The Award-Winning NAVAIR PMA-261 3D Digital Transformation Project

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Agenda

- **Project Overview**
- **Participants and the CH-53K Program**
- **3D Data Exchange Project Solution**
- **Key Points and Next Steps**
- **Acknowledgements**

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Project Overview

Global Product Data Interoperability Summit | **2018**

Use Case:

- **DOD program offices moving to Model Based Enterprise processes must automate organization and verification of OEM delivered data**
- **Programs must deliver MIL-STD-31000 Technical Data Packages for engineering, DLA, LOTAR to avoid proprietary formats**

Details:

- **An automated system to organize and verify OEM MBD data for generation of validated 3D PDF with STEP Technical Data Packages**

Benefits:

- **Millions saved on a typical defense program by avoiding manual OEM data organization or validated MBD TDP creation**
- **Error reduction and increased productivity via application of MBD principles in DOD programs**
- **Acquisition costs reduced**

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Anark Corporation

Leading provider of technical enterprise content management (ECM) software and solutions with advanced visual collaboration for enterprise manufacturing

Empowering the MBE and Digital Thread revolution within A&D, Energy, Industrial, High Tech, Automotive, and Medical Equipment Sectors

Growing company with worldwide network of technology and integration partners

Anark Corporation HQ in Boulder, Colorado, with offices in the Washington DC, Detroit, Chicago, San Francisco, and Bangalore

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International TechneGroup (ITI)

Global Product Data Interoperability Summit | **2018**

Over 30 years experience in developing and delivering interoperability solutions and consulting services to the manufacturing industry

ITI solves complex product data interoperability problems, so that our customers can focus on making great products

Over 1,900 global engineering and manufacturing clients and a trusted advisor to product data standard and industry associations

ITI HQ in **suburban Cincinnati**, Ohio, with offices in Cambridge (UK), Munich, Tel Aviv, Bologna, and subject matter experts around the globe

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Project Participants and the CH-53K

- **NAVAIR PMA-261** – Customer and the NAVAIR CH-53K program office
- **Anark Corporation** - 3D PDF and DLA package publisher
- **ITI** – CAD enhancement, STEP generation, validation/verification
- **Razorleaf Gov Solutions** - Process and ENOVIA integration
- **Naval Shipyard and Advanced Manufacturing** (NSAM) – Project Mgmt

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- **CH-53K is the DoD's most powerful helicopter ever!**
  - Designed as a new-build helicopter to triple the CH-53E lift capability
  - Expands the fleet's ability to move more material, more rapidly. 14 tons at a mission radius of 110 nautical miles in high/hot environments
  - Proven and mature technologies with a lower operating cost per aircraft
  - Designed for equivalent logistics shipboard footprint and less direct maintenance man hours per flight hour
  - OEM is Sikorsky Aircraft using 3DEXPERIENCE

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3D Data Exchange Project Introduction

- **3D Model to 3D PDF conversion capability provides production-quality model-based documents and Technical Data Packages (TDP) for down-stream users**
  - Single configuration controlled data set, thereby accelerating response times, reducing cost, increasing aircraft availability and safety of flight
  - Verifying/validating thousands of complex 3D models in a short time

- **Benefits of a secure 3D Data Exchange system (3DDE) are numerous**
  - Reduce the Amount of Reverse Engineering Requirements
  - Reduce Labor for Translation and Healing of CAD Data
  - Reduce the Amount of Rework Due to Incorrect Technical Data
  - Reduce Requirements for TDP DLA 339s Caused by Programs Using Full Model Based Definition In Lieu of 2D Drawing
  - NAVSUP/DLA ability to provision using 3D PDFs in lieu of native CAD Models in up to 15 different software sets

DLA 339 Records Management System Program gives military Engineering Support Activities online access in one place to access Engineering Support Requests.

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Solution: Tech Data Profile

- Technical data package overview
  - CATIA V5 MBD + associated lists in TIF & PDF
  - Ambiguous Engineering BOMs in Excel
  - Heterogeneous standards/norms
  - Many data domains (sheet metal, composite, tubing, etc.)
  - Many observable “patterns”
  - Data set not “PLM-ready”

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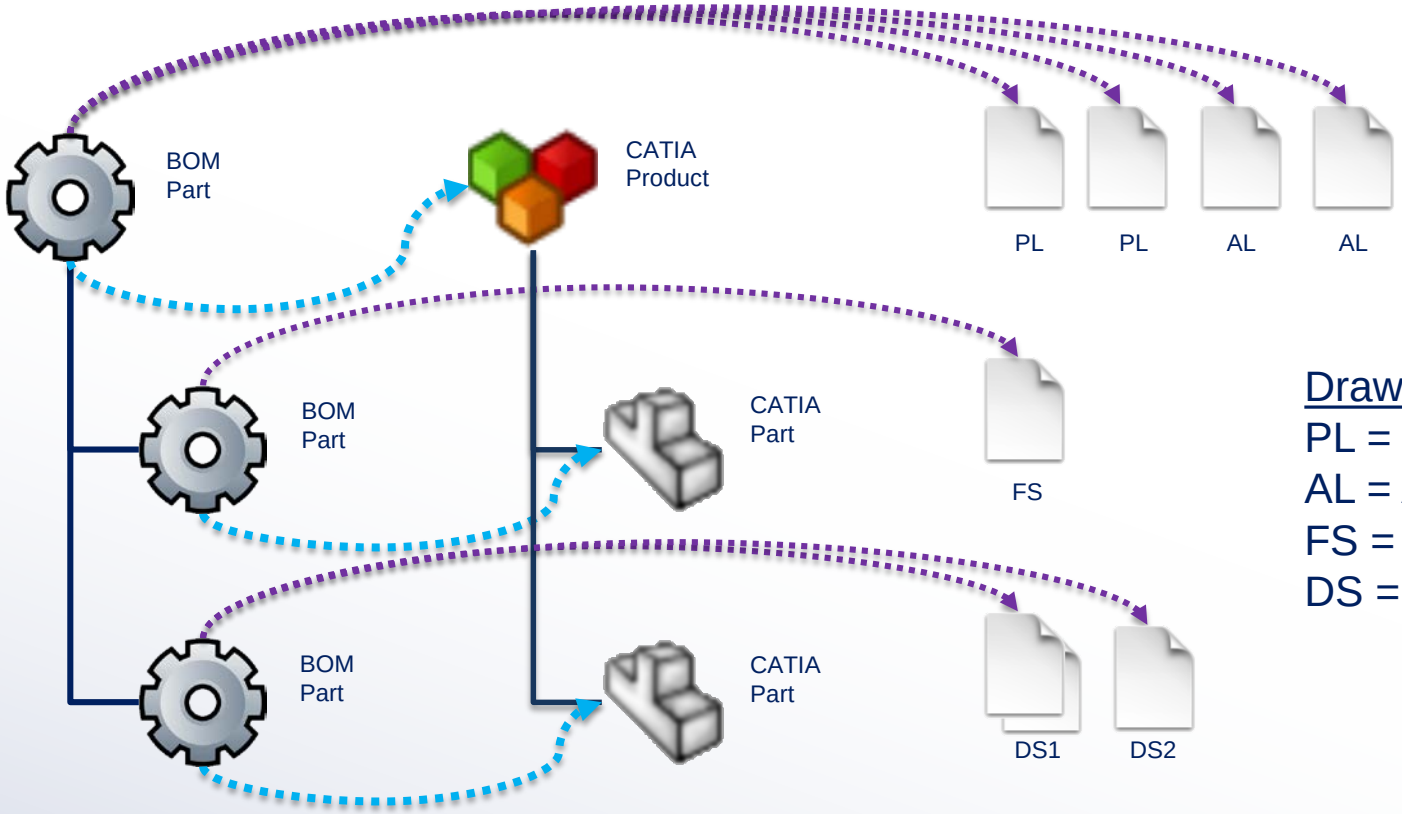
Solution: Tech Data Structure



Drawing Prints:
PL = Parts List
AL = Application List
FS = Field Sheet (2D Dwg)
DS = Data Sheet (Text Dwg)

* Some of the related documents shown may not be present or required

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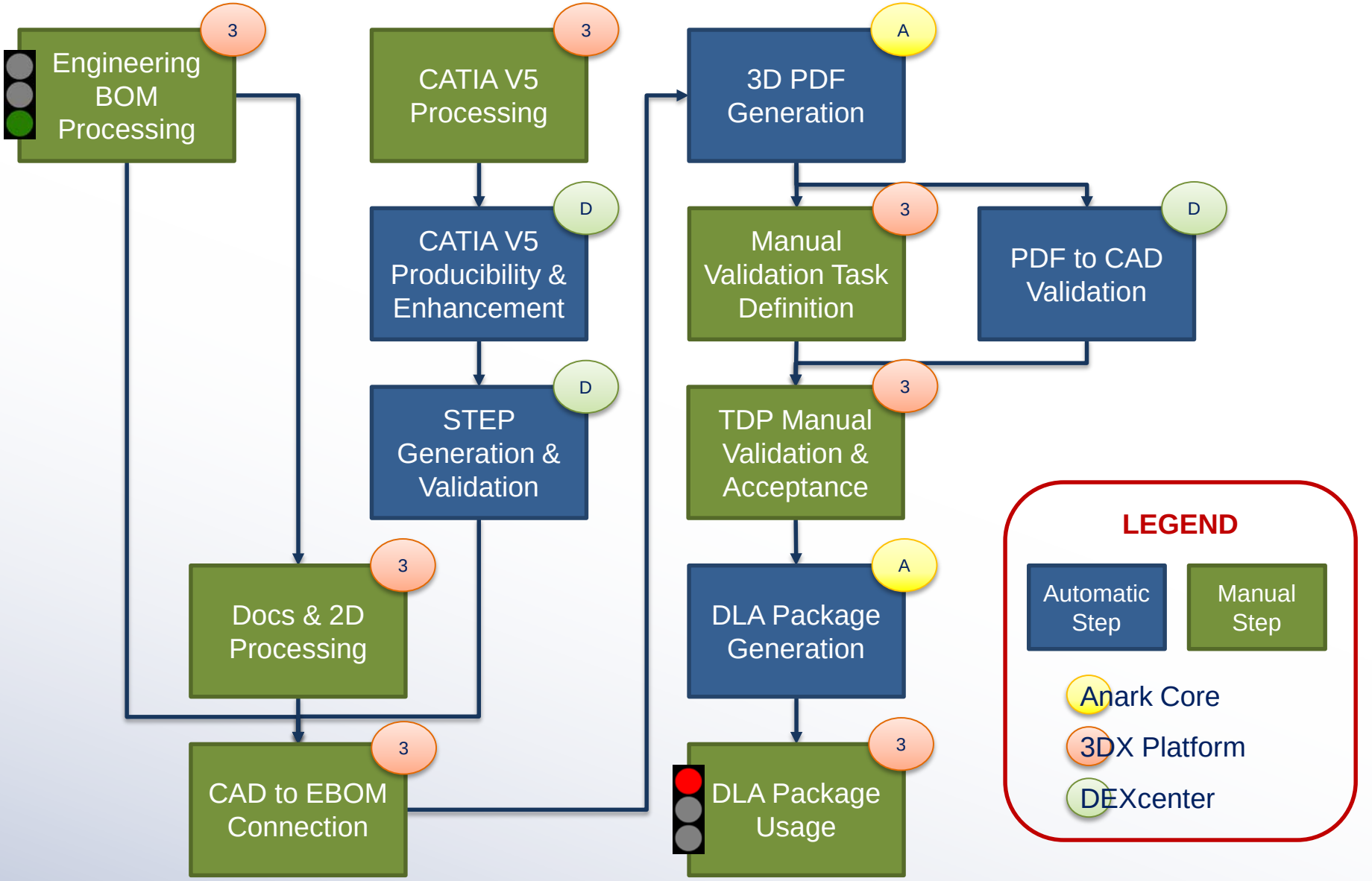
Solution: TDP Ingestion Process



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Solution: 3DDE Micro Processes

- The 3DDE system is broken down into a group of 5 sequential micro-processes
  - CATIA Preprocessing & Verification
  - STEP Generation and Validation
  - 3D PDF Generation
  - 3D PDF Validation
  - DLA Package Assembly & Publishing
- This allows individual micro-processes developed, managed, and maintained independently of one another
- Process Interface and Data Schema control are critical

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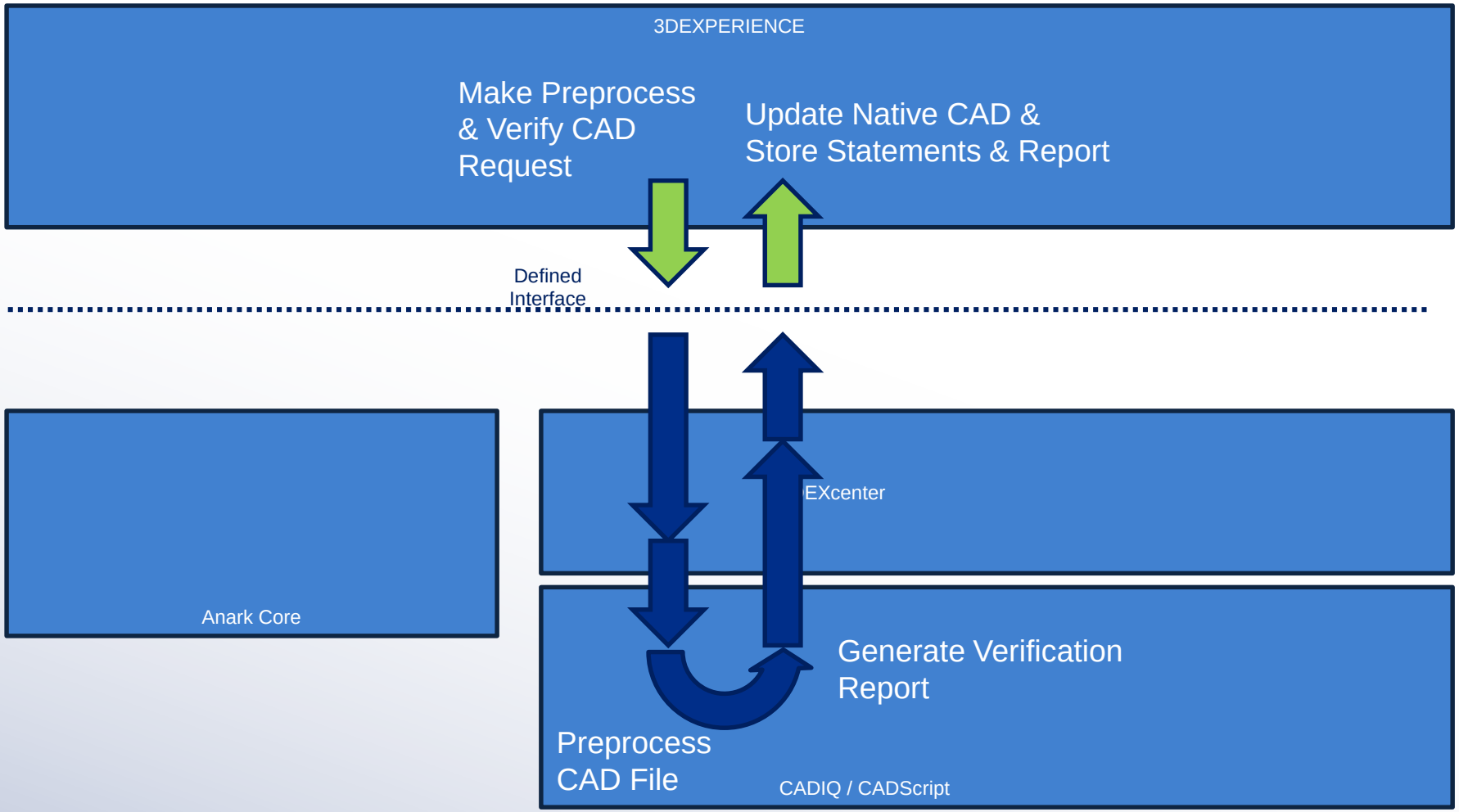
Solution: 3DDE Micro Processes

Preprocess = Extract Statements & Optimize Model for Publishing



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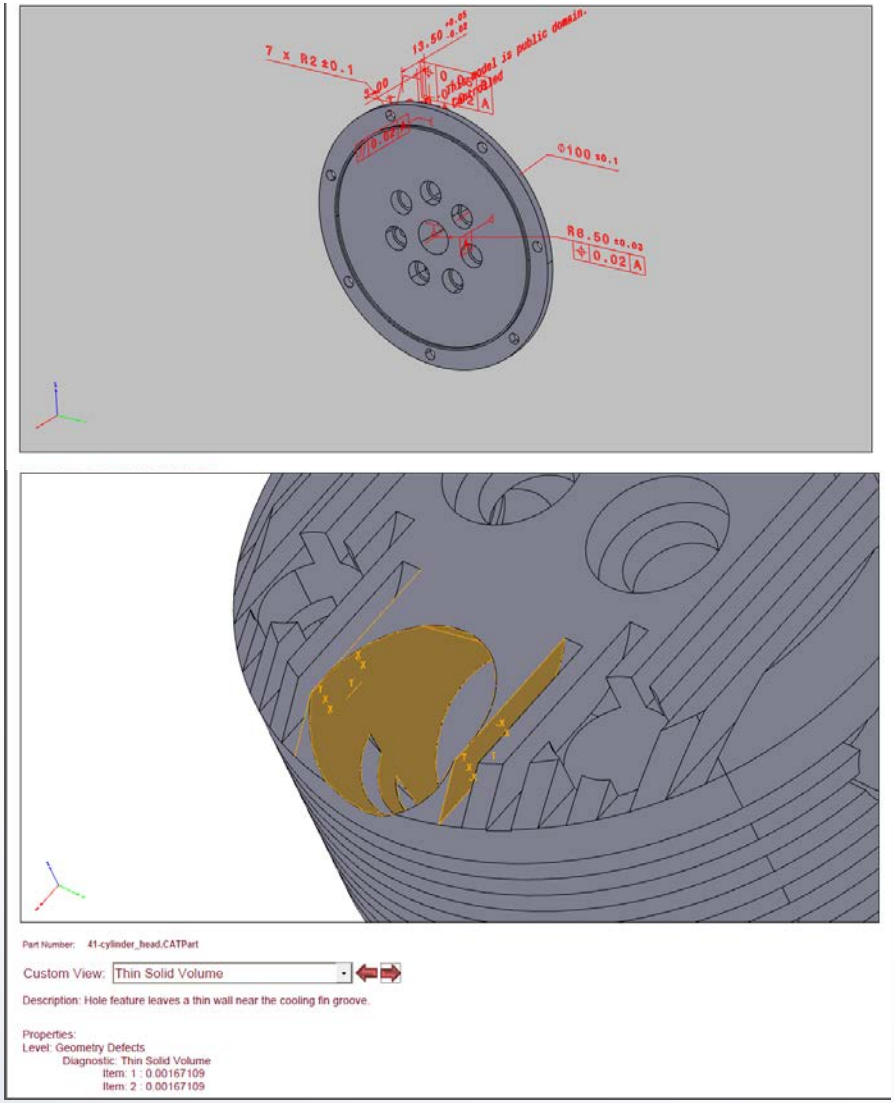
Solution: Preprocessing & Verification

- Native CATIA preprocessing for optimized publishing
  - Rights Statements extraction
  - Visibility management
- Verification of native CATIA models
  - Geometry, PMI, Attributes, Structure, Views



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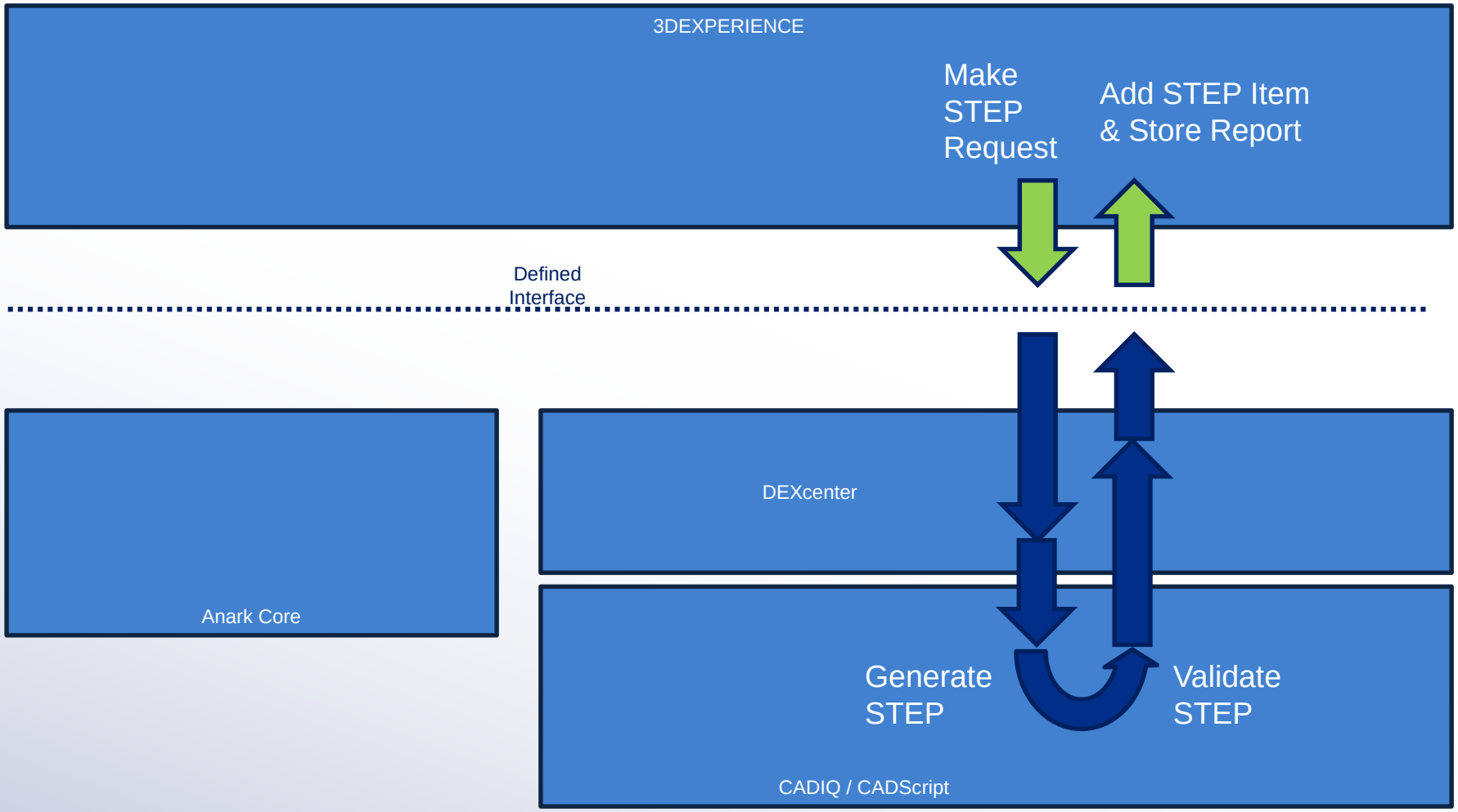
Solution: 3DDE Micro Processes



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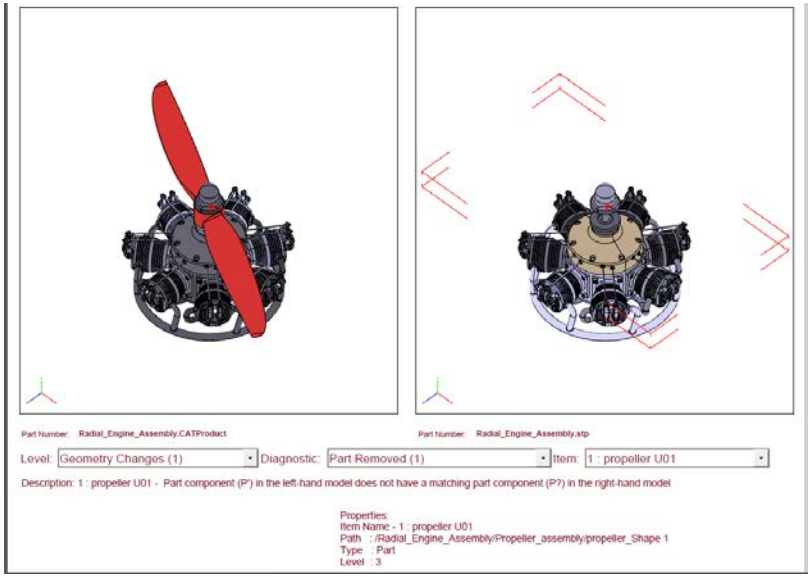
Solution: STEP Generation / Validation

- Generation of STEP AP242 file from native CATIA (AP203 Currently)
- Validation of STEP models relative to native CATIA models
  - Geometry
  - PMI
  - Assembly Structure
  - Model Views



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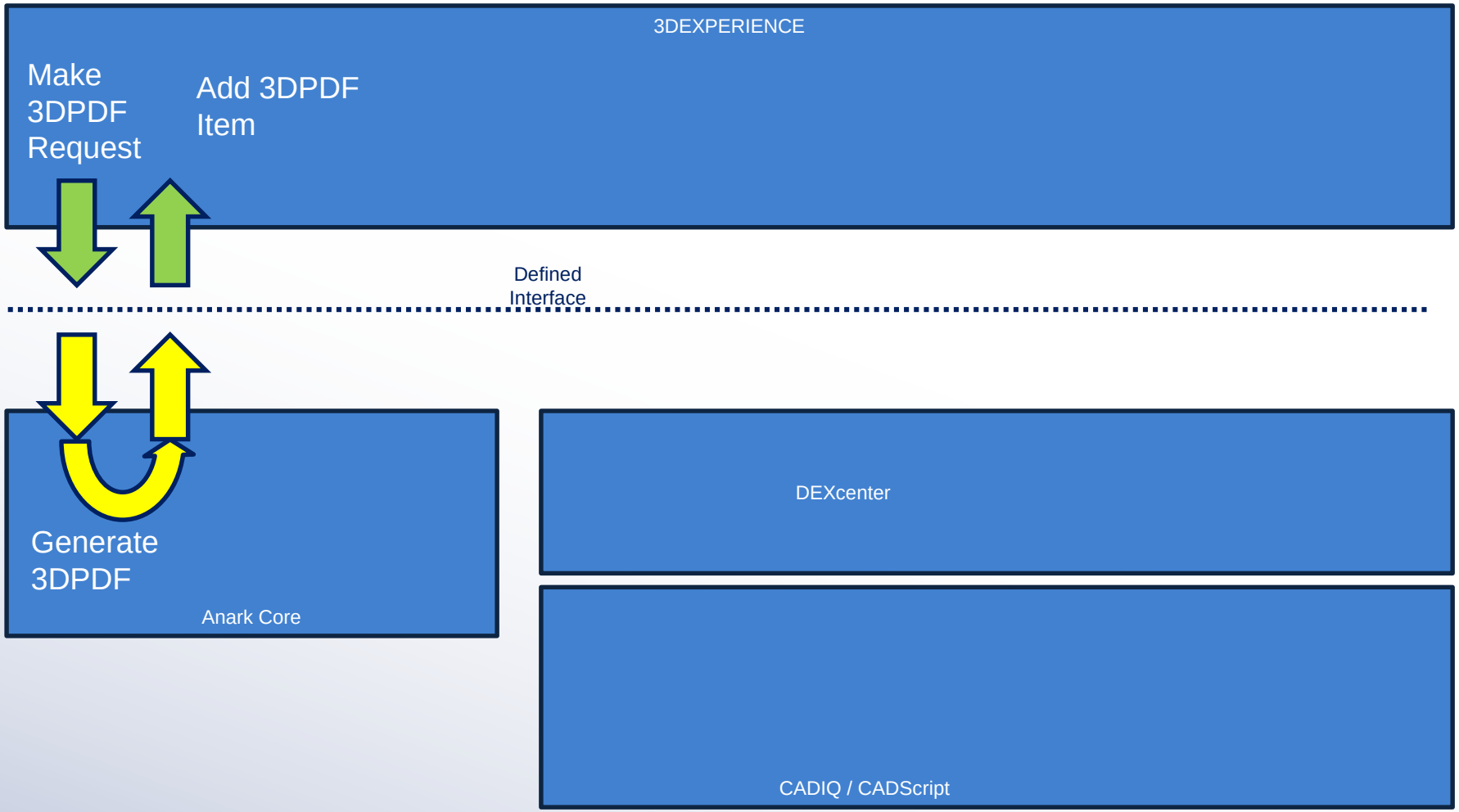
Solution: 3DDE Micro Processes



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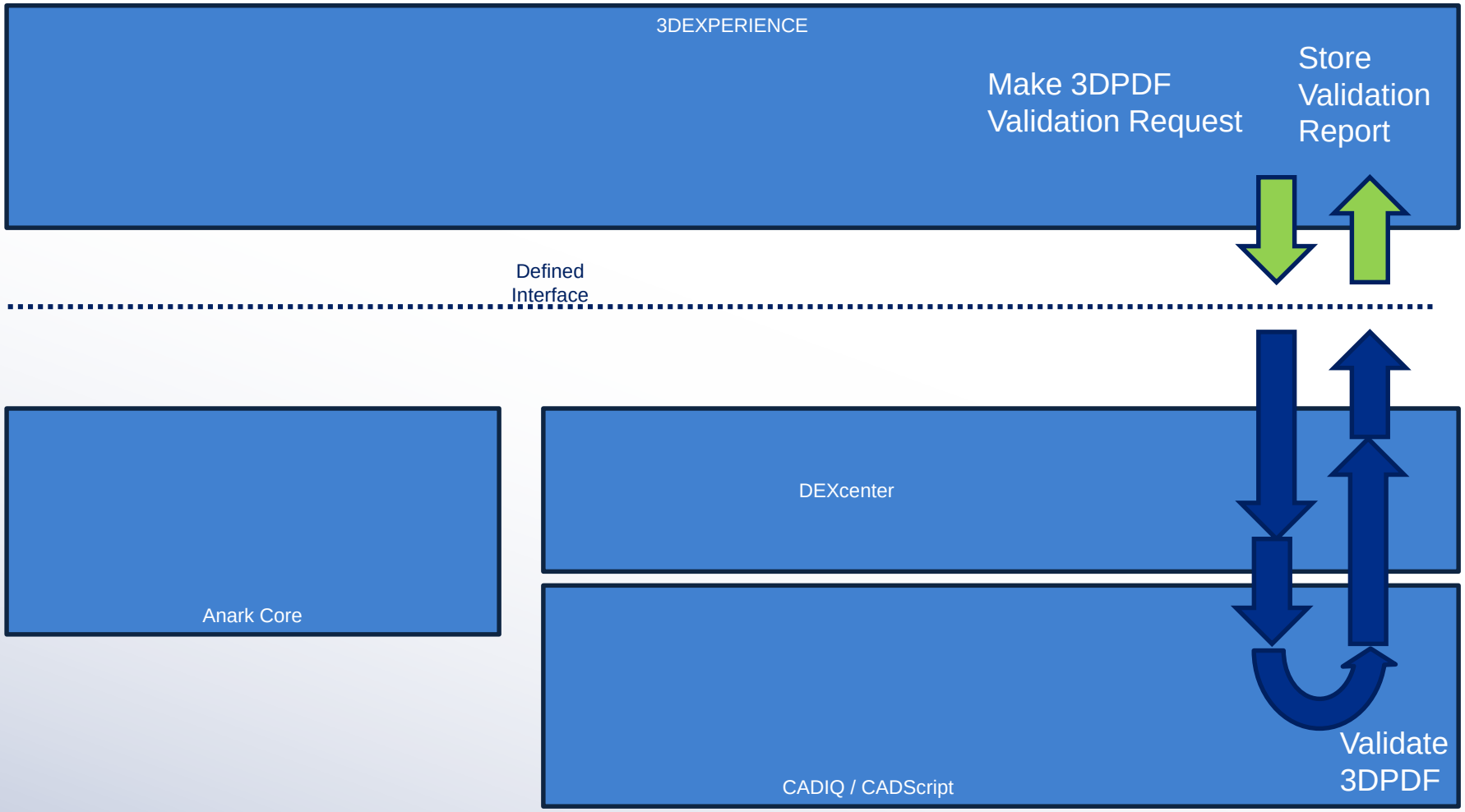
Solution: 3DDE Micro Processes



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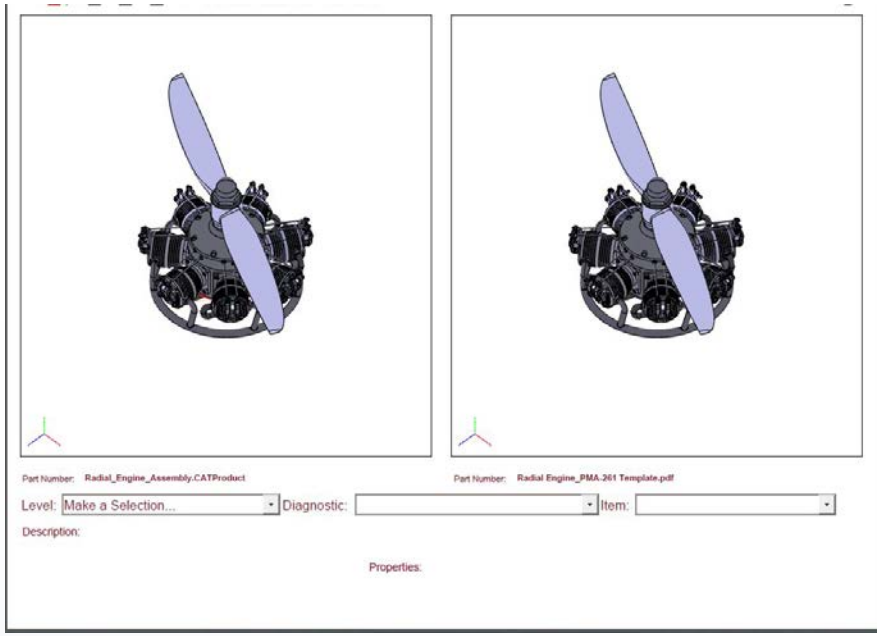
Solution: Anark 3D PDF / Validation

- Validation of 3D PDF documents relative to native CATIA models
  - Geometry
  - PMI
  - Assembly Structure
  - Model Views



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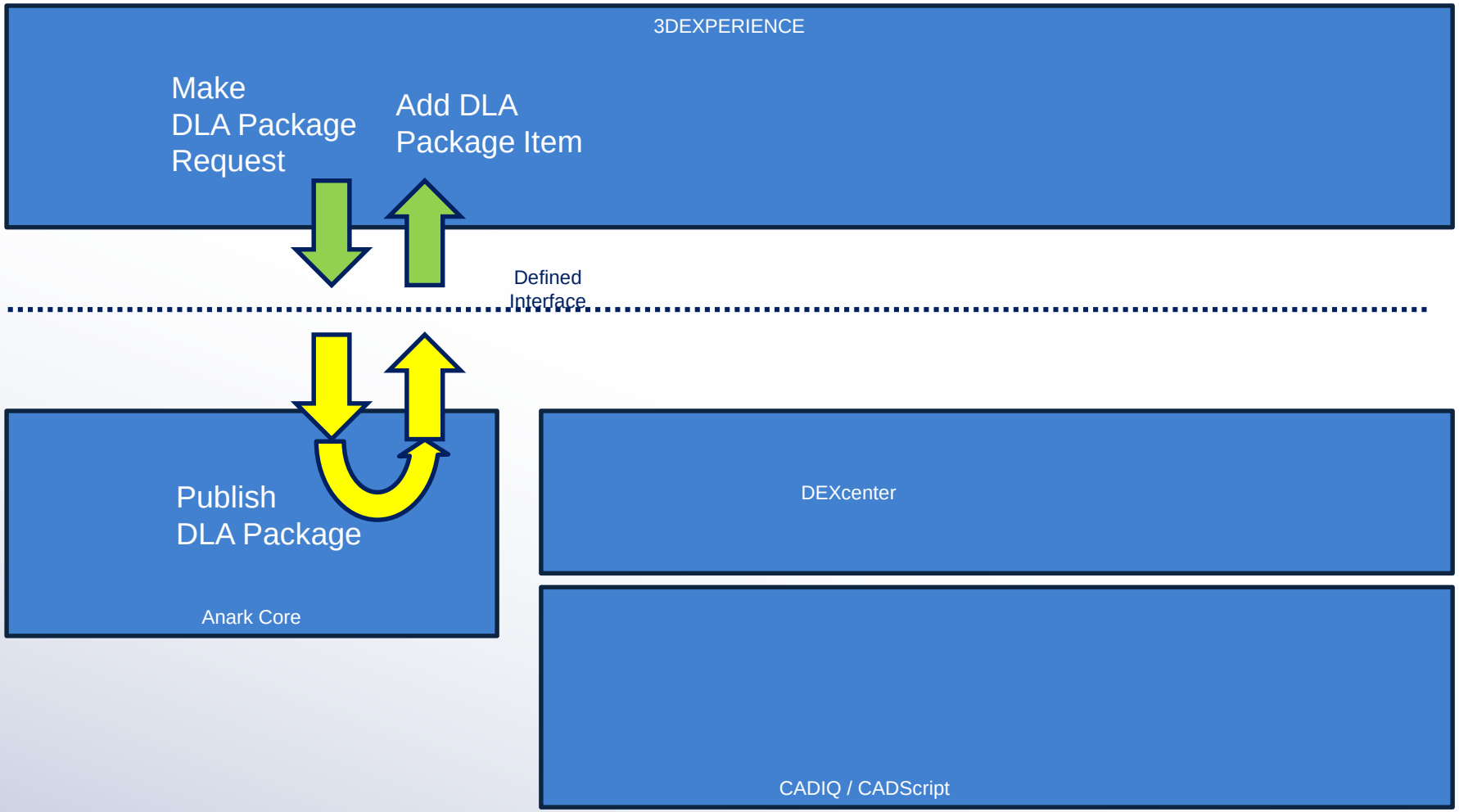
Solution: 3DDE Micro Processes

DLA Package = Attaching validated STEP File / adding Approval



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Solution: 3D PDF Document Layout

Anark Core automated mapping of CATIA V5 MBD content along with BOM, Part/Application Lists, Field and Text Sheets – Sheet 1 of N

DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
PATUXENT RIVER, MD 20670

PMA-261
48187 Stanley Road
Building 4010
Patuxent River, MD 20670

CLASSIFICATION: UNRESTRICTED

CORE ITEM(Y/N): YES

DESIGN CAGE:	DESIGN REV:	DESIGN MODIFICATION DATE:
11221	C	2017-02-17

NOMENCLATURE: RADIAL ENGINE ASSEMBLY

PART OR IDENTIFICATION NUMBER: Radial_Engine_Assembly

EST WT: 174.31lbs

NAVAIR DOC NUMBER: 223123-04-05

DOCUMENT APPROVAL: James Martin

APPROVAL DATE: 2018-01-01

CAD PROGRAM: CATIA V5

NOTES:
UNLESS OTHERWISE SPECIFIED:
•ALL BELOW NOTES HAVE NO MEANING AND ARE AN EXAMPLE ONLY.
•DIMENSIONING AND TOLERANCEING SHALL BE INTERPRETED IAW ASME Y14.5-2009.
•PRODUCT DEFINITION DATA SET (PDDS) TO BE INTERPRETED IAW ASME Y14.41-2012.
•DIMENSIONS ARE IN INCHES.
•PARTS ARE MODELED AT THE NOMINAL DIMENSIONAL CONDITION. IF A NOMINAL CONDITION DOES NOT EXIST, THE PART SHALL BE MODELED AT THE MEDIAN DIMENSIONAL CONDITION.
•THE TRUE GEOMETRY OF THE PART DEFINES THE THEORETICALLY EXACT SIZE, PROFILE, ORIENTATION, OR LOCATION OF A FEATURE OR DATUM. IT IS THE BASIS FROM WHICH PERMISSIBLE VARIATIONS ARE ESTABLISHED BY APPLIED TOLERANCING.
•REMOVE BURRS AND BREAK ALL SHARP EDGES.
•ALL SURFACES IN THIS MODEL THAT APPEAR TO BE INTERSECTING AT RIGHT ANGLES SHALL HAVE IMPLIED 90 DEGREE INTERSECTION ANGLES. THE ALLOWABLE TOLERANCE ON THESE ANGLES SHALL BE AS SPECIFIED ON THE

REVISION NOTES:
A. 12June2016 initial design

B. 19Dec2016 for next phase prototyping purposes

C. 17Mar2017 initial manufacturing prototyping revision
----------END OF STATEMENT----------

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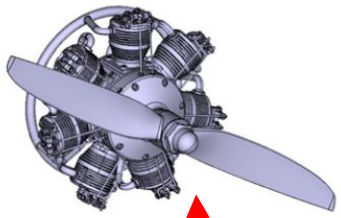
DISTRIBUTION UNLIMITED AS THIS IS NOT A REAL PRODUCT WITH REAL DATA

EXPORT CONTROL:
This is not a real model or a product and thus, there is no export controls on any information in this document.

CRITICALITY STATEMENT:
Criticality is a part identified as critical by the design approval holder during the product type validation process, or otherwise by the exporting authority. Typically, such components include parts for which a replacement time, inspection interval, or related procedure is specified in the Airworthiness Limitations section or certification



VIEW FOR REFERENCE ONLY

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LICENSE AGREEMENT:
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MISC MARKING:
No markings have been applied but, automated watermark creation and updating is possible with type of document

DESTRUCTION NOTICE:
Please do not destruct this document as it is a simple but effective 3D PDF that shows how CATIA V5 and other PLM Metadata is combined into fit-for-purpose Technical Data Package

PARTS LIST

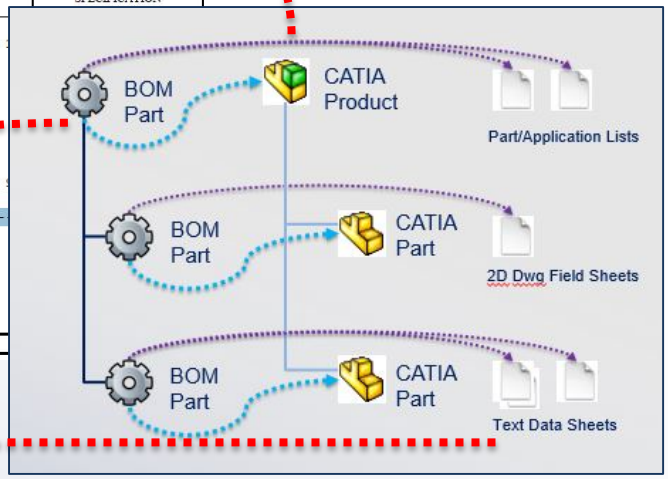
QTY	DESIGN CAGE	PART OR IDENTIFICATION NUMBER	NOMENCLATURE	MATERIAL	SPECIFICATION
1	11221	Radial_Engine_A	RADIAL ENGINE ASSEMBLY		
1	13256	Exhaust_Intake_	EXHAUST INTAKE PIPES	Titanium Grade	
1	40789	Gear_assembly	GEAR ASSEMBLY	316Ti Plate	
7	12749	Piston_assembly	PISTON ASSEMBLY		
1	12639	Propeller_assem	PROPELLER ASSEMBLY	Carbon Fiber	
7	65878	Rocker_arm_asse	ROCKER ARM ASSEMBLY	PH13-8Mo	
1	13453	backplate-assy	BACKPLATE ASSEMBLY	PH13-8Mo	
1	52745	crank-case-asse	CRANK CASE ASSEMBLY	PH13-8Mo	
1	13994	crank-shaft-ass	CRANK SHAFT ASSEMBLY	321 Plate	
7	45367	cylinder	ENGINE CYLINDER	Titanium Grade	
1	24619	front-housing-a	FRONT HOUSING ASSEMBLY	316Ti Plate	

----------END OF LIST----------

Sheet 1 of 2 Sheet Size: B

MBD CATIA V5

BOM



Notes & Statements (Lists appear in Sheets 3 and higher as needed)

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Solution: MBD 3D PDF Information Layout

Anark Core automated mapping of CATIA V5 MBD with selectable BOM List driving a dynamic 3D PDF MBD View – Sheet 2 of N

Title Block

Selectable BOM

CATIA V5 MBD Views

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NAVAL AIR SYSTEMS COMMAND
PATUXENT RIVER, MD 20670

PMA-261
46187 Stanley Road
Building 4010
Patuxent River, MD 20670

DESIGN CAGE:	DESIGN REV:	DESIGN MODIFICATION DATE:
11221	C	2017-02-17

NOMENCLATURE:
RADIAL ENGINE ASSEMBLY

PART OR IDENTIFICATION NUMBER:	EST WT:
Radial_Engine_Assembly	174.31 lbs

PARTS LIST
FOR REFERENCE ONLY

QTY	DESIGN CAGE	PART OR IDENTIFICATION NUMBER	NOMENCLATURE
1	11221	Radial_Engine_A	RADIAL ENGINE A
1	13256	Exhaust_Intake_	EXHAUST INTAKE
1	11789	Gear_assembly	GEAR ASSEMBLY
7	12749	Piston_assembly	PISTON ASSEMBLY
1	12639	Propeller_assem	PROPELLER ASSEM
7	65878	Rocker_arm_asse	ROCKER ARM ASSE
1	13453	backplate-assy	BACKPLATE ASSEM
1	52745	crank-case-asse	CRANK CASE ASSE
1	13994	crank-shaft-ass	CRANK SHAFT ASS
7	45367	cylinder	ENGINE CYLINDER
1	24619	front-housing-a	FRONT HOUSING A

----------END OF LIST----------

AVAILABLE VIEW STATES

PRINT SELECTED VIEWS

CHECK BOX TO SELECT ALL

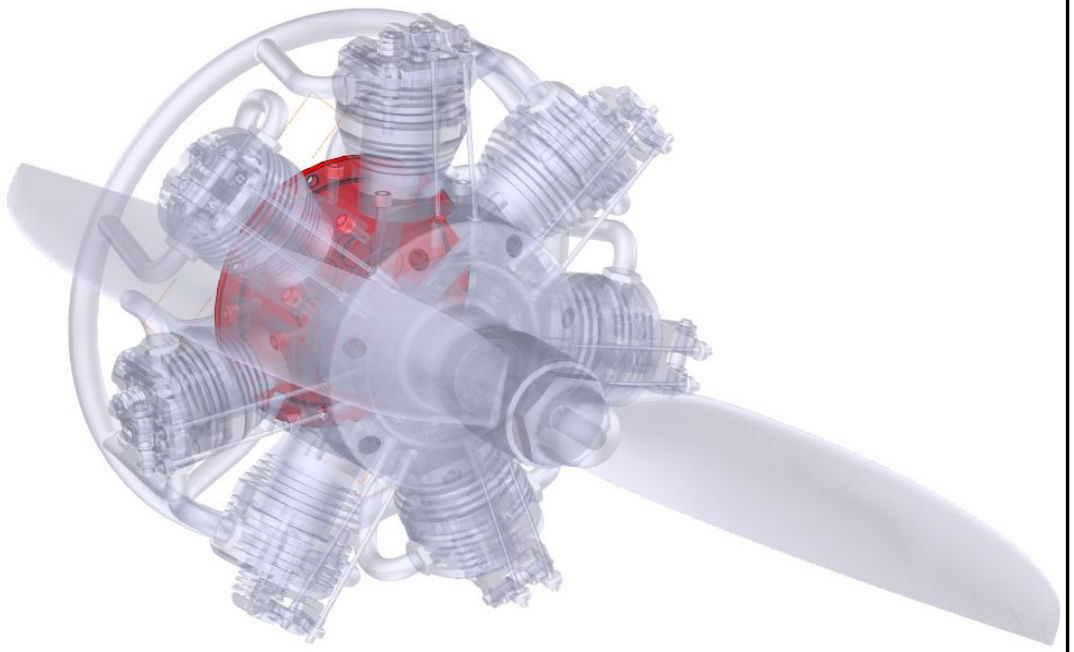
- RELEASE
- ISO
- Axonometric View1
- MBD Back
- Single Section Cut

PREVIEW

SHOW ALL | ZOOM FIT

HIDE | SHOW | ISOLATE

Sheet 2 of 2 Sheet Size: B



3D MBD View of CATIA V5 Backplate Assy Selected

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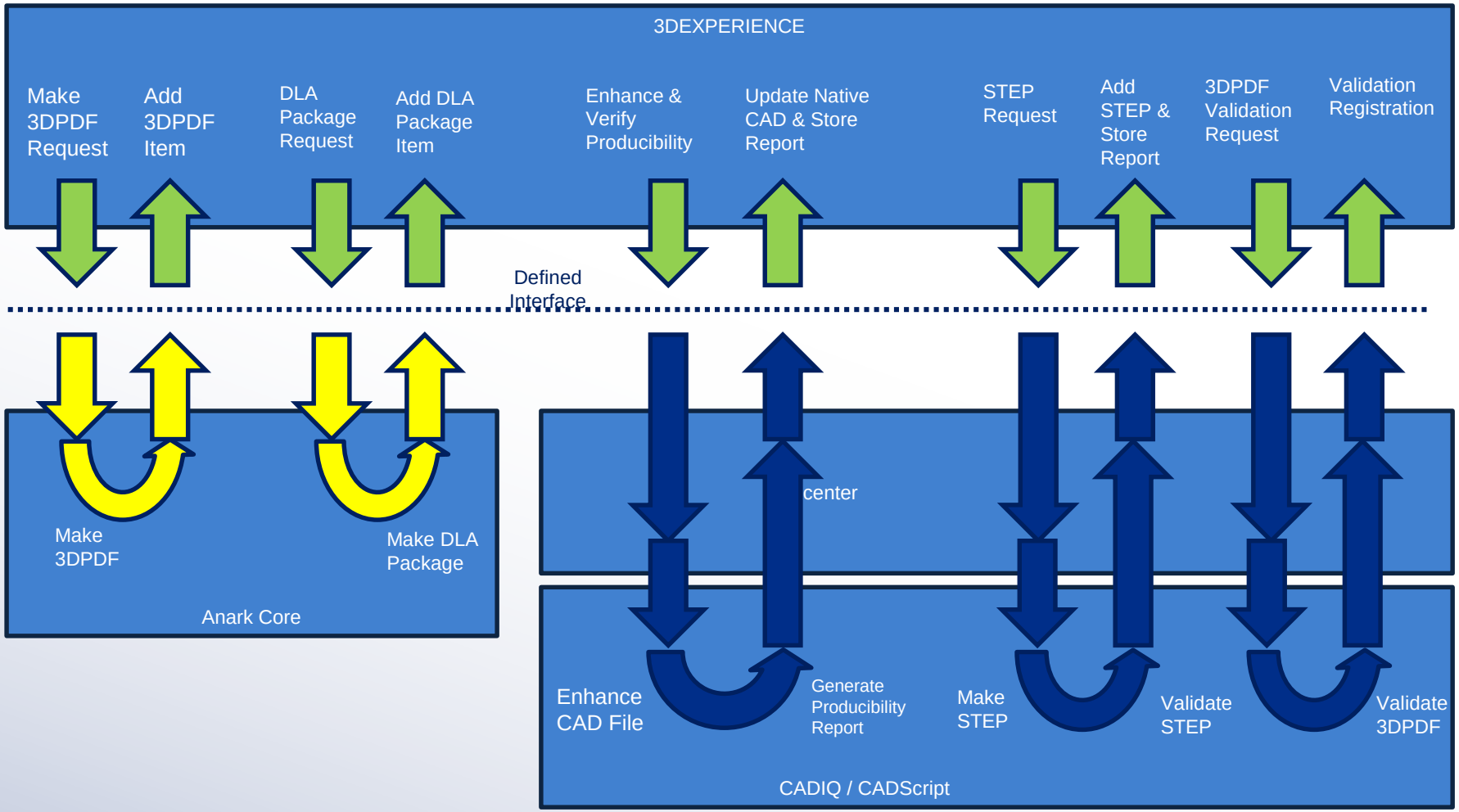
The 3DDE Solution



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Key Points

- **PMA-261**
  - Solution available for non-CAD users to consume MBD content
- **Anark**
  - Automated generation of validated standards-based 3D-PDF-based MIL-STD-31000 documents and Technical Data Packages (TDPs), with lifecycle-appropriate document markings, is a repeatable process from any PLM system

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Key Points

- **ITI**
  - Manipulate data for optimum publishing
  - Provide validated derivative data for trusted content publishing
- **Razorleaf Government Solutions**
  - Develop an architecture for a broad information delivery solution applicable to any PLM or CAD system
  - In a model-based world, 3D PDFs are great “fit-for-purpose” communication tools, but the volume of supporting data has to be managed

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Next Steps

- **Groom Pilot Project for Production Deployment PAX Data Center on NMCI**
  - Perform work to prepare for production
  - Deploy into production in Q2 and Q3 of 2018
  - Explore modularizing solution for application to other PLMs and CADs

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Conclusions

- **OEMs may use modern PLM/CAD systems and MBE processes but data structures mismatch with DOD programs may still need to be addressed.**
- **Automation is required - thousands of models cannot be hand verified, organized, and delivered.**
- **Any system must be defined with flexibility to enable micro-processes that can be applied to varying PLM and CAD OEM data and map the data to DOD systems.**
- **DOD programs must automate MIL-STD-31000-based TDP delivery using standards-based formats such as 3D PDF and STEP that are sustainable.**

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Thank You

Additional Slides from the NAVAIR 3DDE Original Presentation

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3D Data Exchange Project
PMA-261, Anark, ITI, Razorleaf Govt Solutions

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CH-53K Program Introduction PMA-261

CH-53K will be able to get more fighters into the air.

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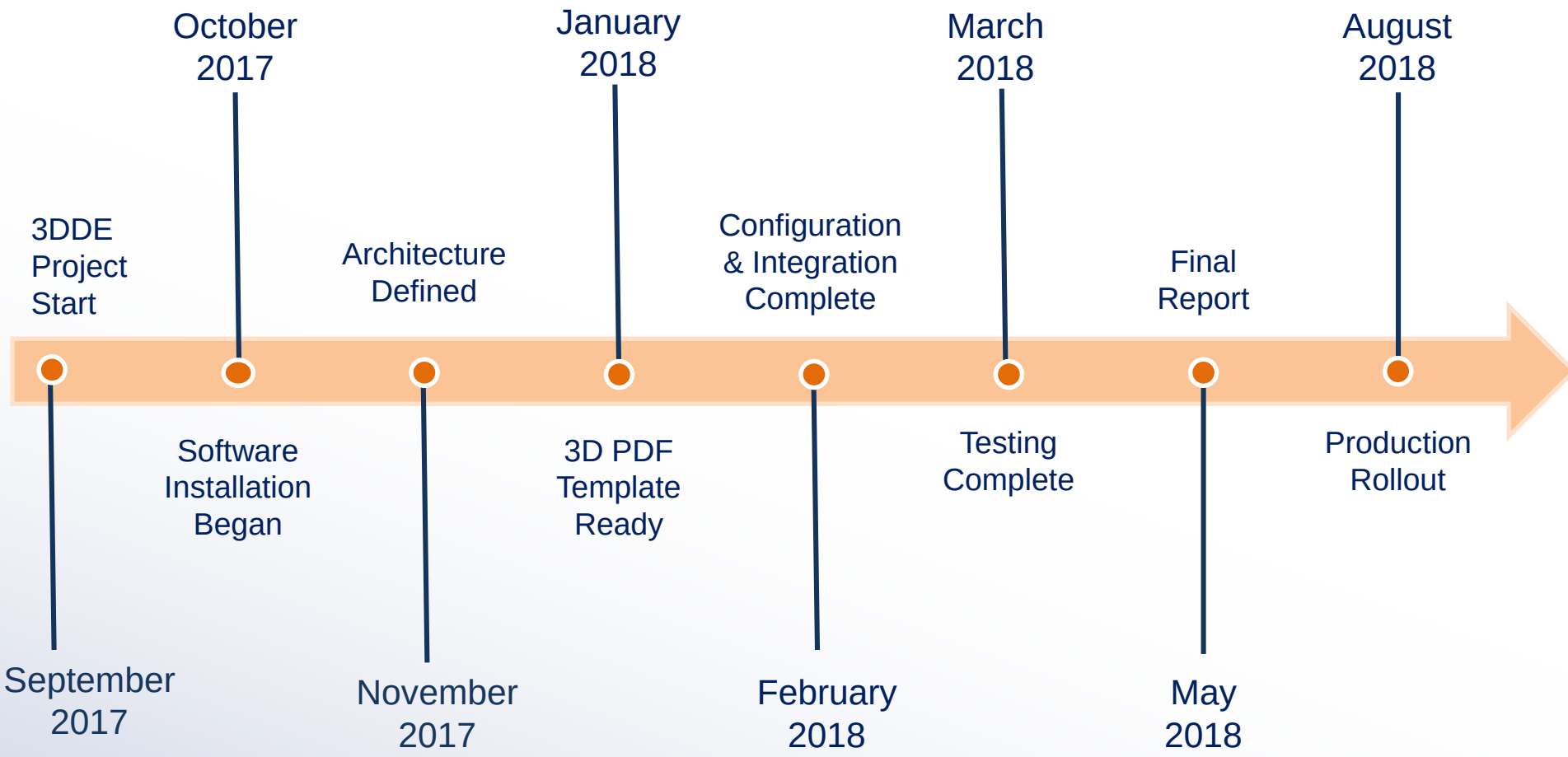
3D Data Exchange Project Introduction



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Acknowledgements

- **NAVAIR Commander's Award**
  - This project has been selected as the winner for Business Innovation
- **Project Support Acknowledgements**
  - **PMA-261**
    - Colonel Hank Vanderborght Program Manager
    - Greg Drohat Deputy Program Manager
  - **AIR 00**
    - Todd Balazs NAVAIR Digital Integration Officer
  - **NAVAIR 6.0**
    - Tom Rudowsky Deputy Assistant Commander for Logistics and Industrial Operations
  - **NAVAIR 6.8**
    - Roy Harris Director Aviation Readiness and Resource Analysis
  - **Office of Naval Research**
    - John Carney NAVY ManTech Director

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Acknowledgements

3D Digital Data Exchange Team

- **PMA-261**
  - Howard Owens / Brent Gordon / Joe Tolarski / Greg McAndrew / Bill Conner / Michael Yu / Mike Kaczmarek / Major Julian Rosemond
- **NAVAIR 6.8**
  - Mary Harris / Tracey Jones
- **NAVAIR 7.2**
  - Jeff Wood
- **FRCE Cherry Point**
  - Dan Ventry / Trey Godwin / Ann Deans
- **Lakehurst**
  - John Schmelzle
- **ATI / NSAM Center**
  - Dick Tiano / Scott Truitt / Tim Macon / Dale Orren
- **Office of Naval Research**
  - Paul Huang
- **NAVSUP**
  - Katie Gagliardi / Tim Lypka / Kevin Joyce
- **DLA**
  - Ron Smith

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Close

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    - 508-904-7880, asa.trainer@iti-global.com
  - Jonathan Scott
    - 443-356-6846, jonathan.scott@razorleaf.com
- Questions?

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