Vertical Lift Consortium

FY20-TR04: Joint Multi-Role (JMR) Mission Systems Architecture Demonstration (MSAD) Support:

Air Vehicle/Mission System Architecture (AV/MSA) Interface Definition (ID) in the Avionics and Systems Session

Presented to VFS Forum 77
10 May 2021

Tucson Embedded Systems

AV/MSA ID – Objectives and Team Organizations

- The US Government (USG) desires the ability to procure mission system capabilities separate from the procurement of the air vehicle for future acquisition projects.
- To achieve this goal, the USG acquired support from the Vertical Lift Consortium (VLC) to collaboratively develop an interface specification consistent with the tenets of a Modular Open Systems Approach (MOSA).
- The VLC AV/MSA Interface Definition Collaboration Team was formed to include a diverse group of companies and subject matter experts (SMEs) that span aircraft developers, systems integrators, suppliers, and academic institutions to obtain the broadest possible consensus on the end products.
- The Cross-Organizational Collaboration Team, comprised fourteen (14) qualified VLC members, collectively analyzed, developed, validated, and delivered a Specification of the AV/MSA Interface with Unlimited Rights (with no proprietary data/information).
- The AV/MSA Interface Definition is purposely aligned with the DoD MOSA to promote simplified sustainment and opportunities for enhanced open competition and innovation.
- The resulting product is positioned to inform other Government S&T and Acquisition activities, and will be useful for and can evolve to support the needs of JMR Technology Demonstrator (TD) efforts, JMR MSAD Capstone Demonstration, follow-on Integrated Mission Equipment (IME), and to inform the Future Vertical Lift (FVL) acquisition strategy.

AV/MSA ID Task 4 Stakeholders and Participants

US Army Government (USG) - Stakeholder

JMR TD Mission Systems Architecture Demonstration (MSAD) - Army Futures Command

Lead by Mr. William Jacobs, US Government, co-author of AV/MSA ID paper

Vertical Lift Consortium (VLC), Advanced Technology International (ATI) – Task-4 Participants

BAE Systems, Bell, Collins Aerospace (CAS), Boeing, GE Aviation, Honeywell,
Lockheed Martin/Sikorsky (LM/SAC), Northrop Grumman (NGC), Piasecki Aircraft Corporation (PiAC),
Raytheon (RTX), SAIC, Skayl, Tucson Embedded Systems (TES), and Univ. of Alabama Huntsville (UAH)

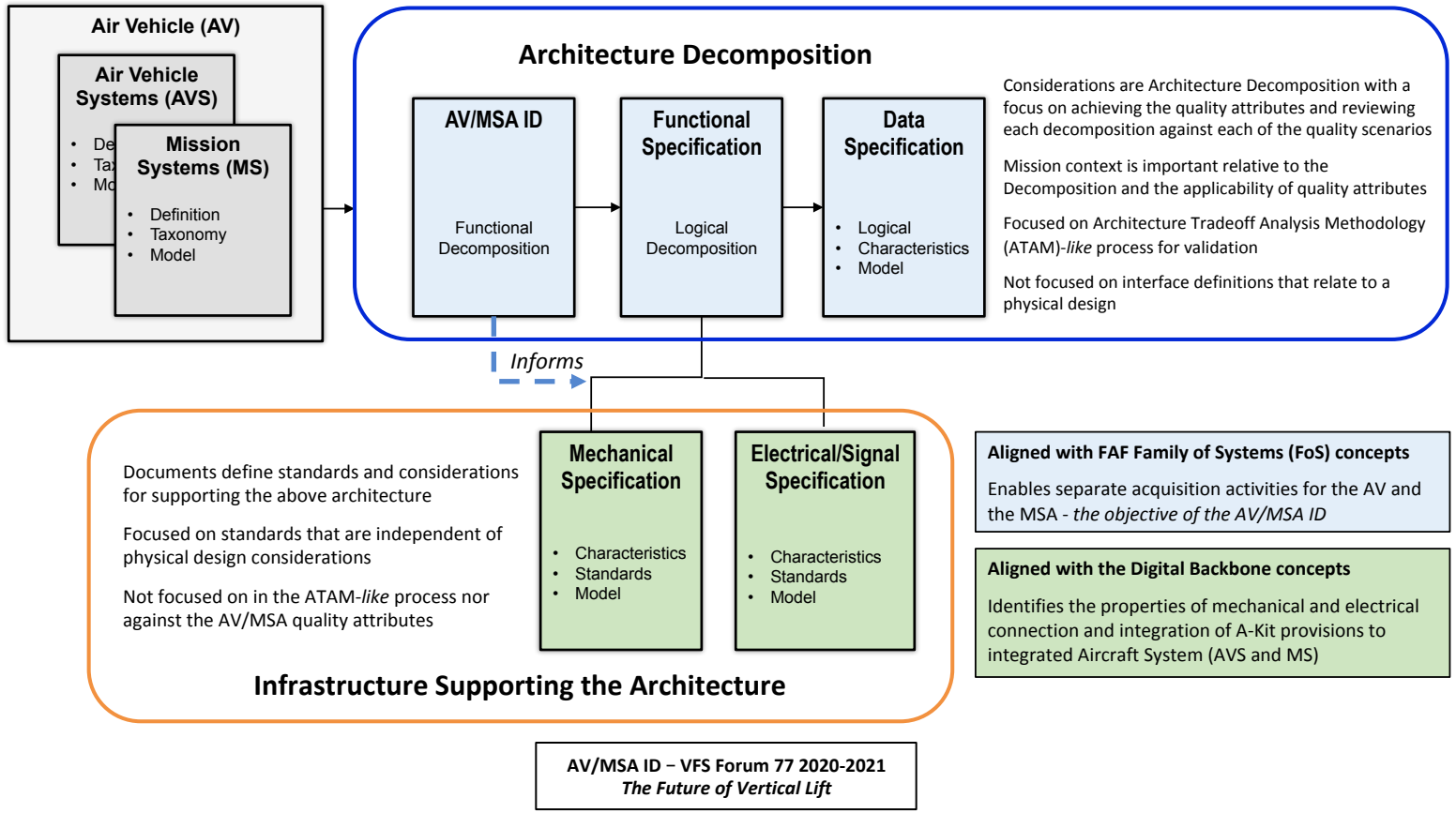
Managed by Mr. Stephen M. Simi - Tucson Embedded Systems (TES), co-author of AV/MSA ID paper

Overview to VLC JMR Task 4 - AV/MSA ID efforts

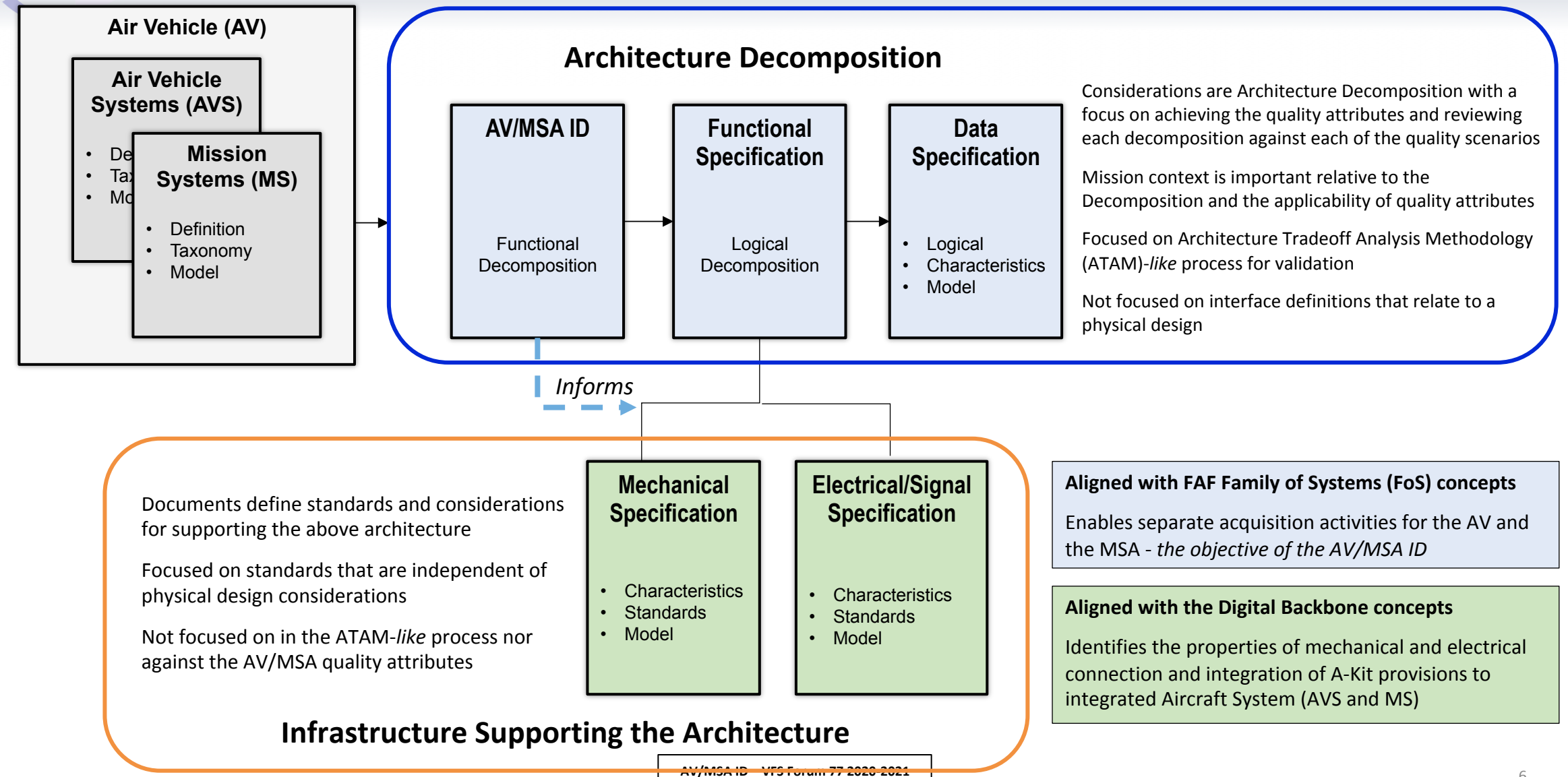
- **Fourteen** of the top-aviation companies were funded by the US Government to position the Defense Community to be in a *better-buying position.*
- Together they defined an open interface definition following the tenets of a Modular Open Systems Approach (MOSA) and developed a set of specifications for next-generation Air Vehicle and Mission Systems Architectures.
- Together they allocated **332** functions (*i.e.*, **74-AV, 174-MSA, and 84-AV *and* MSA**) to *support manned, optionally-piloted, and fully-autonomous flight*.
- **The AV/MSA ID was modeled, and then validated** against real-word avionics components and weapon systems to ensure the Government can use the ID in future procurement efforts.
- The Government Plans to use the AV/MSA ID, with model-based tooling and process improvements, into what will evolve into model-based procurement practices used by the Government.
- *The purpose* is to optimize cost, schedule, and improve the safety of War-fighting capabilities embedded within next-generation DoD military aircraft.

VLC JMR Task 4 AV/MSA ID Organization

- **AV/MSA Interface Definition Organization**
  - This AV/MSA interface exists in the context of a **three elements:** the **air vehicle (AV), the mission system architecture (MSA)**, and the **interface** between them.
  - **The AV and MSA encapsulate functions and exhibit behaviors, which informs the interface** consisting of the physical mechanical connections *and* the electrical and digital signal exchanges.



VLC JMR Task 4 AV/MSA ID Organization



AV/MSA ID – Task 4 Organization

- VLC JMR Task 4 AV/MSA ID efforts, with leads listed

  - **Sub Task 1 – Guidance**
    - 1.1 – Quality Attributes – lead by Raytheon with LM/SAC
    - 1.2 – AV/MSA Strategy – lead by GE Aviation with Raytheon and Collins
    - 1.3 – Governance, CM, and Conformance – lead by TES with UAH
    - 1.4 – Validation Plan & Efforts – lead by UAH with TES

  - **Sub Task 2 – Interface Specification (with models)**
    - 2.1 – AV/MSA Interface Definitions – lead by LM/SAC with NGC & Raytheon & Boeing
    - 2.2 – Mechanical Specification – lead by UAH with Boeing and Collins
    - 2.3 – Electrical Specification – lead by NGC with GE Avn., CAS and UAH
    - 2.4 – Functional Data Interface Specification – lead by Collins with Skayl, SAIC, NGC and TES

  - **Sub Task 3 – Cyber, Cross-cutting to support Tasks 1 & Tasks 2 - lead Bell & Boeing & SAIC**

VFS 2021 Paper describes the objectives and results of each Sub-Task

14 Companies, 75 SME, using 125 references developed the AV/MSA ID with JMR Government Stakeholders

The AV/MSA ID body of work resides in ATI repository with USG Unlimited Rights

AV/MSA Sub-Tasks

Sub-Task 1 - Guidance

Quality Attributes

- Collaborative process focusing on Adaptability, Robustness, Survivability, and Usability

AV/MSA Strategy

- Outlined the considerations, strategies and needed variation to support Army objective

Governance, Configuration Management, and Conformance

- Procedures to maintain, and sustain the AV/MSA ID baseline products

Validation Plan

- Analyzed by the specification groups to validate and evaluate for alignment to AV/MSA ID Model Style Guide

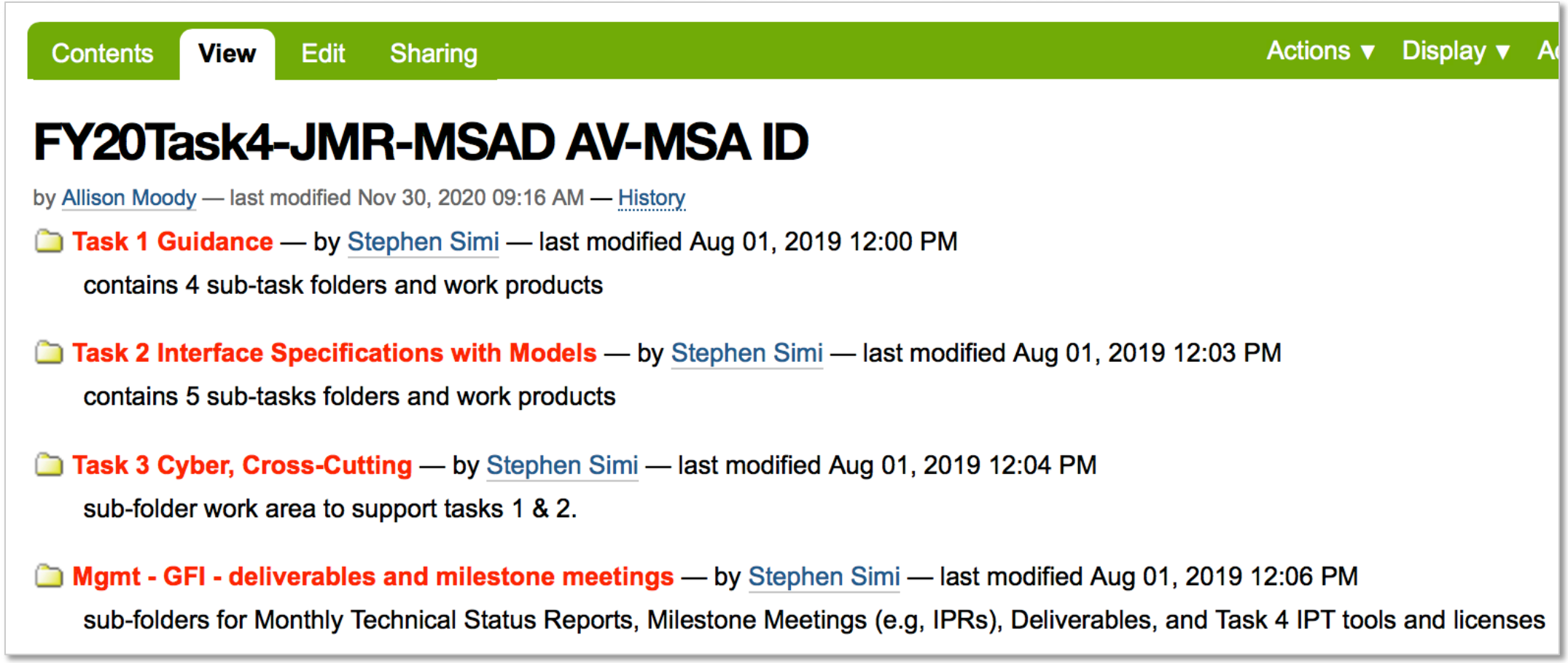
Sub-Task 2 – Interface Specification

- AV/MSA Interface Definitions
  - Established the set of definitions and functional allocations
- Mechanical Interface Specification
  - Defined the properties and standards associated with physical accommodations provided by the AV
- Electrical/Signal Interface Specification
  - Described set of electrical characteristics, standards, and categories of electrical interfaces needed to describe each of a particular platform's AV/MSA interfaces
- Functional/Data Interface Specification
  - Described data, interfaces, operations, and characteristics associated with the functions that are expected to exchange data across the AV and the MSA boundary

Sub-Task 3 – Cyber/Cross Cutting

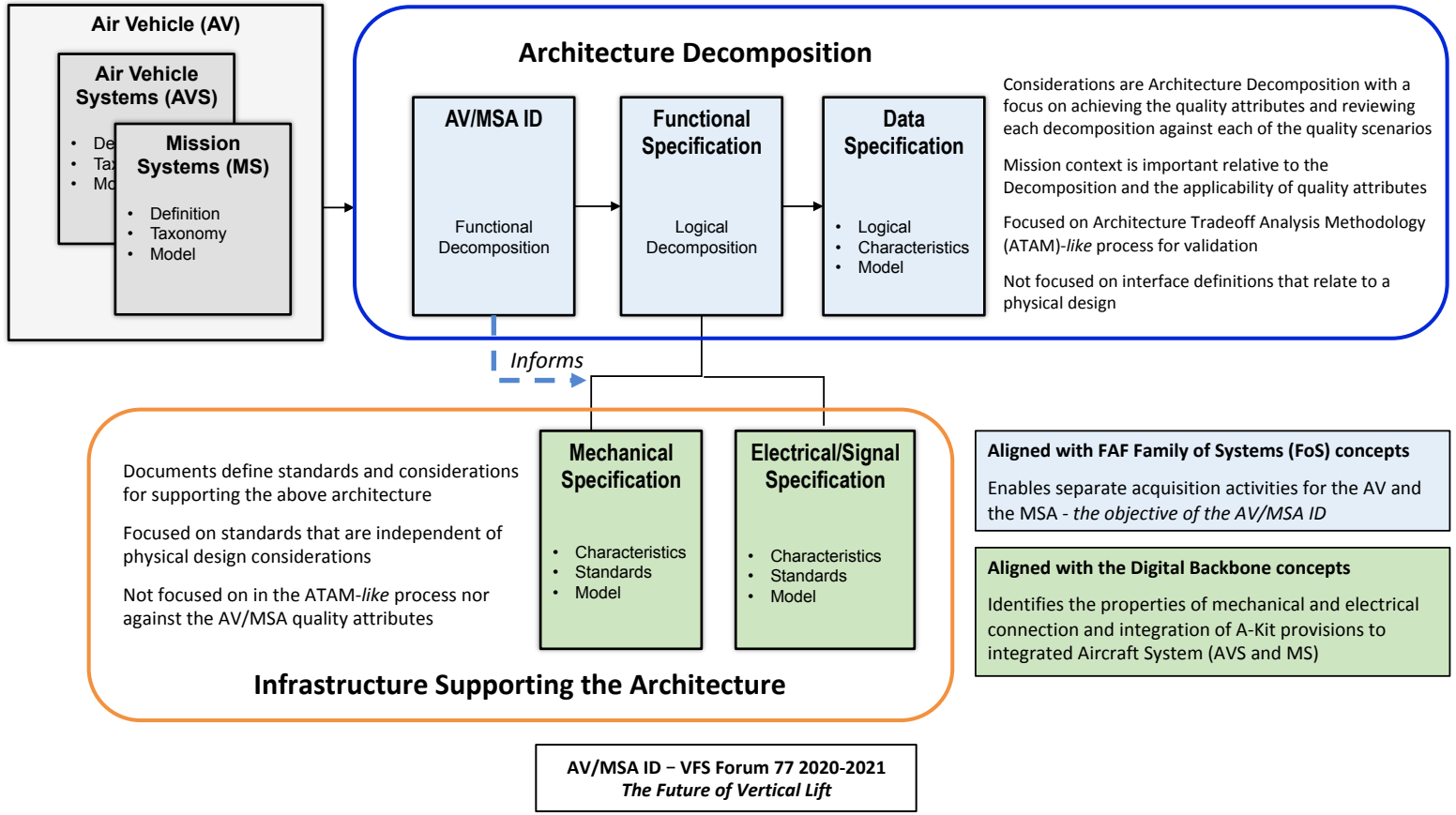
- Supplemented and informed the efforts and results of the other tasks in the context of safety and cyber

ATI Repository - Hosts all AV/MSA ID Work Products



AV/MSA ID – Summary

- The resulting AV/MSA ID product is positioned to inform other Government S&T and Acquisition activities, and will be useful for and can evolve to support the needs of JMR Technology Demonstrator (TD) efforts, JMR MSAD Capstone Demonstration, follow-on Integrated Mission Equipment (IME), and to inform the Future Vertical Lift (FVL) acquisition strategy.



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