Modular Open Systems Approach (MOSA) Panel

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VP and Division Head for Military and Aerospace Solutions (TES-MAS)

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AAAA Panel – MOSA

Matt Sipe

Director, MOSA Transformation Office
PEO Aviation

5 APR 2022

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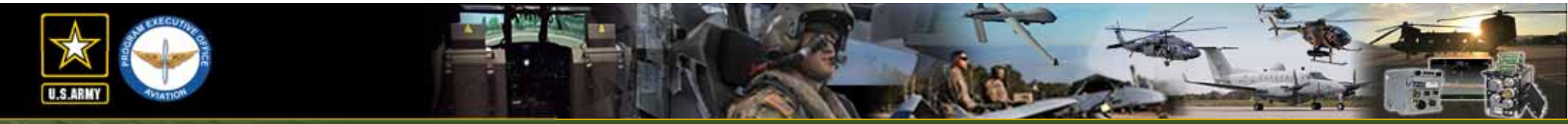
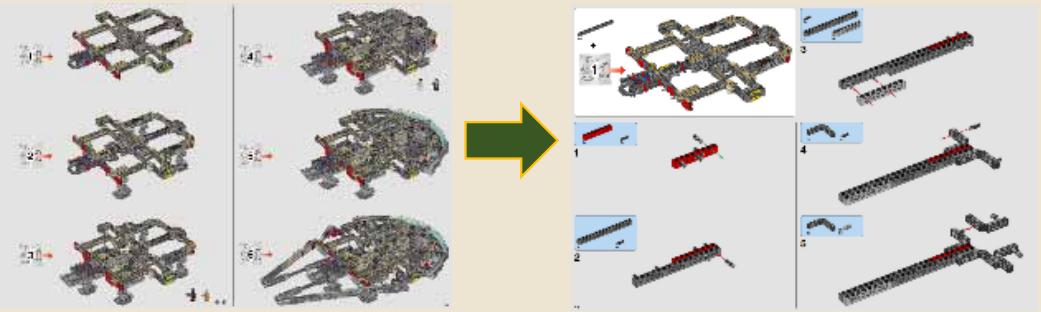


What is MOSA?

Making **Modularity** and **Openness** Decisions enable Complex Systems to be more effectively and efficiently managed in pursuant of MOSA Objectives.

Modularity Decisions break large and complex things into simpler, smaller components.



Openness Decisions ensure the needed/tailored transparency for key areas of concern are obtained.

Platforms, Systems, Components, Interfaces

Limited → Complete Transparency
Enabled primarily through data rights, the right TDP, and use of Standards

DoD's Five MOSA Principles in ACTION in PEO AVN

- **Establish an Enabling Environment**
  - Digital Ecosystem
  - Contracting: Vehicles and Rights
  - Culture
- **Employ Modular Design**
  - Group Functions and Behaviors
- **Designate Key Interfaces**
  - Defined Boundaries
- **Use Open Standards**
  - Consistency
  - Transparency
- **Certify Conformance**
  - Be measurable
  - Be accountable

Closing Comments and Questions

MODULAR OPEN SYSTEMS ARCHITECTURE

UNLOCK THE POWER OF YOUR AVIONICS- SPEED UP CAPABILITIES IN THE BATTLEFIELD

Collins Aerospace

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COLLINS' APPROACH TO MOSA

OUR CUSTOMERS WANT OPTIONS

UPGRADES AT THE "SPEED OF RELEVANCE"

SAFETY CRITICAL CERTIFICATION IS YOUR INSURANCE POLICY

PARTNERSHIP IS KEY

Collins Aerospace

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COLLINS AEROSPACE

- Our military is being driven by near-peer competitors that have evolved very rapidly over the past 10-20 years. As they change, we need to maintain overmatch and be just as fast - if not faster - in our response to those changing threat environments.
- What helps to keep us grounded is trying to consider how to best meet the intent of open systems. Ultimately, open-system architectures grant operators the flexibility to meet the requirements for their mission and how they want to meet them.
- **Our customers want options**
  - Military customers want to update a given capability, and don't want to go back to the same vendor or OEM.
  - they want to upgrade, add, remove, and modify software as dictated by the mission. They have that flexibility without having to go back to one vendor who makes only their own software.
- **Our Customers want upgrades "at the speed of relevance" to keep pace with technology growth and the rate of innovation of our adversaries.**
  - This requires new systems that allow for continuous improvements vs. long cycle block upgrade-style programs - That allows them to on-ramp new technologies as they emerge, which lowers the cost due to commercial commonality with other platforms while outpacing the threat brought by our adversaries
  - Open standards like SOSA, FACE, & OMS not only support system affordability but allow more prototypes with new products and technologies and result in faster system development.
  - Governments need new acquisition methods & industry will require new business models to incentivize rapid change
  - Old model looks at hardware as the fixed cost, software as the variable cost. Open systems may require software as the fixed cost.

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- **Often times, safety-critical applications don't get enough attention until it's too late.**
  - These applications are your insurance policy. It takes a bit more effort to get them certified, but when you arrive at an airworthiness certification, safety-critical certifications will enable your success
  - Goal of safety certification is to protect against defects. Goal of Cybersecurity is to protect against exploitation of defects. These two goals are complimentary
  - How to successfully measure if a system can safety certified is a challenge now, but progress is being made
  - We look at the commercial industry and see that it's built on safety certification. As the government adopts more safety certifications and standards, we'll be able to comply with all of them.
  - All of this increases speed, safety and cybersecurity.
- **Partnership is key**
  - MOSA TO has been great to work and we are optimistic
  - We have already begun integration of MOSARC™ into our Huntsville CEC and other open system demonstrators to educate and help our customers evolve
  - We partner with suppliers and peers, but also a partnership with the Army and MOSA TO is paramount
  - Goal is to demonstrate modular open system architectures at the aircraft and sub-systems levels.
  - Aimed at helping military customers drive the long-term viability of enduring platforms
  - Software sustainment benefits from more frequent and rapid upgrades.
  - How to successfully measure if a system can safety certified is a challenge now, but progress is being made

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AAAA MOSA PANEL

Ike J. Song, VP/GM of Strategy & Growth

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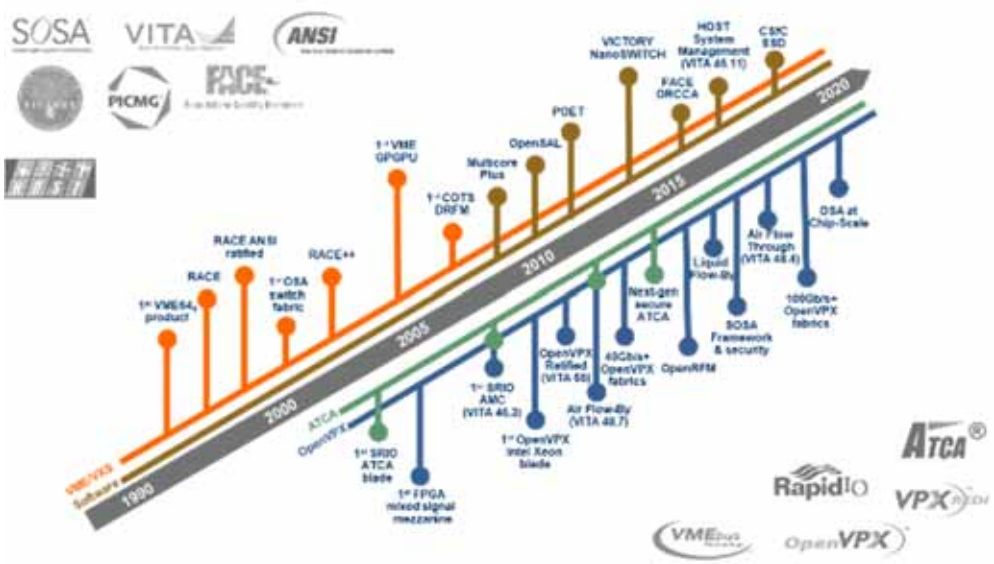
Mercury's Open Architecture culture and leadership for the last 30 years is fueling our growth and enables us to rapidly deploy innovation to the warfighter

MOSA OBJECTIVES

- Threat Based Capability Adaptability
  - Develop AMCS applications on laptops and deploy in weeks or months not years
  - Enable Army to transform industry from systems to "apps" company's
- Faster Fielding of Innovation to Achieve Overmatch
  - Mercury's AMCS delivering 40x performance improvements, to support 15-year Army application roadmap (including AI)
- Total Lifecycle Affordability through Competition
  - Breaking vendor lock, Open GPR, SOSA Upgrades
- Enabling Commonality
  - Mercury's extensible "AMCS Family of Systems" aligned to Enduring and FVL Fleet requirements

MERCURY'S 30 YEAR LEGACY



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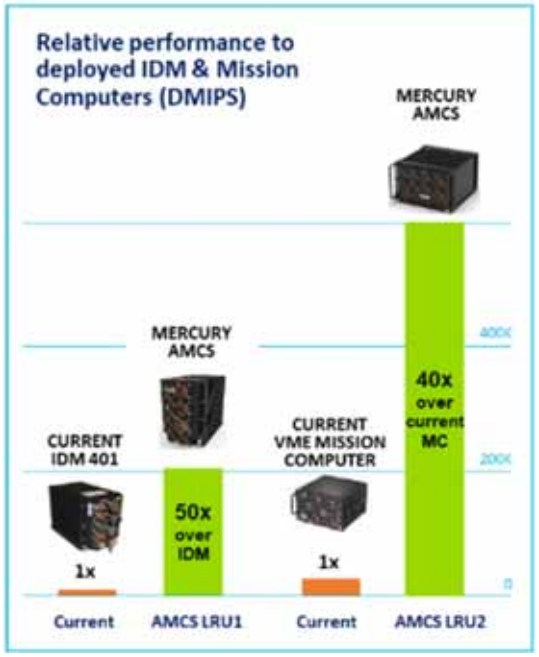
AMCS Strategic Goals aligned to Army AMSA's

AMCS GOALS

- MOSA, SOSA, Multi Core, FACE compliant to AMCE Elements
- System performance to support Army application roadmap
- AMCS Family of Systems "Product Line" to support PEO Aviation Commonality
- Rapidly onboard applications with roadmap to meet evolving threats
- Safety Critical DAL-A Architecture
- Application Ecosystem to "Break Vendor Lock"

PROCESSING PERFORMANCE

Mercury's AMCS will deliver 40–50x the processing power of legacy hardware within the same footprint



DIGITAL CONVERGENCE

Migrating from a federated systems to converged architecture enables quicker apps deployed

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Tucson Embedded Systems, Inc. (TES-i/TES-SAVi)

MOSA Expert Panel
Thoughts, Visions, and Implementations

Quad-A
April 5, 2022

Enablers and Leaders of Reusable Open Architecture Solutions and Standards *e.g.*, FACE™, SOSA™, and HOST; FACE and SOSA Consortium member since inception, 2010

Leadership roles

- Business Working Group, Chair
- Data Architecture, Chair
- IWS, *past* vice-Chair
- Conformance
- Transport
- Security
- Safety



Sanctioned FACE Verification Authority, 2014

- TES-SAVi - The Consortium's first commerical FACE VA
  - VA'd nine (9 of 22) FACE Conformant products

Began with PEO AVN Common Software Initiative 2003-2007, columinating with a CSI Demo 2006

SETA for PEO Aviation

- Reusable Common Radio Control Software, PEO-AVN
- Common Software Demonstration CDA-RC, 2006
- Capability Driven Architecture (CDA) – TES' process patent 2009, foundation of TES-SAVi AWESUM® model-based tool suite, complete lifecycle MBSE aligned with MOSA

US Army Radio Communications - Program of Record (PoR)

- 2007-WDI, 2010-R2C2 – *the Army's first FACE Verified product*, Aug. 2016, FACE ed. 2.1
- 2014 - ARCM, FACE ed. 3.1, DO-178C DAL-C

Future Airborne Capability Environment

Georgia Tech Research Institute

GTRI.gatech.edu

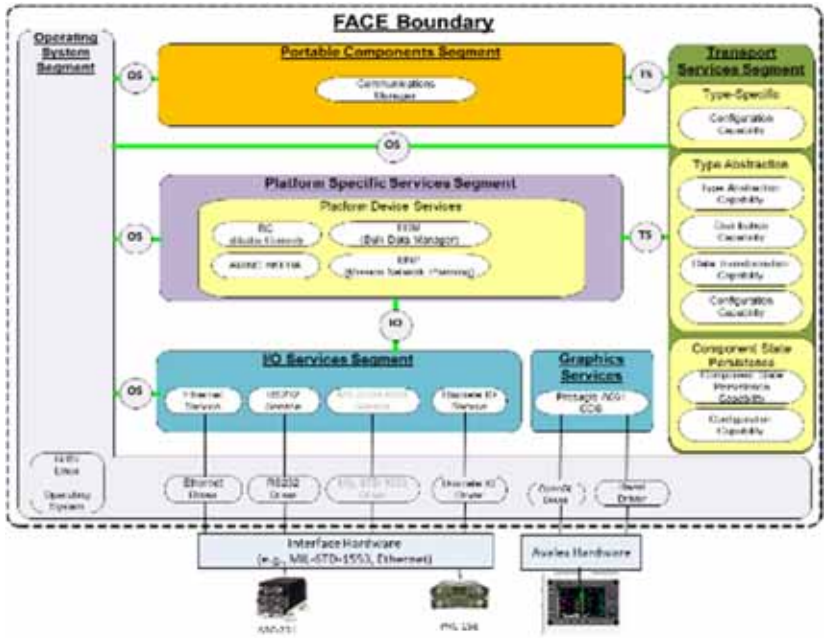
TES i

Common Reusable Radio Control - *Today*

US Army Radio Communications - Program of Record

Aviation Radio Communications Manager (ARCM)

- Radio Control (RC) is a FACE Platform Specific Services Segment (FACE PSSS) for:
  - ARC-231/PRC-158 RC Platform Device Service (PDS)
- Communications Manager (CM) – FACE Portable Component Segment (PCS) that provides management of all communications through the Radio Control PDS and collects and provides ARCM system status to other components.
- Mission and Network Planning (MNP) – FACE PSSS used to parse preset and mission data files and provide configuration data to other components.
- Bulk Data Manager (BDM) is a FACE PSSS component that provides files such as preset and mission data through a FACE IOS interface to other components.
- ARINC 661 UA – GTRI provided User Application (UA) for interfacing the Cockpit Display System (CDS) Graphics Server to the CM for access to the RC interface.



- Hailed as a US Army's flagship program, briefed by PEO-AVN, TSOA-ID

Supporting PEO's MOSA TO - *Today*

MOSA Transformation Office
MOSA TO
Transforming the Future

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U.S.ARMY

Program Executive Office, Aviation

Tri Service Interoperability Conference

Army Aviation – Leading with MOSA Transformation

Specific Example - Aviation Mission Computing Environment

Fundamentally Different Approach to Capability Introduction

- AMCE Introduces Modular/Configurable Processing to Aviation

Radio Control

Cockpit Display Interface

Specific Example – Communications/Datalinks/Control

CMOSS Mounted Form Factor (CMFF) Modular Communications

- **Convergence** of Multiple LRUs Into Radio Cards - Open Standards Modular Environment
  - 1 Capability ⇌ 1 LRU
- Aligns with Army's CMFF A-CDD Modular Communications Effort
- **Scalable** Form Factors – Ease of Integration
- Universal Control Through Aviation Radio Control Manager (**ARCM**)
  - Avoids Opening Platform OFP for New Radio Technology

Convergence of RF LRUs & Waveforms into Single RF Chassis

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TES-i is developing
Comms: ARCM
AMCS: FVL
ASE: Apache D/E
Using FACE COE

Other TES-i / TES-SAVi MOSA Development Program Efforts

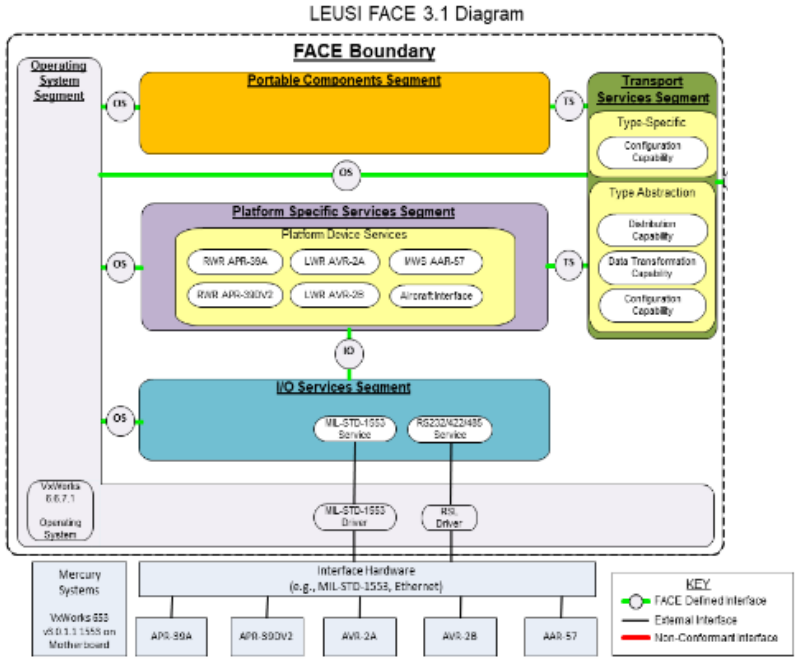
TES-i®

AGx EIS for PM Apache - *Today*

Aircraft Survivability Equipment (ASE) Program of Record

Multiple FACE UoPs developed using TES-SAVi AWESUM® model-based tool suite

Guidance:
FACE Technical Standard, edition 3.1, aligned to the Safety Base Profile
DO-178C DAL-C with data modeling using AWESUM® model-based tool suite.
Unlimited Rights including Model, Software, Tests, and 11.1,..,11.22 DO-178C documentation, *i.e.*, all *funded* products ***Delivered Unlimited Rights Data Rights***



- Two baselines: AH-64D and AH-64E, and *can be re-used for FVL efforts*

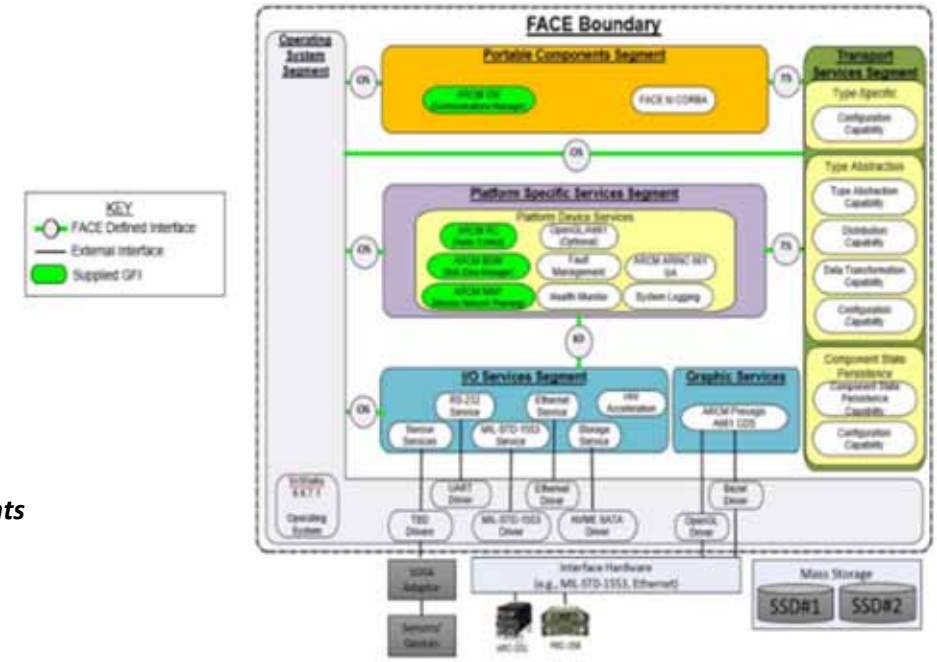
AMCS for AMCA - *Today*

Aviation Mission Common Server (AMCS) - Program of Record

Guidance:
FACE Technical Standard, edition 3.1, aligned to the Safety Base Profile
DO-178C DAL-C, OE DAL-A

TES' task Integrate
- ARCM
- IDM ISA
- ABE
- SNC's DVE

Unlimited Rights Data Rights



Also working with Mercury to test to HOST on its Tiger Lake AMCS processor

FACE
Future Airborne Capability Environment

Preliminary HOST Evaluations

HOST

TES-i

HOST Conformance – *Today / Tomorrow*

Preliminary HOST Evaluations – performed HOST SBIR Phase I & II

Preliminary evaluation of a HOST OpenVPX module in compliance with the **HOST** (**H**ARDWARE **O**PEN **S**YSTEMS **T**ECHNOLOGIES) OpenVPX v4.0 Standard

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3U VPX

6U VPX

- TES is preliminary testing with NAI's SIU 68PPC2 and *AMCS Tiger Lake card*
- *Helping to define HOST and MOSA conformance*

MOSA Transformation Office
MOSA TO
Transforming the Future

Eco-system Tools
aligned with MOSA principles
supports FACE, SOSA, HOST
Development and Test Efforts

TES-i

AWESUM® and FAME™
TES-SAVi's model-based tool suites

AWESUM® model-based tool suite is an end-to-end, complete lifecycle tool suite that fuses systems and software modeling and simulation (M&S) capabilities, modular open system approach (MOSA), putting device and sensor integration techniques into a single package to enable rapid design, development, verification, certification, and deployment of interoperable, platform portable, embedded mission-critical safety-critical avionic systems

FAME™ is a complete end-to-end and round-trip capability for composing FACE-candidate conformant-ready USM and DSDMs conforming to editions 2.1.x and 3.x of the FACE Technical Standard, including 2.1.x to 3.x model migration

https://tes-savi.com/product/

AWESUM® and FAME™
TES-SAVi's model-based tool suites

…run 1-minute Video here…

TES-i's FACE 3.1 COE Link Libraries

- TES-SAVi developed FACE Common Operating Environment (COE) Link Libraries, with Government Purpose Rights (GPR) transferred to the U.S. Army, 2021
- The COE is a set of reusable platform portable software components for FACE TSS, OS, and IOSS, and services
- The Link Libraries are FACE edition 3.1, are aligned with DO-178C DAL-C guidance and were developed and being sustained using TES-SAVi's AWESUM® model-based tool suite.

Collaborations toward next-generation FVL aircraft aligned to MOSA leveraging FACE, SOSA, HOST Development and Test Efforts

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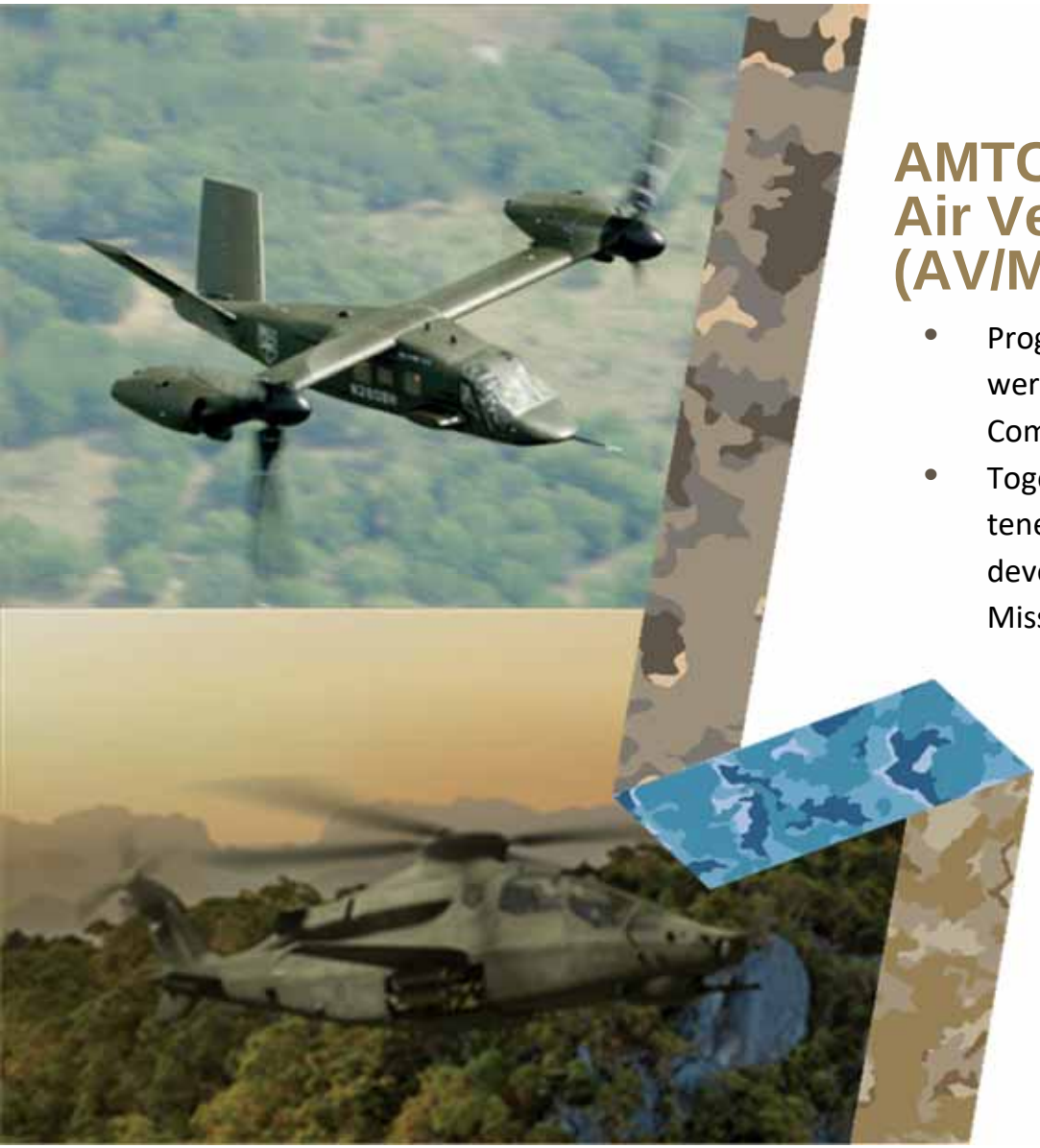
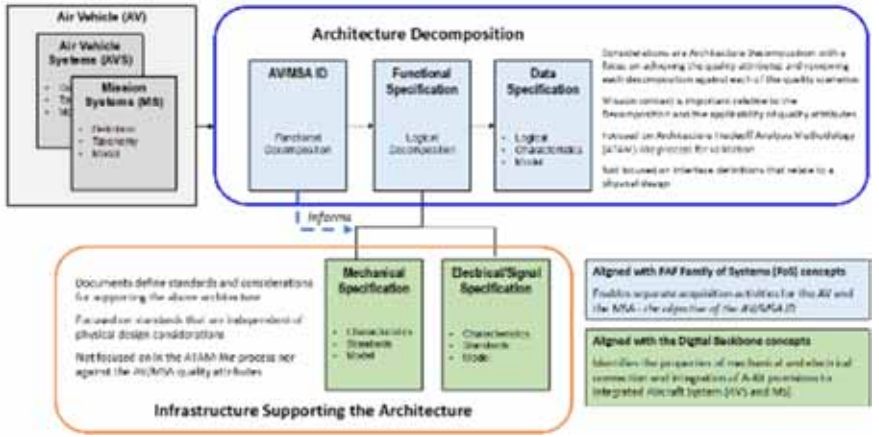


AMTC/VLC's Air Vehicle / Mission System Architecture (AV/MSA) Interface Definition (ID)

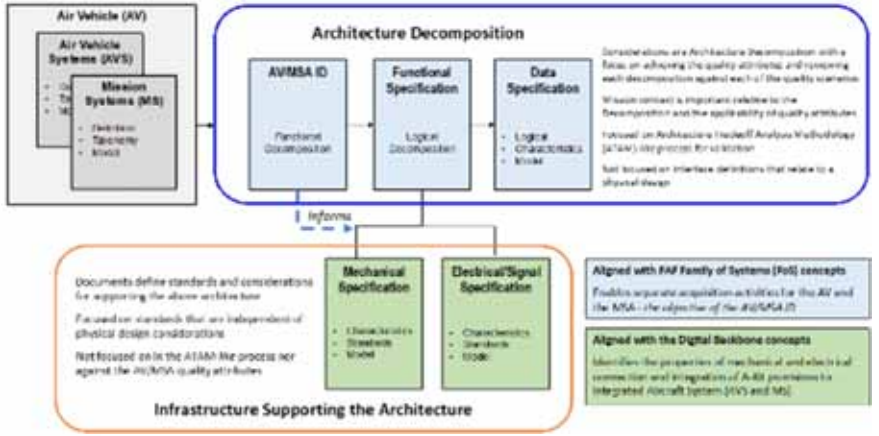
- Program Managed fourteen of the top-aviation companies which were funded by the US Government to position the Defense Community to be in a better-buying position
- Together we defined an open interface definition following the tenets of a Modular Open Systems Approach (MOSA) and developed a set of specifications for next-generation Air Vehicle and Mission Systems Architectures



(*next-up*)

AMTC/VLC's CRADA for MOSA Conformance

- TES will program manager another collaborative VLC effort
- Together we will define what Modular Open Systems Approach (MOSA) is on an Enterprise, Architectural, and Implementation/Platform-level; and develop and test conformance guidelines to gauge MOSA for MOSA TO program usage



The *prototype* FVL FACE Integration Team with TIM Demonstration(s)

IRaD formed by Six (6) FACE Consortium members

- Bell
- TES / TES-SAVi
- North Atlantic Industries
- RTI
- DDC-I
- Rapita Systems, *with*
- US Army DEVCOM

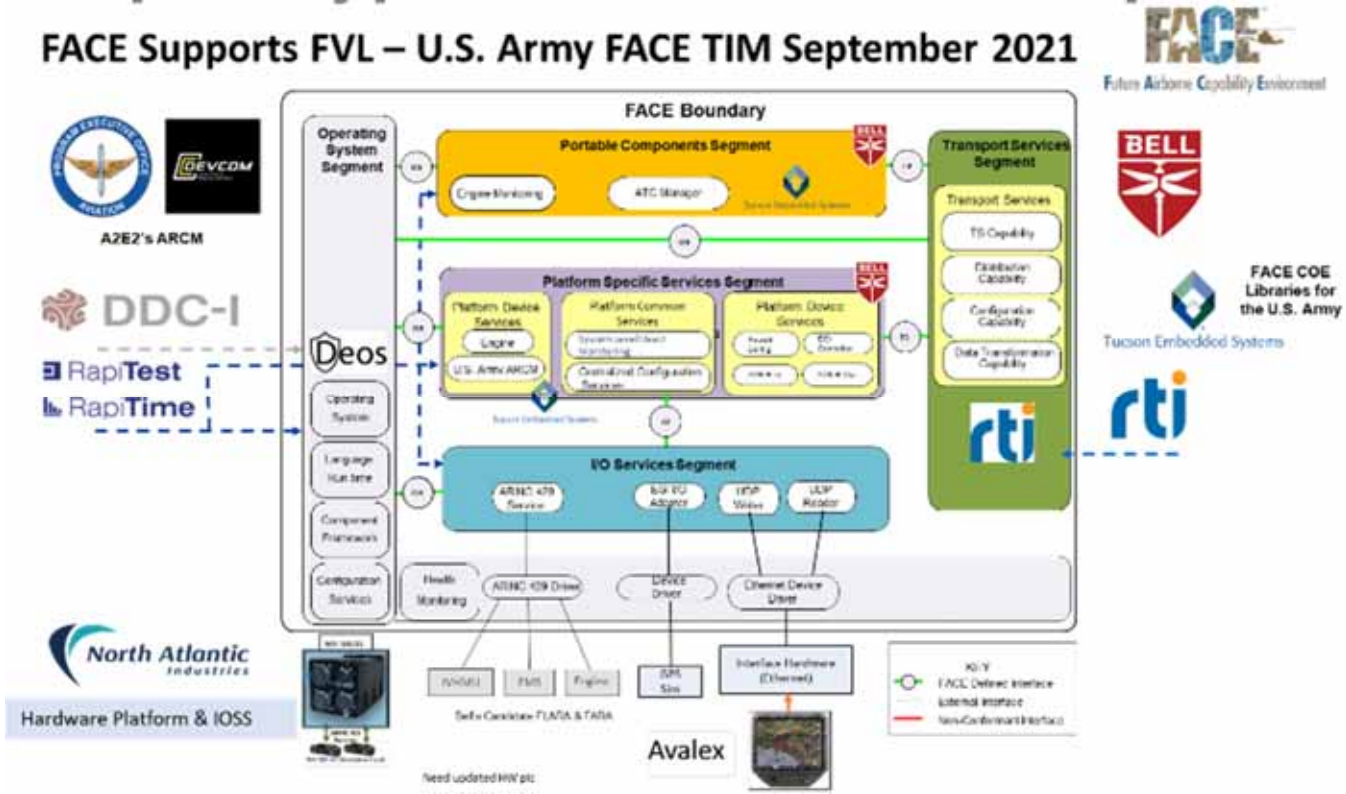
The prototype FVL Team's Objective

Prototype FLRAA and FARA Development efforts aligned to MOSA, *i.e.*, FACE, SOSA, and HOST

- Bell – A/C Platforms for FVL-CP: FLRAA and FARA, ITEP
- TES-SAVi – US Army ARCM and ITEP to FACE 3.1, using TES' FACE 3.1 COE link libraries
- North Atlantic Industries – MOSA aligned Hardware
- RTI – FACE Conformant Transport Services
- DDC-I – FACE Conformant Operating System
- Rapita Systems – Tools for CAST-32A compliance
- US Army DEVCOM – Rapid Integration Framework

***Present accomplishments* at Air Force TIM Sept 2022** – TES-SAVi, RTI, DDC-I, Bell & NAI, Rapita Systems, and Army PEO AVN

The prototype FVL Team's Accomplishment



Fall 2022 FACE TIM:: TES-SAVi, RTI, DDC-I, Bell & NAI, Rapita Systems, and Army PEO AVN

TES-i Enablers and Leaders of Modular Open Systems Approaches ..

Enjoy Quad-A



TES-i

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