



Medical Data Architecture Platform And Recommended Requirements For A Medical Data System For Exploration Missions

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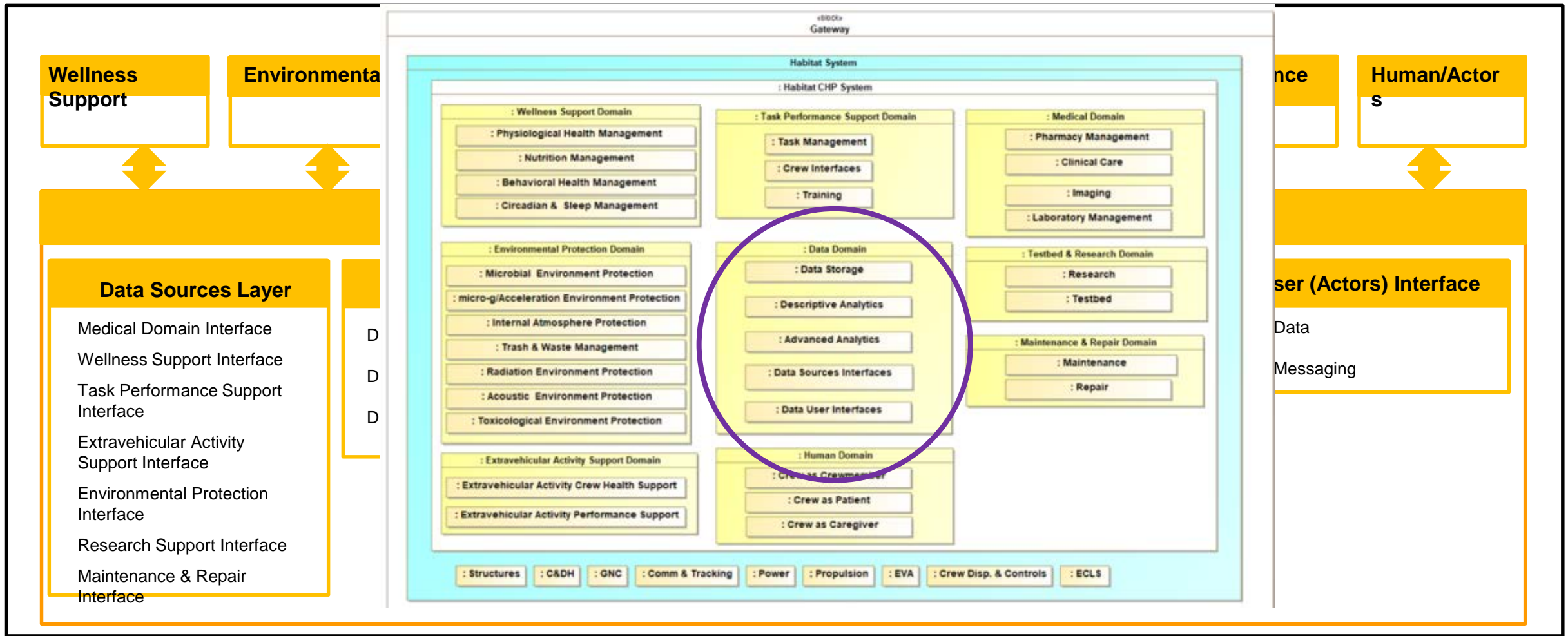
MDA Background



- **ExMC seeks to reduce the risk of adverse health outcomes and decrements in performance due to inflight medical conditions.**
- **The Medical Data Architecture project core focus has been to inform exploration system requirements through prototype platform development that emphasized data collection, management and processing.**
- **Going forward, the MDA project will focus on expanding the MDA platform to enable advanced capabilities for greater understanding of health and performance that enables crew self-reliance.**



Data System – Central to the Crew Health and Performance (CHP) System





MDA Test Bed 3 Objectives



Core focus of the MDA project is to inform ExMC Systems Requirements definition through:

- Systems Engineering
 - Data architecture design
 - SysML model development
 - Functional requirements development
- MDA Implementation
 - Architecture specifications
 - Interface definitions
 - Prototype integrations
 - Inform requirements
- Demonstration
 - **NextSTEP* integrated Gateway Habitat Testing**
 - iPAS Gateway Habitat integrated vehicle demonstration

*NextSTEP – Next Space Technologies for Exploration Partnerships

NextSTEP Habitat Prototypes



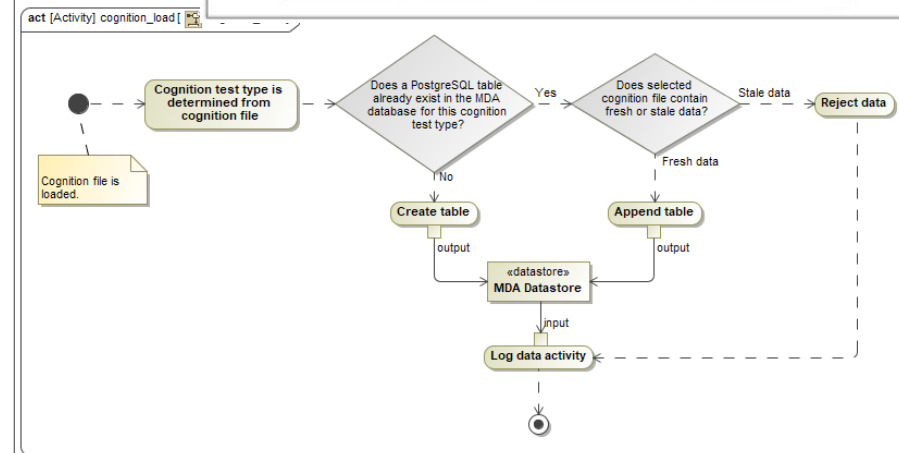
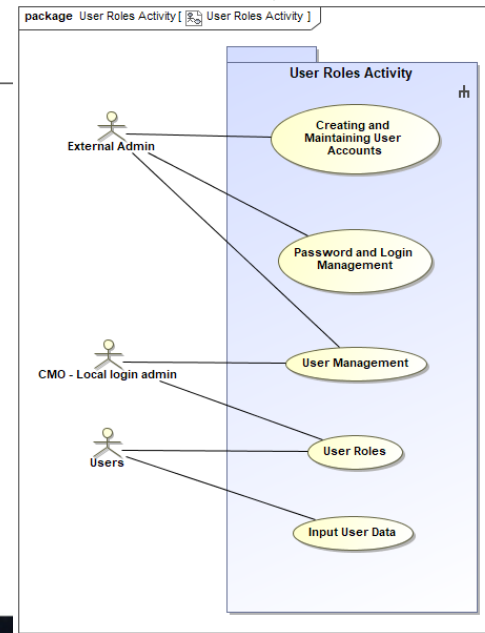
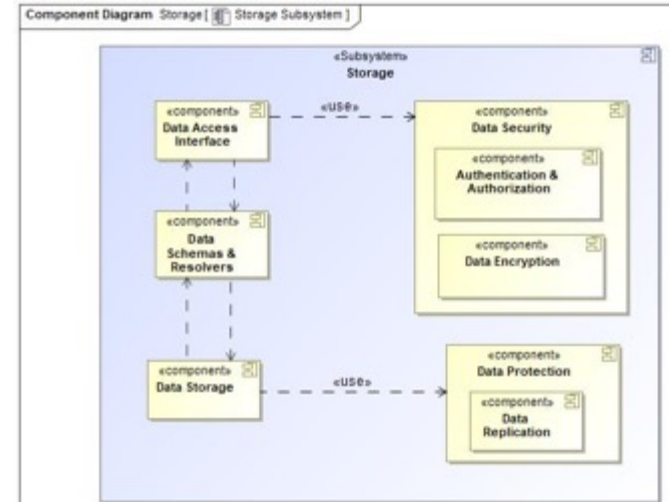
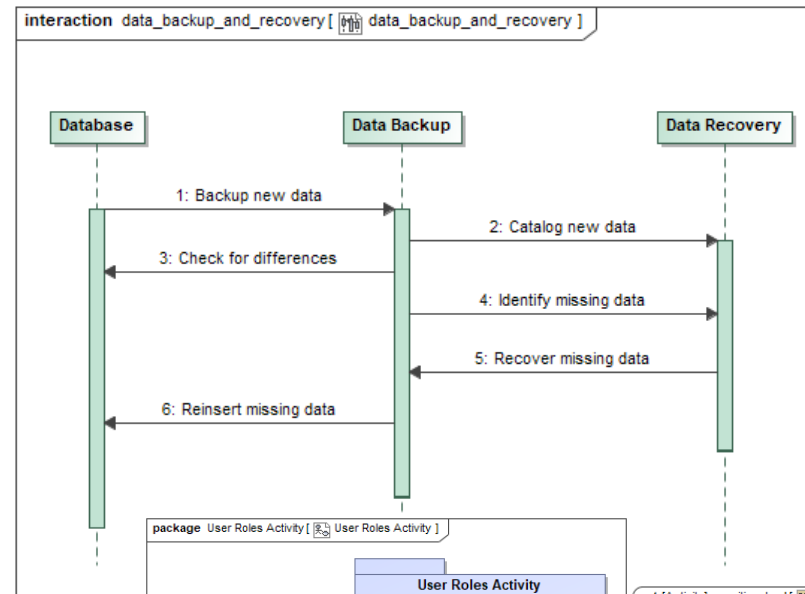


MDA Systems Engineering



Approach

- Develop Use Cases from:
 - Documentation for Medical System and CHP Concept of Operations for Gateway Missions
- Translate Use Cases into a system engineering model via Systems Modeling Language (SysML):
 - Activity, sequence, state machine and block diagrams
- MDA implementation
 - Integrated prototypes



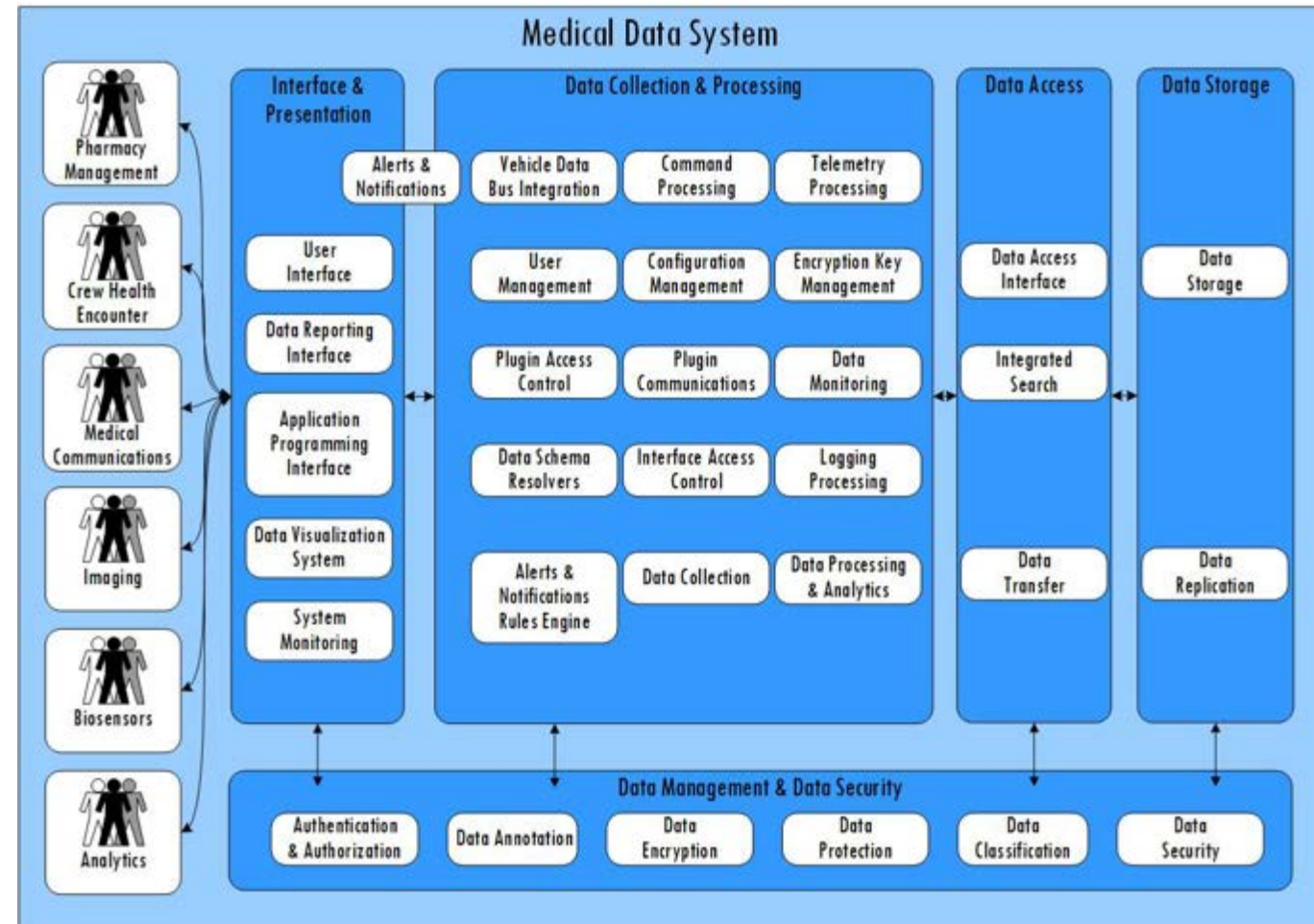


Systems Engineering - MDA Architecture



Architecture Highlights

- Expect future software and hardware technology and standards to be different.
- Modular design provides extensibility
 - Data sources (e.g. medical devices) in future missions will be different from those implemented today
 - Additional data sources/internal components may be added or exchanged without affecting other system components
 - Plugin design accesses the underlying data model and MDA system services through exposed Application Programming Interfaces (APIs)



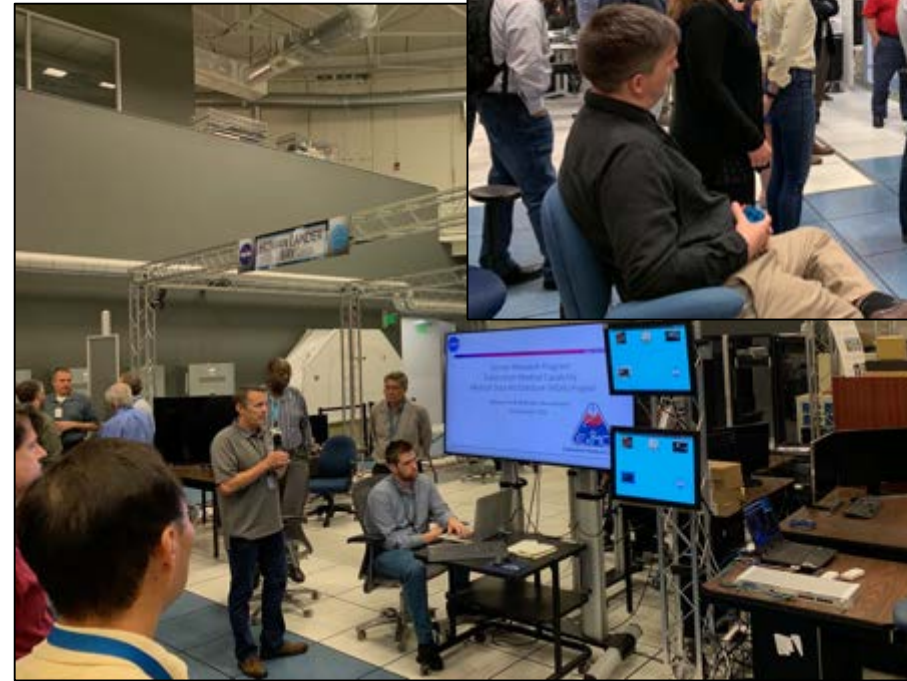


MDA Gateway Habitat Demonstration



Core flight software (cFS) application objectives

- Telemetry MDA Vehicle System status/medical data to Ground System
- Receive and display vehicle sub-system data (e.g. ECLSS simulator data)
- Simulate ground telemetry commands to MDA system
- Stretch Goal: Integrating MDA CFS App on vehicle (Gateway-in-a-box) with MDA Ground through CFS
 - Gateway-in-a-box is a digital simulation of the integrated Gateway vehicle



MDA cFS app demonstration in the Integrated, Power, Avionics and Software test facility at NASA JSC



MDA Gateway Habitat Demo Results



MDA system integrated with analog vehicle core flight software (cFS)

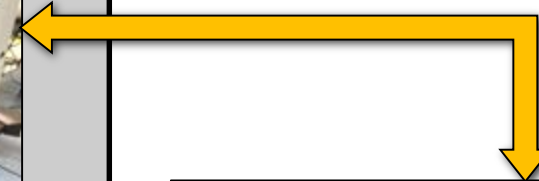
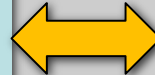
Analog Vehicle System

MDA System

Simulated environmental data



Gateway-in-a-Box
(MDA cFS App inside!)



**Commanding and messaging
MDA Ground Utility**



Summary



MDA Test Bed 3

HRP-48019

- Developed Level 5 Crew Health and Performance Habitat Data System requirements:
 - NASA STD-3001 medical Level of Care IV
 - Prototype integrations built on previous test bed capabilities and included collaborators external to ExMC
 - Systems Engineering products – Use cases, SysML diagrams
- Produced ExMC controlled documents:
 - Recommendation for a Medical Data Architecture for Gateway Missions (Medical Level of Care IV)
 - Recommendation for Draft CHP Habitat Data System Level 5 Functional Requirements for Gateway Missions (Medical Level of Care IV)
- Demonstrated MDA prototype operability in the analog Gateway vehicle environment

Human Research Program
Recommendations for a Medical Data Architecture for
Gateway Missions (Medical Level of Care IV)

Medical Data System Architecture Framework

Verify this is the correct version before use
<https://hrp.sp.jsc.nasa.gov/HRP%20Pages/HRP%20Document%20Management%20System.aspx>

December 2019
Baseline



National Aeronautics and Space Administration
Lyndon B. Johnson Space Center



FY20 MDA Objectives



MDA Test Bed 4 Objectives

- Implement prototype
 - Medical data system platform established
 - FY20 integrations that support a clinical decision support system that provides crew self-reliance
- Develop Level 5 Crew Health and Performance Habitat Data System requirements based on:
 - NASA STD-3001 medical Level of Care V
 - Systems Engineering products
 - Revise architecture framework document

