FY24 ATI Digital Tracking AI overview
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We Deliver Flightline Readiness

• Maintenance, Repair and Overhaul Services
• Worldwide Support
• Lifecycle Sustainment Services
Fleet Readiness Centers are support activities that provide shore-based and depot-level maintenance and support to Naval aviation efforts. They are under the direction of the office of Commander, Fleet Readiness Centers (COMFRC).
FRC East Locations

MCAS Cherry Point
- AV-8B & TAV-8B Harrier
- MV-22 & CV-22 Osprey
- CH-53E/K Super Stallion
- MH-53E Sea Dragon
- F-35A/B/C Lightning II

MCAS New River
- MV-22 & CV-22 Osprey
- AH-1Z Viper
- UH-1Y Venom

NC Global TransPark
- Air Force UH-1N Huey
- C/KC-130T/J Hercules
- HH-60W Jolly Green II
- MH-139A Grey Wolf

MCAS Beaufort
- F/A-18A-D Hornet
- F/A-18E-F Super Hornet

AFB Hurlburt Field
- CV-22 Osprey
Our Capabilities

- AV-8B & TAV-8B Harriers
- MV-22 & CV-22 Osprey
- AH-1Z Viper
- Air Force UH-1N Huey
- HH-60W Jolly Green II *
- C/KC-130T/J Hercules *

- T400 Reduction Gearbox (UH-1N)
- T58-400B (Presidential VH-3D Sea King)

- Gas turbine compressors
- Auxiliary power units
- Gearboxes
- Rotor blades

- Metal plating, coating, forming, heat-treating
- Welding
- Material analysis
- Non-Destructive Inspection

- UH-1Y Venom
- CH-53E/K Super Stallion/King Stallion
- MH-53E Sea Dragon
- F/A-18A-D Hornet & F/A-18E-F Super Hornet
- F-35A/B/C Lightning II
- MH-139A Grey Wolf *

- T64 (CH/MH-53E)
- F-35B Lift System *
- T408 (CH-53K King Stallion) *
- F402 (AV-8B & TAV-8B)

- Hydraulic & pneumatic actuators
- Fuel controls
- Avionics

- Low observable paint
- Titanium tube bending, inspection, testing
- Composite & fiberglass fabrication
- CNC machining (5-axis)
- 3-D printing & additive manufacturing

* Denotes establishing capability
Machines and People Comprise our Capability

Reactive Machine Systems in use or being developed and are primed for future implementation of Machine Learning:

- Additive Manufacturing Polymer and Metal
- Autonomous Material Handling
- Robotic Systems
- Cold and Thermal Spray
- Laser Ablation
- Laser Projection
- Metal Forming
COMFRC Challenges Requiring Solution

What are the challenges? Asset Management

**Upper**
- DoD asset audit failures (FY 24 - 6th consecutive failed DoD wide audit)
- Accountability for 100%, procured, designed, fielded
- 3 main COMFRC sites @ +/- 280k Assets
  - Does not include asset counts for IT, Safety, environmental, Field Team services, or any detachment/interdiction sites. *Always growing, always changing, H60, C-130...*
- Current man hrs. @ 15.5k to conduct COMFRC inventory @ 3 sites
  - With DT and IoT: 372 man hrs. for +/- 80k @ 3 sites
- COMFRC detachment sites = 47 (does not include Depot interdiction sites)

**Middle**
- Pre-Operational records and use
  - Inspection records are handwritten in terms of compliance
  - Assets never stop moving, some records are misplaced, require retention
  - Transfer and acceptance throughout the enterprise complicates

**Lower**
- Business and production planning
  - Where to invest labor and financial investment
  - Accommodate the customer, do I have this organic capability
  - Where to best use limited human and financial resources
Why Digital Tracking, IoT, and AI, how will this address enterprise challenges?

**Upper**
- Reduction of MANYEARS associated with inventory of enterprise assets

**Middle**
- Remove pre-operational record challenge and associate data collected in a variety of ways to facilitate conformance

**Lower**
- What do I have, Where is it, Can I find it, Can I use it?

*IoT and DT comes with semantic model analytics vice conceptual, we turn policy into software processes, inject quality, and mistake proof human data inputs/Outputs. Combining Machine Learning data along with Machine Health & Environmental Monitoring as well as Supply/Logistics, Financial... is beginning of total process data collection and mapping via software input/output like: Integrated Computer-Aided Manufacturing (ICAM), a US Air Force program that develops tools, techniques, and processes to support manufacturing integration.*
Semantic Model Analytics and Ontology of data, what will this do for us = AI

Following the “Weak AI” model type, Humans leveraging RF mobile devices or fixed RF infrastructure through a software that is process driven converted from policy, create a data pool similar to the same data pools collected from “Reactive Machines.” This is called “IoT of things” in DT

- Specific inputs with specific exhausts for specialized duties.

“IoT of things” identifies patterns of human process data sets via mathematical algorithm imbedded into code. Historical data human process data “IoT of things” additionally inputted, provides predictions with new exhaust values.

- This is the essence of Machine Learning (ML): in the IoT of things, humans become the machine, and the ML provides similar data pool opportunities like those collected with equipment data.

- Expected inputs/exhausts = Supervised Learning for ML, with historical data pools added, predictability in future exhausts = Unsupervised Learning; this is the foundation of ML.

Software and Middleware analytics contain hidden algorithms known as “Deep Learning (DL)” allowing for complex relationships in data to form (ontology of data), complex patterns weigh input, historical input, then weigh for best exhausts

- This is what is required to establish optical image, human speech, and language processing in AI

“Natural Language Processing (NLP)” is established with volumes of “DL” data teaching the software and middleware to understand and produce written and spoken language similar to humans

- This is the feature that allows for the “Ask a Question” portions of the software analytics

“Computer Vision” is the application of “ML” collected from DT, images, videos, in a broken-down form to provide exhaust data which identifies, organizes, and tags items in the same manner of humans accordingly.

- This is the feature where all intake of materials within an activity are sorted, organized, and routed which is beneficial for use cases such as Parts Tracking.

“Reactive Machines” react to specific inputs/exhausts, do not store memory, or rely on history to assist with a decision in real time.

- Data collected is used for completing specialized duties in ML, as well as creating conventions for data pool collection.
Software Semantic Analytics

Semantic Model Analytics and Ontology of data, what will this do for us = AI

“Limited Memory” uses past data and predictions based from collected intakes and exhausts to make decisions.
- Uses past data to predict
- Requires continuous training and convention to analyze and utilize new data. Or, an established AI environment enabled to Auto-Train.

* Current software analytic model does NOT pursue “Theory Of Mind AI”, or “Self-Awareness AI” as they do NOT theoretically exist.

Software and Middleware analytics possesses the foundational requirements in type of AI for:
- Weak AI

Software and Middleware analytics possesses the foundational requirements this kind of AI:
- Reactive Machines
- Limited Memory

Software and Middleware analytics possesses the foundational requirements to leverage the following AI tools:
- Machine Learning
- Neural Networks
- Deep Learning
- Natural Language Processing
- Computer Vision

What Type of AI effort are we interested in?

* Leveraging semantic analytics model is the foundation for enhanced AI and a major element of DT implementation
Software Semantic Analytics

Data Engineering
Data Forensics

Semantic Modeling and Knowledge Engineering

Data Ingest & Alignment With V&V testing

Application Design, UI/UX and Data Fabric Interface

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<thead>
<tr>
<th>Vendor</th>
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</thead>
<tbody>
<tr>
<td>ANALYTICS</td>
<td>VAULT</td>
<td>Data Fabric</td>
<td>Vendor</td>
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<tr>
<td>BOM for</td>
<td>Use Cases</td>
<td>XML/OWL Files + B5 + A4 + SRR + PDM Files will be provided to DataOS to ingest</td>
<td>Business Intelligence</td>
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<td>Assets Availability</td>
<td>Supply Readiness Review</td>
<td>Vendor</td>
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<td>Periodic Parts Maintenance</td>
<td>ALC Throughput</td>
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Data Fabric

1. Ingestion - Data from all sources will be ingested into Data Fabric using the provided XML/OWL model to create data connections between the data sets.

2. Transformation - Data will be validated and transformed for data quality in DataOS based on the provided XML/OWL.

3. Cataloguing - Data Dictionary will be generated based on the info provided by XML/OWL. This has to be done manually if DataOS can’t auto dictate using the XML/OWL.

4. Data Controls - Data Masking and controls will be put in place based on the requirements.

5. SWRL Query - Queries will be written and flare jobs will be run in order to increase efficiency on the analytics dashboards.

Analytics and AI/ML Deeper Analysis

Command Center
Embedded KPI
Embedded KPI
Embedded KPI
Embedded KPI
Embedded KPI

Supply Chain
AAV
SRR
PDM

Engineering
BOM

Alerts

Analytics

Data Services
Fabric to Fabric Integration
Direct Data Load
Semantic Model Utilities

Security Services
Data Trust Tagging
Blockchain

Settings
User Management
ABAC Access Controls
External Fabric Connections
Software Semantic Analytics

Asset Inspection Dashboard

Non-Operational Defects
- Broken
- Sharpened, T0D reas...
- Adhesive
- Peened
- Weld...
- Old Shelf
- Other Notes
- Perishable Due
- Tire Dur...
- Locally Mainta...
- Worn

Operational Meter
- Operational
- 96.8 (100%)
- 56

Assets Overview
- 87 (50.5%)
- 741 (89.9%)
- 119

Asset inventoried by Class
- Total Assets: 828
- Non Inv. Assets
- 87

Key influencers
- Top segments

What influences Defects to increase

When...
- DEFECT is Locally Maintained
- Manually Correctable is No
- DEFECT is Perishable Due
- DEFECT is PM Due
- DEFECT is Worn
- DEFECT is Broken

Average of Defects
- Average (Including selected): 123.70

Only show values that are influencers

Activate Window
Software Analytics (extension of awarded SBIR II software state, NAVAIR ontology analytics, use of: semantic modeling tools)

* FUTURE EFFORTS

Ontology leveraging semantic modeling tools adds interconnections for: materials used, personas/person interacting, tools leveraged to effect repair, locations where best/worst actors occur, location population density, technical process ordering, and historical work order data to derive deep analytics by formalizing a system for modeling concepts and their relationships.

Unlike relational database systems, which are essentially interconnected tables, ontologies put a premium on the relationships between concepts or processes by storing the information in a software for use in predictive and augmented solutions driven by software solution modeling.
Software Semantic Analytics & Ontology of data

Lifecycle Design Ontology
System Design Elements
- Definitions
- Format
- Standards
Product Documents & Data
Lifecycle Stakeholder Interfaces, Products, Processes and Data

System Product Design, Engineering, Processes & Modeling
Domain Engineering, Processes & Modeling
UML, XML, SML, ATML, DAGML

IDE
Database(s) Tables Datatypes
DemO with Part/Sample of FMECA DID
Part Nomenclature and MTBF & CA elements

CAMEO
Sustainment Domain Engineering, Products, Processes and Modeling
AI/ML Modeling Applications
Acquisition Domain (MBSE, Requirements Verification, Affordability, Operations, etc.) Engineering, Products, Processes and Modeling

Operational Data