development life cycle and provide continuous delivery with high software quality.
- **DevOps is complementary with Agile software development; several DevOps aspects came from Agile methodology**
- In terms of software development, Agile improves the process of delivery; encouraging changes in the functions and practices of the Business and Development teams to better produce the project / product envisioned by the end-user, or customer.
- DevSecOps improves the lead time and frequency of delivery outcomes through enhanced engineering practices; promoting a more **cohesive collaboration between Development, Security, and Operations** teams as they work towards continuous integration and delivery.

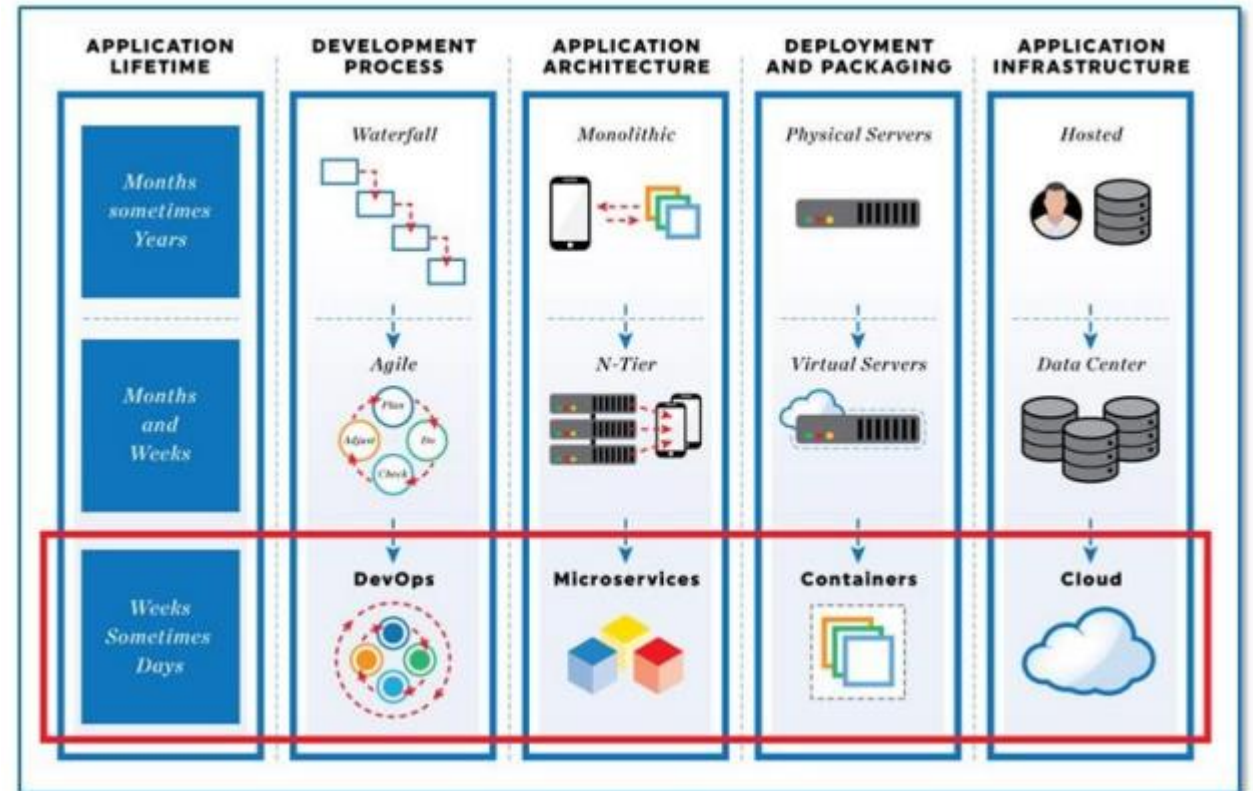
## DevOps VS DevSecOps



# The Layers of DevSecOps (2019)



DevSecOps is software automate tools, services and standards that enable programmes to develop, secure, deploy and operate applications in a secure, flexible and interoperable fashion

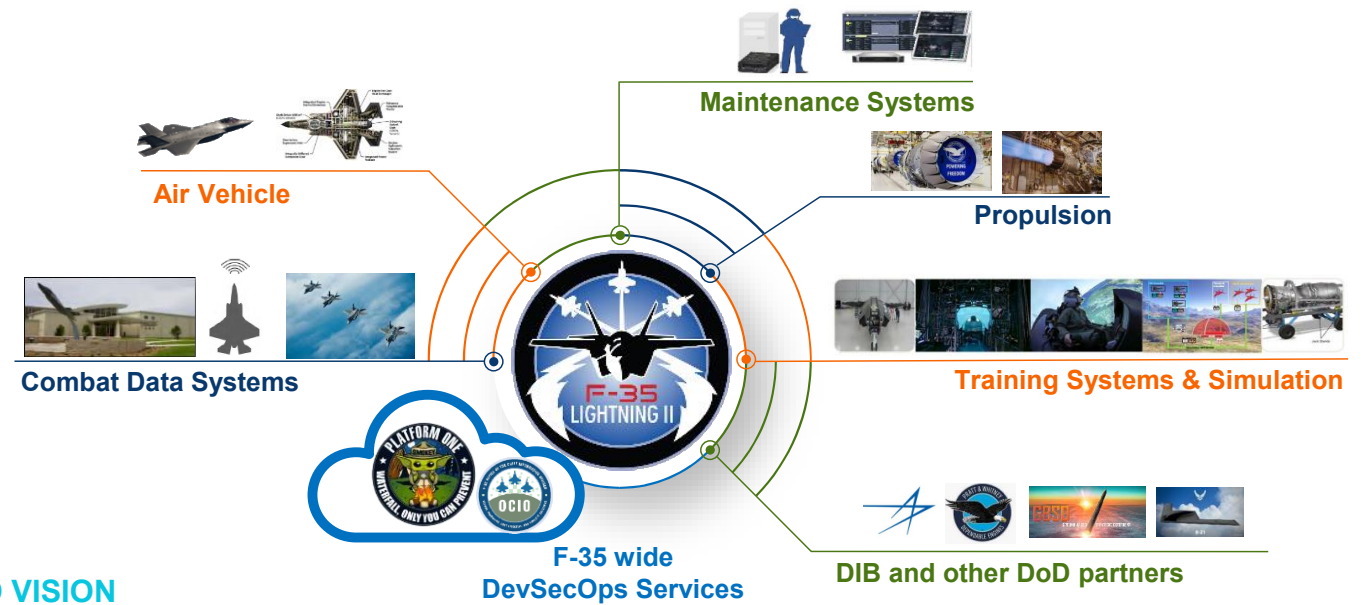




# Synchronisation Challenge



## DevSecOps for the F-35 Enterprise



### JPO VISION

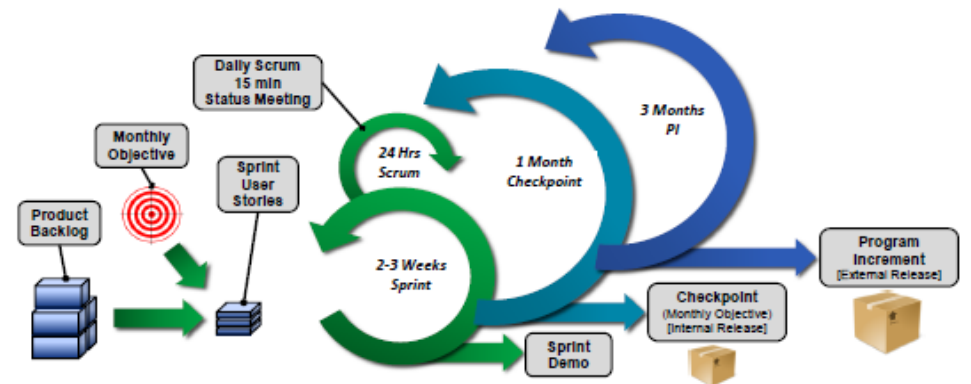
Centralize, modernize and accelerate software capability that can enable F-35 for improved warfighting delivery.

# F35 Agile Tempo (2018 onwards)

- **Tempo:** Oriented around calendar months
- **Sprints:** ~2 weeks / ~2 per month
- **Demos:** Monthly
- **Program Increments (PI):** 3 months
- **Major Releases:** 2 per year to all aircraft and all configurations



- Focused primarily on Air Vehicle (Vehicle Systems and Mission Systems)
  - Other elements of the Air System are also transitioning to Agile methodologies; tempos vary





# 47% of agile transformations fail, 67% are terminal for the organization

<https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/how-to-mess-up-your-agile-transformation-in-seven-easy-mistakes>

*Agile transformation relies on a full spectrum approach to all aspects of the program*

## Questions to Answer

Strategy	Definition of a successful outcome and development of a plan for reaching that goal.
Org Design	Teams aligned to responsibilities and Requirements to deliver the desired outcomes
People	The right people in the right position with the right skills and mindset
Processes	Effective, agile processes that support the release cadence
Metrics	Measures of the performance of teams and processes to track progress
Contracts	Contracts that meet requirements and support the release cadence
Technology	Implement technologies that can be customized Or support the program in enabling Agile
Procedures	A framework for meeting milestones and acquisition milestones that adapts to the new agile environment

- What does success look like? How do we bridge the gap from where we are to where we want to be?*
- How do we organize our teams to be process oriented with clearly defined responsibilities?*
- Do we have the right people in the right positions based on our strategy and processes?*
- What processes need to be optimized, designed, or redesigned to align with Agile Development?*
- What measures capture the performance of the teams and allow us to quantify success?*
- How do we establish a contracting structure that supports Agile while meeting DoD requirements?*
- Which technology applications can we leverage? Which technologies work best for our program?*
- How do we continue to satisfy milestones and acquisition milestones in an Agile construct?*

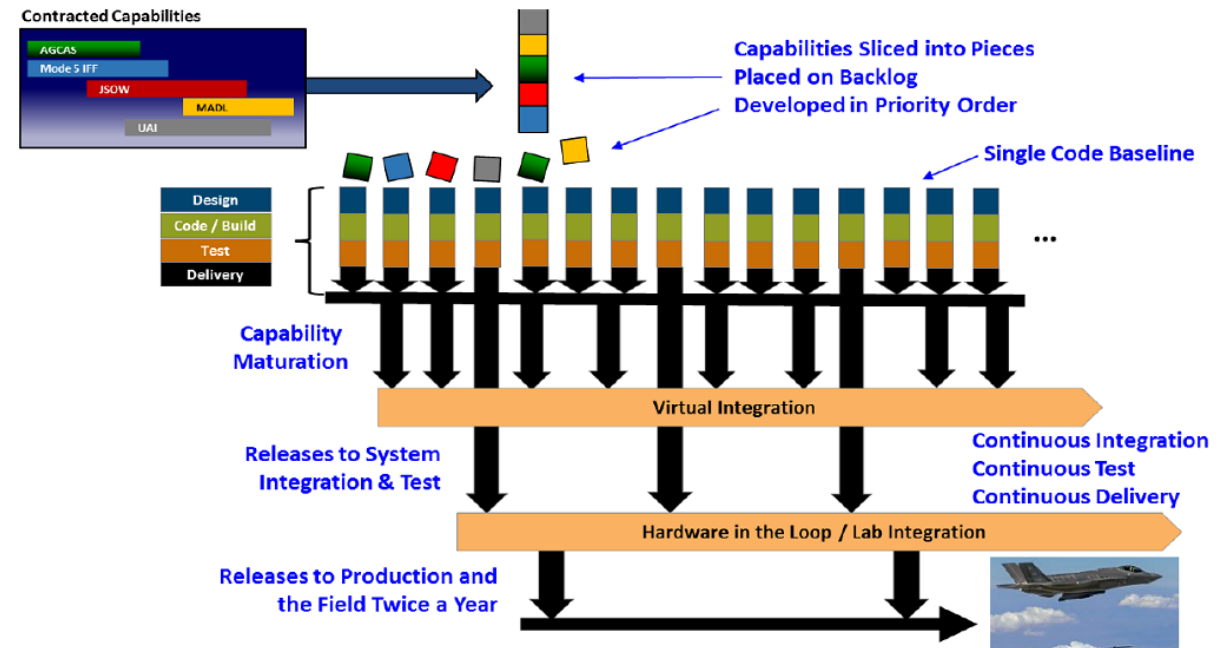
# 180-Day Sprint Challenge (Aug 2018 – Feb 2019)

## Vision Statement

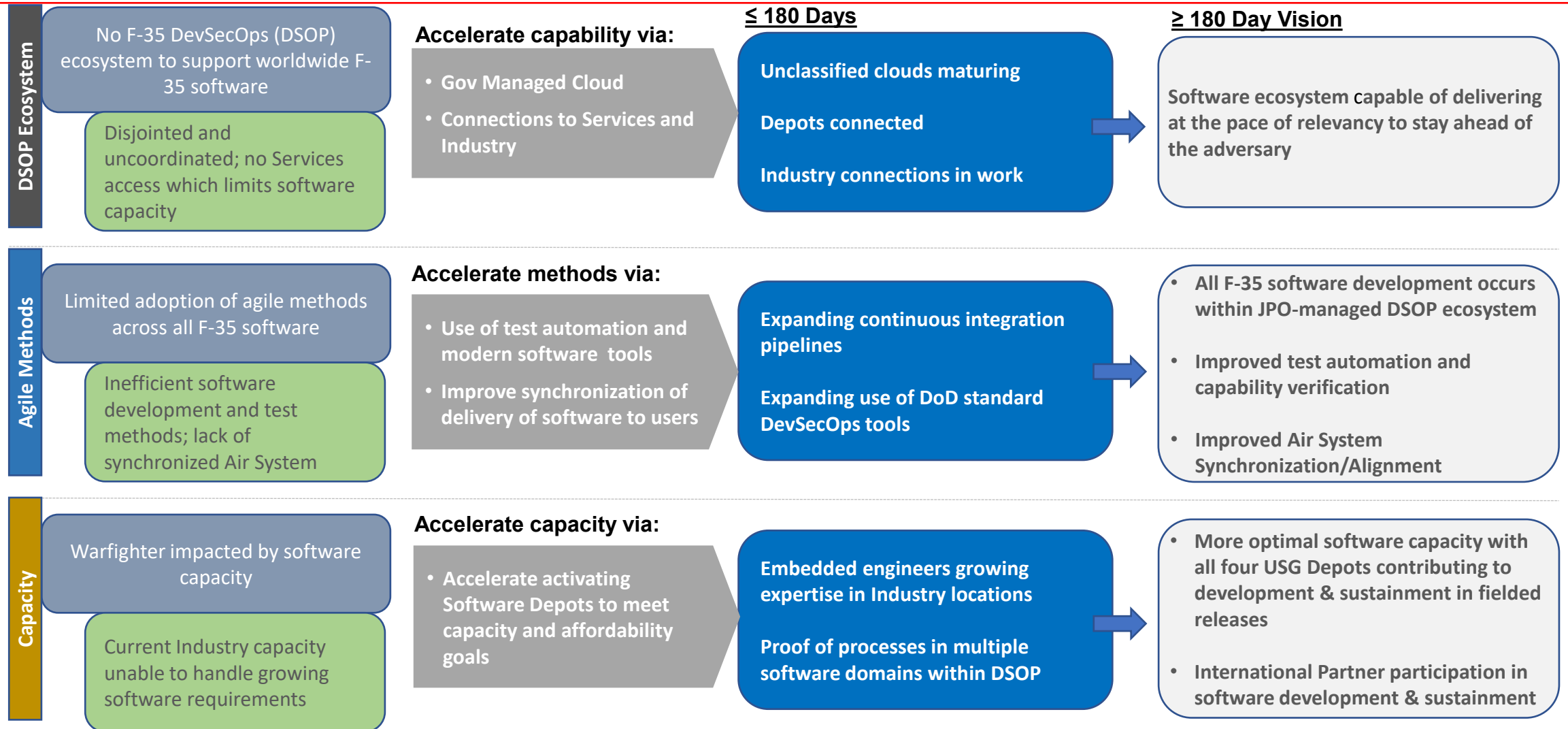
“Affordably decrease the time to deliver high quality warfighter capability from 7 years to 6 months by effective usage of the global software talent pool”

- **Decrease cost (affordability)**
  - » *F35 was too expensive per unit*
- **Improve software quality (availability, capability & deployability)**
  - » *F35 had software driven technical debt leading to less capability than expected and in geographical areas that were rising in threat*
- **Increase capacity (agility)**
  - » *The F35 fleet works best together worldwide; we needed more ability in the US and Partner countries*
- **Increase automation (agility)**
  - » *Skill sets were a challenge – working 24/7 in time zones worldwide is a missed opportunities*

- **Decomposition of requirements into capabilities and features**
  - Enable frequent deliveries of incremental functional capability
- **Schedule advantages**
  - Early software development on production representative hardware
  - Continuous burn down of software & hardware technical risk
  - Short feedback loops eliminate wait states and verify assumptions quickly



# 180-Day Sprint Challenge (Aug 2018 – Feb 2019)



# Germany opts for US rather than European F-35 assembly (May 2024)

Germany's 35 F-35As will be built at the Fort Worth facility in the US (pictured) rather than at the Cameri site in Italy. (Lockheed Martin)

Berlin has decided that the F-35A variant aircraft contracted for the Luftwaffe are to be built at the US final assembly and check-out (FACO) facility in Fort Worth, Texas, rather than at the European FACO at Cameri, Italy.

The Luftwaffe is to receive 35 F-35As, with deliveries commencing in the US in 2026 and the first aircraft arriving in Germany in 2027.

With Italy, the Netherlands, and Switzerland having previously committed to have their entire or a portion of their fleets built at Cameri, the US government recently decided to open up the European facility to any other continental customers that might wish to use it.



Courtesy of Janes.com Defence News 7 May 2024

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Greece	Switzerland	



## Lockheed Martin's F35A in Germany (8:08)



<https://www.youtube.com/watch?v=EjRraYNC41Q>

# QUESTIONS?



**Delivering the F-35 to the Warfighter**



Enterprise Data Management ♦

Enterprise DevSecOps ♦

Global Support Solution Data Integration ♦

Depot Activation and Software Modernization ♦

Capability Innovation and Efficiency Improvement ♦

Data Governance, Security, and Enterprise Provisioning ♦

ESB LIGHTNING II

♦ JPO Cloud and Hosting Scalability

♦ Enterprise Network Management

♦ Partner Integration and Data Distribution

♦ Classified Network Support and Integration

♦ Authoritative Data Source Alignment and Capitalization

♦ Enterprise Standards & M&S Components Implementation

