



# CANEUS-Shared Small Satellites

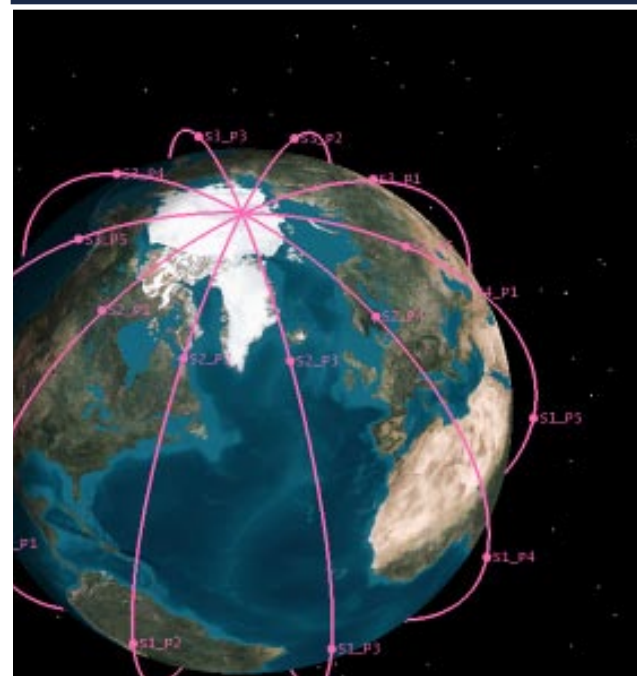
CSSP (Collective Security, Safety, and Prosperity)

International Workshop

October 20-22, 2010

Hosted by NATO Undersea Research Center (NURC)

in Marina di Carrara, Tuscany, ITALY



# To Create a low-cost, internationally shared communications backbone in space with exceptionally low barriers to entry for participating nations.

The CANEUS Shared Small Satellites CSSP (Collective Safety, Security and Prosperity) International Workshop is the forum dedicated to fostering Global collaboration to create a concept for space-based communications infrastructure owned and operated by a multi-national cooperative. The capability envisions data collection from position reporting systems and other distributed sensors to enhance partners' safety and security. The NATO Undersea Research Centre (NURC) will be hosting the event from October 20-22, 2010 in Marina di Carrara (MS) - ITALY.

The concept involves a network of simple ground terminals and nano-satellites to provide communications access to "unwired" places: open oceans, polar regions, jungles, and deserts. Access to the entire communications capacity is available to partner nations that contribute materially to the constellation thus providing a significant return on the individual investment of any participating partner. The multi-national, shared infrastructure promotes cooperation, trust and encourages sharing of data to the mutual benefit of the partners.

Workshop participants will include military, maritime authorities and law enforcement agencies, government-sponsored "watchdogs", non-governmental, private voluntary, and international organizations, and industry.

Ultimately, the workshop aims to identify issues for the potential Concept of Operation and international cooperation framework. It will also explore the particulars of international technology developments and applications that complement and are enabled by such a capability, so that a comprehensive profile of international impact may be quantified. The workshop deliverables will help formalize an implementation and transition plan for the operational phase of this international, cooperative nano-satellite project.



## BACKGROUND

The world's oceans, seas, and waterways are trade routes that are increasingly threatened by non-state actors, perpetrating criminal acts of terrorism, piracy, drug trafficking, over-fishing, pollution, illegal immigration and other abuses to international cooperation and law. For the first time in history, these non-state actors now have the ability for global reach and the potential for disastrous global impact. The emergence of unrestricted, asymmetric threats facilitated by the proliferation of technology and emergence of the global economy underscores the need for increased global situational awareness, and sharing that awareness with legitimate national sovereignties to enhance safety, security and prosperity.

To-date, it has not been technically possible to establish a sufficiently affordable and transparent capability to allow all nations to participate in a cooperative program to collect situational awareness data from every place on earth.

This workshop will review the initiatives underway, worldwide, and explore the proposed concept for creating an international framework, with space, at-sea, and terrestrial segments, to establish global, transparent, cooperative and persistent situational awareness. The concept would provide access to both ships' Automatic Identification System (AIS) position reports and sensor data from thousands of unattended maritime and terrestrial sensors through a constellation of nano-satellites and supporting ground terminals.

The spacecraft, ground terminals and sensors would be managed by an international consortium of participating nations with the cost of the entire system shared through fractional ownership. This concept of fractional ownership lowers the barriers to entry into the space age, and encourages nations with austere finances and minimal technical infrastructure to monitor their terrestrial and maritime territories. This situational awareness is the foundation for better governance, security, and resource management.

## Need for New International Cooperation Framework



Global, persistent access to AIS and reliable and timely access to data from unattended sensors can extend situational awareness across the globe.

Existing and proposed commercial systems lack transparency for all international partners, being driven by profit incentives or hampered by classification and sharing issues inherent with intelligence collection. Instead of facilitating the ubiquitous exchange of information at the lowest possible cost, situational awareness derived from commercial or intelligence sources is enjoyed by the “haves” and but unavailable to the “have-nots.”

Nations without the ability or means to establish, situational awareness in their “unwired” territories have little or no information about the illegal activities occurring there. There may be no perceived address these unseen threats. Resource allocation and force structure decisions that would improve governance are starving for data.

The ability to detect and monitor suspicious activity and to share that information will enable international partners to collaborate and cooperate to enhance their collective security.

## Shared Space Based Communications Infrastructure



At this workshop, we will explore shared communications infrastructure designed to retrieve data from beyond line of sight and in unwired regions for fusion, analysis, and action, with minimum latency. By using a global constellation, participating nations can collect and share data from the “unwired world” that then can be used to enhance the safety, security, economic development and environmental protection of each sovereign state.

## Cooperating to Stay Competitive



Collaborating and sharing information mutually enhances nations’ security and prosperity by expanding their capacity for situational awareness of their territories. The emergence of the global economy and non-state actors now calls for the establishment of a new global framework for the exchange of information, much of which may be based on monitoring activities in under-governed and unwired regions. The Workshop is an opportunity for constructive engagement in space technology with partners that will increase member nations’ capacity to combat terrorism, secure their borders, and protect their economic interests.

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In the collaboration model, multinational participants partner to deploy a constellation of relatively inexpensive nano-satellites and a network of small, moveable ground terminals that together create an efficient, persistent communications infrastructure. Partnership is provided in return for investment in the system. Investment may be monetary or in-kind contributions such as launch services or ground station operation.

Fractional ownership models have been successful in providing previously unaffordable capabilities to partner nations who cooperatively share and manage assets. Two slightly different models have been successful in the establishment of the Strategic Airlift Capability (SAC) by NATO and the Disaster Monitoring Constellation (DMC).

In the first example, the SAC agreement, 10 NATO countries plus two partner countries agreed to acquire and operate three Boeing C-17 transport aircraft. Each nation agreed to support a certain number of flight hours for these aircraft and the corresponding share of maintenance and operations costs. A central coordination activity was established and jointly funded to manage SAC aircraft according to the Memorandum of Understanding between the partner countries.

The second example, the DMC, consists of six countries that agreed to cooperatively manage imaging satellites. A commercial company manages the tasking and operation of the satellites on behalf of the countries for commercial purposes, but when needed, these capabilities are turned to emergency, scientific, and disaster support.

At this workshop, we will analyze several collaboration models that define alternatives for sharing the capacity of the system between the partners and providing services to external subscribers. For example, a Consortium Member country would be entitled to a share of the available bandwidth from the total constellation. The satellites would relay data from that nation's sensors to a ground terminal (which may be in another country), and from there to an enterprise server (in yet another country, perhaps) for distribution to the country owning the data. That country could then choose to share this information to enhance cooperation with the other constellation partners and / or its neighbors who may not be participating.

The vision for this international workshop is in line with national and international Cooperative Security strategies to promote safety, security, protection of the environment, and global economic development. Our national commitment to engagement is manifest in programs and projects across all dimensions of international relations.

The proposed international capability would contribute a data transport "space segment" accessible to all countries through "fractional ownership" in the satellite constellation. While the ability of developing nations to contribute funds may be limited, the concept of fractional ownership would allow each country to participate at a level commensurate with their capabilities, and to use the shared communications backbone in space in some measure commensurate with their contribution to the program.

To the extent that data delivered through such international capability are shared, as AIS data from land-based receivers are now shared, participating nations become part of a new global security network by reducing the ease with which "unwired" areas become "ungoverned." Space, with the "God's Eye" view of the world, unites nations more than any other domain.

Creation of such an international system would make collaboration in space accessible to all nations, and would promote its use to foster governance in the difficult, "unwired" regions of the world.

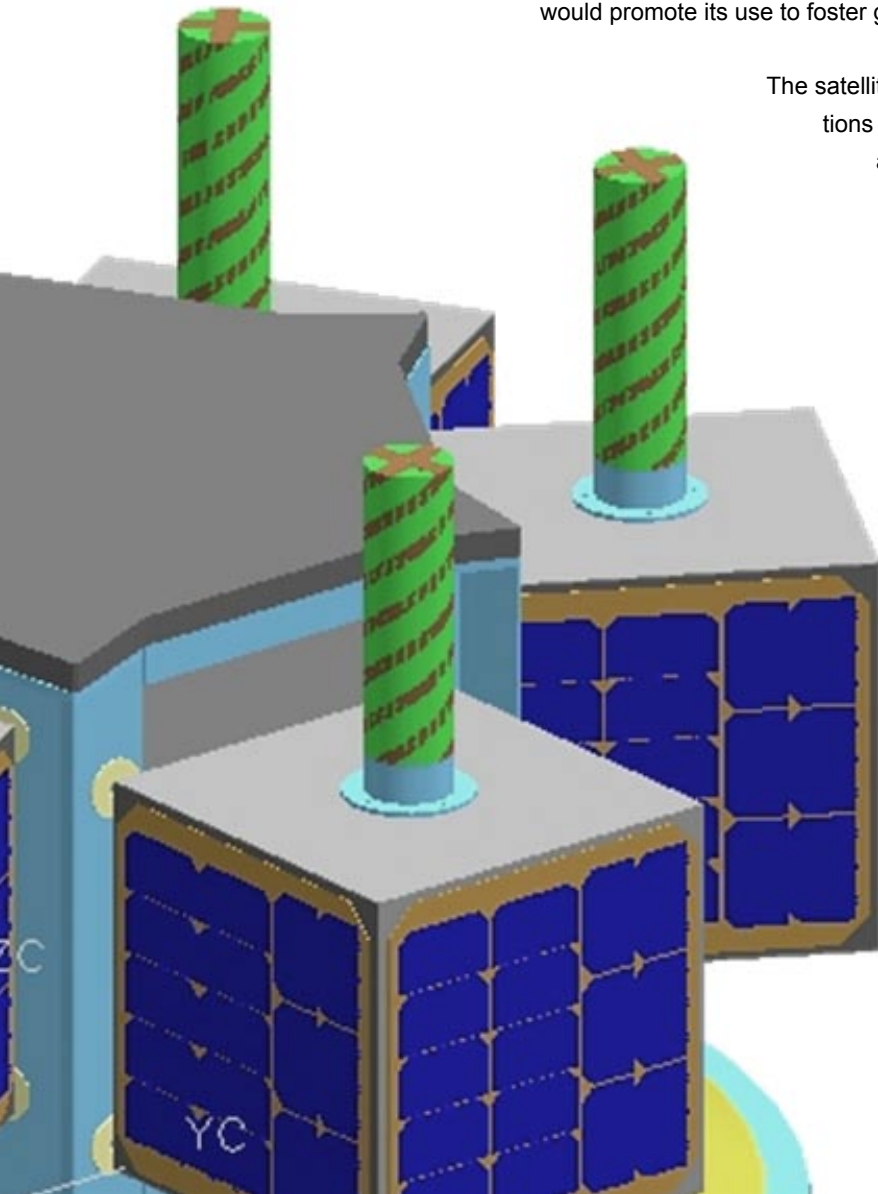
The satellite constellation, when fully populated, would host communications payloads chosen to foster awareness of activity in "unwired" areas of the globe, and to enable better governance based on that awareness.

Examples of the kind of information that might use such capability as a transmission path could include: ships' automatic identification system (AIS) signals from the open ocean, environmental data from sensors in the polar regions and deserts, seismic sensors indicating activity in the rain forests and border regions of the world. The proposed constellation of satellites would provide nearly continuous coverage of the entire globe for low bandwidth data streams, and it would be available to all countries, large and small, which participate as members of the consortium.

## OBJECTIVES

The CANEUS Shared Small Satellites CSSP International Workshop aims to:

- Provide participants and potential stakeholders with an interactive, in-depth assessment of current **end-user requirements** for AIS and data exfiltration to support short term and potential long



term requirements, including potential new applications. This assessment would also help identify and address outstanding issues with current AIS and data exfiltration systems, such as, safety, security, privacy, infrastructure care and feeding cost, policies on data sharing, vulnerabilities to interference, reliability, and authentication.

- Present **program factors** with the active participation and contributions of attendees to articulate data gathering, data handling, and data distribution concepts; Small Sat Constellation Systems and Technologies; AIS and data exfiltration Applications.
- Facilitate **international partnership** by addressing challenges to **collaborative framework models**. Issues to be discussed include: proposed data formats, assigned frequencies and bandwidth; legal policies and considerations; regulatory considerations; and proposed Consortium scope, structure, roadmap and ROM funding.

The CANEUS Shared Small Satellites CSSP International Workshop has a unique flow-down format which emphasizes, as its primary deliverable, an international framework proposed for joining this undertaking as a stakeholder; the issues, costs and benefits involved; what prospective stakeholders can expect to gain by participation, as well as the potential business model.

## DESIRED OUTCOMES

As an essential step in realizing the vision of international cooperation, the Workshop will build on and fuse the complementary core expertise of key scientists, engineers, program managers, investors, and policy-makers from across world.

Participants will represent both the international space-based system development community, including space infrastructure, ground support, and service providers, as well end users of data originating in “unwired” regions .

In particular, the Workshop will take a practical approach to efficiently overcoming the challenges associated with the program factors, including: data gathering, data handling, and data distribution concepts, small sat constellation systems and technologies, AIS and data exfiltration applications, proposed data formats, assigned frequencies and bandwidth, legal policies and regulatory considerations, collaborative framework models.

Ultimately, participants will collectively define a potential implementation plan and action items, and identify potential funding sources, within the international cooperation framework.

# PARTICIPANTS

CANEUS expects to receive 350 international experts and participants, representing stakeholders from all segments of the international space community, including technology providers, end-users, and policy-makers.

In addition to the notable lead speakers that would be addressing the event, the list of speakers and participants is expected to include representatives from several high-profile organizations. Previous CANEUS workshops have drawn representatives from the Americas, Europe and Asia Pacific regions.

# THEMES

The Workshop is dedicated to the overarching theme of international collaboration in the development of an accessible data transport small satellite constellation. The workshops will also draft an implementation and transition plan for an enduring operational capability. To this end, sub-themes include:

1. **Needs assessment:** The State-of-the-Art in AIS and data exfiltration capabilities as a baseline, followed by end-user requirements for short term and long term data transport, and a glimpse into future capabilities:
  - Current capabilities
  - End-user Needs
  - Outstanding Issues with Current AIS and data exfiltration Systems
  - Lessons Learned
  - Technology Providers' Updates,
  - Exhibits
2. **Collaborative innovation**
  - Short Courses
  - Plenary sessions
  - Split sessions
3. **Policy and regulation**
4. **Concept Implementation Plan** and Action Items
  - Formation of Working Groups
  - Awards
  - Poster Sessions

# Pre-Workshop Short Courses and Review of the State of the Art in International Space Systems

The objective is to bring the attendees up to date on key issues associated with the international space system, as well as case studies from such authorities, and regulatory issues. The short courses will include topical issues that will support the workshop sessions. It is hoped that knowledge acquired from these activities will allow participants to engage in informed discussions and decision-making during program definition and implementation planning.

Four topical Short Courses will be taught by world-class experts on the day prior to the opening of the event to allow participants to increase their awareness and understanding of key areas of the industry such as:

- **Short Course 1 –Unattended sensors and signals, including AIS**
- **Short Course 2 –Small satellite design tradeoffs**
- **Short Course 3 –Policy and regulatory environment**
- **Short Course 4 –Sharing satellite capacity and controlling data dissemination**

## Exhibits

International technology providers and end-users specializing in areas closely related to the small satellite constellation and data extraction will participate in the exhibits. A broad range of exhibits covering the latest developments in several international space systems representing end-user applications, technology products, and business development organizations will be held concurrently with the Workshop sessions.

25 exhibit spaces are allocated for “Country Pavilions” for those countries expressing interest in such a collaborative concept.

## Poster Sessions

Poster presentations will cover:

- Exciting early results from international space systems authorities for their AIS and data exfiltration needs for short term and potential long term requirements – include new applications not currently touch on.
- International Space Systems, e.g. GEOS, GMES (Kopernikus), DMS, IGMAS, MSSIS, ESCAP, UN-Spider, Other UN sponsored project managers, NATO, Theater Commanders, Commercial Services, Other AIS and data exfiltration related program authorities.
- Perspectives of end-users and stake-holders, including “lessons learned” from the implementation of space systems in AIS and data exfiltration applications. These include: government agencies; affected non-government agencies; satellite providers; satellite sub-system suppliers; launch services; ground support services/facilities; data aggregators /distributors; sensor suppliers/services; communication Infrastructure Suppliers.
- Outstanding Issues with current AIS and data exfiltration systems, e.g. safety, security, privacy, infrastructure care and feeding cost, policies on data sharing, radiometry vulnerabilities, reliability, authentication
- Small Sat Constellation Systems and Technologies; AIS and data exfiltration Applications; proposed data formats, assigned frequencies and bandwidth
- Data management- Case Studies; sharing global AIS information on an open network environment; Concept of Open Global Maritime Data Sharing; Utilization of existing and future maritime information sharing systems.
- International collaborative Framework Models: Examples of international, cross-border collaborations leading to joint developments in Civil, Commercial, and Military Sectors, with legal policies and regulatory considerations
- US Caribbean AIS/MSSIS Initiative; other similar programs; e.g. International Association of Maritime Aids to Navigation and Lighthouse Authorities (IALA)
- Investment perspectives, both private and government

	<i>Day 1: Needs Assessment – End User Requirements</i>
<b>AM</b>	<b>PLENARY 1:</b> Workshop Overview and Collaborative Process for the 3 days
	<b>KEYNOTE 1:</b> Summary of international Space Systems authorities for their AIS and x-data needs for short term and potential long term requirements – include new applications not currently touch on. International Space System Authorities would include for example: GEOS, GMES (Kopernikus), DMS, IALA, MSSIS, ESCAP, UN-Spider, Other UN sponsored project managers, NATO, Theater Commanders, Commercial Services, Other AIS and x-data related program authorities
	<b>KEYNOTE 2</b>
<b>PM</b>	<b>FOUR BREAK OUT SESSIONS:</b> Outstanding Issues with Current AIS systems (Safety, security, privacy, infrastructure care and feeding cost; Policies on data sharing; Radiometry vulnerabilities; Reliability; Authentication <ol style="list-style-type: none"> <li>1. End Users</li> <li>2. Space Infrastructure</li> <li>3. Ground Support</li> <li>4. Services</li> </ol>
	<b>Coffee Break</b>
	<b>FOUR BREAK OUT SESSIONS:</b> Outstanding Issues with x-data systems (Safety, security, privacy, infrastructure care and feeding cost; policies on data sharing; data fusion; radiometry vulnerabilities; authentication <ol style="list-style-type: none"> <li>1. End Users</li> <li>2. Space Infrastructure</li> <li>3. Ground Support</li> <li>4. Services</li> </ol>
	<b>PLENARY 2:</b> Breakout Debriefing/Common Themes
	<b>Evening Reception</b>

**End-user Needs, Outstanding Issues’ Updates, and Lessons Learned**

The Workshops will include thematic sessions covering each of the following issues:

- Users & Uses of data exfiltration and AIS
- Safety, security, privacy, infrastructure maintenance cost
- Policies on data sharing
- Vulnerabilities to interference
- Reliability
- Authentication

Given the focused objectives and unique structure of the Workshops, each of the contributing and invited speakers is a world-class authority in his or her respective field

<i>Day 2: Program Factors</i>	<i>Day 3: Program Definition and Implementation</i>
<b>PLENARY 3:</b> Program Overview (include data gathering, data handling, and data distribution concepts)	<b>PLENARY 4:</b> Overview from previous day's input from the breakouts
<b>SESSIONS:</b>  1. Small Sat Constellation Systems and Technologies 2. AIS and x-data Applications 3. Proposed data formats, assigned frequencies and bandwidth	<b>KEYNOTE 5</b>  <b>BREAK OUT SESSIONS:</b>  1. Validate/Embellish AIS and x-data services assumptions 2. Validate/Embellish data gathering, data handling, data distribution assumptions 3. Validate/Embellish Structure/Framework and Business Case for the Consortium
<b>KEYNOTE 4</b>	<b>KEYNOTE 6</b>
<b>SESSIONS:</b>  4. Legal Policies and Considerations 5. Regulatory Considerations 6. Civil, Commercial, and Military Sectors 7. Collaborative Framework Models	<b>SESSIONS:</b>  • Debriefing of Breakouts and Consolidated Consortium Program Profile • Validate Support from International Space Systems Authorities • Program Funding Sources
<b>Coffee Break</b>	<b>Coffee Break</b>
<b>FOUR BREAK OUT SESSIONS:</b> Consortium Proposed Scope, Structure, Roadmap and ROM Funding:  • End Users • Space Infrastructure • Ground Support • Services	<b>PLENARY 5:</b> Summary and Define Program Implementation Plan and Action Items

**Program Overview: including data gathering, data handling, and data distribution concepts**

These sessions will cover developments in small sat constellation systems and technologies, AIS and data exfiltration applications, proposed data formats, assigned frequencies and bandwidth, legal policies and considerations, regulatory considerations, and collaborative framework models.

**Consortium Profile, Funding Sources, Implementation Plan, Action Items**

These sessions will first summarize developments from Track 2 and then the breakout groups will discuss following issues to validate / embellish the potential program implementation plan. Topics for the breakout sessions covered include:

1. AIS and data exfiltration services assumptions
2. Data gathering, data handling, data distribution assumptions
3. Structure/Framework and Business Case for the international system

Panelists from these sessions will summarize approaches taken by various organizations to address issues related to consolidated system program profile validation. The follow-up sessions will also review approaches taken by various international space systems organizations to address issues related to the implementation process, followed by implementation plan and action items.

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