

Air Force Materiel Command



US Air Force Digital Enterprise

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HQ AFMC/EN
Feb 2019



OSD's Digital Engineering Strategy



https://www.acq.osd.mil/se/initiatives/init_de.html

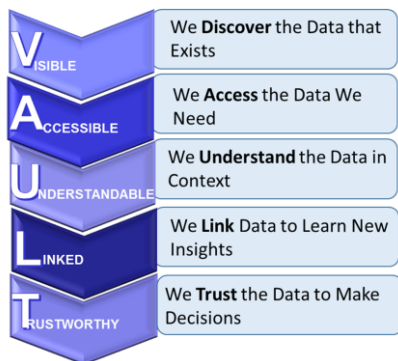


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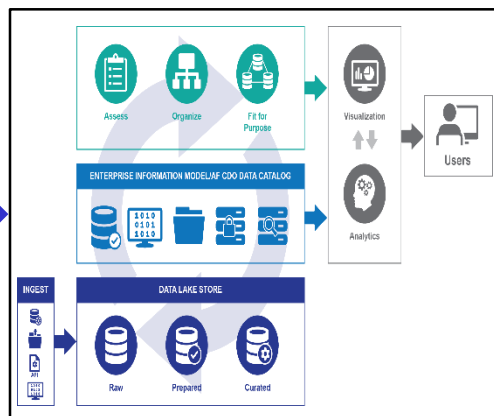
Major Influences on our Enterprise's Future



DoD Digital Engineering Strategy

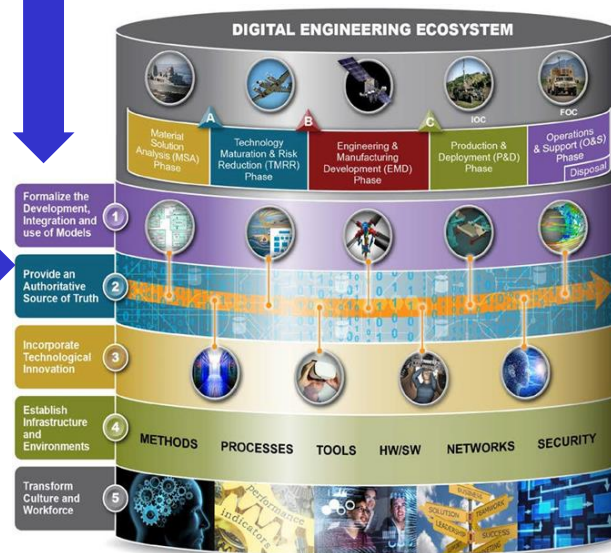


Air Force Data Strategy



Air Force Data Solution Architecture

- 1 Formalize the **development, integration and use of models** to inform enterprise and program decision making
- 2 Provide an enduring **authoritative source of truth**
- 3 Incorporate **technological innovation** to improve the engineering practice
- 4 Establish supporting **infrastructure and environments** to perform activities, collaborate, and communicate across stakeholders
- 5 Transform a **culture and workforce** that adopts and supports Digital Engineering across the lifecycle



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Integrity - Service - Excellence



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More Influences on our Enterprise's Future

Rapid Acq Memos

- SAF/AQ Rapid Prototyping Memo, 13 Jun 18
 - Calls for use of Digital Enterprise, Agile SW, etc.
 - Go Faster *with* Rigor
- SAF/AQ DoDI 5000.02 and Rapid Acquisition Memo, 10 Aug 18
 - “We get what we reward...”
 - “...reward things like speed and digitization”

United States Air Force Engineering Enterprise Roadmap 2018-2022



Assistant Secretary of the Air Force
(Acquisition, Technology & Logistics)
Washington, DC
November 2018
w/Change 2

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Engineering Enterprise Roadmap

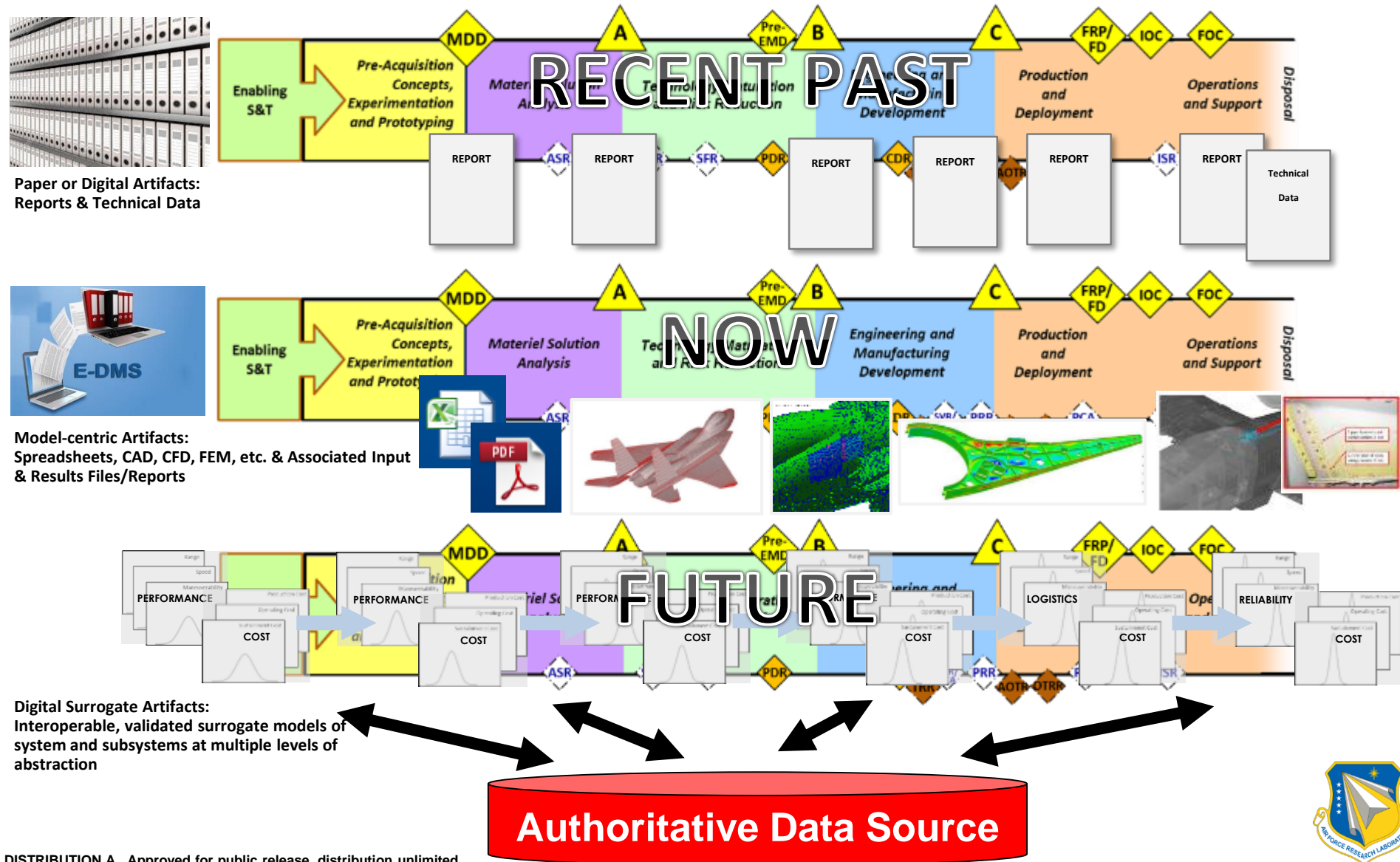
INTEGRITY – SERVICE – EXCELLENCE

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AF Digital Enterprise Journey

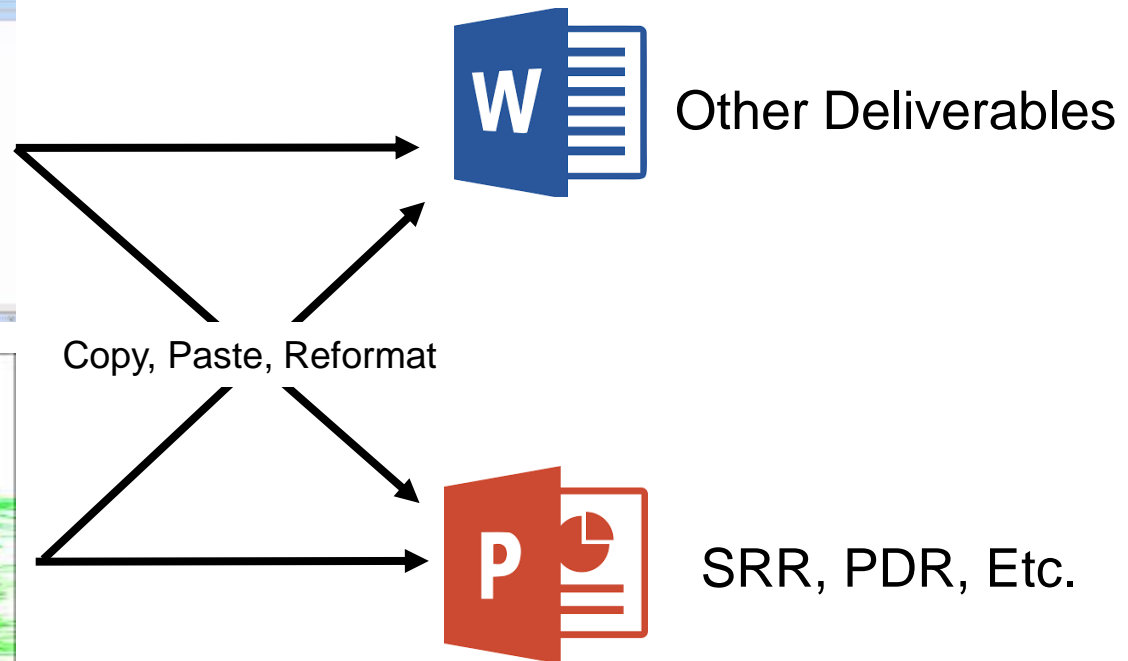
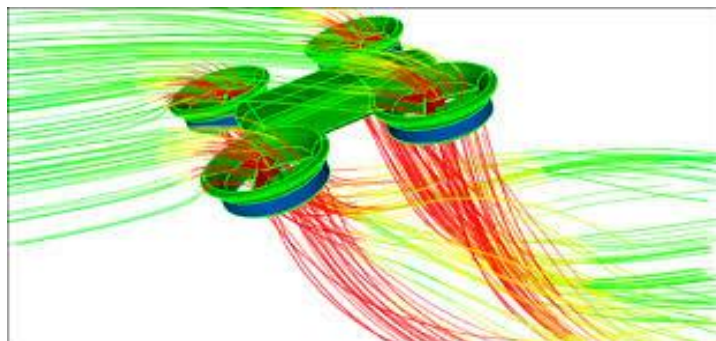
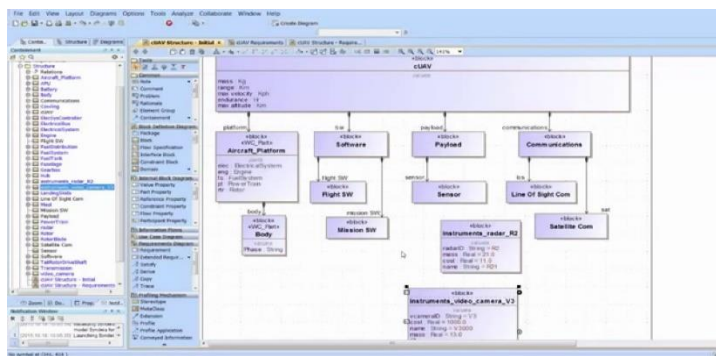




Challenges



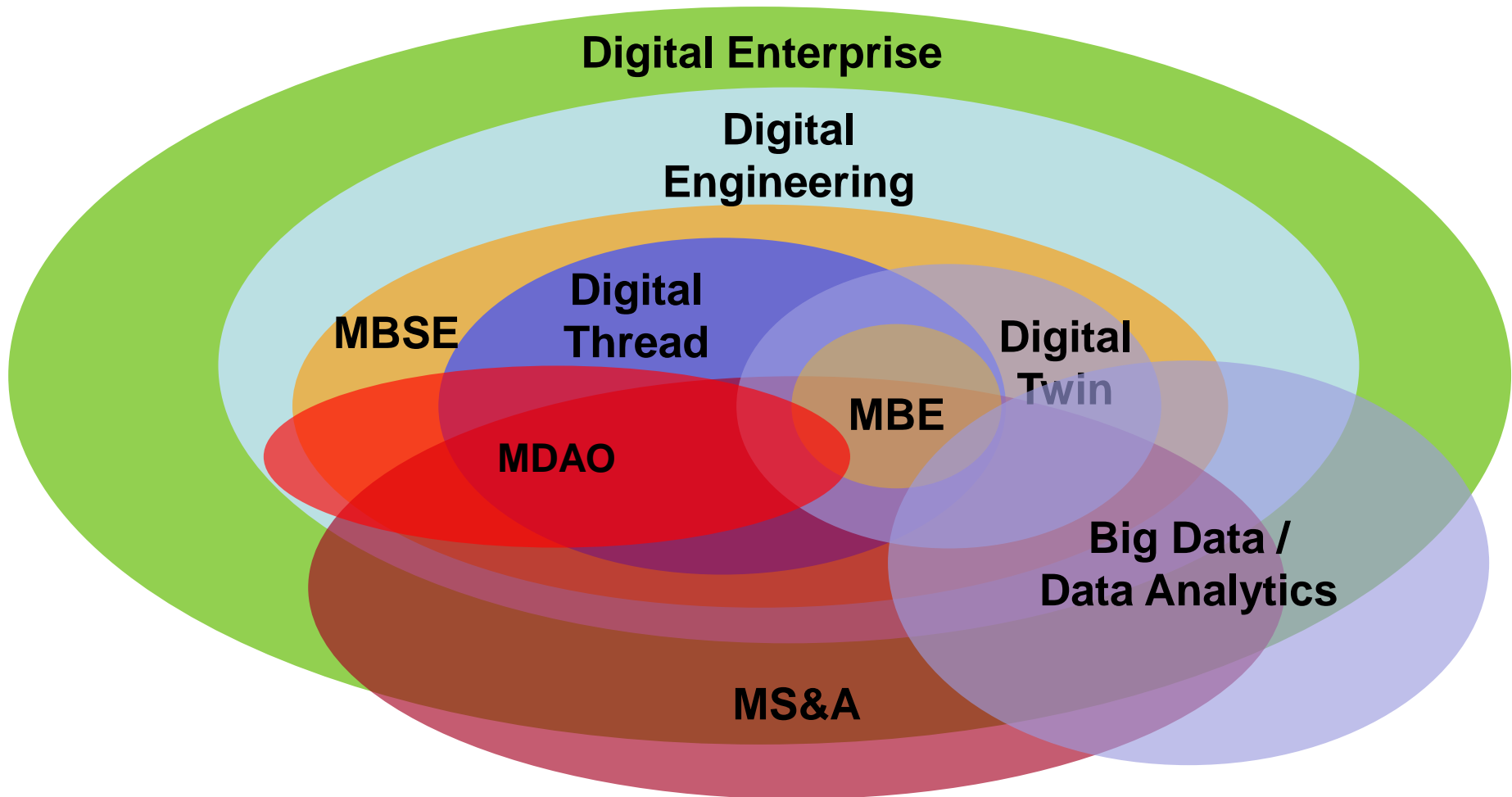
- Major Primes are implementing model-based processes
 - “Dumbing down” deliverables per contracts



**Stop Double Work (Creating Models AND Digital Artifacts)
Get Engineers back to doing Engineering**



Digital Enterprise Ecosphere





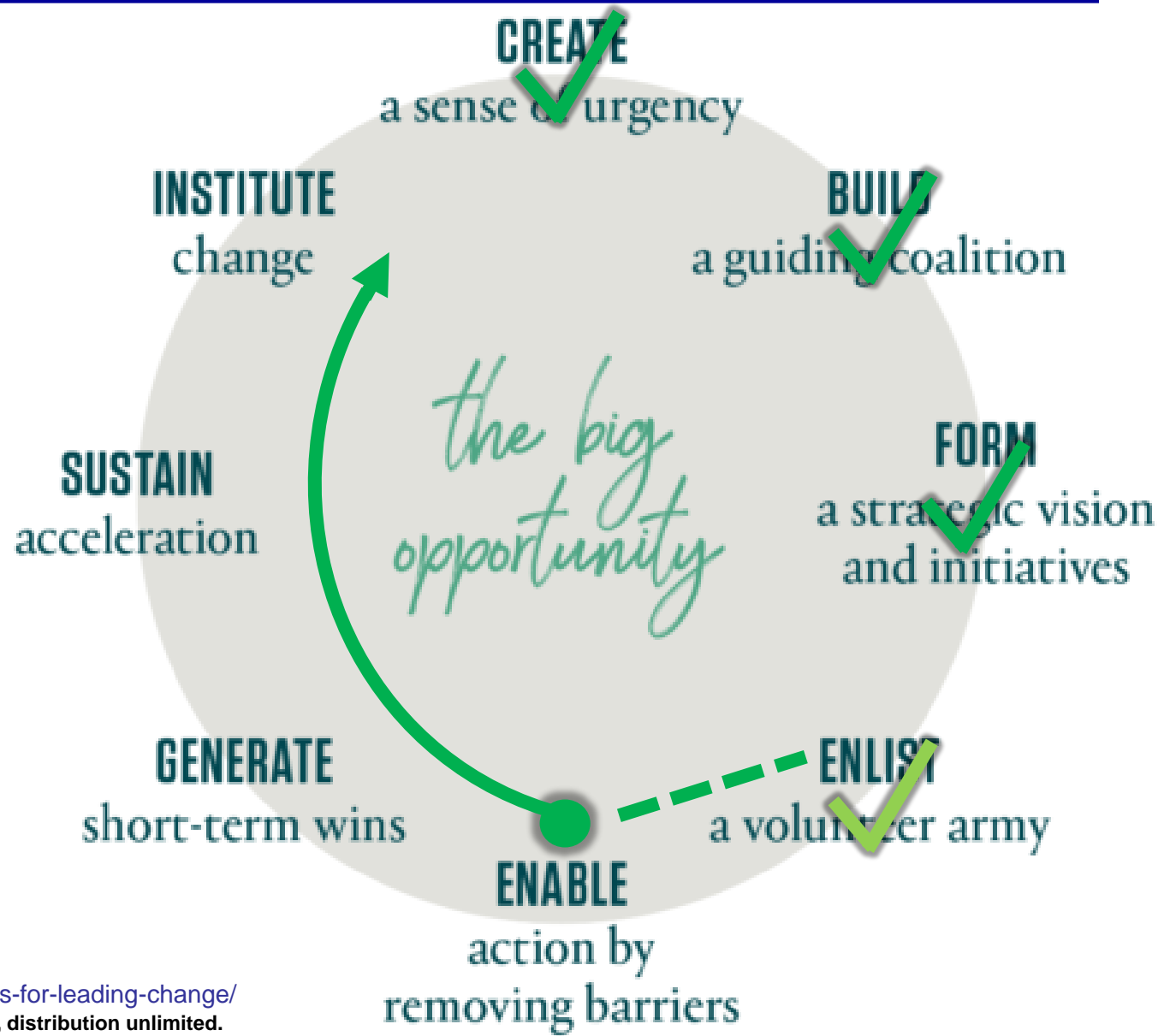
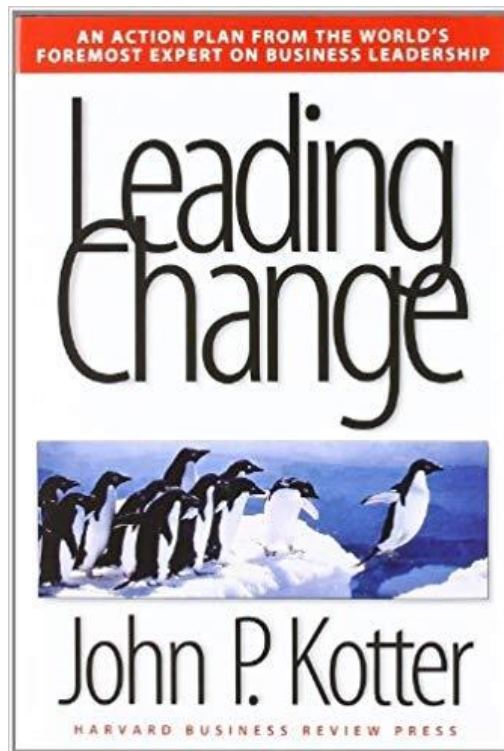
What Model?



Is Your Program Building Models for the Enterprise?



Cultural Change





Enlist an Army, Enable Action



Active Projects

Digital Engineering (DE)	MS&A	Logistics & Sustainment	Programs Implementing Digital Engineering	
Product Lifecycle Management Capability Initiative (PLM-CI)	ERS Pilot - HPC for JSTARS AoA	Rapid Sustainment Office	Ground Based Strategic Deterrent (GBSD)	Presidential & National Voice Conferencing (PNVC)
Air Force Systems Engineering Resource Center (AFSERC)	Enterprise Cost Estimation through Lifecycle Simulations (ELIS)	LogIT	Small Diameter Bomb II	GPS Systems Engineering and Integration
DEATHSTAR	DCGS for Digital Engineering	NLINE for NDI	E-3 AWACS 40/45	C-ABSAA
CREATE	Reinventing the Culture for a Digital Enterprise	Imaging Drone for Aircraft Inspection	Seek Eagle	MASIES
Technical Data Needs Determination Tool (TDNDT)	Air Force JEDMICS Business Process Automation Accelerator Program	Gearbox Repair - Additive Manufacturing	Agile Condor Pod	Ground Based Space Surveillance
3-n-1 Tool	Mapping Disparate Taxonomies of a Single Underlying System	Advanced Technology & Training Centers	Protected Tactical Enterprise Service (PTES)	Space Based Space Surveillance Program
Digital Engineering Environment Sandbox	Normalizing Management of Product Life Cycle Data	Product Innovation Platform	PEO ENGINES	Long Range Anti Ship Missile (LRASM) AGM-158C
MITRE Support to AF DE Implementation	SEAMS and SMARTUQ Alignment	Enabling the DLA Business Processes for AM	B-52 CERP	Space Fence
Engine Data Transformation	MATE Enterprise Tool Development	<u>SBIRS</u>	HC/AC/MC-130J	Battle Management Command and Control (BMC2)
MITRE Sprint I, II, III Engineering Tools and Data	Lifecycle Cost Modeling Tools for Elements of a DE Ecosystem	Data Card Effort	KC-46A Tanker	Next Generation Overhead Persistent Infrared (Next Gen OPIR)
Engine Health Management (EHM)	Integrated Dynamic Digital Engineering Ecosystem Cost-Model (IDEC)	Digital Greenhouse	JSTARS-R	Extending the Digital Thread from the A-10 SPO to the Shop Floor
		Sim Common Architecture Reqs and Standards (SCARS)	SMC Enterprise MBSE Framework	Architecture and Plans
		Advanced Framework for Simulation, Integration, & Modeling (AFSIM)	ISR Futures	B-52 RMP
		Model Based Systems Engineering MBSE (SBIR)	F-35 Systems Engineering Transformation Team	Long Range Stand Off (LRSO)
			Remote Sensor Engineering	A-10 Wing Replacement Program

The future is here. It is just not evenly distributed
- William Gibson



Current Activities



- **Engineering Enterprise Roadmap Update**
 - AF Response to OSD DE Strategy
- **AcqNet** - DREN b/w++, AO assigned, building process
- **PLM-CI** – Enterprise PLM licenses
- **DE Guidebook Build-out**
 - https://www.milsuite.mil/wiki/Portal:Digital_Enterprise_Guidebook
- **Experiments and Implementations**
 - CDRLs, DIDs, PK Language
 - Program successes -> AFLCMC ACE Office
 - DE Cloud Environment
 - Programs implementing DE, MBSE, MBE, ...



Digital Engineering Environment

Guiding Questions



- **What do we want our engineers doing tomorrow, that they aren't doing today?**
 - I've been asked to do Digital Eng. How do I do that?
- **Can we build a "MS Office" for engineers?**
 - Advanced tools available at the desktop
- **GOTS/COTS tools available now. Do they integrate?**
 - Tools used *now* by Automotive, Aerospace, Consumer Products, etc.
 - Can we use them in AF use cases?
 - Do they integrate? Can I pull and AF digital thread through them?
- **Consider cloud 1st: Is a cloud-based environment usable from the AFNET?**



AFIT COA + AFMC/EN



















DEEC Scope and Team



Prototype Desired Outcomes

1. Identify DOTMLPF-P Implications
2. Inform Scalable Strategy Decisions
3. Develop R&D, Production, Deployment, and Sustainment Architecture Integration Plan



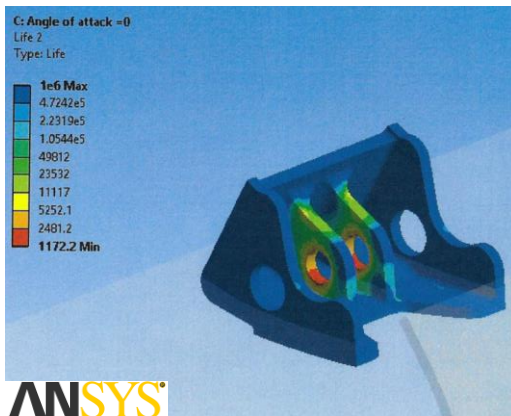
Tool Integration	 CREATE  CATIA  SolidWorks  creo NX  AUTOCAD				
Platform Integration	 ANSYS  DASSAULT SYSTEMES  ptc SIEMENS  robsi				
Architecture Integration	 amazon web services  Microsoft Azure		Impact Analysis	 AFRL DSRC  DoD SUPERCOMPUTING RESOURCE CENTER  DISA  GCSS-AF  DoD Partners  Industry Partners	
Data Integration	Structured / Unstructured / Meta; Dissimilar File Structures; Open Source Models; Real-time Collaboration; Discoverable – Publishable; Authoritative  A-10 Data				



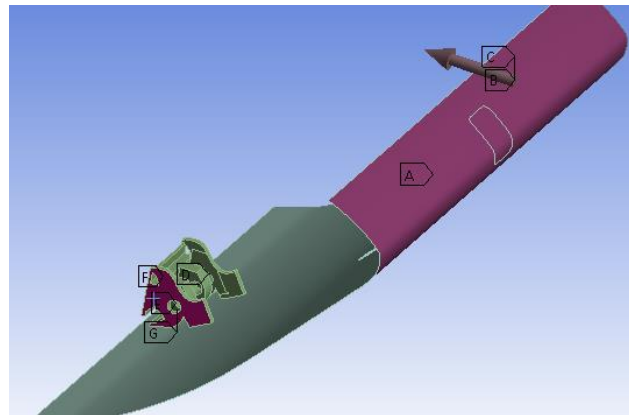
DEEC Demonstration



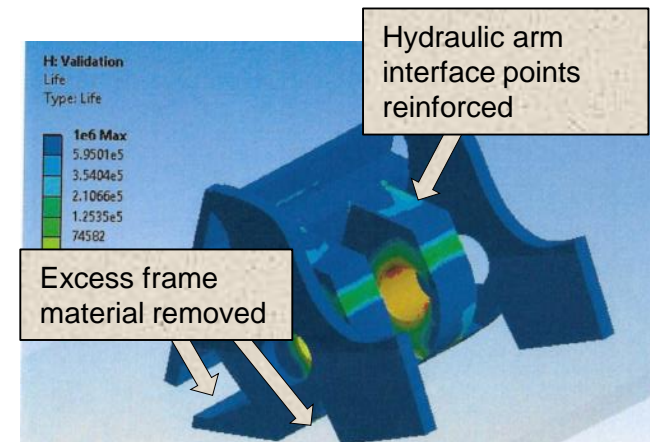
- A-10 hydraulic slat mount drawing (2D PDF file)
ingested and converted to 3D model
- Computational Fluid Dynamics (CFD) for external aero-loading applied
 - Inertial loads from slat actuation included
 - Multi-vector loads applied for *fatigue analysis*
- *Shape and topology optimization* applied to improve design



*Drawing converted into 3D
Model and CFD applied*



*Multi-vector stresses
analyzed*



*Part optimized for
performance*

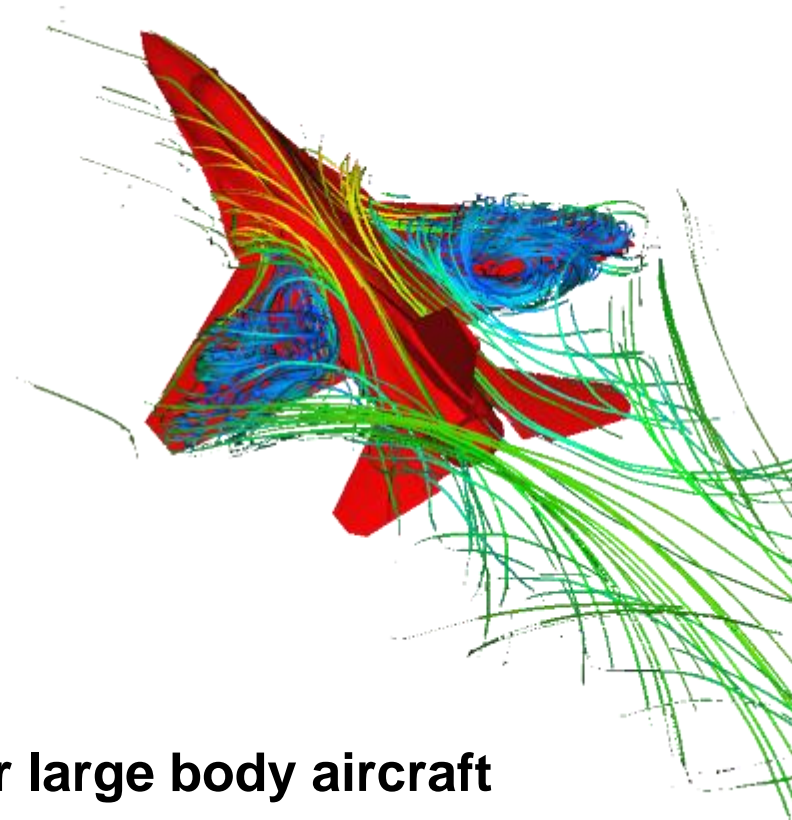
Optimized part is 15% lighter and operating life increased over 8x



More Challenges



- **Cyber Security**
 - Need to protect our information
- **Personnel**
 - Culture
 - Training
- **Industry Partnerships**
 - Data rights
 - Contracting language
 - Standards
- **Data**
 - Size – Estimated petabytes at rest for large body aircraft
 - LOTAR – Long Term Archive and Retrieval





Long Term Archive and Retrieval LOTAR



- “Cool, you 3D-printed the save icon!”



Two thirds of children don't know what a floppy disk is

Children aged 6-18 were shown the photos below and asked if they knew what each was. Figures shown are the % of children who either said they didn't know what the item was, or gave an incorrect answer (children answered in their own words)



What is Your Program's Data Strategy, Formats and Media?





Why we do this

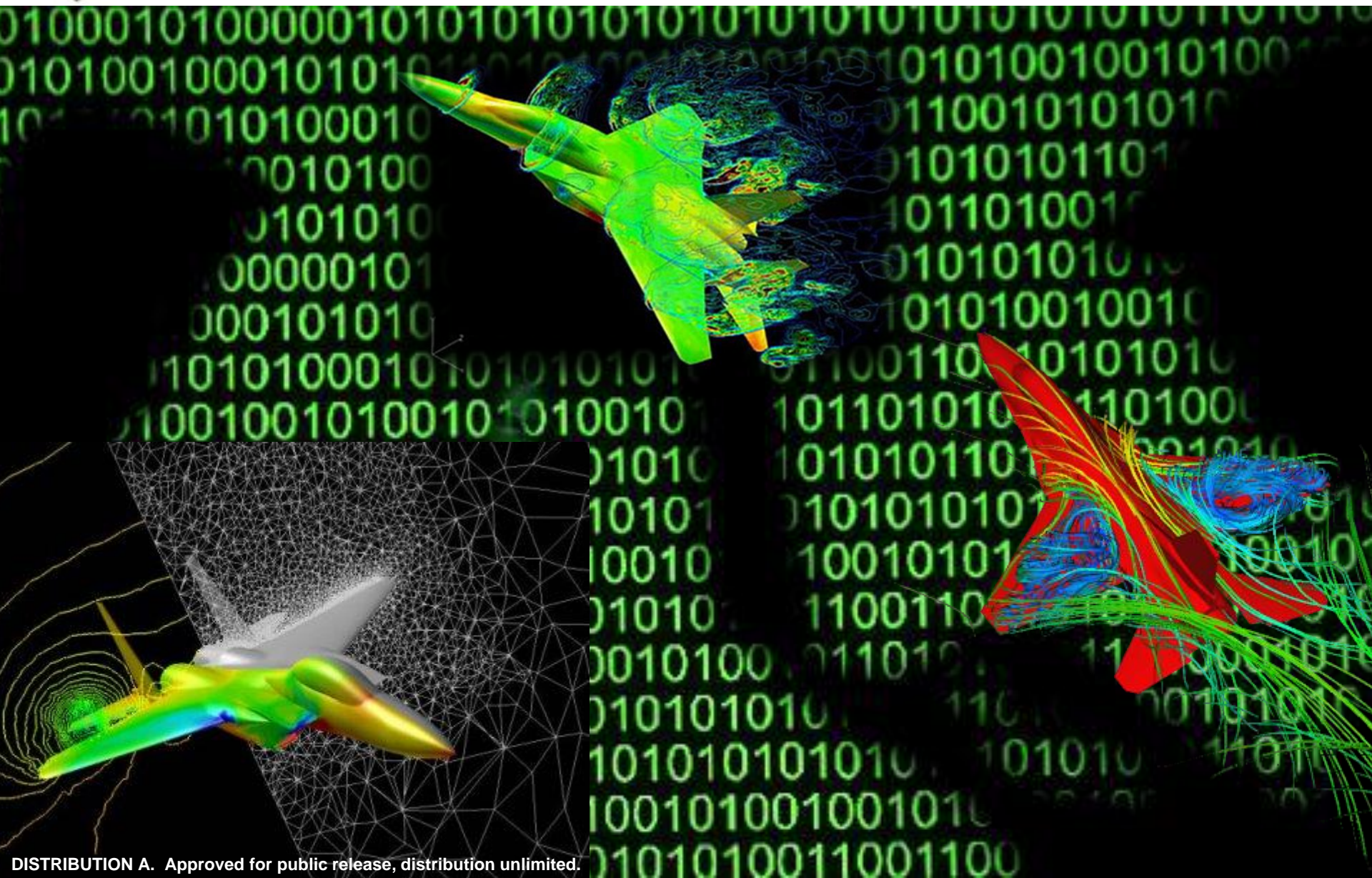
Give 'em the best! Bring 'em home safe!



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Questions

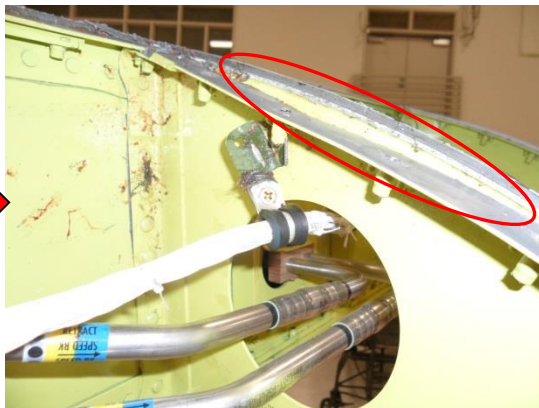




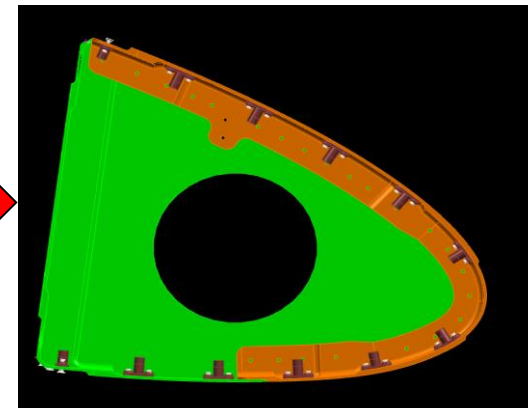
Technical Data Package Demo



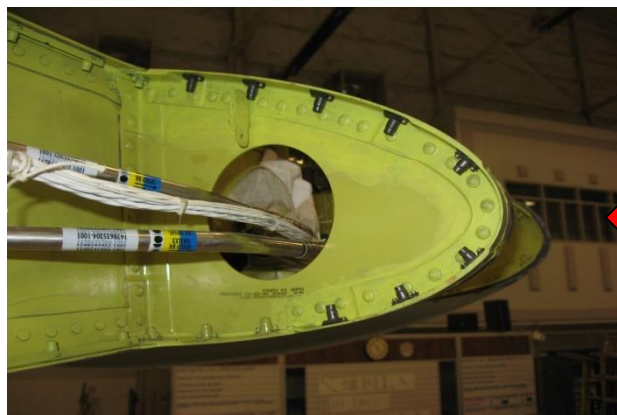
Bird Strike Area



Damage to Leading Edge



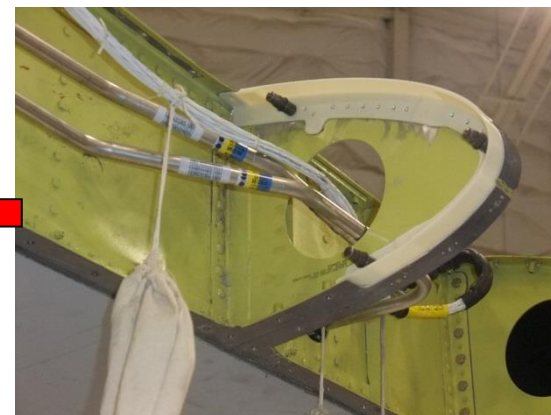
CAD Model of Repair



Final Installed Repair



CNC Milling of Repair Part



Test fit of 3D Printed Repair Part

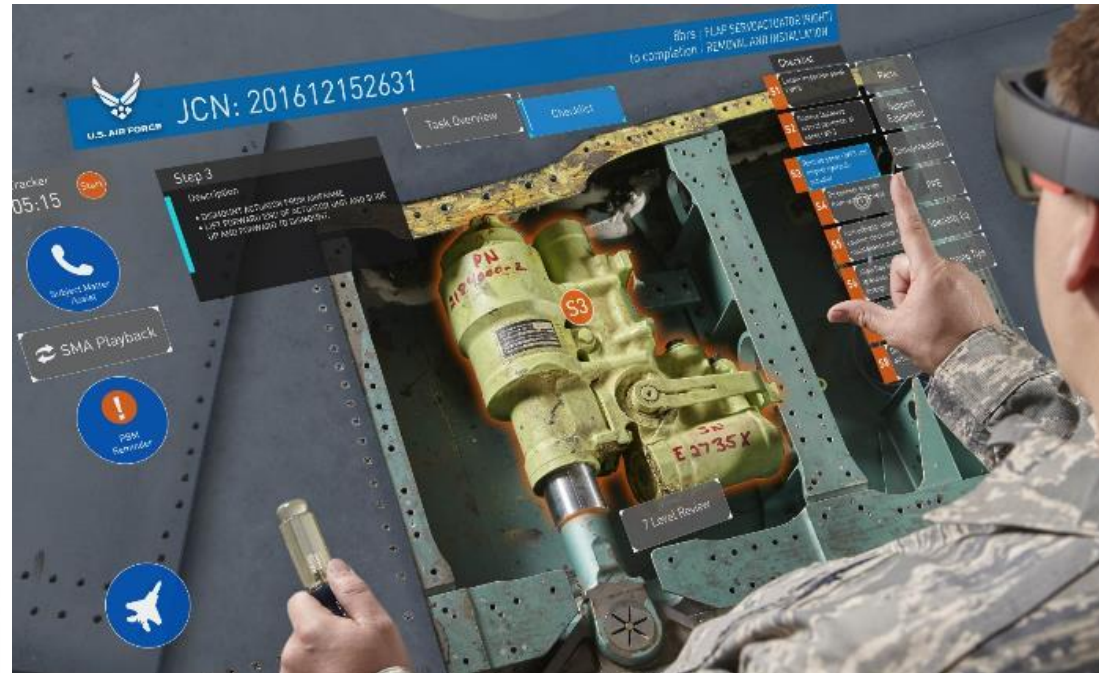


Augmented Reality for Aircraft Maintenance



Inside the HoloLens

1. Camera
2. Computer
3. Lenses
4. Vent
5. Sensor
6. Buttons



Augmented reality leveraging a Digital Thread ecosystem to improve maintenance execution & data collection