UNITED STATES AIR FORCE
ENTERPRISE ARCHITECTURE

Air Force Enterprise Architecture Framework (AF-EAF)

U.S. AIR FORCE

AF Chief Architect's Office
AF-CIO/A

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1 AF ENTERPRISE ARCHITECTURE FRAMEWORK (AF-EAF)

1.1 INTRODUCTION

The Air Force Enterprise Architecture (AF-EA) is intended to guide the AF's Information Technology (IT) efforts to effectively support its vision, mission, transformational objectives, and operational concepts. The AF-EA describes the information relationships among key AF institutional processes and the supporting IT to ensure:

- Alignment of requirements for information systems with the processes that support the AF missions
- Adequate AF, joint, and combined interoperability
- Integration, assurance and security of information systems
- Prioritized allocation of resources to critical capabilities
- The application and maintenance of a set of standards (including technical standards) by which the AF evaluates and acquires new systems

1.2 PURPOSE

The AF Enterprise Architecture Framework (AF-EAF) provides a logical structure for classifying, organizing and relating the breadth and depth of information that describes and documents the Air Force Enterprise Architecture (AF-EA).

The AF-EAF does not define the AF-EA content, rather it consists of various approaches, models, and definitions for communicating and facilitating the presentation of key architecture components (i.e. architecture vision, governance, principles, guidance, products, etc.) required for the development and integration of AF architectures. The AF-EAF establishes a common foundation for understanding, comparing and integrating architectures and as such provides the overarching guidance for generating AF architectures.

OMB Circular A-130 requires that each agency use an Enterprise Architecture Framework to document the linkages between its mission needs, information content, and information technology capabilities. The AF-EAF described in this document, which leverages both the Department of Defense Architecture Framework (DoDAF)[1] and the Federal Enterprise Architecture Framework (FEAF) and Reference Models[2], represents the Air Force's fulfillment of that requirement.

1.3 OVERVIEW

The AF-EAF consists of three major parts or columns as shown in Figure 1. The first column identifies the architectural drivers and inputs. The second column consists of all of the

[1] *DoD Architecture Framework*, Version 1.0 Draft, Jan 2003, found at http://66.170.237.138/dodfw/
[2] *Federal Enterprise Architecture (FEA) Reference Models* found at http://www.feapmo.gov/fea.htm

architecture products that describe and document the AF-EA. The third column identifies the uses and intended impacts of the architectural effort. Each of these three columns of the AF-EAF is described in more detail in the paragraphs below.

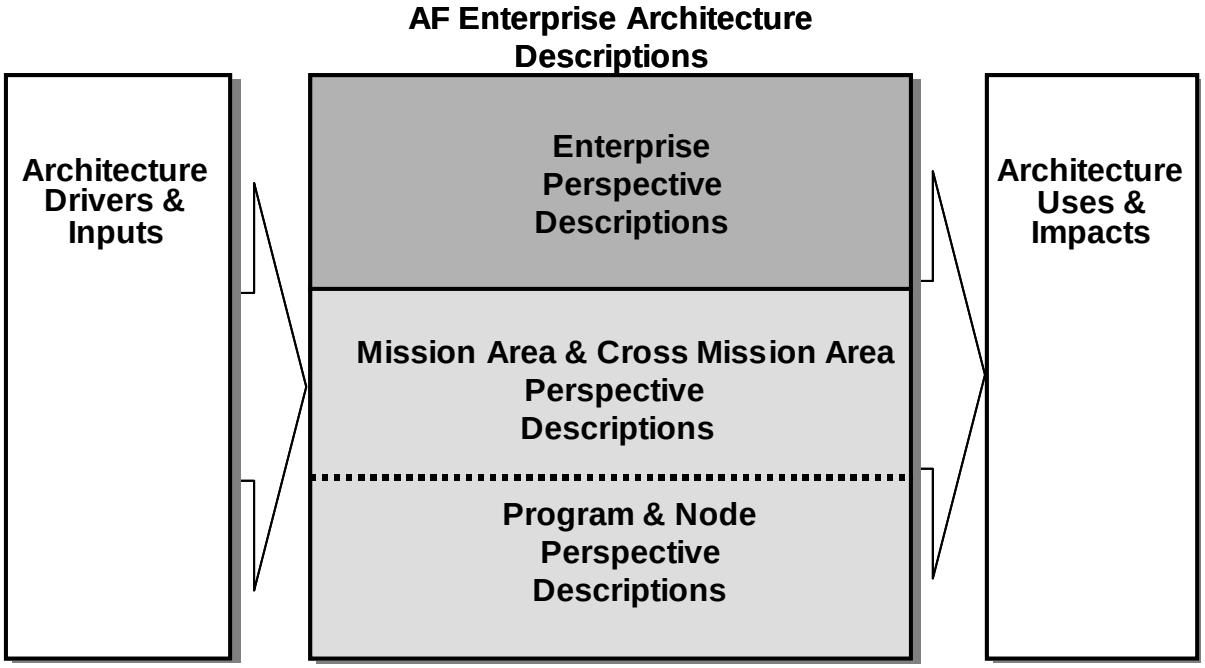

Figure 1: Overview - Air Force Enterprise Architecture Framework

2 ARCHITECTURE DRIVERS AND INPUTS

The Architecture Drivers and Inputs column of the AF-EAF identifies the primary architectural governance/guidance drivers and inputs. These items are not part of the AF-EA, but influence its development and content. The AF's strategic direction provides a foundation for developing and maintaining the AF-EA. In addition to that foundation, specific resources become drivers or inputs (Figures 2 and 3) for the development of the architecture and influence specific architecture work products. Depending on the intended use of the architecture, different combinations of these drivers and inputs become more important than others.

2.1 GOVERNANCE AND GUIDANCE

- **Legislation** – Laws and mandates approved and issued by federal government organizations drive the top-down approach to architecture development. The Clinger-Cohen Act (CCA), Executive Order 13011 of 17 July 1996, *Federal Information Technology*, and the Office of Management and Budget's Circular A-130, *Management of Federal Information Resources* (OMB Circular A-130) all require government agencies to develop and use architectures to better integrate information technology with their mission and business processes.

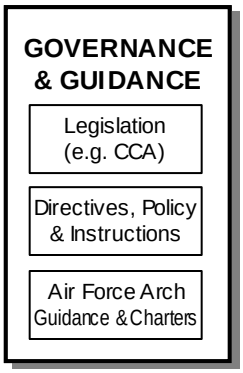

Figure 2: Architecture Governance & Guidance

Other examples of federal laws and guidance that are related to enterprise architecture include:

- **GPRA:** The Government Performance & Reform Act of 1993. Part of the National Performance Review (NPR), GPRA sets the stage for later Information Resource Management (IRM) reform laws.
- **PRA '95:** The Paperwork Reduction Act of 1995. The original act that addressed IRM practices.
- **GPEA:** The Government Paperwork Elimination Act of 1998. This Act requires agencies to adopt electronic business processes for all Government-to-Government (G2G), Government-to-Business (G2B), Government-to-Consumer (G2C) transactions by 2003.
- **Public Law 107-347:** "The E-Government Act of 2002", 12 Dec 2002 – Enhances the management and promotion of electronic government services and processes by establishing a Federal CIO within OMB and a framework of measures.
- **FISMA:** The Federal Information Security Management Act of 2002. Follows GISRA and requires IT security planning as part of EA. FISMA is Title III of the E-Gov Act of 2002.
- OMB Circulars A-11 andA-130: Federal Budgeting, Strategic Planning, and Performance Reporting (July 2002). Provides guidance on the budget process and supporting strategic planning and performance planning/reporting activities. Requires annual submission of Section 53, Form 300 inputs for agency IT systems.

- **Directives, Policies and Instructions** – Specific DoD and AF key documents (directives, policies and instructions) that influence the development of the AF-EA.

  Examples of such documents include:

  - DoD Directive 5000.1, *The Defense Acquisition System*, 12 May 2003 and DoD Instruction (DoDI) 5000.2, *Operation of the Defense Acquisition System*, 12 May 2003 require the collaborative development of joint capability integrated architectures and DoD component functional area integrated architectures that are documented using the DoDAF. They direct that these integrated architectures be used to develop "integrated plans or roadmaps" to conduct capability assessments, guide systems development, and define the associated investment plans as the basis for aligning resources and as an input to the Defense Planning Guidance, Program Objective Memorandum development, and Program and Budget Reviews.
  - CJCSI 3170.01C (Draft), *Joint Capabilities Integration and Development System (JCIDS)*. This instruction, replaces the rescinded Requirements Generation System (CJCSI 3170.01B), implements a new process to assess legacy and proposed systems in the aggregate (rather than individually) and define desired joint capabilities. The instruction states that joint concepts and supporting integrated architectures will serve

as the basis for evaluating and approving all future joint and service capabilities proposals.

- DoD Directive (DoDD) 4630.5, *Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)*, 11 January 2002, states that "IT and NSS interoperability and supportability requirements shall be characterized through operational mission area integrated architectures…" Further, it requires that Information Exchange Requirements (IERs) and associated interoperability Key Performance Parameters (KPPs) be derived from the operational views of the appropriate mission area integrated architecture.
- CJCSI 6212.01B, *Interoperability and Supportability of NSS/IT*, 8 May 2000, establishes the requirement for a Command, Control, Communications, Computers, and Intelligence (C4I) support plan for each DoD IT/NSS system and requires that the interoperability KPPs and top-level IERs documented in the C4ISP be based on the format and content of the integrated architecture products described in the C4ISR (DoD) architecture framework.
- DoDI 8400.xx (Draft), *DoD Architecture Development* – This instruction will implement policy and assign responsibility for DoD architecture development. It will require DoD Component architectures to be developed and maintained consistent with the Global Information Grid (GIG) architecture, direct the use of the DoDAF (DoD 8400.1-M), and implement a standard approach and data requirement for architecture development using the DoD Core Architecture Data Model (DoD 8400.1-STD). Until this draft DoDI is signed, the OSD Memorandum, *Strategic Direction for a DoD Architecture Framework*, dated 23 Feb 98 applies.
- OSD Policy Memorandum, *Promulgation of DoD Technical Reference Model (TRM) Version 2.0*, 15 April 2002. This memorandum provides guidance on the use of the DoD TRM by defining its use in architecture development, describing GIG services and interfaces, and requiring the Services to derive their respective technical reference model based on the DoD TRM structure
- Air Force Policy Directive 10-28 (Draft), Air Force Concept Development, provides a common framework and practical guidelines for developing and writing Air Force concepts. It states that architecture is one of several elements that should be included, as required, in all AF concepts.
- Air Force Policy Memorandum, *Enterprise Architecting*, 06 August 2002 – This memorandum establishes AF policy on enterprise architecting, outlines organizational responsibilities for architecture development and emphasizes key AF uses for architecture.
- Air Force Instruction (AFI) 33-124, *Enterprise Information Technology Architectures*, 1 May 2000, establishes Air Force Enterprise IT architecture developmental responsibilities. It supports the architecture-related mandates of the Clinger-Cohen Act of 1996, *Information Technology Management Reform Act*, and promulgates Air Force Enterprise C4ISR architecture products identified in the DoDAF. This AFI will be updated to reflect current architecture policy and guidance.

- **Air Force Architecture Guidance and Architecture Council Charters** -- The Enterprise Architecture Integration Council (EAIC) and Mission/Business Area Architecture Councils will publish guidance for their respective areas. The Architecture Councils will establish priorities in accordance with their sponsors, address crosscutting architecture issues, and validate architecture efforts.

Additional architectural guidance is also vetted through AF CIO Discussion Papers (DP). Once such guidance has been articulated via DPs and properly vetted within the AF (and Industry) cognizant architectural community, the resultant course(s) of action are documented in official AF Policy Memoranda (PM) signed by the CSAF, SECAF or the AF CIO. Alternatively, for less significant implementation issues, architectural guidance is promulgated via AF-CIO signed Architecture Guidance Memoranda (AGM).

2.2 ARCHITECTURE INPUTS

Many different information resources are used by the architect to support architecture development. Some of the more common information inputs are described below. This listing is not meant to be exhaustive.

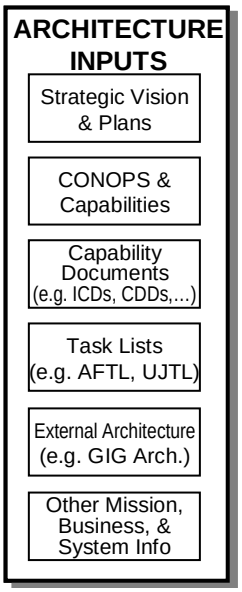

Figure 3: Architecture Inputs

- **Strategic Vision & Plans** – These references include documentation that identifies an organization's key goals, objectives, priorities, strategies, and its plans to fulfill those objectives. Documents might include the President's Management Agenda, National Military Strategy, Defense Planning Guidance, the AF Strategic Plan, the AF Information Strategy, AF Planning and Programming Guidance, and MAJCOM Mission Area Plans depending on the purpose of the architecture. These plans establish the mission or business vision for the architecture and provide an overarching context.
- **CONOPS & Capabilities** – Concepts of Operations (CONOPS) and capability statements are an essential input to development of an architecture. They help to focus the development effort and establish the scope of the activities, organizations, information, and systems reflected in the architecture. They also help to identify the important operational threads and activity sequences that the architecture must address.
- **Capability Documents** – These are textual descriptions of enterprise-level needs such as the Initial Capabilities Document (ICD), Capabilities Development Document (CDD), and Capability Production Document (CPD) that are part of the new Joint Capabilities Integration and Development System (JCIDS). MNS and CRDs will become less significant as they are replaced by the JCIDS capability-based documents and integrated architectures.
- **Task Lists** – The Universal Joint Task List (UJTL) and the Air Force Task List (AFTL) contain a comprehensive hierarchical listing of the tasks performed by Joint and AF forces. The task lists are a common language and common reference system for force commanders, combat support agencies, operational planners, combat developers, and trainers to communicate mission requirements, capabilities, and combat or business activities. These

documents are key for establishing the functional alignment of architectures across organizations.

- **External Architectures** – One of the basic reasons for building architectures is to improve warfighting and business capabilities by improving the interoperability and integration of the AF Enterprise with Joint and Coalition forces, other Services and National Agencies. This requires AF architects to account for and align to these external architectures. Examples include the DoD Global Information Grid (GIG) architecture, the DoD Network-Centric Operations and Warfare (NCOW) Reference Model, the DoD Technical Reference Model (TRM), the DoD Business Enterprise Architecture [aka Financial Management (Modernization Program's) Enterprise Architecture (FMEA)], Joint combatant command architectures, other Service architectures, and federal architectures (e.g. Federal Enterprise Architecture and E-Gov architectures).
- **Other Mission, Business & System Information** – There is a large amount of additional information that contributes to development of an architecture. This includes doctrine, operational procedures and checklists, training materials, testing documentation, business best practices, system documentation, and information on commercial IT trends and technologies.

3 AF ENTERPRISE ARCHITECTURE DESCRIPTIONS

The AF Enterprise Architecture Descriptions column of the AF-EAF depicts three architectural description layers or perspectives (see Figure 4) that represent the "full spectrum" of AF-EA products and artifacts. These architecture products and artifacts can take a variety of forms to include structured data stored in an architecture tool or database repository, graphical depictions of the information in hard copy or electronic format, or unstructured data or text.

Each of the three perspectives is comprised of a group of work products that are of interest to (and generally built by) a particular group of functionally oriented or organizationally based stakeholders. Generally, no single person or organization develops or looks at the entire enterprise model. Instead, each contributes to, and uses, those components that are relevant to their own perspective. These independently developed work products, however, are built and used within the context of the AF enterprise and must therefore be traceable and relatable to the larger AF enterprise architecture.

The first layer represents the top-level, enterprise perspective[3]. The second layer represents the mission/business architecture areas (i.e., the core competencies of the AF) as well as cross-mission area architectures (e.g., CONOPS, Infostructure, etc.). The third layer represents node/platform architectures and the program/system architectures that contribute to them. Executives and enterprise-level planners (such as AF/XP, AF-CIO, and AF/XI), Major Commands (MAJCOMs), and Node/Program Managers are examples of stakeholders that have these different perspectives.

[3] A subset of this enterprise perspective, consisting of logical groupings of mission/business areas is referred to as a sub-enterprise. Examples of this would be the Command, Control, Intelligence, Surveillance, and Reconnaissance (C2ISR) warfighting sub-enterprise, Business and Combat Support sub-enterprise, and the (common) Information Infrastructure (the "Infosphere") sub-enterprise.

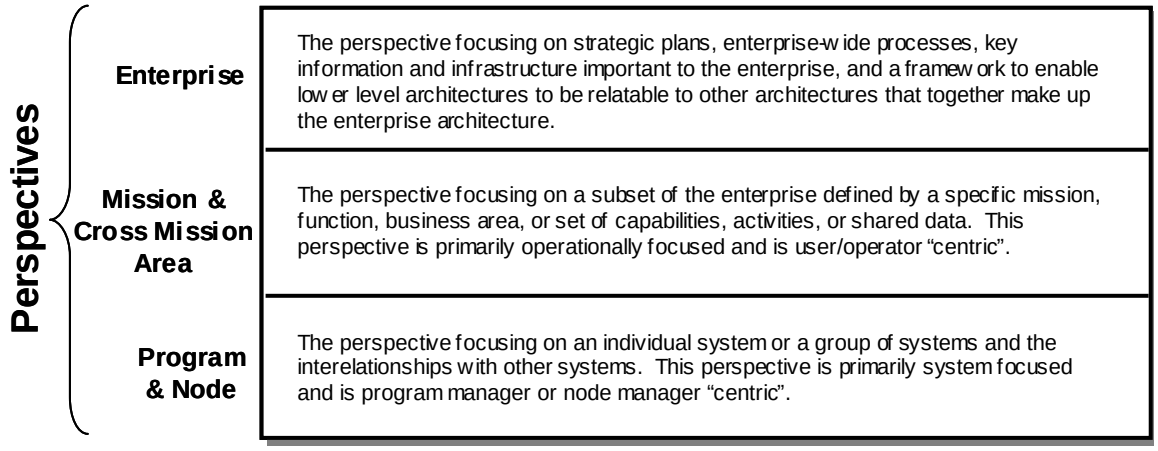

Figure 4: Perspectives of the AF-EA

The details for these description layers or perspectives are further defined in the paragraphs below and leverage specifications as defined in the DoDAF and the FEAF and FEA Reference Models. These specifications guide the development of architecture work products and artifacts that when built describe and document the AF-EA.

3.1 ENTERPRISE PERSPECTIVE

The architectures at the enterprise (and sub-enterprise) perspective of the AF-EA (represented by Figure 5) consist primarily of a set of AF defined Architecture Reference Models that are traceable to the Office of Management and Budget's (OMB) Federal Enterprise Architecture (FEA) Reference Models and the DoD Global Information Grid (GIG) but are extended and tailored for AF use. The AF Reference Models are documented using guidance from the FEA Reference Models.[4] Additional architecture artifacts including summary and overview information will also be included in the enterprise perspective following EA constructs as specified by DoD and OMB. These EA constructs are currently documented in the DoDAF and FEAF[5] documents.

The enterprise (and sub-enterprise) level of the AF-EA focuses on architectures mainly produced by the "owners" of the enterprise and sub-enterprises (e.g. Air Staff, MAJCOMs, etc.). The resulting AF Reference Models created following the above guidance serve several purposes.

First, they provide a common set of terms and definitions (i.e. "pick list") that can be used by all AF architects so that their separately developed mission/business area or program level architectures can be related, compared and reused (i.e., the same term or entity represents and means the same thing in each separately developed architecture). An example of this would

[4] The FEA PMO has not completed the "official" release of all five FEA reference models at this time and DoD is presently working with OMB on their release. The definition of the AF reference models will therefore evolve as the FEA reference models are further defined and matured.
[5] A more complete discussion on the FEA reference models can be found at the FEA Program Management Office website located at: http://www.feapmo.gov/.

include a list of commonly used AF and Joint operational nodes, such as Aerospace Operations Center (AOC), Air Support Operations Center (ASOC), etc.

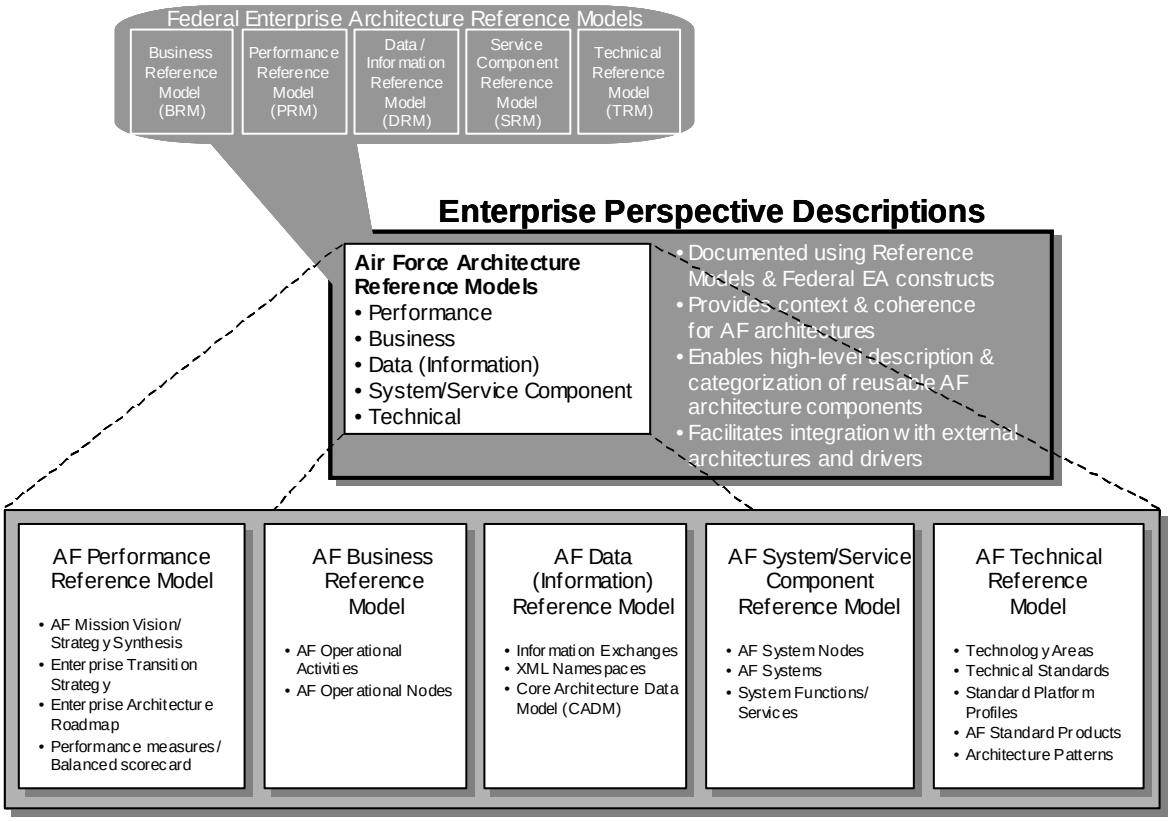

Figure 5: AF-EAF - Enterprise Perspective

Second, the AF Reference Models can be used to allocate development and configuration control responsibilities for separate portions of the AF-EA. For example, each mission/business area architecture council would be assigned responsibility for a specific set of operational activities that are most closely associated with their particular mission/business area. This would help ensure that duplicate and possibly conflicting architectures are not developed. It would also help architecture users to know which council they needed to consult for specific architecture information.

Third, the AF Reference Models can be used for portfolio management by providing a standard lexicon for describing the types of activities and organizations that a system supports, the data and technology the system uses, and the functionality the system provides, for every AF system. This would allow AF decision makers to identify duplicate and redundant systems that could be combined or divested, identify systems impacted by a technology change, identify inefficient and duplicate data stores, and identify what combination of systems are necessary to provide a specific capability. Use of the reference models to categorize each AF system allows for "apples to apples" comparisons.

Finally, the AF Reference Models can help provide traceability to externally developed architectures and serve as an integrated reference source for externally established standards, terms and definitions, and requirements relevant to the AF.

These enterprise (and sub-enterprise) reference models and views of the AF should be developed with the mission/business area and cross-mission area stakeholders' needs in mind. Enterprise (and sub-enterprise) architectures should be developed in a collaborative environment with the mission/business area and cross-mission stakeholders to ensure that all views are integrated. Enterprise (and sub-enterprise) area architectures should accurately reflect the CONOPS and operational requirements of the "top-level" of the AF. To assist in the linkages and traceability between enterprise and mission/cross-mission architecture artifacts, Appendix A defines the relationship between the DoDAF work products and the AF Reference Models.

3.1.1 AIR FORCE PERFORMANCE REFERENCE MODEL (PRM)

The PRM identifies what is important to the AF in terms of its vision, strategy, priorities, and guiding principles, their relationship to the AF-EA, and the transition strategies and roadmaps necessary to implement an AF-EA that efficiently and effectively supports the AF's mission. It also contains a set performance metrics and assessment criteria with which to measure how well and what progress is being made in implementing the AF-EA. The information in this model includes:

- *AF Mission/Business & Vision/Strategy Synthesis.* Textual and visual description and analysis of the AF enterprise's overarching mission, vision, goals, objectives, strategies, principles, and critical success factors for the future. Also included are the master effects list and master capabilities list that are being developed to serve as the basis for AF CONOPS development and analysis.

- *Enterprise Transition Strategy*. Approaches for transitioning an enterprise from its current mission/business processes to the target mission/business processes using IT support.

- *Enterprise Architecture Roadmap*. A temporally ordered event execution sequence depiction of the Enterprise's Transition Strategy that illustrates the intended path for incrementally moving mission/business initiatives and existing systems from the current environment to the targeted state.

- *Performance Measures/Balanced Scorecard*. A form of architecture metrics used to assess the architecture and the systems that make up the architecture.

3.1.2 AIR FORCE BUSINESS REFERENCE MODEL (BRM)

The BRM provides an organized, hierarchical construct (called a taxonomy) for describing the activities performed by the AF and the organizations and individuals that perform those activities. The information in this model includes:

- *Operational Activities*. The taxonomy minimally consists of names, descriptions, and decomposition into the constituent parts that comprise a process-activity. Examples of an operational activity taxonomy include the Universal Joint Task List (UJTL), the AF Task List (AFTL), the GIG architecture activity tree, and the Federal Enterprise Architecture BRM.

- *Operational Nodes* that represent Organizations, Organization Types, and Occupational Specialties. The taxonomy minimally consists of names, descriptions, and breakdowns into the parts of the organization, organization type, or occupational specialty.

3.1.3 AIR FORCE DATA (INFORMATION) REFERENCE MODEL (DRM)

The DRM describes, at an aggregate level, the data and information that the AF uses in accomplishment of its mission. It includes:

- *Information Exchanges.* The taxonomy minimally consists of names, descriptions, decomposition into constituent parts and subtypes and mapping to systems data exchanges.

- *XML Namespaces* - consists of the names of each of the XML communities of interest (COI) established by the DoD (http://diides.ncr.disa.mil/xmlreg/user/index.cfm) and other organizations to help create and promote the use of standard sets of XML elements and attributes within each COI to enable interoperability between systems/applications.

- *DoD Core Architecture Data Model (CADM)* – a logical data model that:

  – Will be mandated in the draft DoDI on architecture development and will be applicable to all AF architecture efforts

  – Provides a conceptual view of how information is organized, rather than a description of how the data is actually stored in a real database. It is designed to provide a common approach for organizing and portraying the structure of architecture information

  – Supports the database that underlies the storage of all architecture information including the Integrated Dictionary. The CADM ties together all three of the views: Technical, Systems, and Operational

  – Provides data requirement specifications for the essential elements of information contained in DoD architectures. The CADM is not an architecture product; rather, it is a core data requirement specification for building databases to support preparation, modification, and reuse of architecture products

  – Can be found at: http://www.c3i.osd.mil/org/cio/i3/AWG_Digital_Library/index.htm

3.1.4 AIR FORCE SYSTEM/SERVICE COMPONENT REFERENCE MODEL (SRM)

The SRM identifies and provides a common definition/description of existing AF and selected OSD/Joint IT/NSS systems, system nodes (combinations of systems), and system functions/services (such as GIG Enterprise Services aka Network Centric Enterprise Services). It also includes list of common system functions and services and their definitions. The information in this model includes:

- *Systems Nodes* that represent facilities, platforms, units, and locations. The taxonomy minimally consists of names, descriptions, breakdowns into constituent parts of the node, and categorizations of types of facilities, platforms, units, and locations.

- *Systems* consisting of Families of Systems (FoS), Systems of Systems (SoS), networks of systems, individual systems, and components (e.g., equipment and software). The taxonomy minimally consists of names, descriptions, breakdowns into the constituent parts of the system and categorization of types of systems by system functions and services. Typing may also address variations across time and systems node installation.

- *System Functions/Services*. The taxonomy minimally consists of names, descriptions, and decomposition into the constituent parts that comprise a system function and/or service.

3.1.5 AIR FORCE TECHNICAL REFERENCE MODEL (TRM)

The TRM provides a hierarchical foundation to describe the mandated and preferred standards and technologies that are used by all AF developers. The AF TRM will reflect the integration of the I-TRM with the DoD TRM. The information in this model includes:

- *Technology Areas*. The taxonomy minimally consists of names, descriptions, and categories of technologies into which individual science and technology initiatives and programs can be categorized.

- *Technical Standards*. The taxonomy minimally consists of categories of standards but also includes specific technical standards adopted by the AF and DoD and may also include listings of products that have been determined to meet those standards.

- *Standard Platform Profiles*. Structured statements of scope, function, purpose, conformance requirements, and usage details which purposely restrict/constrain the choice of system implementation options to the extent necessary to enhance capabilities integration and/or interoperability.

- *Standardized products*. The AF TRM will identify products that the AF has determined to provide sufficient operational and/or business benefit to warrant their being designated a standard product solution for the AF.

- *Architecture Patterns*. In the future, the AF TRM may also include descriptions of combinations of technologies and standards that capture successful solutions to common or repeating problems. The intent is to provide a mechanism for capturing AF IT implementation knowledge and experience and to facilitate reuse.

3.2 MISSION AREA AND CROSS-MISSION AREA PERSPECTIVE

The architectures at the mission/business area and cross-mission area perspective of the AF-EA (represented by Figure 6) are integrated architectures that consist of operational, system, and technical views and their associated products as shown in Table 1-1 from the DoDAF. The mission/business area/cross-mission area level of the AF-EA primarily focuses on operational views and is comprised of architectures produced by AF architecture councils, MAJCOMs, AF Functionals, and AF Field Operating Agencies (FOA). One representative example of this architectural perspective is a "Mission Area Integrated Architecture" required by several of the DoD's directives and instructions detailed in Section 2.1. The information in these architectures, however, may also be used by Air Staff and others to "drill down" from the enterprise perspective level to get more detailed information, or by acquisition program managers and node managers to provide context for their architectures.

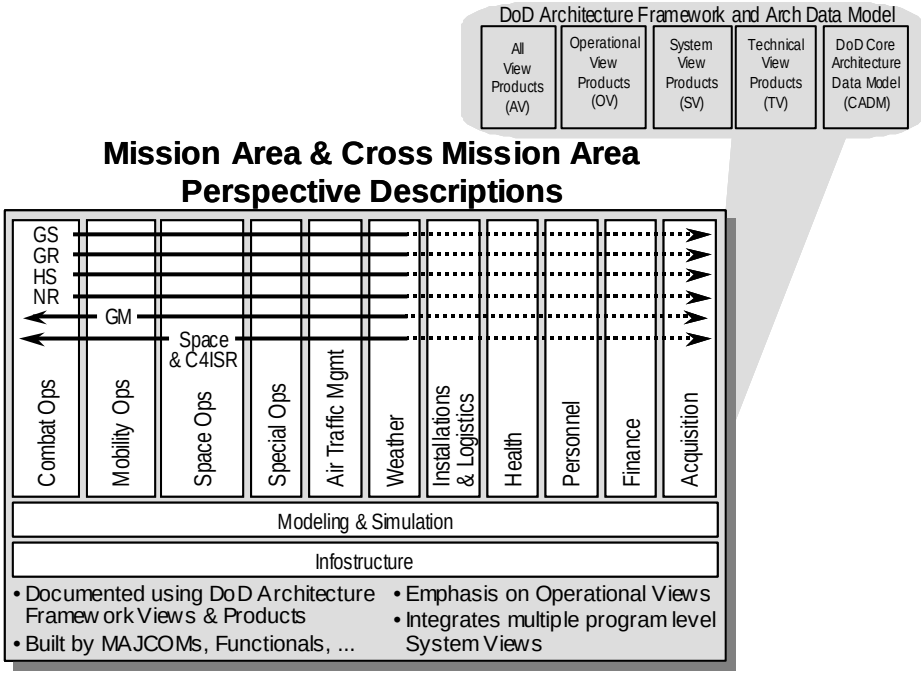

Figure 6: AF-EAF Mission Area and Cross-Mission Area Perspective

Each mission/business area and cross-mission area manager's set of operational architecture views should be traceable to the enterprise and sub-enterprise reference models and views for the enterprise area(s) or sub-enterprise area(s) they support. If the enterprise area or sub-enterprise area views associated with a specific mission/business area or cross mission area have not been defined or developed, the mission/business area or cross mission area manager should note this gap and collaborate with the sub-enterprise owner in order to develop and use the architecture for its intended purpose. Again refer to Appendix A to understand the basic relationships between DoDAF and FEA Reference Model architecture artifacts for this gap analysis.

Applicable View	Framework Product	Framework Product Name	General Description
All Views	AV-1	Overview and Summary Information	Scope, purpose, intended users, environment depicted, analytical findings
All Views	AV-2	Integrated Dictionary	Data repository with definitions of all terms used in all products
Operational	OV-1	High-Level Operational Concept Graphic	High-level graphical/ textual description of operational concept
Operational	OV-2	Operational Node Connectivity Description	Operational nodes, operational activities performed at each node, connectivity and information exchange needlines between nodes
Operational	OV-3	Operational Information Exchange Matrix	Information exchanged between nodes and the relevant attributes of that exchange
Operational	OV-4	Organizational Relationships Chart	Organizational, role, or other relationships among organizations
Operational	OV-5	Operational Activity Model	Operational Activities, relationships among activities, inputs and outputs. Overlays can show cost, performing nodes, or other pertinent information.
Operational	OV-6a	Operational Rules Model	One of the three products used to describe operational activity sequence and timing - identifies business rules that constrain operation
Operational	OV-6b	Operational State Transition Description	One of three products used to describe operational activity sequence and timing - identifies business process responses to events
Operational	OV-6c	Operational Event-Trace Description	One of three products used to describe operational activity sequence and timing - traces actions in a scenario or sequence of events and specifies timing of events
Operational	OV-7	Logical Data Model	Documentation of the information entities and attributes and structural business process rules of the Operational View.
Systems	SV-1	Systems Interface Description	Identification of systems and system components and their interconnections, within and between nodes
Systems	SV-2	Systems Communications Description	Systems nodes and their related communications lay-downs
Systems	SV-3	Systems-Systems Matrix	Relationships among systems in a given architecture; can be designed to show relationships of interest, e.g., system-type interfaces, planned vs. existing interfaces, etc.
Systems	SV-4	Systems Functionality Description	Functions performed by systems and the information flow among system functions
Systems	SV-5	Operational Activity to Systems Function Traceability Matrix	Mapping of systems back to operational capabilities or of system functions back to operational activities
Systems	SV-6	Systems Data Exchange Matrix	Provides details of systems data being exchanged between systems
Systems	SV-7	Systems Performance Parameters Matrix	Performance characteristics of each system(s) hardware and software elements, for the appropriate timeframe(s)
Systems	SV-8	Systems Evolution Description	Planned incremental steps toward migrating a suite of systems to a more efficient suite, or toward evolving a current system to a future implementation
Systems	SV-9	Systems Technology Forecast	Emerging technologies and software/hardware products that are expected to be available in a given set of timeframes, and that will affect future development of the architecture
Systems	SV-10a	Systems Rules Model	One of three products used to describe systems activity sequence and timing—Constraints that are imposed on systems functionality due to some aspect of systems design or implementation
Systems	SV-10b	Systems State Transition Description	One of three products used to describe systems activity sequence and timing—Responses of a system to events
Systems	SV-10c	Systems Event-Trace Description	One of three products used to describe systems activity sequence and timing -- System-specific refinements of critical sequences of events and the timing of these events
Systems	SV-11	Physical Schema	Physical implementation of the information of the Logical Data Model, e.g., message formats, file structures, physical schema
Technical	TV-1	Technical Standards Profile	Extraction of standards that apply to the given architecture
Technical	TV-2	Technical Standards Forecast	Description of emerging standards that are expected to apply to the given architecture, within an appropriate set of timeframes

Table 1-1: DoD Architecture Framework Products (Version 1 Draft)

Similar to the need to connect enterprise and mission/business area architecture artifacts together, the operational views of a mission area should be developed with the program and node managers' needs in mind. Mission/business area and cross-mission area architectures should be developed in a collaborative environment with the program managers to ensure that all views are integrated. Mission/business area and cross-mission area architectures should accurately reflect the CONOPS and operational requirements of the appropriate domain(s). The architect at this level also must ensure that external interfaces are properly described and deconflicted.

3.3 PROGRAM AND NODE PERSPECTIVE

The architectures at the program and node perspective of the AF-EA (represented by Figure 7) are also integrated architectures but focus primarily on system and technical views and their associated products shown in Table 1-1 from the DoDAF. This level of the AF-EA focuses on architectures mainly produced by the materiel developer for acquisition and technology implementation. Information in these architectures, however, may also be required by Air Staff and MAJCOMs for support to other core processes such as the PPBS inputs for investment decisions.

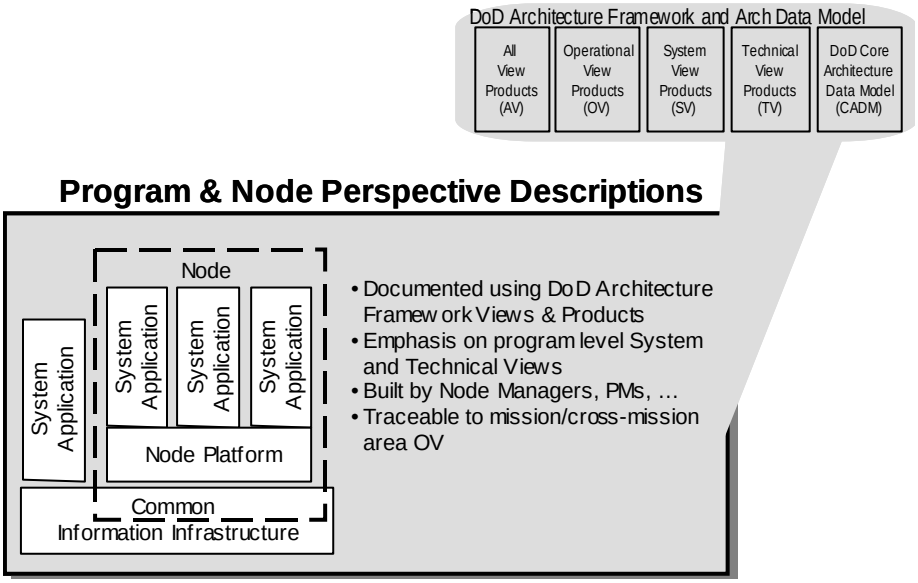

Figure 7: AF-EAF – Program & Node Perspective

The architectures of this perspective typically describe either a grouping of systems that are managed by a designated node manager or an individual application/system/FoS/SoS managed by a designated program manager. Program/node architectures address the relationships among the systems, nodes, and the information infrastructure, particularly as related to information exchanges and services (enterprise and node). In addition to these system/node relationships, each program or node manager's set of system and technical architecture views should be traceable to the operational views for the mission/business area(s) or cross-mission area(s) they support. If the mission/business area or cross mission area operational views associated with a specific system, program or node have not been defined or developed, the program or node manager may have to complete this work in order to use the architecture for its intended purpose.

4 ARCHITECTURE USES AND IMPACTS

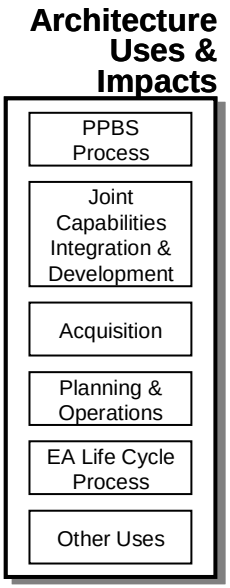

Figure 8: Architecture Uses & Impacts

Identifying and prioritizing the uses of an architecture is the first step in the architecture development process. It is critical to determine this so that efforts are focused properly. The following paragraphs summarize primary uses (Figure 8) of architecture in support of AF core processes. Due to the investment costs of building an architecture, it is important to enable multiple uses for the architecture information.

4.1 ARCHITECTURE SUPPORT TO THE PLANNING, PROGRAMMING, AND BUDGETING SYSTEM (PPBS) PROCESS

Planning, Programming, and Budgeting involves making decisions on how best to allocate funds among a large number of competing programs and activities. The challenge is to make these investment decisions in such a way that it provides maximum benefit to the AF. Architectures can assist in this process by identifying:

- What functionality each IT system or application provides
- What IT systems or applications are needed to provide a specific warfighting or business capability
- Where the gaps or deficiencies are in providing a critical capability
- Where redundant functionality and capability exists
- The interrelationships and dependencies between system and applications
- An integrated roadmap of system-of-systems migration

Architecture provides context, supports capability-based decision-making, and enables the development of a coherent IT investment strategy.

4.2 ARCHITECTURE SUPPORT TO THE JOINT CAPABILITIES INTEGRATION AND DEVELOPMENT SYSTEM

The joint capabilities integration and development process produces information for decision-makers on the projected capability needs of the warfighter. Functional area focused and capabilities-based documents will describe these needs. (The mission needs statement is being replaced as described in CJCSI 3170.01C). Concepts depicted in CRDs will be captured within functional concept(s) and supporting integrated architecture(s). These needs and concepts will be described in terms of capability needs in the Initial Capabilities Document (ICD), and functional and performance requirements in the Capability Development Document (CDD), and Capability Production Document (CPD).

Throughout this process, there is a need for detailed information on the current and planned capabilities of the existing systems. Architectures can provide this information. Few AF

systems or applications operate in isolation. They must share information with other systems and applications. Architecture documents these interdependencies and provides the context in which the new system or application must operate. The architecture also captures the functionality resident in each existing or planned system which can help the requirements developer identify the required functionality for any new system without introducing unnecessary duplication or redundancy. In addition, analysis of architecture products can lead to identification of gaps or deficiencies that prevent the AF from achieving critical capabilities or mission needs and which could lead to the development of a new or update to an existing ICD, CDD or CPD.

4.3 ARCHITECTURE SUPPORT TO THE ACQUISITION PROCESS

Architecture and more particularly the architecture products defined by DoDAF are traditionally most closely associated with system acquisition and development. The architecture products document the required functionality of the system, the information that must be exchanged with other systems and applications, the interfaces required to implement the information exchanges, the IT services and infostructure that the system can make use of, and the technical standards that apply to the system. The architecture is intended to guide and constrain the engineering choices of the system developer such that the resulting system is fully interoperable with the rest of the systems and applications that make up the enterprise architecture. The architecture products also support developmental and operational testing throughout the system development and acquisition process.

4.4 ARCHITECTURE SUPPORT TO THE PLANNING AND OPERATIONS PROCESSES

A key objective of the AF-EA is to provide effective IT support to the warfighter. While the AF-EA is an important IT investment decision tool, it is also a powerful tool for the warfighter directly, particularly in support of planning for contingency situations.

The (full spectrum) AF-EA can provide significant utility for Combatant Commanders and their supporting AF component commanders by providing a complete set of operational and system view products that define existing warfighting IT capabilities. These products identify capabilities and limitations with respect to specific contingency operations and provide the basis for rapid reconfiguration of architectures and capabilities to meet unforeseen needs. The Unified Commands can use the AF-EA to support their efforts to generate and validate joint requirements, design joint IT systems and capability configurations, and develop joint objective architectures.

4.5 ARCHITECTURE SUPPORT TO THE ENTERPRISE ARCHITECTURE LIFE CYCLE PROCESS

The AF-EA Life Cycle is the dynamic, iterative process of evolving and improving the AF enterprise over time by incorporating new mission/business processes, new technologies, new capabilities, as well as the maintenance and disposition of existing elements of the enterprise. It is accomplished through the combination of capability requirements development and integration

(i.e. JCIDs), systems engineering and program management (i.e. system acquisition), and capital planning and investment control (CPIC) (i.e. PPBS). As described above, architecture information supports all of these life cycle or "core processes". The key, however, is not to produce the necessary information for each process independently, but rather to build and maintain a single, integrated set of architecture information and products to support all of the processes. By doing so, each of these separately implemented and managed processes can be better integrated to produce a more effective and efficient enterprise. This requires the creation of a comprehensive EA program to ensure that architectures are built that meet the collective needs of the AF and that they are also maintained and updated as the AF enterprise evolves. Such an EA program will include architectural guidance, compliance rules, standards and identification of specific products to support the AF's core/life cycle processes.

5 SUMMARY

Depicted below (Figure 9) is the complete AF-EAF that the AF will use to organize, relate, and integrate its full spectrum of architectural information in order to support AF core processes.

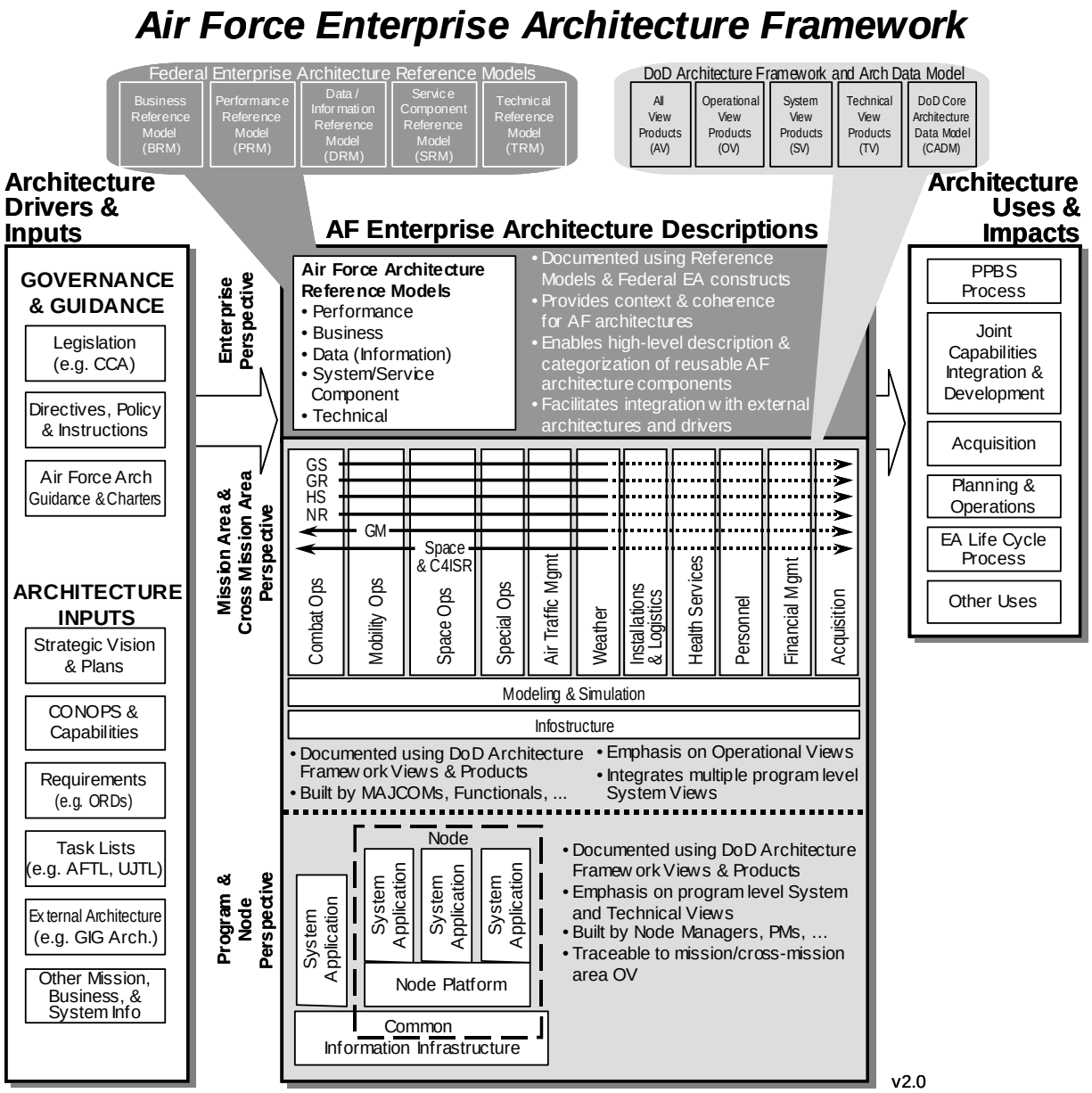

Figure 9: Summary View - Air Force Enterprise Architecture Framework

APPENDIX A: RELATIONSHIP BETWEEN THE AF REFERENCE MODELS AND THE DOD ARCHITECTURE FRAMEWORK

The AF Reference Models consist of architecture information that is directly related to, but is not as detailed as, the information contained in the lower level mission/business area/cross mission area architectures and program/node architectures. This is purposeful, since the intent of the reference models is not to provide detailed system or operational architectures, but is to provide an enterprise (and sub-enterprise) architecture construct for organizing and relating the lower level architectures and providing the means for managing the large number of activities, systems, and technologies that make up the AF Enterprise Architecture. Much of the information contained in the Reference Models consists of hierarchical lists called *taxonomies*. Some of these taxonomies are, in fact, similar to elements of the DoDAF and included in the *Integrated Dictionary (AV-2).* The DoDAF defines the AV-2 as

> *"The Integrated Dictionary contains definitions of terms used in the given architecture. It consists of textual information in the form of a glossary, a repository of architecture data, their taxonomies, and their metadata (i.e., data about the data elements), including meta-data for tailored products, associated with the architecture products developed. The Integrated Dictionary provides a central repository for a given architecture's data element definitions and metadata. AV-2 enables the set of architecture products to stand alone, allowing them to be read and understood with minimal reference to outside resources."*

The relationship between the AF Reference Models and the DoDAF defined taxonomies is shown in Figure A-1. According to the DoD Architecture Framework, these taxonomies are used to construct various architecture products as shown in Figure A-2. These similar taxonomies, therefore, help to provide the traceability between the Reference Models at the enterprise perspective level and the DoDAF products and data that document architectures developed at the mission/cross mission and program/node perspective levels. Again, as DoD and OMB provide further guidance these figures will be updated accordingly.

AF Reference Model	DoD Architecture Framework Taxonomy Type
Business Reference Model (BRM)	***Operational Nodes*** that represent Organizations, Organization Types, and Occupational Specialties. The taxonomy minimally consists of names, descriptions, and breakdowns into the parts of the organization, organization type, or occupational specialty.
Business Reference Model (BRM)	***Operational Activities (or Tasks).*** The taxonomy minimally consists of names, descriptions, and decomposition into the constituent parts that comprise a process-activity.
Data (Information) Reference Model (DRM)	***Information Exchanges.*** The taxonomy minimally consists of names, descriptions, decomposition into constituent parts and subtypes and mapping to systems data exchanges.
System/Service Component Reference Model (SRM)	***Systems Nodes*** that represent facilities, platforms, units, and locations. The taxonomy minimally consists of names, descriptions, breakdowns into constituent parts of the node, and categorizations of types of facilities, platforms, units, and locations.
System/Service Component Reference Model (SRM)	***Systems*** consisting of Families of Systems, Systems of Systems, networks of systems, individual systems, and components (e.g., equipment and software). The taxonomy minimally consists of names, descriptions, breakdowns into the constituent parts of the system and categorization of types of systems. Typing may also address variations across time and systems node installation.
System/Service Component Reference Model (SRM)	***System Functions*** . The taxonomy minimally consists of names, descriptions, and decomposition into the constituent parts that comprise a system function.
N/A	***Triggers/Events.*** The taxonomy minimally consists of names, descriptions, and breakdown into constituent parts of the event or trigger and categorization of types of events or triggers.
Performance Reference Model (PRM)	***Performance Parameters.*** The taxonomy minimally consists of names, descriptions, units of measure, and conditions that may be applicable to performance parameters.
Technical Reference Model (TRM)	***Technical Standards.*** The taxonomy minimally consists of categories of standards.
Technical Reference Model (TRM)	***Technology Areas.*** The taxonomy minimally consists of names, descriptions, and categories of technologies into which individual science and technology initiatives and programs can be categorized.

Figure A-1: AF Reference Models - DoD Architecture Framework Relationship

ARCHITECTURE PRODUCTS

TAXONOMY TYPES	STRUCTURE	AV		Operational View (OV)							System View (SV)											TV	
		1	2	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9	10	11	1	2
Operational Nodes *Organizations, Types of Organizations, and Occupational Specialties*	Taxonomy & Composition		●		●	●	●	●	●		◉					◉							
Operational Activities	Taxonomy & Composition		●		●	●		●	●	●					●	◉					●		
Information Exchanges *and mappings to Systems Data Exchanges*	Taxonomy & Composition		●		◉	●		●	●	●				◉		◉				◉	●	◉	◉
Systems Nodes *Facilities, Platforms, Units, and Locations*	Taxonomy & Composition		●								●	●	◉	◉		●							
Systems *Families-of-Systems, Systems-of-Systems, Networks, Applications, Software, and Equipment*	Taxonomy & Composition		●								●	●	●	●	◉	●	●	●	●	●		◉	◉
System Functions	Composition		●								◉			●	●	●	◉	◉	◉	●			
Triggers / Events	Taxonomy & Composition		●			●		●	●					●		●				●			
Performance Parameters	Taxonomy & Composition		●					●						●		●	●	●	●				
Technical Standards *Info Processing, Info Transfer, Data Security, and Human Factors*	Taxonomy & Composition		●								●	●		◉		●		●	●		◉	●	●
Technology Areas *Systems and Standards*	Taxonomy & Composition		●																●				●

● = Taxonomy element plays a primary role ◉ = Secondary role blank = element not part of this product

Figure A-2: Taxonomies Used in Products[6]

[6] *DoD Architecture Framework*, Version 1.0 Draft, Jan 2003