

Human Spaceflight Architecture Model (HSFAM) Data Dictionary

Version 1.0



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HSFAM Database Representation

HSFAM offers a straight-forward way of supporting ISO/IEC/IEEE-15288-2015 **architecture definition process** activities for human spaceflight. HSFAM is a **relational database**; its purpose is not to establish a single architecture, but rather to serve as an organizing tool to support **exploratory investigations** of candidate **human spaceflight architectures** containing **multiple systems** that operate together over **multi-decade** timespans. In particular, it provides an integrated “dictionary” to identify **architectural-level artifacts**, along with the means to capture key **relationships and parameter values** to be used in **quantitative analyses**.

HSFAM is a data model based on the DoDAF 2.02 data model with some ‘for purpose’ extensions.¹ These extensions are designed to permit quantitative analyses regarding stakeholder concerns about technical feasibility, configuration and interface issues, and budgetary and/or economic viability. HSFAM captures information required to create several standard DoDAF-style viewpoints, as well as information to be used as inputs to analytic models addressing additional key concerns.

The DoDAF 2.02 data model is described in the literature as having three levels: a top-level Conceptual Data Model (CDM), a mid-level Logical Data Model (LDM), and a Physical Exchange Schema (PES). Each of these is described below as it applies to the HSFAM.

1. The top-level CDM defines the high-level data constructs (in non-technical terms) from which architectural descriptions are created. The upper part of Table 1 shows these high-level constructs for the HSFAM. These constructs are the fundamental building blocks for any human spaceflight architecture. They identify “locations” in space (Operational Nodes), systems to be deployed and employed at these locations (Systems), timing of events (Milestones), performing space agencies and commercial actors (Partners), etc., and the quantitative metrics (Measures) needed to further characterize these fundamental constructs.
2. The mid-level LDM clarifies relationships in an unambiguous manner and is the actual repository of the architecture’s technical information, i.e., the specific attributes in the CDM. For example, to represent the Apollo 11 landing in the HSFAM, one would identify (i.e., list) each of the following in their respective tables, and then use those unique designations to declare in the Milestones x Systems x Measures Table that the measure’s (system quantity) value is one:
 - In the Operational Nodes Table: Tranquility Base (Its lunar coordinates are 00°41’15”N, 23°26’00”E.)
 - In the Systems Table: Apollo Lunar Module
 - In the Milestones Table: July 20, 1969 at Tranquility Base
 - In the Partners Table: NASA
 - In the Measures Table: Quantity.

HSFAM’s LDM consists of about 30 tables in a relational database. The attributes of each table are fully described in this document. The E-R diagram in Figure 1 shows these tables and their relationships to each other. The figure is presented in three parts simply because of its size. Consequently, the same table, e.g., Operational Nodes, may appear in all three parts just to make the figure more readable.

3. The bottom-level PES describes the tool-specific formats and means by which data from the LDM is extracted, shared, and passed, as needed, to downstream analytic models (and other tools). HSFAM is currently realized as an Excel© workbook.² In many cases, this simplifies the exchange of information from HSFAM to other analytic models. In some previous uses of the HSFAM, we built analytic models in the same Excel workbook that contained the HSFAM tables;

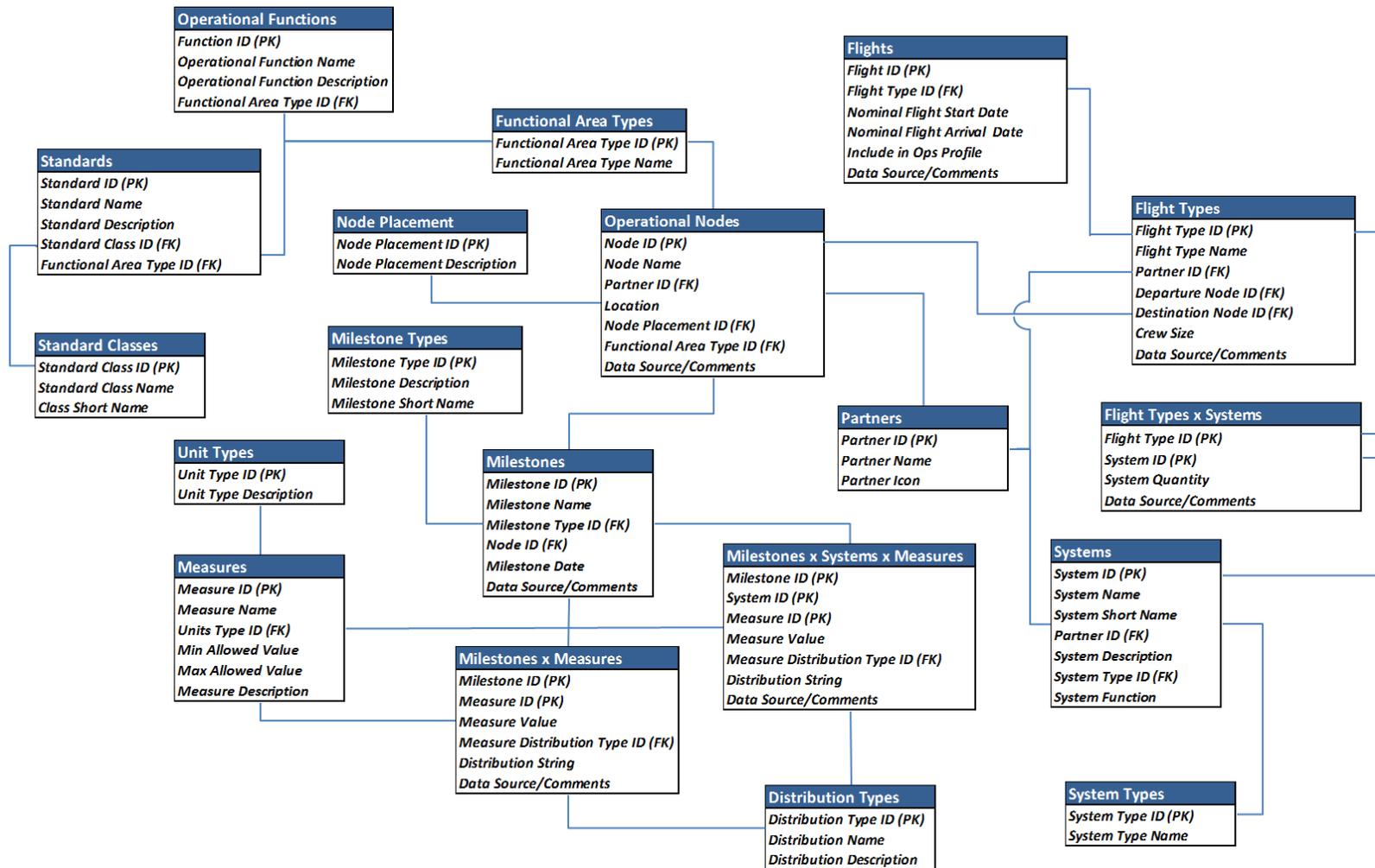
¹ Those familiar with DoDAF, a widely-used formal architecture framework, should be able to see the similarities to HSFAM constructs. See DoDAF 2.02 website: http://dodcio.defense.gov/Portals/0/Documents/DODAF/DoDAF_v2-02_web.pdf (accessed August 2016).

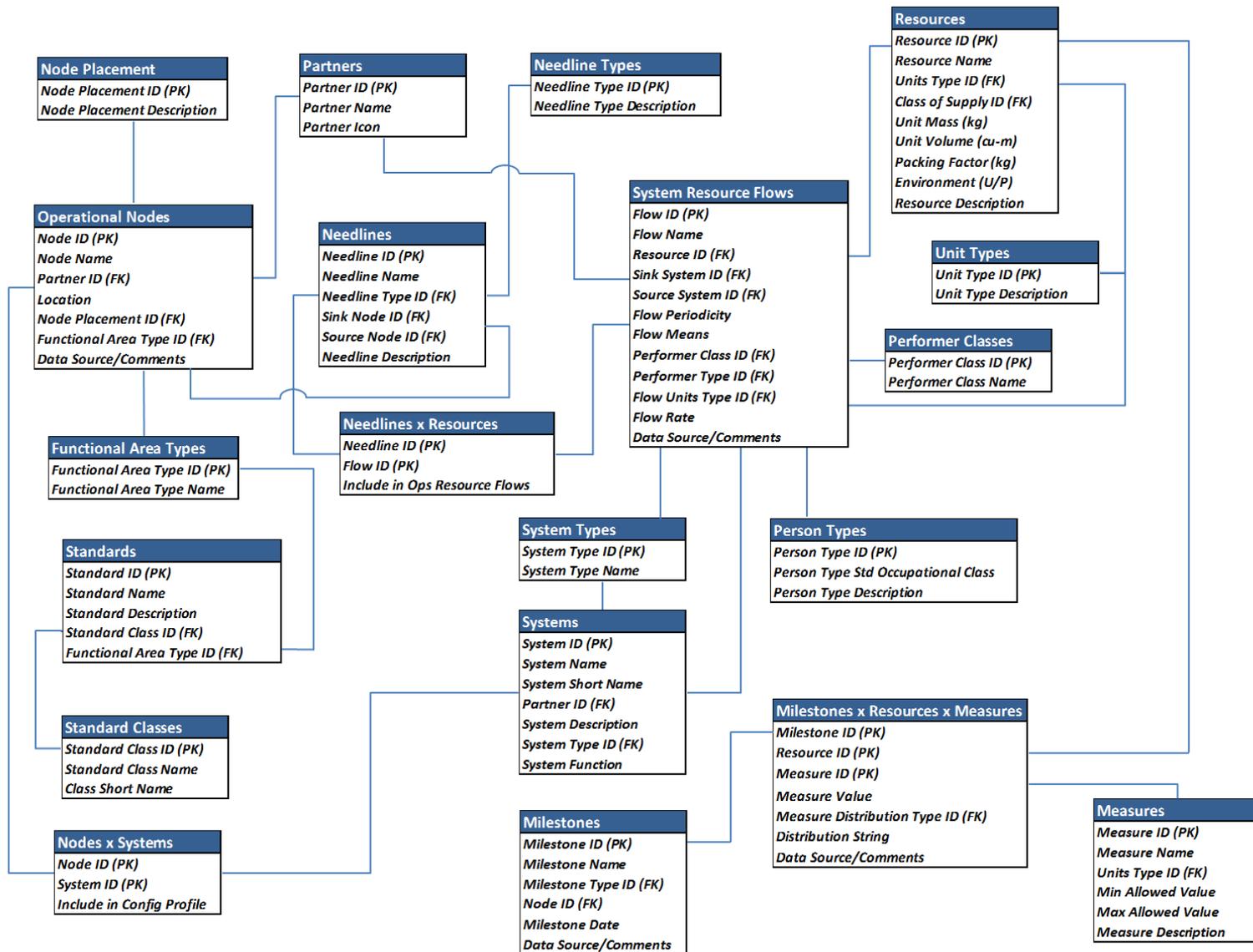
² The Excel workbook contains embedded VBA code so that the spreadsheets display not just the unique identifiers for attributes within a record, but also the human-readable names and descriptions associated with each identifier.

in these cases, data are passed by direct reference to the appropriate cells. In more complex uses, where separate downstream analytic models are preferred, or where one or more analytic models are not Excel models, we have used a commercial tool, ModelCenter©, to pass data from the HSFAM tables to those downstream analytic models.

Table 1: Summary of HSFAM Core Tables

Table Name	Description of Architectural Content	Classes, Types, and Subtypes
Operational Nodes	Spatial locations in the solar system; locus of an operational function or activity	Surface locations (terrestrial and planetary); orbits; Lagrange points
Systems	Notional objects that fulfill a function; a hardware and/or software build	Based on broad system purposes, e.g., surface mobility, habitation
Operational Functions	Activities that transform inputs (resources) into outputs (other resources or end products), or change their state	Based on broad functional areas
Milestones	Time-stamped identification of significant changes; milestones are four-dimensional.	Based on capability achieved, e.g., initial operational capability (IOC)
Needlines	Needed interactions or exchanges between operational nodes	Based on the primary resource exchanged
Resources	Commodities of value to be tracked, e.g., information, labor, energy, materiel, etc.	
Partners	Organizational performers with development and/or operational responsibilities	Space agencies (e.g., NASA, ESA, JAXA), commercial firms, etc.
Measures	Measurable (quantifiable) properties or attributes of interest	Mass, cost, quantity, etc.
Person Types	Individual (skill-based) performers with operational responsibilities	Subtypes based on skills from U.S. Bureau of Labor Statistics Standard Occupational Classification (SOC)
Standards	Applicable technical, operational or business standards and rules	ISO, ANSI, Community of Practice (CoP), government-unique, etc.
Flight Types	Conveyance of systems from one operational node to another	
Flights	Time-stamped assignment of flight types	
Nodes x Systems	Association of systems with operational nodes	
Flight Types x Systems	Assignment of systems to flight types	
Milestones x Measures	Time-stamped assignment of measure values to milestones	
Milestones x Systems x Measures	Time-stamped assignment of measure values to systems	
Milestones x Person Types x Gender Types x Measures	Time-stamped assignment of measure values to person and gender types, the latter being important in addressing life support, health, and logistics concerns	
Milestones x Resources x Measures	Time-stamped assignment of measure values to resources	
Needlines x Resources	Decomposition of needlines into individual system resource flows	
System Resource Flows	Identification of resource flows from one system to another; essentially, system interfaces	





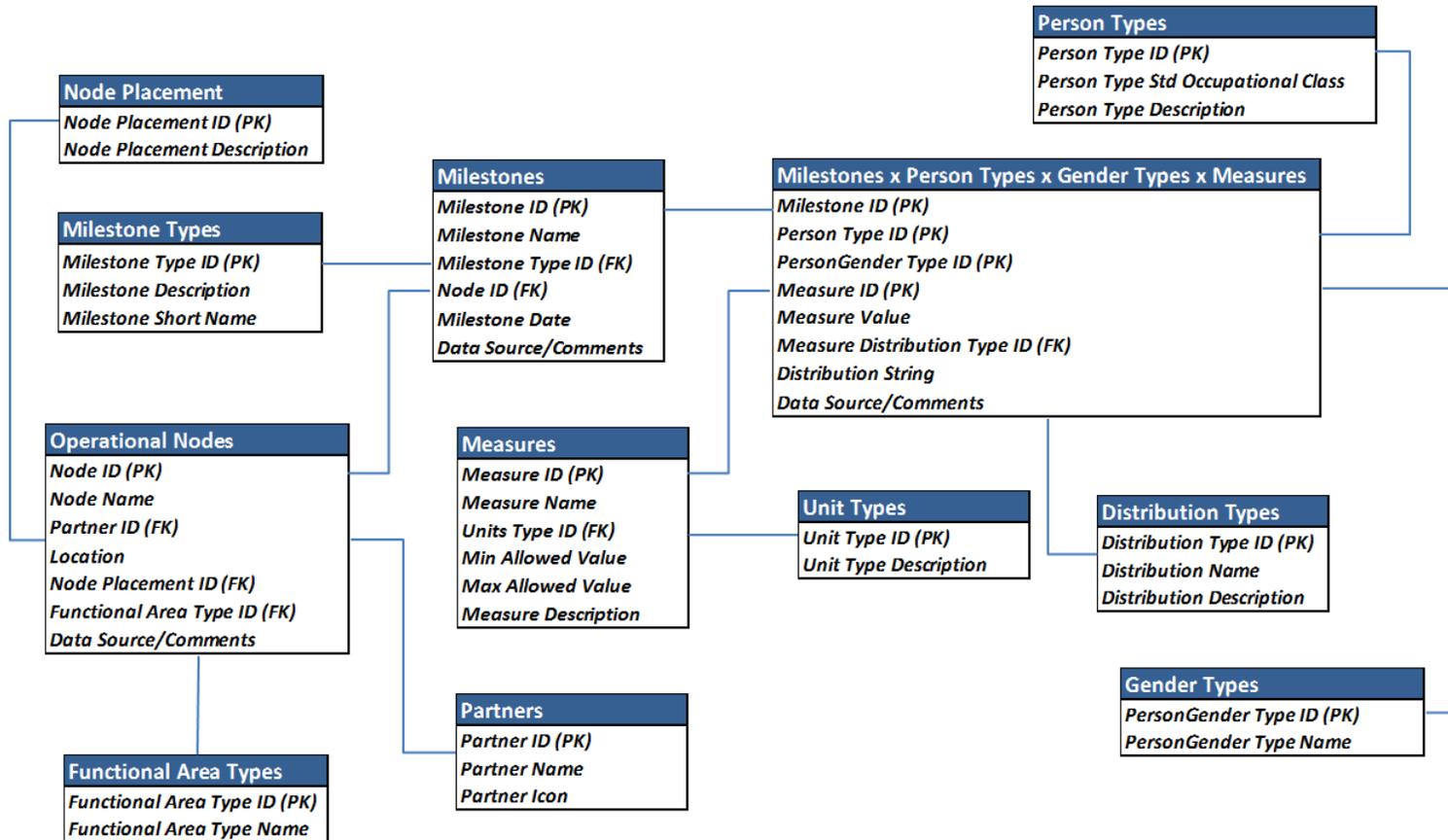


Figure 1. Entity-Relationship Diagram for HSFAM Database

Naming Conventions

1. Choose descriptive names to reduce the chance of a naming confusion or collision.
2. The primary key ID(s) in a given table must be unique.
3. Measure names should be without spaces or special characters; use of the character “_” is preferred as a word separator, as in “*system_quantity*”
4. Names can be abbreviated. Some abbreviations already in use:

a.	msn	mission
b.	ops	operations
c.	proj	project
d.	fac	facility
e.	gen	generic
f.	dev	development
g.	flt	flight
h.	trn	training
i.	def	definition
j.	intf	interface
k.	req	requirements
l.	prop	proportion
m.	enr	engineering
n.	sys	system
o.	intg	integration
p.	verf	verification
q.	vald	validation
5. To compare terminologies in DoDAF, MoDAF, UPDM, and HSFAM, the table below provides a terminology cross-walk for some of the constructs in HSFAM.

DoDAF 2.02	UPDM	MoDAF 1.3	HSFAM
Node	Node	Node	Node
System	System or CapabilityConfiguration	CapabilityConfiguration	System
Needline (informal in v2.02)	Needline	Needline	Needline
Activity	Function	Function	Function
Measure	Measurement	MeasurableProperty	Measure Value
MeasureType	MeasureType	N/A	Measure
MeasureTypeUnitsofMeasure	SysML DimensionType (SysML 1.3 uses ValueType)	N/A	Unit Type
N/A	ActualProjectMilestone or DeployedMilestone or IncrementMilestone or NoLongerUsedMilestone	ProjectMilestone or DeployedMilestone or CapabilityIncrement or StatusAtMilestone	Milestone
Organization	ActualOrganization	ActualOrganisation	Partner
LocationNamedByAddress	LocationKind or GeopoliticalExtent	N/A	Node Location
Performer	Participant or PhysicalResource or LogicalArchitecture or Performer	Node or PhysicalAsset or LogicalArchitecture	Performer Class
whole part of a PersonRoleType	PersonType	N/A	Person Type (by BLS Standard Occupation Classification)
Representation	Alias	Alias	Short Name
Resource	ExchangeElement	ResourceType	Resource

Sample Tables

The HSFAM is intended to help represent and describe complex system-of-systems architectures for human spaceflight. Its purpose is not to establish a single architecture, but rather to serve a flexible organizing tool to explore many architecture alternatives. In past studies³, it has been used to support an “analysis of alternatives” (AoA) of Mars ISRU by linking to and feeding multiple “downstream” models with architectural-level artifacts (e.g., operational nodes and systems), relationships, and technical parameters. Before that, it was used in the now-cancelled Constellation Program to support the estimation of operations costs for multiple lunar outpost architectures and for Mars DRA 5.0.⁴ In general, however, which models are introduced into the analysis ensemble is determined completely by what specific analyses and views are needed to address the targeted concerns and issues of the human spaceflight stakeholder community.

A portion of the Operational Nodes Table built for the Mars ISRU study is shown in Figure 2 below.

								
Node ID	Node Name	Partner ID	Location	Node Placement ID	Node Placement Description	Functional Area Type ID	Functional Area Description	Data Source/Comments
0	Disposal	0	Various	1	Terrestrial	12	Other	
1	Orion Recovery Site	1	Various	1	Terrestrial	4	Ground Ops	
2	DSN Ground Station	0	Goldstone, Madrid, and Canberra	1	Terrestrial	6	Communications and Tracking	
3	HEO Mars Transfer Orbit	0	200 km x 340,000 km, highly elliptical	2	Cislunar	8	Rendezvous	Earth departure to Mars
4	LEO Rendezvous Orbit	0	300 km alt circular 28.5 deg	2	Cislunar	8	Rendezvous	Parking orbit used by Apollo missions prior to TLI
5	NASA Program Office	1	JSC	1	Terrestrial	1	Management	
6	Mission Control Center, Hou	1	JSC	1	Terrestrial	3	Mission Ops	
7	Training Center, Hou	1	JSC	1	Terrestrial	3	Mission Ops	
8	Mission Control Center, Mos	2	Moscow, Russia	1	Terrestrial	3	Mission Ops	
9	Training Facility, FP	2	Star City, Russia	1	Terrestrial	3	Mission Ops	
10	Launch Facility, KSC	1	KSC	1	Terrestrial	4	Ground Ops	
11	Launch Facility, Baik	2	Baikour, Kazakhstan	1	Terrestrial	4	Ground Ops	
12	Launch Facility, Kourou	3	Kourou, French Guiana	1	Terrestrial	4	Ground Ops	
13	Launch Facility, Tan	4	Tanegashima, Japan	1	Terrestrial	4	Ground Ops	
14	Logistics Facility	1	KSC	1	Terrestrial	5	Integrated Logistics Support	
15	Mars Comm Relay Orbit	0	1 sol orbit at altitude = 17,030 km	4	Deep Space	6	Communications and Tracking	Arcostationary orbit
16	Mars Parking Orbit	0	250 km x 33,793 km	4	Deep Space	8	Rendezvous	
17	Mars Settlement Site A	0	Isidis Planitia 12°54'N 87°00'E	5	Mars Surface	7	Settlement	SP-2009-566 ADD, Human Exploration of Mars DRA 5.0 Addendum
18	Mars Settlement Site B	0	N. Amazonis Planitia 35°50'N 145°00'W	5	Mars Surface	7	Settlement	Website http://marsbase.org/location , accessed 27 Feb 2015
19	Mars Settlement Site C	0	Utopia Planitia 42°00'N 150°00'E	5	Mars Surface	7	Settlement	Website http://marsbase.org/location , accessed 27 Feb 2015
20	Mars Settlement Site D	0	Isidis Basin 18°30'N 77°30'E	5	Mars Surface	7	Settlement	Website http://marsbase.org/location , accessed 27 Feb 2015
21	Mars Water Mining Site	0	Panchara Rupes 64°14'N 146°00'E	5	Mars Surface	9	ISRU-Type 1 (Volatiles)	Thierry de Roche, UNSW, School of Mining, 2015

Figure 2. Operational Nodes Table Example

A portion of the Systems Table built using the Project Aldrin-Purdue study⁵ is shown in Figure 3.

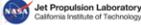
							
System ID	System Name	System Short Name	Partner ID	System Description	System Type ID	System Type Name	System Function
1	Space Launch System (Block 1A)	SLS (Blk 1A)	1		1	Launch Vehicle	70 MT to LEO
2	Space Launch System (Block 1B)	SLS (Blk 1B)	1		1	Launch Vehicle	105 MT to LEO
3	Orion Command Module	Orion (CM)	1		2	In-Space Transportation	Earth
4	Orion Service Module	Orion (SM)	3		2	In-Space Transportation	Provides power and propulsion for the Orion system
5	Space Launch System (Blk 2)	SLS (Blk 2)	1		1	Launch Vehicle	130 MT to LEO
35	Falcon 9 Heavy	F9-H	8	Space X heavy lift launch vehicle	1	Launch Vehicle	53 MT to LEO
43	Exploration Module 1	XM1		Bigelow Aerospace 330 Inflatable Habitat	2	In-Space Transportation	LEO testing, Project Aldrin-Purdue Final Report, April 9, 2015
44	Exploration Module 2	XM2		Rigid structure habitat module	7	Lunar Surface Habitation	Lunar testing, Project Aldrin-Purdue Final Report, April 9, 2015
45	Exploration Module 3 Mars	XM3-M		Rigid structure habitat module for Mars colonists; three living levels plus utility level	15	Mars Surface Habitation	See Project Aldrin-Purdue Final Report, April 9, 2015
46	Exploration Module 3 Phobos	XM3-P		Rigid structure habitat module for Phobos crew; two living levels, one medical bay level plus utility level	22	Other Mars Surface System	See Project Aldrin-Purdue Final Report, April 9, 2015
47	Exploration Module 3 Mars Farming	XM3-M-F		Rigid structure module for Mars farming; three farming plus utility level; solar arrays; ~91 m ² area	21	Mars Surface Logistics	See Project Aldrin-Purdue Final Report, April 9, 2015
48	Exploration Module 3 Mars Water	XM3-M-W		Rigid structure module for Mars water systems; two living levels, one water system level plus utility level	15	Mars Surface Habitation	See Project Aldrin-Purdue Final Report, April 9, 2015
49	Exploration Module 3 Cyclar	XM3-C		Rigid structure module for Mars Cyclar; two living levels, one medical bay level plus utility level	2	In-Space Transportation	See Project Aldrin-Purdue Final Report, April 9, 2015
50	Exploration Module 3 Mars Medical	XM3-M-M		Rigid structure module for Mars colonists; two living levels, one medical bay level plus utility level	15	Mars Surface Habitation	See Project Aldrin-Purdue Final Report, April 9, 2015
51	Aldrin Mars Cyclar Core Structure	AMC - Core			2	In-Space Transportation	
52	Aldrin Mars Cyclar Electric Power Generation Unit	AMC - EPGU		Cylindrical pressurized units, with MMOD shielding for Earth flyby	2	In-Space Transportation	
53	Aldrin Mars Cyclar Communications Array	AMC - CA		Two 10m ASTRONESH antennas with connecting structure; 3-axis rotation capability	4	Deep Space Communications	Alternative communication link during Earth-Mars solar conjunction
54	Aldrin Mars Cyclar Solar Panels	AMC - SP		Two 28m diameter arrays with connecting structure	2	In-Space Transportation	
55	Aldrin Mars Cyclar Connector and Docking Structure	AMC - CDS			2	In-Space Transportation	
56	Aldrin Mars Cyclar SEP	AMC - SEP		Solar electric propulsion module, 12kW Hall thrusters	2	In-Space Transportation	Trajectory Control Maneuvers (TCMs) for Mars Cyclar
57	Human Lander Capsule	HuLa		Aerocapture and balloon-assisted descent	2	In-Space Transportation	Transports 8 from LEO to the Cyclar, then landing on Phobos/Mars
59	Crane	Crane		16m height	21	Mars Surface Logistics	See Project Aldrin-Purdue Final Report, April 9, 2015
60	Human Lander Boost Vehicle	HuLa BV		LOX/LH2	2	In-Space Transportation	Hyperbolic rendezvous of three HuLa with the Aldrin Mars Cyclar
61	Cargo Lander	CarLa		22mt capacity, once landed, converted to farming modules	2	In-Space Transportation	See Project Aldrin-Purdue Final Report, April 9, 2015
62	Refuel Depot			Depot for lunar-derived fuel, in circular HEO	2	In-Space Transportation	See Project Aldrin-Purdue Final Report, April 9, 2015
63	Lunar Propellant Production Unit	LPPU		Thermal reactor, solar reflectors, optical waveguide transmission line	9	Lunar Surface ISRU-Type 1	See Project Aldrin-Purdue Final Report, April 9, 2015
64	Dome			Inflatable using Vectran material; central supporting structure	15	Mars Surface Habitation	Provides radiation protection; see Project Aldrin-Purdue Final Report
65	Nuclear Reactor			900kW thermal Brayton cycle conversion to 22kW electric, uses sodium heat pipes	20	Mars Surface Power	See Project Aldrin-Purdue Final Report, April 9, 2015
66	Liquid Propulsion Booster			LOX/LH2	2	In-Space Transportation	Initiates Mars Cyclar S1L1 orbit insertion, then is jettisoned
67	Large SEP Tug			250kW	2	In-Space Transportation	Completes Mars Cyclar S1L1 orbit insertion, then is jettisoned

Figure 3. Systems Table Example

³ Shishko, R., R. Fradet, S. Saydam, et al.: “An Integrated Economics Model for ISRU in Support of a Mars Colony—Initial Results Report,” AIAA SciTech Conference, Grapevine, TX, January 2017.

⁴ Shishko, R.: “Modeling Operations Costs for Human Exploration Architectures,” AIAA-2013-5489, SPACE Conference and Exposition, San Diego, CA, September 2013.

⁵ Purdue University, Department of Aeronautics and Astronautics: Project Aldrin-Purdue Final Report, April 9, 2015. <https://engineering.purdue.edu/AEE/Academics/Courses/ae450/2015/spring/docs/ProjectAldrin-PurdueFinalReport.pdf> (accessed 2 July 2015)

A portion of the Measures Table used for multiple studies is shown in Figure 4.

						
Measure ID	Measure Name	Units Type ID	Units Type	Min Allowed Value	Max Allowed Value	Measure Description
0	quantity		1 integer, dimensionless	0		
1	mass_dry		8 kg	0		
2	volume		34 cu-m	0		
3	system_effcy_annual		12 per year	0	1	
4	system_effcy_day		35 per day	0	1	
5	system_output_mass		38 kg/hour	0		
6	system_output_power		31 watts	0		
7	system_output_info		33 Gb/sec	0		
8	system_output_labor		18 workhours/year	0		
9	person_food_con_rate		42 kcal/day	0		
10	person_wage_rate		11 \$FY15K/year	0		
11	person_annual_wkhours		15 hours/year	0	2040	
12	available_content		9 percent	0	100	
13	drill_rate		57 m/hour	0		
14	drill_diameter		50 meters	0		
15	system_avg_speed_over_terrain		6 m/sec	0		
16	person_avg_speed_over_terrain		6 m/sec	0		
17	evms_hours_per_week		14 hours/week	0	168	
18	initial_price_per_unit		3 \$FY15K	0		
19	price_drift		59 percent/week	0		
20	price_volatility		59 percent/week	0		
21	design_life		60 years	0		
22	capacity		34 cu-m	0		
23	system_dev_cost		4 \$FY15M	0		
24	system_tfu_cost		4 \$FY15M	0		
25	system_sustainengr_cost		61 \$FY15M/year	0		
26	system_dev_time		60 years	0		
27	system_prod_time		60 years	0		
28	system_prod_learnrate		9 percent	0	100	
29	duty_cycle		9 percent	0	100	
30	mass_wet		8 kg	0		

Figure 4. Measures Table Example

A portion of the Resources Table used for multiple studies is shown in Figure 5.

									
Resource ID	Resource Name	Units Type ID	Units Type	Class of Supply ID	Unit Mass (kilograms)	Unit Volume (cubic meters)	Packing Factor (kilograms)	Environment (U/P)	Resource Description
0	Information		32 Gb						
1	Labor		39 workhours						
2	Water		8 kg	201	1	0.001			
3	Oxygen		8 kg	203	1				
4	Hydrogen		8 kg	203	1				
5	Carbon Dioxide		8 kg	203	1				
6	Electric Energy		58 kWh						
7	Mars Icy Regolith		8 kg			1			
8	Lunar Icy Regolith		8 kg			1			
9	Food from Plant Sources		8 kg	202	1				
10	Food from Animal Sources		8 kg	202	1				
11	Nitrogen		8 kg	203	1				
12	Methane		8 kg	104	1				

Figure 5. Resources Table Example

Types, Subtypes, and Classes Tables are shown in Appendix B. Types, Subtypes, and Classes Tables are short lists of items that are used throughout HSFAM to define, for example, useful groups of things or functions. Examples are the group of all terrestrial Operational Nodes, or the group of all lunar surface mobility systems, or the group of all logistics functions. Other Types, Subtypes, and Classes Tables deal with measure units, and both individual and organizational performers. Although these tables can be augmented for new studies, they are provided with the idea that it is beneficial across multiple studies to use the same basic group definitions, unit types, and identifiers for individual and organizational performers.

Database Dictionary

How to read these tables: Nullable means the attribute is not required for the table to be valid, so may be left blank. [PK] indicates the attribute is (or is part of) the Primary Key of the table. [FK] indicates a Foreign Key, i.e., a pointer to the Primary Key of another table.

Table Name: Operational Nodes

DoDAF Views: AV-2

Table Theme: Identifies the set of operational nodes from which an architecture can be constructed

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Node ID [PK]	Unique identifier	F	Integer ≥ 0
Node Name	Descriptive name of the node	T	Text
Partner ID [FK]	Indicates primary responsibility for the node, and determines color of node icon. FK reference to Table Name: Partners	F	Integer ≥ 0
Node Location	Descriptive text for node location (Description depends whether node is a terrestrial or planetary surface location, orbit, or Lagrange point.) Useful in constructing an architecture visualization	T	Text
Node Placement ID [FK]	Determines where node icon is initially placed in architecture visualization, i.e., terrestrial, cislunar, lunar surface, deep space, or Mars surface	T	Integer [1,5]
Functional Area Type ID [FK]	Indicates the primary functional area/activity at the node. FK reference to Table Name: Functional Area Type	T	Integer [1,12]
Data Source/ Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Systems

DoDAF Views: AV-2, SV-1, SV-4

Table Theme: Identifies systems that can be included in an architecture.

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
System ID [PK]	Unique identifier	F	Integer ≥ 1
System Name	Descriptive name of the system	T	Text
System Short Name	Acronym or shorthand name for this system	T	Text
Partner ID [FK]	Indicates primary responsibility for this system. FK reference to Table Name: Partners	F	Integer ≥ 0
System Description	Descriptive text of the system's major components, design, and/or performance	T	Text
System Type ID [FK]	Indicates broadly the system's purpose and/or how it is intended to be used. FK reference to Table Name: System Type	T	Integer [1,22]
System Function	Descriptive text of the system's intended functions	T	Text

Table Name: Nodes x Systems

DoDAF Views: SV-8

Table Theme: Associates systems with nodes; this association can be physical (meaning the system is physically at the node), or logical (meaning the system has a relationship with a node without its physical presence there, e.g., a system and its program office)

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Node ID [PK]	PK reference to Table Name: Operational Nodes	F	Integer ≥0
System ID [PK]	PK reference to Table Name: Systems	F	Integer ≥1
Include in Config Profile	Boolean that includes/excludes this system at this node in the SV-8 view	T	T/F

Table Name: Milestones

DoDAF Views: AV-2, PV-2

Table Theme: Identifies a set of architecture milestones representing an event at a node

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Milestone ID [PK]	Unique identifier	F	Integer ≥0
Milestone Name	Descriptive name of the milestone	T	Text
Milestone Type ID [FK]	FK reference to Table Name: Milestone Type	T	Integer [0,7]
Node ID [FK]	FK reference to Table Name: Operational Nodes	F	Integer ≥0
Milestone Date	Milestone date expressed as a date or as a fiscal year in decimal notation, e.g., 2019.75 = July 1, 2019	F	≥1900
Data Source/Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Measures

DoDAF Views: AV-2, SV-7

Table Theme: Identifies attributes of a measure

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Measure ID [PK]	Unique identifier	F	Integer ≥0
Measure Name	Descriptive name of the measure	T	Text
Units Type ID [FK]	FK reference to Table Name: Unit Types	F	Integer ≥1
Min Allowed Value	Minimum allowed value of the measure	T	Real Number
Max Allowed Value	Maximum allowed value of the measure	T	Real Number
Measure Description	Descriptive text of the measure's definition beyond the name, as needed for clarity	T	Text

Table Name: Milestones x Measures

DoDAF Views: SV-7

Table Theme: Identifies measure values and probability distribution parameters across multiple milestones

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Milestone ID [PK]	PK reference to Table Name: Milestones	F	Integer ≥ 0
Measure ID [PK]	PK reference to Table Name: Measures	F	Integer ≥ 0
Measure Value	The value taken on by the measure at the milestone. (Note: This value persists until possibly revised at some future milestone.)	F	Real Number
Measure Distribution Type ID [FK]	FK reference to Table Name: Distribution Types	T	Integer [0,13]
Distribution String	The string of arguments, e.g., mean, standard deviation, separated by commas, required by the selected measure distribution function when running any linked model in Monte Carlo mode. (Note: This string persists until possibly revised at some future milestone.)	T	Text
Data Source/ Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Milestones x Systems x Measures

DoDAF Views: SV-7

Table Theme: Identifies system measure values and probability distribution parameters across multiple milestones

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Milestones ID [PK]	PK reference to Table Name: Milestones	F	Integer ≥ 0
System ID [PK]	PK reference to Table Name: Systems	F	Integer ≥ 1
Measure ID [PK]	PK reference to Table Name: Measures	F	Integer ≥ 0
Measure Value	The value taken on by the system measure at the milestone (Note: This value persists until possibly revised at some future milestone.)	F	Real Number
Measure Distribution Type ID [FK]	FK reference to Table Name: Distribution Types	T	Integer [0,13]
Distribution String	The string of arguments, e.g., mean, standard deviation, separated by commas, required by the selected measure distribution function when running any linked model in Monte Carlo mode (Note: This string persists until possibly revised at some future milestone.)	T	Text
Data Source/ Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Resources

DoDAF Views: AV-2, SV-6

Table Theme: Identifies resources and resource attributes for system flows in an architecture

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Resource ID [PK]	Unique identifier	F	Integer ≥ 0
Resource Name	Descriptive name for this resource	T	Text
Unit Type ID [FK]	Identifies the units for the quantity of this resource. FK reference to Table Name: Unit Types. (Note: It is imperative to distinguish between stock units and flow units. This attribute refers to the former.)	F	Integer ≥ 1
Class of Supply ID [FK]	FK reference to Table Name: Supply Classes (Note: Reserved for future use.)	T	Text
Unit Mass (kg)	(Note: Reserved for future use.)	T	≥ 0
Unit Volume (cu-m)	(Note: Reserved for future use.)	T	≥ 0
Packing Factor (kg)	(Note: Reserved for future use.)	T	≥ 0
Environment (U/P)	Unpressurized or Pressurized. (Note: Reserved for future use.)	T	U, P
Resource Description	Descriptive text on the resource beyond the name, as needed for clarity	T	Text

Table Name: Milestones x Resources x Measures

DoDAF Views: SV-7

Table Theme: Identifies resource measure values and probability distribution parameters across multiple milestones

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Milestones ID [PK]	PK reference to Table Name: Milestones	F	Integer ≥ 0
Resource ID [PK]	PK reference to Table Name: Resources	F	Integer ≥ 0
Measure ID [PK]	PK reference to Table Name: Measures	F	Integer ≥ 0
Measure Value	The value taken on by the resource measure at the milestone (Note: This value persists until possibly revised at some future milestone.)	F	Real Number
Measure Distribution Type ID [FK]	FK reference to Table Name: Distribution Types	T	Integer [0,13]
Distribution String	The string of arguments, e.g., mean, standard deviation, separated by commas, required by the selected measure distribution function when running any linked model in Monte Carlo mode (Note: This string persists until possibly revised at some future milestone.)	T	Text
Data Source/ Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Needlines

DoDAF Views: AV-2, OV-2

Table Theme: Identifies producer-consumer connectivity between operational nodes in an architecture

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Needline ID [PK]	Unique identifier	F	Integer ≥ 1
Needline Name	Descriptive name for the needline, e.g., Node x to Node y	T	Text
Needline Type ID [FK]	FK reference to Table Name: Needline Types	F	Integer [1,6]
Sink Node [FK]	FK reference to Table Name: Operational Nodes	F	Integer ≥ 0
Source Node [FK]	FK reference to Table Name: Operational Nodes	F	Integer ≥ 0
Needline Description	Descriptive text on the needline beyond the name, as needed for clarity	T	Text

Table Name: Needlines x Resources

DoDAF Views: OV-3

Table Theme: Breaks needlines into constituent resource flows

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Needline ID [PK]	PK reference to Table Name: Needlines	F	Integer ≥ 1
Flow ID [PK]	PK reference to Table Name: System Resource Flows	F	Integer ≥ 1
Include in Ops Resource Flows	Boolean that includes/excludes this flow in this needline from the OV-3 view	T	T/F

Table Name: Flight Types

DoDAF Views: AV-2

Table Theme: Identifies flight types and associated attributes in an architecture

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Flight Type ID [PK]	Unique identifier	F	Integer ≥ 1
Flight Type Name	Descriptive name for the flight type, e.g., log resupply	T	Text
Partner ID [FK]	Indicates primary responsibility for the flight type. FK reference to Table Name: Partners	F	Integer ≥ 0
Departure Node [FK]	FK reference to Table Name: Operational Nodes	F	Integer ≥ 0
Destination Node [FK]	FK reference to Table Name: Operational Nodes	F	Integer ≥ 0
Crew Size	Number of crew associated with the flight type	T	Integer ≥ 0
Data Source/Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Flights

DoDAF Views: PV-2

Table Theme: Identifies a schedule of planned flights

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Flight ID [PK]	Unique identifier	F	Integer ≥ 1
Flight Type ID [FK]	FK reference to Table Name: Flight Types	F	Integer ≥ 1
Nominal Flight Start Date	Anticipated or planned launch date expressed as a date or as a fiscal year in decimal notation, e.g., 2019.75 = July 1, 2019	F	≥ 1900
Nominal Flight Arrival Date	Anticipated arrival date based on the launch date and selected trajectory, expressed as a date or as a fiscal year in decimal notation, e.g., 2019.75 = July 1, 2019	T	≥ 1900
Included in Ops Profile	Boolean that includes/excludes this flight from the PV-2 deployment view. (Note: Useful for running alternative schedules or manifests.)	F	T/F
Data Source/Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: System Resource Flows

DoDAF Views: SV-3, SV-6

Table Theme: Identifies system interfaces, system-to-system resource flows, and associated attributes in an architecture

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Flow ID [PK]	Unique identifier	F	Integer ≥ 1
Flow Name	Descriptive name for the flow, e.g., X to Y	T	Text
Resource ID [FK]	Identifies the unique resource in the flow. FK reference to Table Name: Resources	F	Integer ≥ 0
Sink System [FK]	FK reference to Table Name: Systems	F	Integer ≥ 1
Source System [FK]	FK reference to Table Name: Systems	F	Integer ≥ 1
Flow Periodicity	Identifies the regularity or lack of it in the flow. (Note: The terms 'continuous', 'periodic', 'irregular', and 'one-time' are preferred, but not required.)	T	Text
Flow Means	Identifies how the flow is accomplished, e.g., for power, a power cable	T	Text
Performer Class ID [FK]	Identifies the kind of actor that performs this flow	F	Integer [0,3]
Performer Type ID [FK]	Identifies the flow performer in more detail depending on the selected Flow Performer Class ID. (Note: Valid range is variable as a result.)	T	Integer ≥ 0
Flow Units Type ID [FK]	Identifies the units for this flow. FK reference to Table Name: Unit Types. (Note: It is imperative to distinguish between stock units and flow units. This attribute refers to the latter.)	T	Integer ≥ 1
Flow Rate	The flow rate of the resource from each source system to each sink system	T	≥ 0
Data Source/Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Milestones x Person Types x Gender Types x Measures **DoDAF Views:** -
Table Theme: Identifies measure values and probability distribution parameters across multiple milestones for person types and additionally by gender

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Milestones ID [PK]	PK reference to Table Name: Milestones	F	Integer ≥0
Person Type ID [PK]	PK reference to Table Name: Person Types	F	Integer ≥1
PersonGender Type ID [PK]	PK reference to Table Name: PersonGender Types	F	0, 1
Measure ID [PK]	PK reference to Table Name: Measures	F	Integer ≥0
Measure Value	The value taken on by the system measure at the milestone (Note: This value persists until possibly revised at some future milestone.)	F	Real Number
Measure Distribution Type ID [FK]	FK reference to Table Name: Distribution Types	T	Integer [0,13]
Distribution String	The string of arguments, e.g., mean, standard deviation, separated by commas, required by the selected measure distribution function when running any linked model in Monte Carlo mode (Note: This string persists until possibly revised at some future milestone.)	T	Text
Data Source/ Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Operational Functions

DoDAF Views: OV-5a

Table Theme: Identifies functions/activities in an architecture

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Function ID [PK]	Unique identifier	F	Integer ≥1
Operational Function Name	Descriptive name for the function, e.g., training, mining	T	Text
Operational Function Description	Descriptive text on the function beyond the name, as needed for clarity (Note: May be derived from an operational Work Breakdown Structure (WBS) dictionary.)	T	Text
Functional Area Type ID [FK]	Indicates the broad area under which this function/activity falls. FK reference to Table Name: Functional Area Type	T	Integer [1,12]

Table Name: Flight Types x Systems

DoDAF Views: PV-2

Table Theme: Identifies all the systems participating in a flight type, including the launch vehicle (or propulsive element) and all systems that are considered payloads

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Flight Type ID [PK]	FK reference to Table Name: Flight Types	F	Integer ≥ 1
System ID [PK]	FK reference to Table Name: Systems	F	Integer ≥ 1
System Quantity	Quantity of this system associated with this flight type	T	Integer ≥ 0
Data Source/ Comments	Available for documenting the source of the data in this record or general comments regarding this record	T	Text

Table Name: Standards

DoDAF Views: StdV-1

Table Theme: Defines the technical, operational, and business standards, guidance, and policy applicable to the architecture being described

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Standard ID [PK]	Unique identifier	F	Integer ≥ 1
Standard Name	Descriptive name for the standard, presumably its published title	T	Text
Standard Description	Descriptive text on the standard	T	Text
Standard Class ID [FK]	Identifies the standards organization promulgating the standard and/or the acceptance regime for the standard. FK reference to Table Name: Standard Classes	T	Integer [0,6]
Functional Area Type ID [FK]	Indicates the broad area under which this function/activity falls. FK reference to Table Name: Functional Area Type	T	Integer [1,12]

Note: The following tables are fixed by HSFAM developers. Those with (*) may be amended as needed.

Table Name: Unit Types*

DoDAF Views: AV-2

Table Theme: Identifies types of units used

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Units Type ID [PK]	Unique identifier	F	Integer ≥1
Units Type Name	Units name (use '/' instead of 'per') to appear with each cost driver, e.g., percent/year, \$FY07M, kg, kW	T	Text

Table Name: Partners*

DoDAF Views: AV-2

Table Theme: Identifies specific international partners, and/or responsible governmental organizations or commercial enterprises

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Partner ID [PK]	Unique identifier	F	Integer ≥0
Partner Name	Short name for partner, governmental organization, e.g., NASA, or commercial enterprise	T	Text

Table Name: System Types

DoDAF Views: AV-2

Table Theme: Identifies types of systems based on system function

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
System Type ID [PK]	Unique identifier	F	Integer [1,22]
System Type Name	Descriptive text for the system type, e.g., in-space transportation	T	Text

Table Name: Distribution Types

DoDAF Views: AV-2

Table Theme: Identifies the available probability distribution functions for a measure

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Distribution Type ID [PK]	Unique identifier	F	Integer [0,13]
Distribution Name	Probability distribution function name with arguments	T	Text
Distribution Description	Descriptive text as needed to indicate common usage of this distribution	T	Text

Table Name: Functional Area Types

DoDAF Views: AV-2

Table Theme: Identifies operationally significant groups of functions and/or activities

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Functional Area Type ID [PK]	Unique identifier	F	Integer [1,12]
Functional Area Type Name	Descriptive text for the functional area, e.g., mission operations, ground operations	T	Text

Table Name: Node Placement

DoDAF Views: AV-2

Table Theme: Identifies where node is to be placed

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Node Placement ID [PK]	Unique identifier	F	Integer [1,5]
Node Placement Name	Descriptive text for node placement, e.g., terrestrial, cislunar	T	Text

Table Name: Needline Types

DoDAF Views: AV-2

Table Theme: Identifies the primary connectivity relationship between nodes

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Needline Type ID [PK]	Unique identifier	F	Integer [1,6]
Needline Type Description	Descriptive text for needline type, e.g., logistics, mission data, commands, telemetry. Logistics is used whenever the flow is other than information.	T	Text

Table Name: Performer Classes

DoDAF Views: AV-2

Table Theme: Identifies what kinds of actors perform a flow

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Performer Class ID [PK]	Unique identifier	F	Integer [0,3]
Performer Class Name	Descriptive text for flow performer class, e.g., system, person, organization. Based on this attribute, a performer type can be assigned, e.g., Person uses Person Types table.	T	Text

Table Name: Milestone Types
Table Theme: Identifies maturity of a node

DoDAF Views: AV-2

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Milestone Type ID [PK]	Unique identifier	F	Integer [0,7]
Milestone Description	Descriptive text for milestone maturity, e.g., Initial Operational Capability, Full Operational Capability, End-of-Mission	T	Text
Milestone Short Name	Acronym for milestone maturity, e.g., IOC, FOC, EOM	T	Text

Table Name: Person Types
Table Theme: Identifies types of persons as performers based on standard occupations

DoDAF Views: AV-2

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Person Type ID [PK]	Unique identifier	F	Integer [0,23]
Person Type Standard Occupational Class	U.S. Bureau of Labor Statistics (BLS) 2010 Standard Occupational Class (SOC) Major Groups (Code). Note: use BLS Minor Groups for Person Subtypes, etc.	T	Text
Person Type Description	Descriptive title from the U.S. BLS for the 2010 SOC Major Groups	T	Text

Table Name: Gender Types
Table Theme: Identifies types of genders

DoDAF Views: AV-2

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
PersonGender Type ID [PK]	Unique identifier	F	0, 1
PersonGender Type Name	Descriptive text for the gender type, i.e., male or female	T	Text

Table Name: Standard Classes
Table Theme: Identifies the standards organization promulgating a standard and/or the acceptance regime for a standard

DoDAF Views: AV-2

<i>Attribute Name</i>	<i>Definition [units]</i>	<i>Nullable (T/F)</i>	<i>Valid Range</i>
Standard Class ID [PK]	Unique identifier	F	Integer [0,6]
Standard Class Name	Generally, the name of the promulgating standards organization, e.g., International Standards Organization	T	Text
Class Short Name	Short name for the promulgating standards organization, e.g., ISO	T	Text

Appendix A Acronyms

ANSI	American National Standards Institute
AoA	Analysis of Alternatives
BLS	Bureau of Labor Statistics (U.S. Government)
CoP	Community of Practice
CV	Capabilities Viewpoint
DAV	Descent/Ascent Vehicle
DoDAF	Department of Defense Architecture Framework
DRA	Design Reference Architecture
ECLS	Environmental Control and Life Support
EOC	Enhanced Operational Capability
EOM	End-of-Mission
EOPM	End-of-Prime Mission
E-R	Entity-Relationship (Diagram)
ESA	European Space Agency
EVA	Extra-Vehicular Activity
FK	Foreign Key
FOC	Full Operational Capability
GEO	Geosynchronous Earth Orbit
HEO	High Earth Orbit
HSFAM	Human Spaceflight Architecture Model
ID	Identifier
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IOC	Initial Operational Capability
ISO	International Standards Organization
ISRU	<i>In Situ</i> Resource Utilization
IVA	Intra-Vehicular Activity

JAXA	Japan Aerospace Exploration Agency
L&M	Logistics and Maintenance
LCC	Life-Cycle Cost
LEO	Low Earth Orbit
MoDAF	Ministry of Defence Architecture Framework (U.K.)
OV	Operational Viewpoint (DoDAF)
PK	Primary Key
PV	Project Viewpoint (DoDAF)
SOC	Standard Occupational Classification (BLS)
SV	Systems Viewpoint (DoDAF)
UAF	Unified Architecture Framework (Object Management Group)
UPDM	Unified Profile for DoDAF and MoDAF (currently being reformulated as the UAF)
VBA	Visual Basic for Applications (Microsoft)
WBS	Work Breakdown Structure

Appendix B Basic Types and Classes Tables

Needline Type ID	Needline Type Description
	1 Logistics (LOG)
	2 Mission Data (MSD)
	3 Commands (CMD)
	4 Telemetry (TLM)
	5 Positioning, Navigation, and Timing (PNT)
	6 General Communications (COMM)
Distribution Type ID	Listbox Text
	0 None
	1 BETA(alpha,beta,min,max)
	2 DISCRETE({x1,p1,x2,p2, . . . ,xn,pn})
	3 DUNIFORM({x1,x2, . . . ,xn})
	4 EXPON(lambda)
	5 GAMMA(alpha,beta)
	6 LOGNORMAL(ln-mean,ln-std dev)
	7 LOGNORMAL2(mean,std dev)
	8 NORMAL(mean,std dev)
	9 POISSON(lambda)
	10 TRIANG(min,most likely,max)
	11 TRIGEN(bottom,most likely, top, bottom perc,top perc)
	12 UNIFORM(min,max)
	13 WEIBULL(shape, life)
Functional Area Type ID	Functional Area Description
	1 Management
	2 Systems Engineering and Integration
	3 Mission Ops
	4 Ground Ops
	5 Integrated Logistics Support
	6 Communications and Tracking
	7 Settlement
	8 Rendezvous
	9 ISRU-Type 1 (Volatiles)
	10 ISRU-Type 2 (Non-Volatiles)
	11 Exploration
	12 Other

PersonGender ID	PersonGender Name
	0 Male
	1 Female

System Type ID	System Type Name
	1 Launch Vehicle
	2 In-Space Transportation
	3 International Space Station
	4 Deep Space Communications
	5 Mission Operations
	6 Ground Operations
	7 Lunar Surface Habitation
	8 Lunar Surface Mobility
	9 Lunar Surface ISRU-Type 1
	10 Lunar Surface ISRU-Type 2
	11 Lunar Surface Comm/Nav
	12 Lunar Surface Power
	13 Lunar Surface Logistics
	14 Other Lunar Surface System
	15 Mars Surface Habitation
	16 Mars Surface Mobility
	17 Mars Surface ISRU-Type 1
	18 Mars Surface ISRU-Type 2
	19 Mars Surface Comm/Nav
	20 Mars Surface Power
	21 Mars Surface Logistics
	22 Other Mars Surface System
	23 Cis-Lunar Habitation
	24 Cis-Lunar Comm/Nav
	25 Cis-Lunar Power/Propulsion
	26 Cis-Lunar Logistics
Flow Performer Class ID	Flow Performer Class Name
	0 unknown, unallocated, or not applicable
	1 System
	2 Person
	3 Organization

Units Type ID	Units Type Description
1	integer, dimensionless
2	real, dimensionless
3	\$FY15K
4	\$FY15M
5	string
6	m/sec
7	percent/year
8	kg
9	percent
10	\$FY15K/launch
11	\$FY15K/year
12	per year
13	\$FY16/hour
14	hours/week
15	hours/year
16	per launch
17	kslocs/workyear
18	workhours/year
19	workhours/mission
20	workhours/launch
21	boolean
22	days
23	\$FY15K/kg
24	kslocs
25	\$FY15/minute
26	\$FY15/pass
27	per week
28	hours/pass
29	kg/day
30	cu-m/day
31	watts
32	Gb
33	Gb/sec
34	cu-m
35	per day
36	km
37	hectares
38	kg/hour
39	workhours
40	kb/sec
41	kcal
42	kcal/day
43	kcal/sol
44	cu-m/hour
45	kg/cu-m
46	Mb/pass
47	kPa
48	seconds
49	joules
50	meters
51	Kelvin
52	kN
53	sievert
54	Hz
55	mole
56	ampere
57	m/hour
58	kWh
59	percent/week
60	years
61	\$FY15M/year

PersonType ID	PersonType SOC	PersonType Description
0	unknown	unknown, unallocated, or not applicable
1	11-0000	Management Occupations
2	13-0000	Business and Financial Operations Occupations
3	15-0000	Computer and Mathematical Occupations
4	17-0000	Architecture and Engineering Occupations
5	19-0000	Life, Physical, and Social Science Occupations
12	33-0000	Protective Service Occupations
13	35-0000	Food Preparation and Serving Related Occupations
14	37-0000	Building and Grounds Cleaning and Maintenance Occupations
15	39-0000	Personal Care and Service Occupations
16	41-0000	Sales and Related Occupations
17	43-0000	Office and Administrative Support Occupations
18	45-0000	Farming, Fishing, and Forestry Occupations
19	47-0000	Construction and Extraction Occupations
20	49-0000	Installation, Maintenance, and Repair Occupations
21	51-0000	Production Occupations
22	53-0000	Transportation and Material Moving Occupations
23	55-0000	Military Specific Occupations

Milestone Type ID	Milestone Type Description	MS Short Name
0	Pre-Initial Operational Capability	Pre-IOC
1	Initial Operational Capability	IOC
2	Enhanced Operational Capability	EOC
3	Full Operational Capability	FOC
4	Post-Full Operational Capability	Post-FOC
5	End of Prime Mission	EOPM
6	End of Mission	EOM
7	Other	Other

Partner ID	Partner Name	Icon
0	Joint	GrayBall
1	NASA	 RedBall
2	RSA	BlueBall
3	ESA	 GreenBall
4	JAXA	OrangeBall
5	CSA	 PurpleBall
6	CNSA	TurquoiseBall
7	ISRO	EmeraldBall
8	Commercial	 GoldBall

Standards Class ID	Standards Class Name	Class Short Name
0	unknown, unallocated, or not applicable	N/A
1	International Standards Organization	ISO
2	American National Standards Institute	ANSI
3	Community of Practice Standard	CoP
4	Agency or Government-Unique Standard	Agency
5	Local Standard	Local
6	Other	Other