Information Fusion & Analytics for Human Lunar Exploration

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Technology Taxonomy Area (TX): 11.5 Mission Architecture, Systems Analysis, and Concept Development
11.5.2 Tools and Methodologies for Performing Systems Analysis, 11.5.3 Tools and Methodologies for Vehicle or Concept Definition Activities
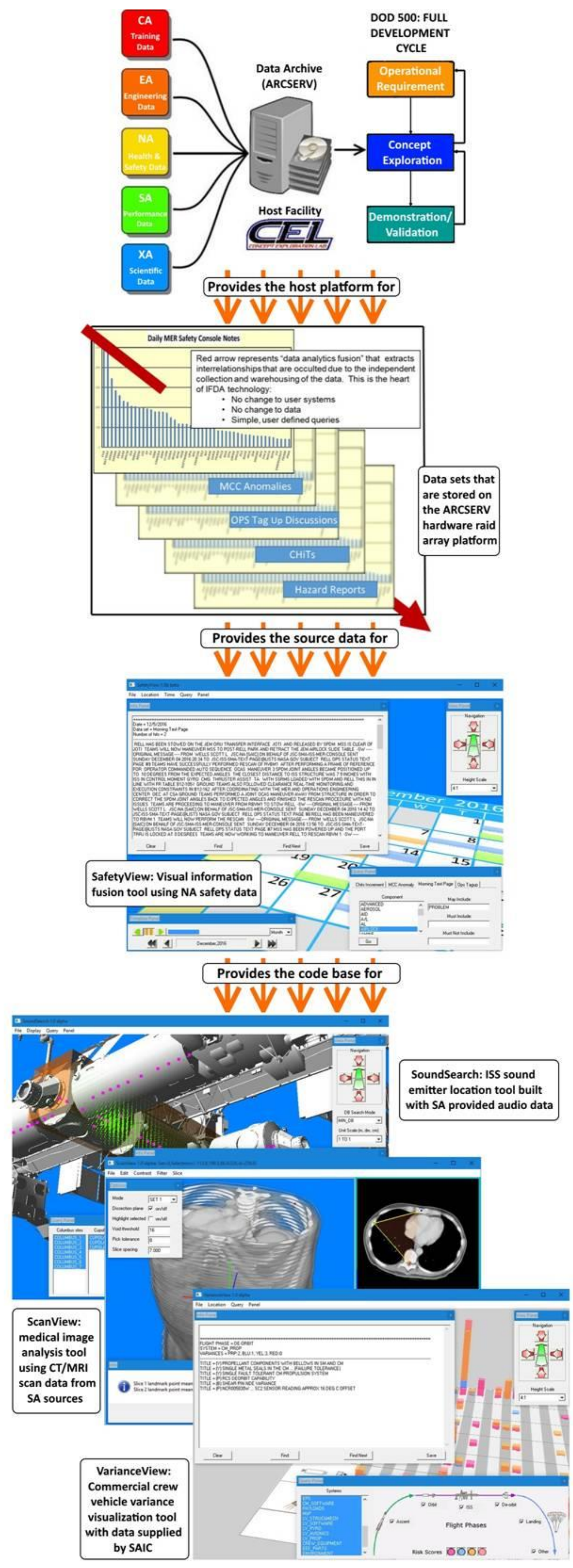
TRL: Start 4 / Current 5

FY21 IRAD PROJECT OVERVIEW

The Information Fusion & Data Analytics (IFDA) project commenced in FY20, continued through FY21, and began its final platform development phase in FY22. The objective remains the fusion and rapid accessibility of large quantities of disparate sourced human spaceflight data. IFDA is a platform tailored for NA (S&MA) to develop highly advanced operational data integration and analysis techniques. IFDA leverages the JSC ER7 modeling, simulation, and data fusion capabilities to collect, warehouse, and augment data human exploration data integration and analysis techniques The IFDA project's integrated data visualizations have been demonstrated in two validation scenarios and provided the architecture and platform basis for a full-scale data analysis suite and storage solution useful to all JSC organizations engaged in real time operations and safety tasks.

INNOVATION

This project addresses the problem of data and information isolation that has been created through the technology and cultural barriers with NASA. Insufficient integrated analytics and forecasting has caused cost overruns, technical missteps, and program terminations. The solution is data fusion and subsequent data analysis. This data integration and utilization will take on more complexity with Gateway as NASA assets are spread over immense areas and with TBD connectivity. This project addresses the gap by demonstrating how to:

A. Import disparate source data sets to include very large (big data genre) sets and multiples into a single interactive and easily accessible visualization environment.
B. Fuse such data without content interpolation or other core modification.
C. Generate visualizations that are data-interactive for test and evaluation.
D. Generate final product data-driven visualizations for program knowledge base, public transport, and knowledge archive.

Provides the host platform for

Provides the source data for

SafetyView: Visual information fusion tool using NA safety data

Provides the code base for

SoundSearch: ISS sound emitter location tool built with SA provided audio data

ScanView: medical image analysis tool using CT/MRI scan data from SA sources

VarianceView: Commercial crew vehicle variance visualization tool with data supplied by SAIC

OUTCOME

- Migrated system to ubuntu Linux for increased security and delivered system to the CEL for training and workshops.
- Collected ISS telemetry, acoustic data, safety notes, anomalies, operations minutes, CHiTS, and hazard reports.
- SafetyView – Shows correlated safety data across time to help spot trends.
- SoundSearch – Calculates the locations of anomalous sounds on ISS down to 1/2m resolution.
- ScanView – CT/MRI analysis tool for pre-flight, flight, post-flight comparisons supporting per slice editing and analysis.
- VarianceView – Visualization of accumulated risk for the commercial crew missions by flight phase. Built in 3 weeks based on FY20/21 IRAD developed tools.

INFUSION SPACE / EARTH

IFDA's tooling and analytics visualization environment allows astronauts, flight controllers, engineers, and managers to observe a detailed and integrated visual composite of relevant data sets *simultaneously,* thereby detecting trends and latent safety risks that might otherwise be overlooked when data sets are individually analyzed using traditional methods and computational environments.

PARTNERSHIPS / COLLABORATIONS

This work continues with support : NE, SA/SK, OZ, OI, EA/ER EC, CK, AD, and XT/XA. These JSC partners are providing data sources and insights. IFDA capitalized upon previous collaboration between the ER Concept Exploration Lab, the Hobby Center for Public Affairs, the University of Houston, and the State of Texas DFPS. The toolkits and libraries of past collaborations were modified to create the IFDA toolset.

FUTURE WORK

Safety workshops are planned with NA in the CEL. These workshops will allow MER Safety console operators to improve their ability to access risk in real-time by using the data fusion capabilities of this project. Real-time calls to communicate risk to the flight team will be more effective through the quick access of data from across all the safety data sources at once.