



Small Satellites & Inter-operating Network Communications Architecture (INCA) Requirements for DHS CBP Opportunity/Strategy Discussion

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Facilitator:

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Introduction – XISP-Inc

- XISP-Inc is a for-profit U.S. based and owned small business focused on definition and execution of Technology Development, Demonstration and Deployment (TD³) missions leveraging space assets.
- The XISP-Inc mission consortiums currently include 22 commercial entities, 25 staff/consultants, 3 government agencies, 4 non-profit organizations, 6 universities, and 4 international space agencies.
- By leveraging the resources of XISP-Inc, NASA, other government agencies, universities, commercial entities, and non-profit organizations XISP-Inc can dramatically accelerate a viable cost effective commercial implementation of space and terrestrial INCA technologies.
- *XISP-Inc is acting with the advice and consent of the NASA Space Communications & Navigation (SCaN) Program Office and the Naval Research Lab consortium participants.*

Company Overview

- Lead Participant: Gary Pearce Barnhard, President & CEO
- Xtraordinary Innovative Space Partnerships, Inc (XISP-Inc)
- 8012 MacArthur Boulevard, Cabin John, MD 20818
- XISP-Inc is a virtual enterprise with over 25 staff/consultants, 22 companies, 6 universities, 4 non-profits, and 3 agencies.
- XISP-Inc is a U.S. for-profit entity focused on the creation of Cislunar TD³ missions and the Public Private Partnerships to execute them.
- XISP-Inc staff have been part of every space station program in this epoch and the rollout of ISDN BRI&PRI/adsl/sdsl/Fios



- Auto telco “central office” for ISS
- XISP-Inc/Barnhard Associates. LLC has built 7 generations of analogous custom IP server/security gateway products
- TRL 3 to 9 (terrestrial), by definition TRL 3 to 5 (space)
- XISP-Inc Xrosslink protocol provides a cognitive framework for implementing near--real-time state models for the characterization and management of all network functions
- Implements QoS-based routing for multiple functions
- Computationally practical interoperable networking
- Implements IPSec, Opportunistic Encryption & WAVESec

Technology Overview

- Commercial Interoperable Network Communication Architecture (INCA) Delay/Disturbance Tolerant Networking (DTN)-enabled gateway realizable in 12 to 24 months
- Implements DTN as a service
- Operates in a pervasively networked environment
- Implements secure bundle protocol as it evolves
- Quality of Service (QoS)-based routing (i.e., performance, availability and security)
- Supports Portable Function/ Application layer links for multiple Earth-facing and/or space-facing applications.

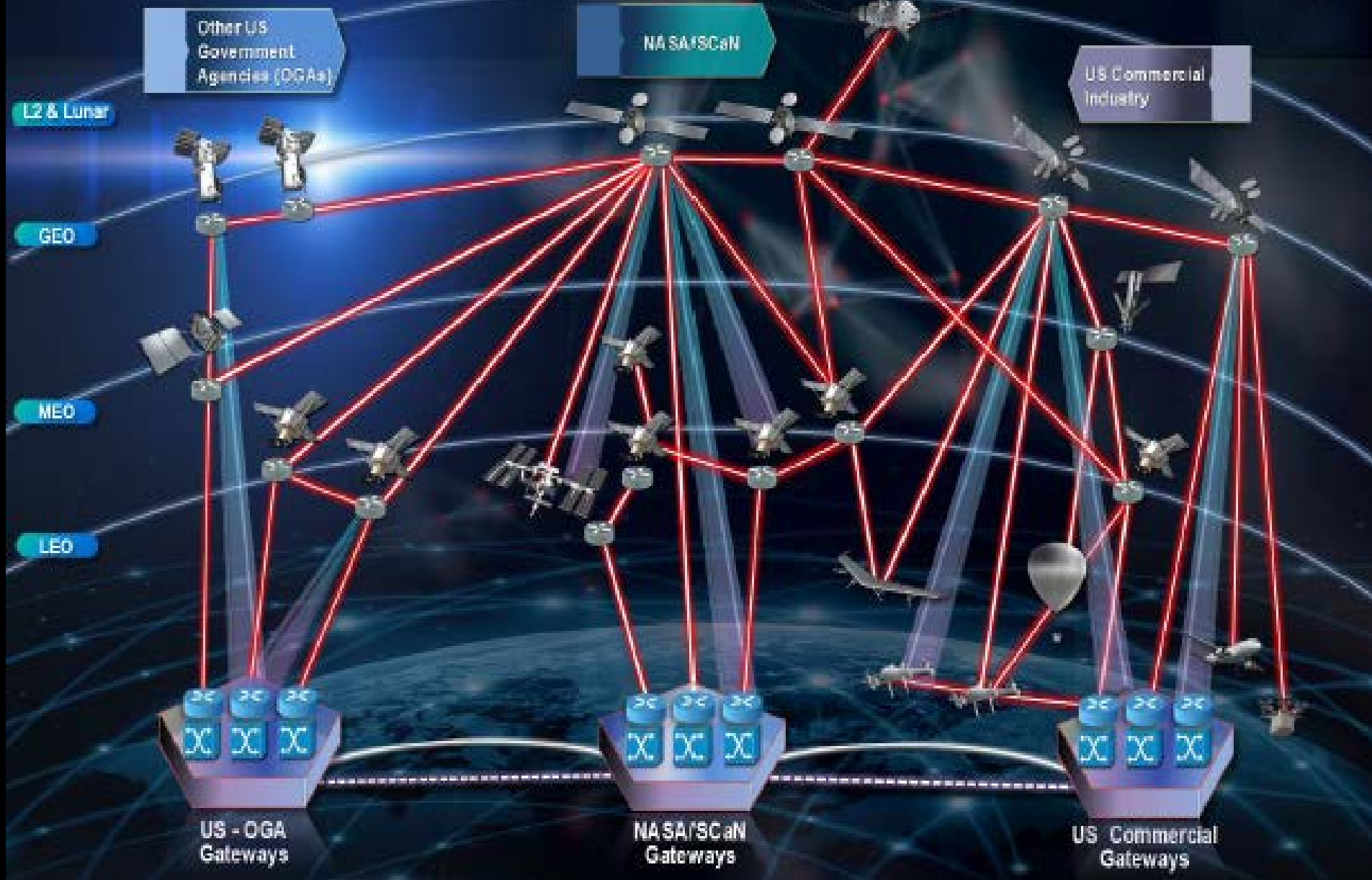
- Market is space & terrestrial QoS requirements driven customers
- Potential market \$100s of millions
- Supports interoperable network communications

- Leverages commercial investment in technology development from terrestrial non-space companies in return for data access/test results (e.g., NASA Federal, Intel, HP)
- Revenue from Earth-facing and Space-facing Functions/Apps
- Revenue from replicable software only and turnkey nodes
- Emergency Preparedness and Response Network Nodes
- Cislunar Ad Hoc Mesh Network Nodes

Commercialization Overview

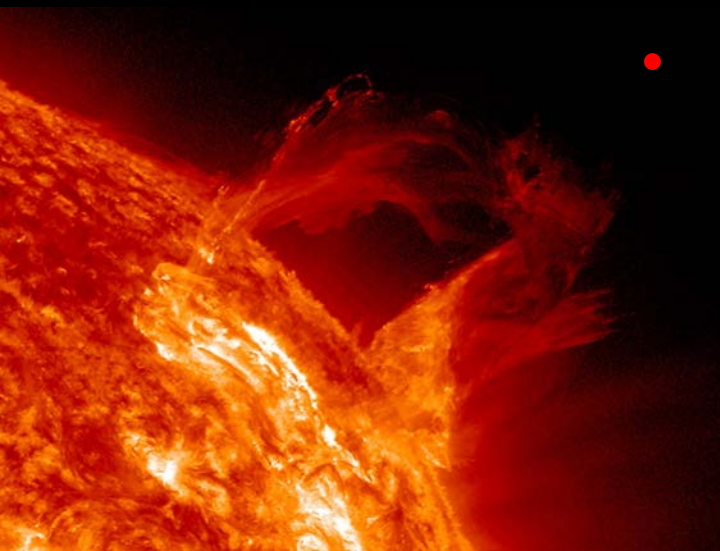
Our Vision Fully Connected Interoperable Space Domains

Router ATM Switch Optical Links



Border Security Challenges

- Border security is critical, expensive, difficult, and inherently collaborative.
- Border security requires a seamless interoperable communications capability which enables situational awareness which does not exist.
- DHS CBP has a demonstrated need to close coverage gaps (Cellular and Land Mobile Radio) along certain locations at the Southern border Between the United States and Mexico.
- These gaps present a serious Office Safety issue when CBP Agents enter one of the areas as they lose ALL contact/communications with our dispatch center and/or other Border Patrol Units in the area.
 - *The Office of Boarder Patrol has identified this as a critical issue. The DHS CBP representatives believe that Micro Satellites might help in providing cost effective coverage in these areas.*



Border Security Challenges

- Situational awareness is required for officers in the field, the command centers, and with all participants in the operational group assembled for each action.
- Systems must interoperate with existing and new equipment.
- Systems must be simple to use, durable, maintainable, and evolvable.
- Systems must allow for the integration of new capabilities on a prioritized basis.
- Systems must have clearly defined interfaces which can be built to on a competitive basis not create additional instances of vendor lock-in.
- ***Conventional procurement processes have not resulted in economically deployable solutions that actually meet DHS CBP mission requirements.***



XISP-Inc Solution

- XISP-Inc is leading a consortium of businesses that are willing and able to work together to execute the TD³ mission to deliver an INCA space segment capability for direct purchase or as a service.
- This work could proceed under Other Transactional Authority such as a NASA Space Act Umbrella Agreement with funding provisions, and/or other existing IDIQ procurement vehicles as a collaborative TD³ mission.
- XISP-Inc is prepared to submit an unsolicited proposal for a Department of Homeland Security (DHS) Customs and Border Protection (CBP) Inter-operable Network Communications Architecture (INCA) system with the support of NASA and NRL.



INCA CONSTELLATION

Xtraordinary Innovative
Space Partnerships, Inc



First Step - Scope of Work

- XISP-Inc, in cooperation/collaboration with multiple industry partners, proposes to conduct a DHS CBP INCA system feasibility study for the Space Segment.
- An initial concept of operations for the proposed INCA system is shown in Figure 1 - Proposed DHS CBP INCA System Preliminary Concept of Operations.
- This study will develop and implement a Work Breakdown Structure in sufficient detail to allow an actionable quotes/offers to be generated and a full report documenting the same in three to five months.

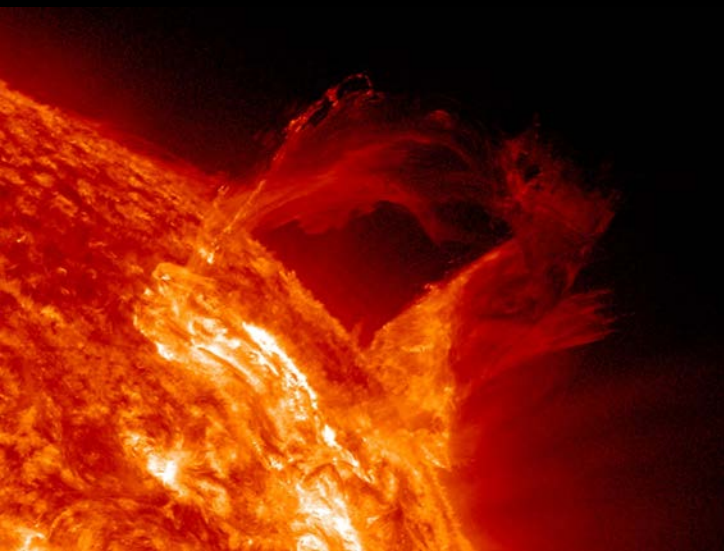
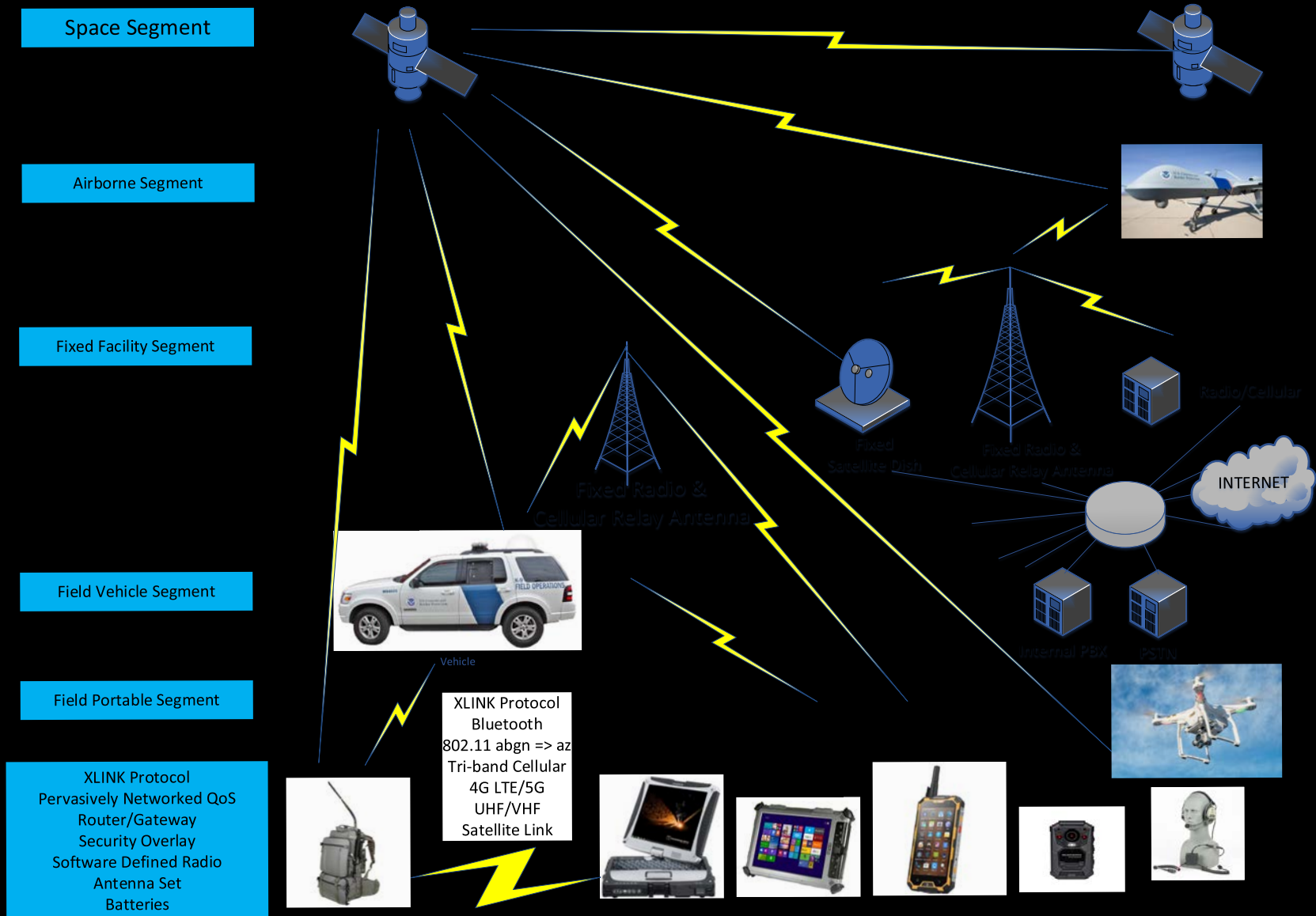


Figure 1 - Proposed CBP INCA System Preliminary Concept of Operations



INCA Interface Matrix

			RECEIVE				
			A	B	C	D	E
TRANSMIT			Space Segment	Airborne Segment	Fixed Facility Segment	Field Vehicle Segment	Field Portable Segment
	A	Space Segment	TxA-RxA	TxA-RxB	TxA-RxC	TxA-RxD	TxA-RxE
	B	Airborne Segment	TxB-RxA	TxB-RxB	TxB-RxC	TxB-RxD	TxB-RxE
	C	Fixed Facility Segment	TXC-RxA	TXC-RxB	TXC-RxC	TXC-RxD	TXC-RxE
	D	Field Vehicle Segment	TXD-RxA	TXD-RxB	TXD-RxC	TXD-RxD	TXD-RxE
	E	Field Portable Segment	TxE-RxA	TxE-RxB	TxE-RxC	TxE-RxD	TxE-RxE

Situational Awareness

What does a field officer need?

- What is my current location?
- How far away is my nearest backup?
- Where is my target of interest?
- How do I reach my target of interest?
- Who and what is near me?
 - Potential breaches and threats
 - Assets
 - Subset of capabilities/functions (if variable)
- What time is it and is the operational group synchronized?
- What other mission related data would be helpful to know?

Priorities – Field Officer Perspective

Priorities	Field Officer Perspective	Directionality - Comments
1st	Voice	Bi-Directional, manual and/or automatic voice operated switching (VOX)
2nd	Geospatial	
	- Location	Incoming - GPS Signals, Local
	- Time	Incoming - UTC & Local
	- Terrain	Incoming - Satellite, Aerial, GIS
3rd	Imagery (Still & Video)	
	- Visible Light	Bi-Directional - Satellite, Aerial, Field Officer
	- Thermal	Bi-Directional - Satellite, Aerial, Field Officer
	- Multi-Spectral False Color	Bi-Directional - Satellite, Aerial, Field Officer
4th	Ancillary Data Display	Incoming - Other Available Images, Reports, Drawings, Notes, etc.
5th	Data Fusion Services	
	- Targeting	Bi-Directional - Command Center, Field Officer
	- Identification Friend or Foe	Bi-Directional - Command Center, Field Officer, other segments?
	- Facial Recognition	Bi-Directional - Command Center, Field Officer

Initial Requirements/Constraints/Considerations?

The following systems level requirements, constraints, and considerations will serve as the starting point for the effort.

- Availability: 95%
- Range: +/- 200 Miles on either side of borders
- Priorities: 1st Southern Border, 2nd Northern Border, 3rd West Coast, 4th East Coast & Caribbean, (5th Gulf of Mexico?)
- Encryption: AES
- Existing Equipment: Last two generations of Motorola Push-To-Talk handsets used by approximately 23,000 Border Patrol Agents, while long term compatibility is not a requirement an orderly if not seamless transition is.

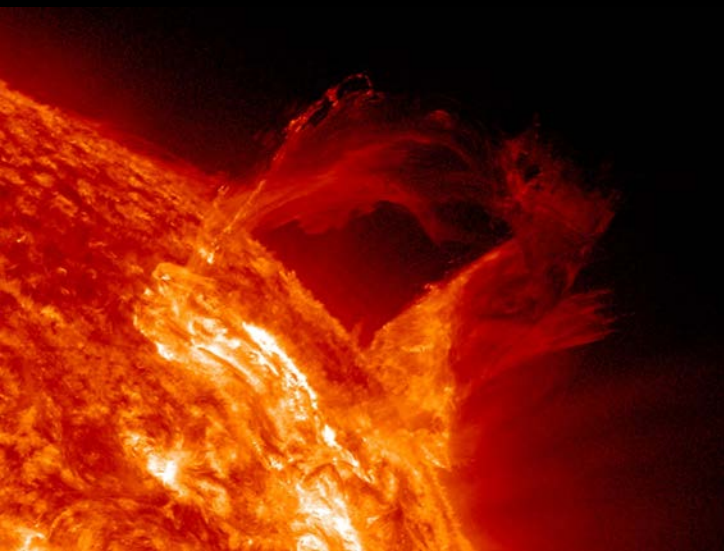
Conclusion

- XISP-Inc is prepared to submit an unsolicited proposal to prepare a mission development report for a Department of Homeland Security (DHS) Customs and Border Protection (CBP) Interoperable Network Communications Architecture (INCA) space segment.
- Included in the proposed report will be:
 - a Firm Fixed Price quote for the space segment,
 - a Cost Plus offer for phased integration, and
 - an alternative Service/Subscription model for the same.



Backup Slides

- Backup Slides
 - Initial Requirements/Considerations/Assumptions
 - Additional Derived Requirements/Considerations
 - DHS CBP INCA System Functions
 - XISP-Inc Proposed Deliverables
 - Space Segment Examples



Initial Requirements/Constraints/Considerations

- Minimum Test Criteria: Must provide sufficient clarity to be able to definitively differentiate between "Shoot" and "Don't Shoot"
- Time Frame: Operational system within two years of authority to proceed.
- Feasibility Study Window: 4 months.
- Primary Function: Two-way communications (Voice)
- Secondary Function: Information transfer (Data) in context, including but not limited to the physical location of each officer and vehicle.
- Tertiary Function: situational awareness (video) including site imaging, information in perspective, data fusion, time to backup, target identification, and other available sensor data in context.

Initial Requirements/Constraints/Considerations

- Study must be complete in time to support a FY2019 procurement action either through Inter-Agency leveraging of NASA Space Act Agreement authority with XISP-Inc, or other available Other Transaction Authority deemed necessary and appropriate.
- It is understood by all participants that the study results may or may not lead to a direct contract award. The study results may or may not be used by the U.S. Government to motivate a more competitive procurement environment including study participants should they choose to participate.
- The DHS CBP may or may not choose to defer/terminate further work after the completion of this study and make no contract award at the sole convenience of the U.S. Government.

Additional Derived Requirements/Considerations/Assumptions

- “on demand” access to all system resources is a derived requirement.
- Quality of Service (QoS) based routing <performance, availability, security> is a derived requirement.
- A pervasively networked environment implementing Ad Hoc mesh networks with QoS based routing is the future that the INCA system will have to co-exist is a derived requirement.
- Design for interoperability is a derived requirement.
- Defining and controlling the bar for what constitutes an interoperable node in networks is a derived requirement.
- Incorporating Delay and Disturbance Networking Technology (DNT) is a derived requirement.

Additional Derived Requirements/Considerations/Assumptions

- Incorporating authorization, authentication, and encryption technologies is a derived requirement.
- Plug-in/Plug-out technology for both hardware and software is a derived requirement.
- Establishing the confluence of interests necessary to yield optimal support of Mission “Functions” is key aspect of this study.
- The transition between the existing systems and the proposed system must be tractable and as seamless as possible.
- The study effort is necessarily both iterative and recursive so full traceability will be captured and provided for all reported findings.

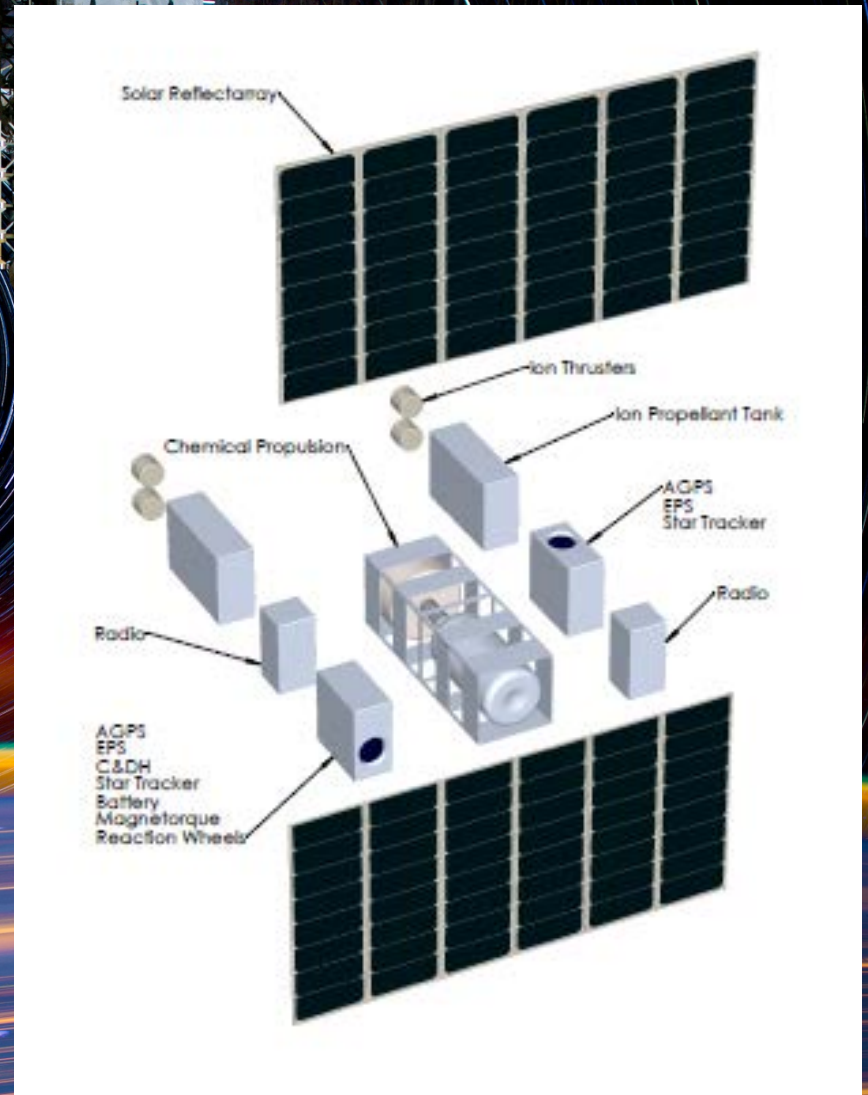
DHS CBP INCA System Functions

- Primary Function: Two-way communications (Voice)
- Secondary Function: Information transfer (Data) in context, including but not limited to the physical location of each officer and vehicle.
- Tertiary Function: situational awareness (video) including site imaging, information in perspective, data fusion, time to backup, target identification, and other available sensor data in context.
- Each “Function” decomposes into a set of:
 - “Features” which yield functional requirements,
 - “Physical Elements” which yield system/subsystem requirements, and
 - “Interfaces” which include hardware, software, specifications/standards, and operational guidelines/rules

XISP-Inc Proposed Deliverables

- Feasibility Study Face-to-Face Kickoff Meeting Participation and Presentation
- Feasibility Study Face-to-Face Midterm Meeting Participation, Presentation, and Interim report
- Feasibility Study Final Report w/Pro Forma actionable quote for the proposed system, starting with the space segment
- Feasibility Study Face-to-Face Final Meeting Participation and Presentation

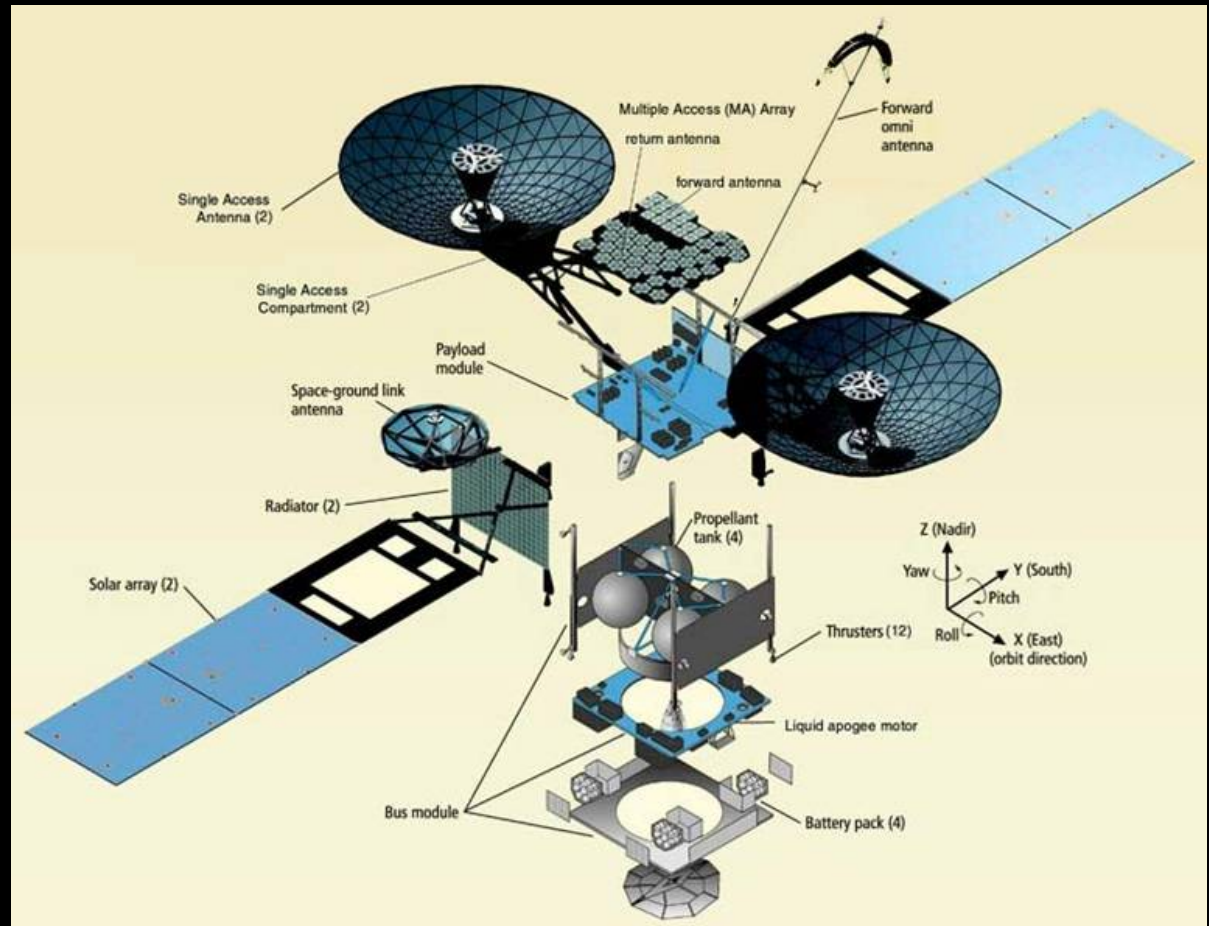
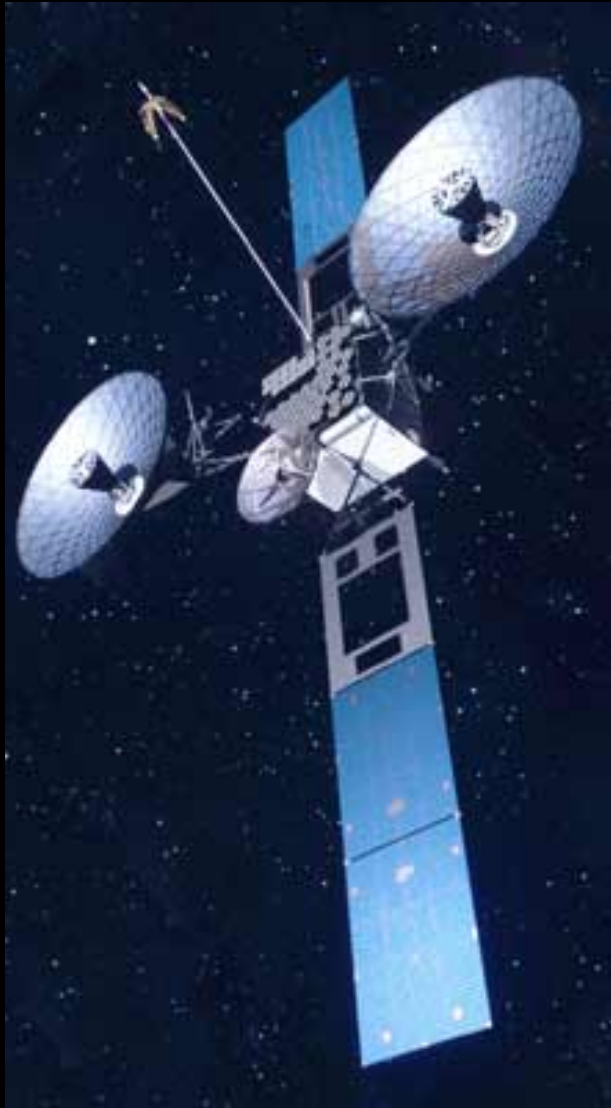
INCA 6U Flight Test Article Example



NASA Ka Band Antenna Flight Test Article Example



NASA TDRSS Example



Space Systems Loral/MDA JCSAT-14 Satellite

