

AFRL

Digital Nondestructive Evaluation

Advanced Sustainment Knowledge via Nondestructive Evaluation

*ASK NDE *

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MATERIALS AND MANUFACTURING DIRECTORATE

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AFRL ASK NDE Capability Pilot Demonstration

Objective/Scope – Research, develop, and demonstrate a digital NDI/E data capability for enhancement of field and depot inspection, engineering, and maintenance operations.

MISSION 1: Facilitate NDI Data Capture and Documentation ****IMMEDIATE GOAL****

- Display technical orders, capture metadata necessary for reproducing NDI process, easily capture inspection results / interpretations, generate required forms
- Digitize workflows, enable data availability to various sustainment rules (NDI, MX, EGR, etc.)

MISSION 2: Enable Use of Full Raw NDI Data to Improve Sustainment **Long Term Perspective**

- Collect; capture; store; and enable retrieval and analytics of full raw NDI data and metadata
- Provide access to NDI, maintenance (MX), and engineering (EGR) roles
 - Allow EGR to perform further analysis of particular inspections
 - Facilitate searching / trending of depot and field data; from one tail number to the entire fleet
 - Enable management of inspection intervals inspect based on condition

GOVERNMENT-OWNED SOLUTION

- Enables vendor-agnostic customization/enhancements after end of this capability demo project
- Addresses inputs from all key stakeholders (NDI, MX, EGR), with potential for growth without vendor lock
- Leverages existing software tools toward integration for digital engineering and optimized sustainment

Make aircraft sustainers' lives easier!

Next Generation NDI/E – Motivation



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Full NDI Data/Metadata Capture

- Automatically capture all NDI data to maximize insight over time
- Advanced NDI Data Utilization
 - Easier documentation improves throughput
 - Track issues and discover trends
 - Research and integrate predictive analysis techniques (eventually, AI)
- Software, Network & IT

USSF

- Next generation infrastructure (incl. cloud)
- Enhanced interface applications
- Easy and intuitive transfer of data to those who need it now, by role
- Appropriate security policies/procedures

Team Members:

ARCTOS, Enrique Medina Engineering

Blue Quartz, Boeing

AF – AMXG, SMXG, B-52 ASIP, AFSC/ENSI, AFRL CyberSecurity





KC-135 NDI Workflow (2017)





Typical Production Level Inspection Reports







ASK NDE

DIGITAL ENGINEERING

- Data Acquisition
- Transmission
- Analytics
- Storage



Data Transfer to :

- FSID B-52 EGR Processes (ASIP) ... EGR Disposition/MX Decisions
- HyperThought Data Analytics Post Processing, Analytics, Trending



milCloud

storage

ASK NDE - Data Flow

ASK NDE will demo FSID ingestion of NDI metadata collected using IRIS.

FSID

(Functional Systems Integrated Database)

- U.S. Government-owned / contractoroperated.
- Used by program engineers to support the integrity programs of eight USAF platforms (as of Jan 2019).
- Web-based interface.
- Current authorization to operate (ATO).
- Enables / facilitates sustainment workflow documentation and analysis (Process and Task Tracking System, or PaTTS, module).
- Enables storage / retrieval / analysis of metadata for inspection, repair, and other sustainment activities.

B-52 / E-3 / KC-135

<u>IRIS</u>

(Inspection Reporting and Instruction System)

- AFRL-developed and U.S. Governmentowned.
- <u>ASK NDE GOAL #1</u> Facilitate nondestructive inspection data capture and documentation on the shop floor
 - Inspectors use tablet computer to view inspection tech orders and digitally document inspection settings, results, and interpretations at inspection site (depot and field).
 - Inspectors import inspection data into FSID (and other tools as needed).
 - NDI, MX, and EGR personnel access NDI data when/where needed.
- The ASK NDE Capability Pilot Demonstration is developing IRIS and integrating it with FSID and HyperThought.

ASK NDE will demo HT ingestion of (raw) NDI data collected using IRIS.

HyperThought (HT)

milCloud storage

- AFRL-developed and U.S. Governmentowned.
- General capability for big data storage, applications, and analytics.
- <u>ASK NDE GOAL #2</u> Enable Data Analytics:
 - Collection of **ALL NDI information** (raw data), including spatial registration in the future.
 - Further analysis of previous inspection data, to facilitate true condition-based maintenance.
 - Trending over time using all data from inspections performed at all locations for all aircraft.

Muss Prototype Digital NDI Data Reporting Capability AFRL











FSID – Opening View





FSID Inspection Metadata (Transferred from IRIS)



AFR



FSID Inspection Results (Transferred from IRIS)

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B-52 FSID USER ACCEPTANCE Functional Systems Integrated Database	FOR OFFICIAL USE ONLY Enrique Medina : User logout
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ASK NDE - Full Data Capture Schematic



THE AIR FORCE RESEARCH LABORATORY -

AFRL





Questions / Discussion

Final Report

- DTIC
- AFRL-RX-WP-TR-2021-0217
- 29 Nov 2021
- FA8650-18-F-5296
- Distribution Statement C