Evolvable Communications Infrastructure on ISS and Interoperating Flight/Ground Systems

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Outline

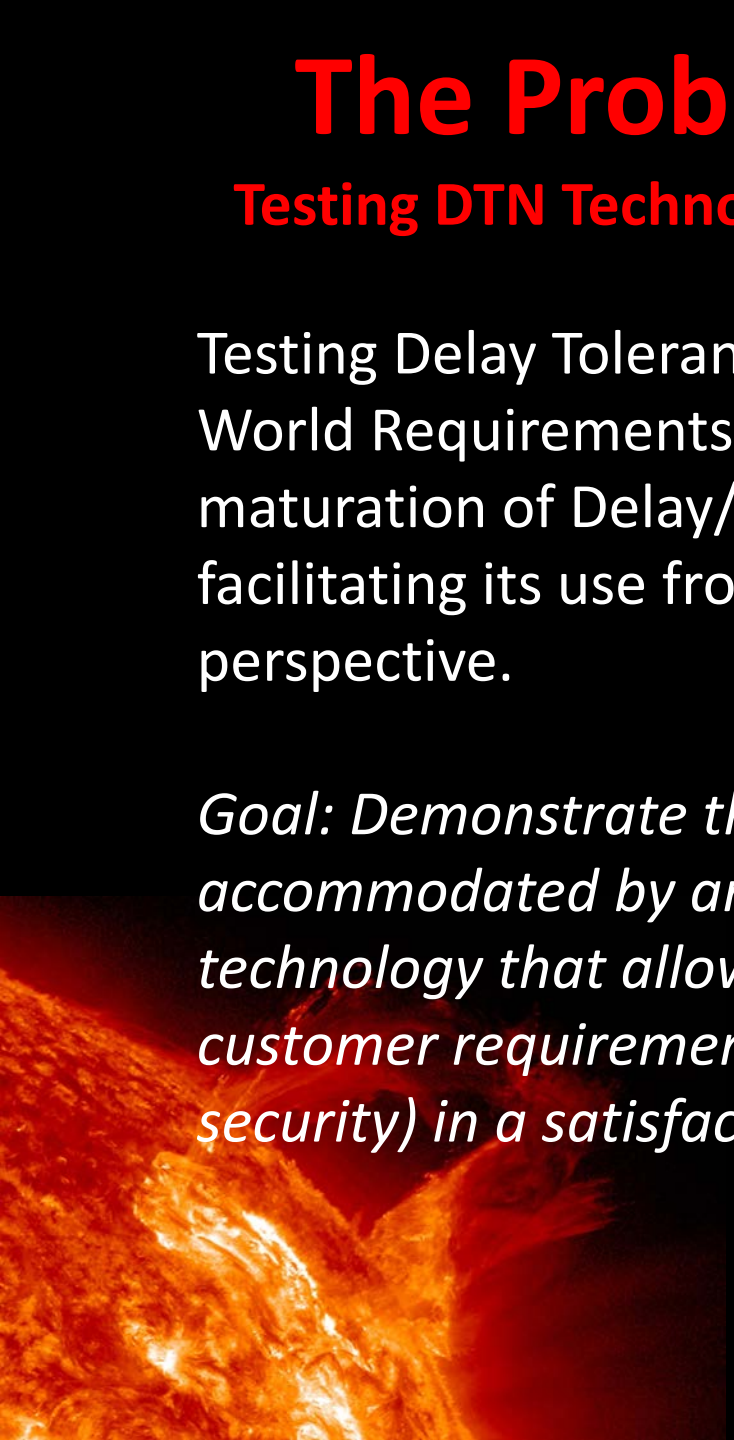
- The Problem Addressed . . .
- The Solution Proposed . . .
- Possible Applications
- Conclusions . . .

The Problem Addressed . . .

Testing DTN Technology with Real World Requirements

Testing Delay Tolerant Networking Technology with Real World Requirements approaches the problem of maturation of Delay/Disturbance (DTN) technology and facilitating its use from an end-user requirements perspective.

Goal: Demonstrate that real world requirements can be accommodated by an operational implementation of DTN technology that allows it to be used as tool that meets customer requirements (performance, availability, and security) in a satisfactory and sufficient manner



The Problem Addressed . . .

Pervasively Networked DTN Gateway

A Pervasively Networked DTN Gateway approaches the problem of maturation of DTN technology and facilitating its use from an infrastructure perspective.

Goal: A pervasively networked point-of-presence gateway supporting quality of service based routing (performance, availability, and security) on all available internal and external networks accessible on the International Space Station for payload use consistent with operational guidelines.

The Problem Addressed . . .

Near-Earth Emergency Preparedness and Response Network

Near-Earth Emergency Preparedness and Response Network Focal Point approaches the problem of maturation of DTN technology and facilitating its use from a cooperating / interoperating network interface perspective with an emphasis on terrestrial applications.

Goal: Support the development and implementation of a Near-Earth Emergency Preparedness and Response Network by prototyping and testing a readily deployable pervasively networked highly mobile point-of-presence system

The Problem Addressed . . .

Cis-Lunar Pervasively Networked Communications

Cis-Lunar Pervasively Networked Communications Technology Development approaches the problem of maturation of DTN technology and facilitating its use from a cooperating/interoperating network interface perspective with an emphasis on Cis-Lunar applications.

Support the development and implementation of a Cis-Lunar Communications Network by prototyping and testing readily integratable interface kits for allowing new - and where possible - existing space systems to be become cooperating / interoperating nodes interacting with pervasively networked point-of-presence systems.

The Solution Proposed - 1

This presentation describes a set of technology development missions proposed for the International Space Station (ISS) which:

1. leverages available resources to serve as a testbed,
2. has an integral evolutionary path from experiment to infrastructure, and
3. helps to mitigate perceived cost, schedule, and technical risk associated with the accommodation and use of new communications technologies.

The work described has been proposed as part of a draft Space Act Umbrella Agreement Annex under negotiation between NASA and XISP-Inc.

The Solution Proposed – 2

INCA Experiment Elements

Function: Internet Banking
Purpose: Source of Real World Performance/Availability/Security Requirements
Value: Testing, which supports the verification, and validation of INCA Architecture with real interoperating network requirements

Function: Pervasively Networked DTN Gateway
Purpose: Enables INCA QoS Based Routing
Value: Testing INCA Architecture for LEO/MEO/GEO Use

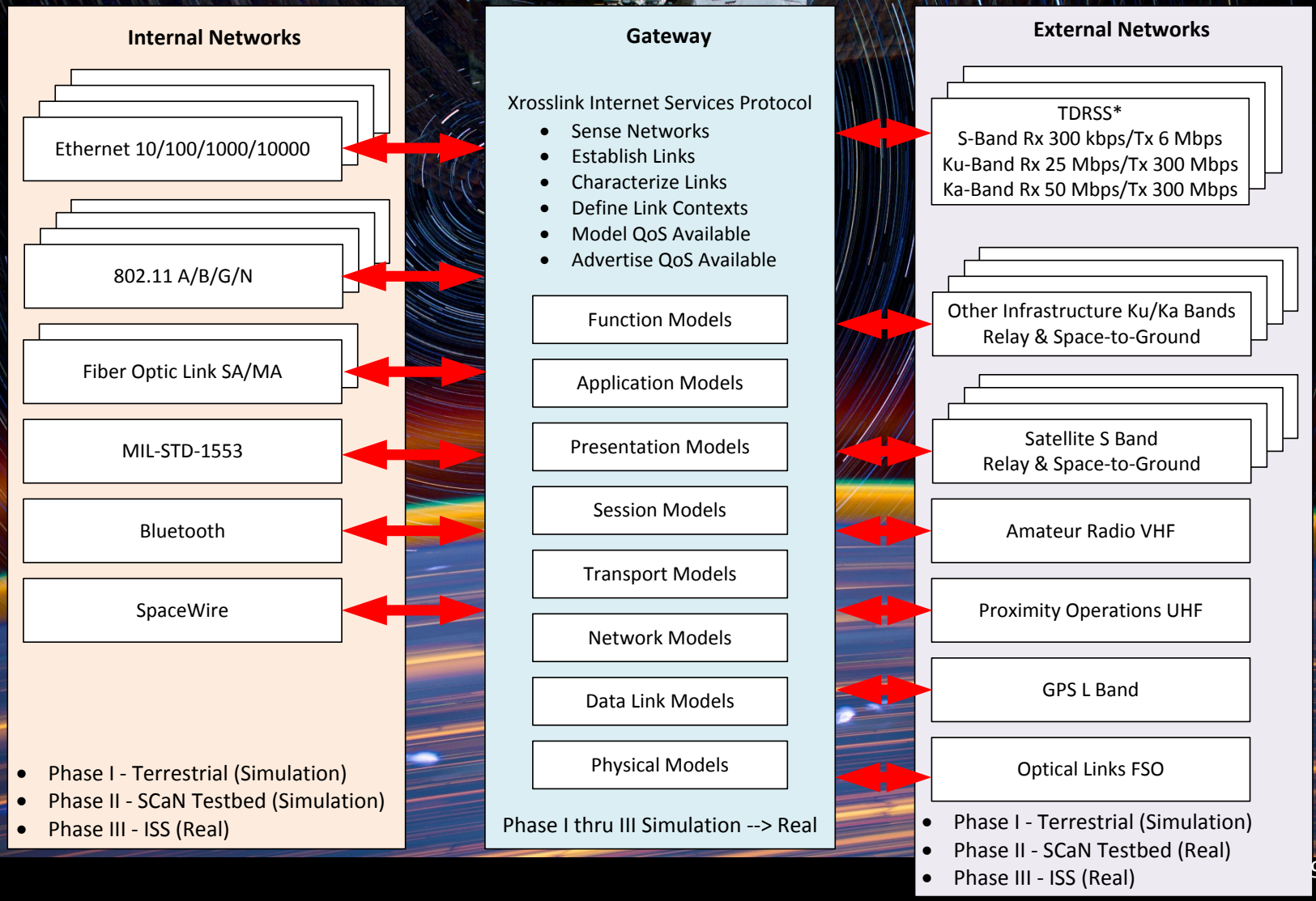
ITERATIVE **&** **RECURSIVE**

Function: Cis-Lunar Pervasively Networked Communications Interface
Purpose: Enables & Demonstrates BEO Application
Value: Testing INCA Architecture for BEO Flight Project Use

Function: Near-Earth Emergency Preparedness and Response Network
Purpose: Enables & Demonstrates Terrestrial Application
Value: Testing INCA Architecture for Terrestrial Use

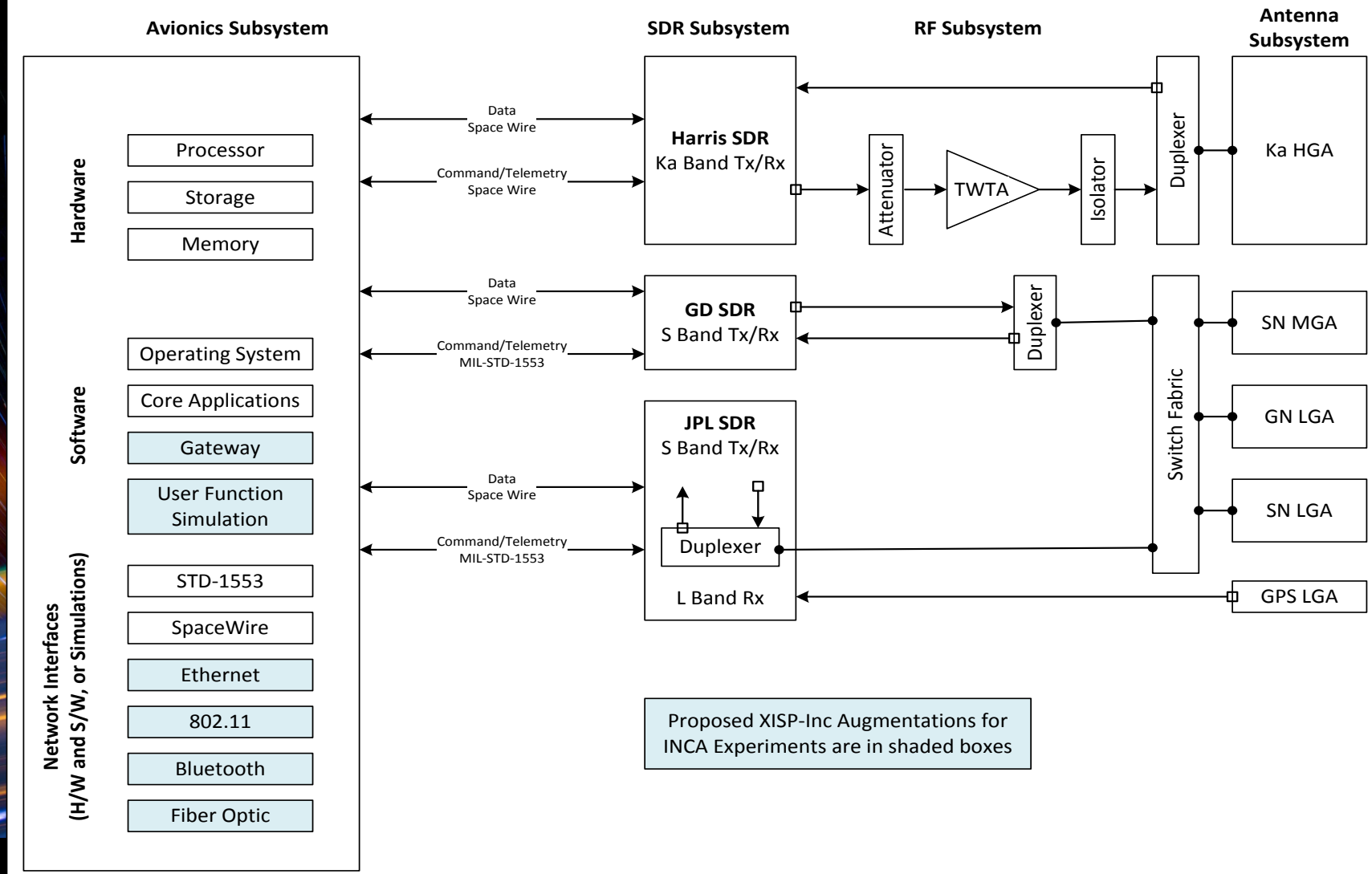
The Solution Proposed – 3

INCA Pervasively Networked Gateway w/Quality of Service (QoS) Based Routing



The Solution Proposed – 4

INCA Augmented SCaN Testbed Functional Block Diagram



The Solution Proposed – 5

INCA Augmented Space Qualified Intel ® Next Unit of Computing (NUC)

Possible Applications– 1

INCA Proposed Function Implementation

MISSION ANNEX 1
Testing DTN with Real World Requirements

Function Model
Website Access w/ defined QoS Requirements
- End User Command Stream
- QoS Requirements Baseline
- QoS Measurement
Performance/Availability/Security
- State Models
- Operational Guidelines
- Processed Data Storage
- Linked Page Implementation

Xrosslink Internet Services Protocol
- Defined Network
- Establish Link
- Characterize Link
- Define Link Context
- Model QoS Available
- Advertise QoS Available

MISSION ANNEX 2
Pervasively Networked Gateway w/QoS Based Routing

Function Model
Pervasively Networked Gateway w/ QoS Based Routing
- End User Command Stream
- QoS Requirements Baseline
- QoS Measurement
Performance/Availability/Security
- State Models
- Operational Guidelines
- Processed Data Storage
- Linked Page Implementation

Xrosslink Internet Services Protocol
- Sense Networks
- Establish Links
- Characterize Links
- Define Link Contexts
- Model QoS Available
- Advertise QoS Available

Possible Applications – 2

INCA Proposed Function Implementation (Continued)

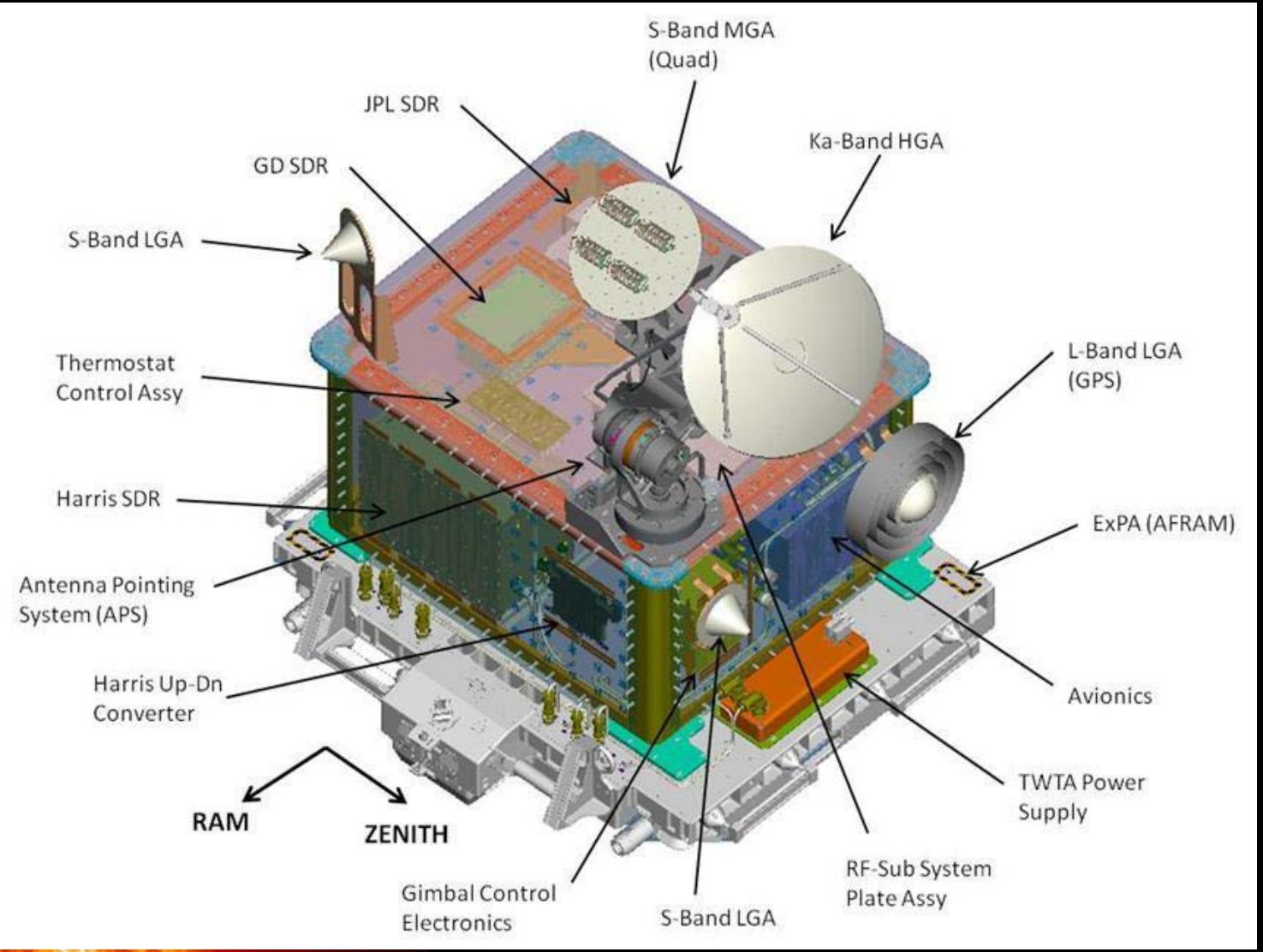
MISSION ANNEX 3
Near Earth Emergency Preparedness and Response Network

Function Model
Interoperating Earth Node Interface Kit
- Hardware Requirements
- Software Requirements
- Specifications
- Operational Guidelines

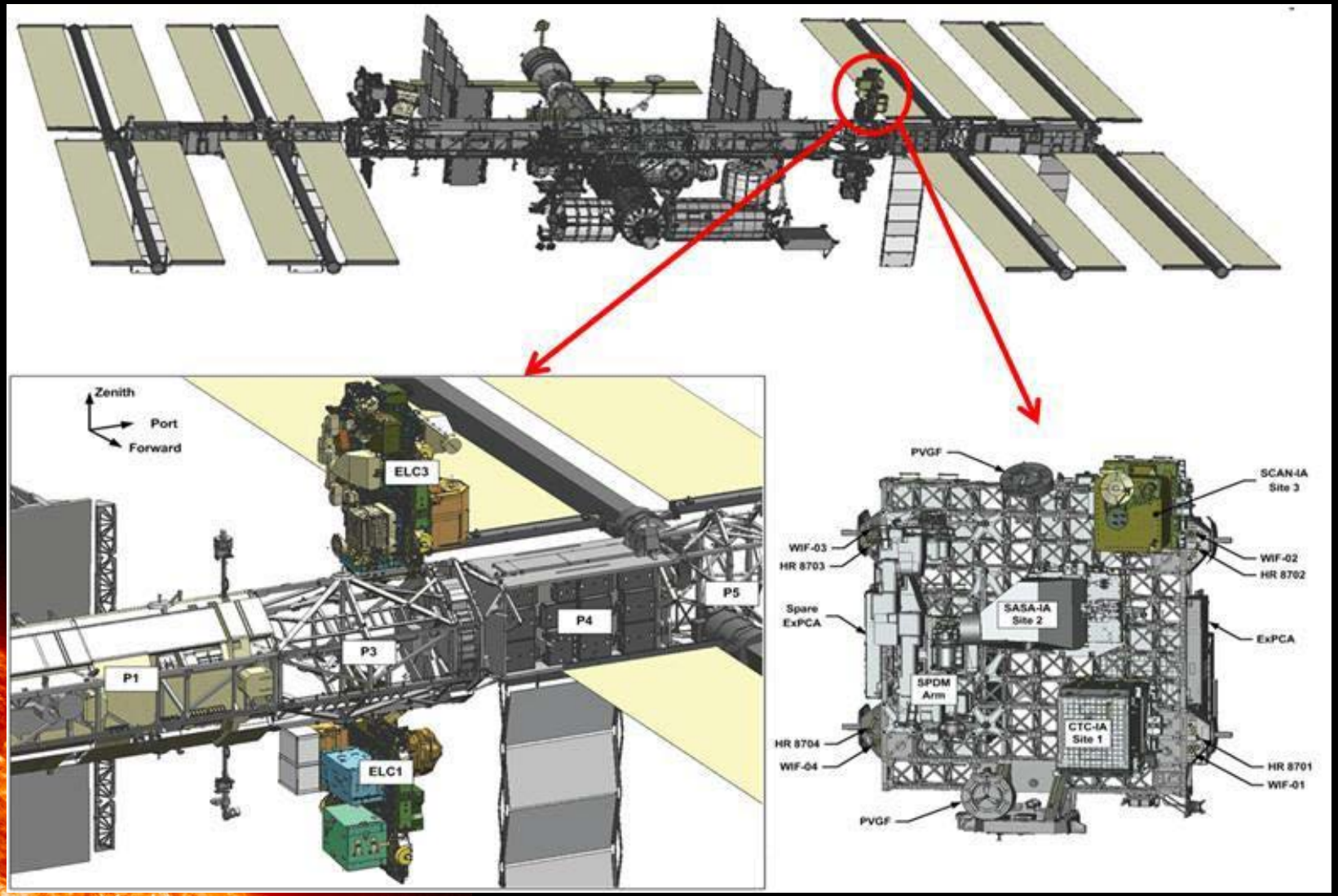
MISSION ANNEX 4
Cis-Lunar Pervasively Networked Communications Technology Development

Function Model
Interoperating Space Node Interface Kit
- Hardware Requirements
- Software Requirements
- Specifications
- Operational Guidelines

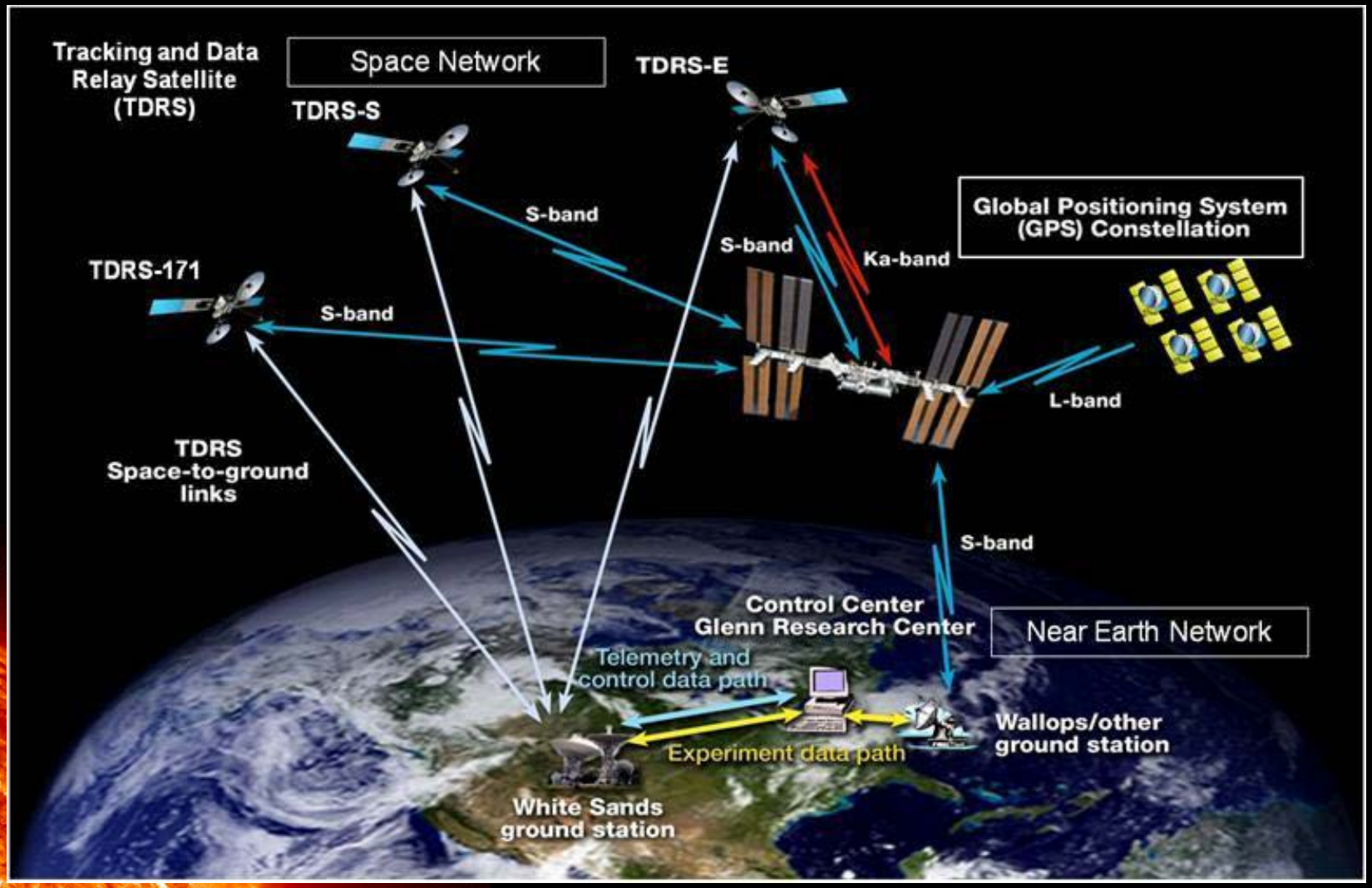
ISS SCaN Testbed Components



ISS SCaN Testbed Location



SCaN Testbed System Overview



Conclusion

The path forward now entails translating the narrative into actually building real systems that provide services of demonstrable value and validating the same through peer review in the communities of interest. It is through this cyclic process that maximum value can be derived from each increment of resources committed to this mission set as well as it's anticipated extensions and follow-ons.

The fact the INCA mission is under formal evaluation as a mission candidate should not be construed as commitment on the part of NASA to go forward with the mission set in whole or in part . As of the time of submittal for this paper the INCA mission set has not yet been approved by NASA.