

International Cooperation for Small Satellites Development

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ABSTRACT

Participants at the CANEUS 2006 Conference in Toulouse, France agreed that in order to open up the market for small satellites and facilitate dialogue between the many stakeholders in the industry, it was necessary to create an international consortium for the coordination and standardization of the small satellite industry. The CANEUS Small Satellite Sector Consortium aims to take an approach similar to that designed for the semiconductor industry, namely the SEMATECH industry group. The Small Sat Sector Consortium focuses on providing opportunities for industry representatives to participate in cutting-edge technical discussions while establishing the future direction of the small satellite industry. It oversees five projects and initiatives dedicated to (a) developing standards so as to ensure international interoperability, (b) identifying launch opportunities and services, (c) providing stakeholder liaison and strategic development, (d) addressing Intellectual Property and ITAR issues in accordance with CANEUS International's broader mission, and (e) organizing launch certification services. This presentation describes Small Satellite developments within the international cooperation framework of the CANEUS network.

INTRODUCTION

The current state of the international small satellite industry is very fragmented. Numerous governments and private agencies run sub-critical small satellite programs with very little communication between these groups. Furthermore, many component and sub-system developers are not familiar with small

satellite end-user needs and customer requirements. There is also concern that there exists a lack of transparency between developers and end-users. Participants at the CANEUS 2006 Conference in Toulouse, France agreed that in order to open up the market for small satellites and facilitate dialogue between the many stakeholders in the industry, it was

necessary to create an international consortium for the coordination and standardization of the small satellite industry.

The CANEUS Small Sat Sector Consortium aims to take an approach similar to that designed for the semiconductor industry, namely the SEMATECH industry group. The CANEUS Small Sat Sector Consortium focuses on providing opportunities for industry representatives to participate in cutting-edge technical discussions while establishing the future direction of the small satellite industry. By actively participating in establishing standards, stakeholders can influence important industry trends. Companies engaged in current industry dialogue can decrease manufacturing costs, increase reliability and productivity, and enjoy increased access to customers, end-users, and the global market. The CANEUS Small Sat Sector Consortium will emphasize the identification of end-users of small satellite missions and their specific needs. We will then collaborate to establish how the small satellite industry can respond to these mission or product requirements. This will have the effect of opening up the small satellite market and providing business and investment opportunities by facilitating dialogue and the establishment of cooperative relationships.

Agency and industry representatives from Canada, Europe, USA, Brazil, Japan and other parts of the world have come together in this enterprise. This presentation describes Small Satellite developments within the international cooperation framework of the CANEUS network.

THE SMALL SATELLITE SECTOR CONSORTIUM

Background

CANEUS International is a non-profit organization catering primarily to the needs of the aerospace sector by fostering the coordinated international development of Micro-Nano Technologies (MNT) for aerospace and defense applications. CANEUS focuses on the practical aspects of transitioning MNT rapidly and efficiently from the concept to the system level, that is, in a seamless manner through Technology Readiness Levels (TRL) 1 to 9. Particular attention is paid to transiting TRL levels 4 to 7, commonly known as the 'Valley of Death' for technology development. It does this by bringing together developers, aerospace end-users, governmental agencies and investors from, initially, Canada, Europe and the U.S (hence the acronym CANEUS). Organizations from other countries, namely Japan and Brazil, have now joined in

CANEUS activities. The motivation is collectively to mitigate the risks and costs for stakeholders to deploy next-generation Small Satellites.

To achieve its objectives, CANEUS has formed several sector consortia, one of which is the CANEUS Small Satellite Sector Consortium.

History

In light of the first collaborative step taken at Toulouse, industry stakeholders, end-users, and system developers convened in Montreal, Quebec on October 24-25, 2006 to establish the structure, mandate, objective, and action items for the Sector Consortium. A further meeting took place in the spring of 2007 in Littleton, Colorado, during which the diverse needs of Sector Consortium members were identified and formalized. During its most recent workshop held in El Segundo, California in early 2008, the need for common standards between the US, Europe, and other countries worldwide was addressed.

Mission

The mission of the CANEUS Small Sat Sector Consortium has three elements:

- To provide advocacy for its members and foster the advancement and increased use of MEMS and Nano Technology toward the expansion of the small satellite market;
- To be the world's catalyst for the small (Micro/Nano/Pico) satellite industry to bring breakthrough ("disruptive") technologies to the space sector by ensuring space qualification, reliability, lower cost and added-value, and
- By setting a global direction, to create opportunities for the flexible collaboration and conduct of strategic research and development (R&D) so as to yield a significant return on investment (ROI) to the Small Satellite industry partners.

Objectives

The core objectives of the CANEUS Small Sat Sector Consortium include:

- Advancing the maturity of emerging MNT concepts via the development of end-to-end system development strategies;
- Encouraging an attractive investment environment focused on the rapid, cost-effective development of MNT and related technologies

that will lead to an expansion of the Small Satellite market;

- Fostering increased access to space by enabling the periodic and routine availability of primary and secondary space lift opportunities for Small Satellites;
- Leading in the development of functional and performance standards for Small, Micro and Nano-Satellites;
- Working with members to be a rapid and cost-effective mechanism that drives the pervasive use of next-generation Micro/Nano/Pico space satellite systems;
- Addressing critical challenges in advanced Micro/Nano/Pico satellite technologies, and finding ways to speed development, reduce costs, share risks, and increase utilization;
- Mitigating risks and costs collectively for the Small Satellite stakeholders by:
 - Providing space flight arrangements to validate MNT and related technologies;
 - Arranging NPS satellite constellations, and
 - Expediting launch on demand.

IMPLEMENTATION PLAN

The arrangements for implementing the activities of the CANEUS Small Satellite Sector Consortium envisages, within the spirit of international cooperation, the sharing of tasks and funding among members in, initially, Canada, Europe and the U.S.A.

PROJECTS/INITIATIVES

The five projects/initiatives currently operating within the Small Sat Sector Consortium are dedicated to: (a) developing standards so as to ensure international interoperability, (b) identifying launch opportunities and services, (c) providing stakeholder liaison and strategic development, (d) addressing Intellectual Property and ITAR issues in accordance with CANEUS International's broader mission, and (e) organizing launch certification services.

The objectives for the first three projects or initiatives have been established at this time.

Standards Development

This initiative aims to define form factors for nano and micro platforms, develop a collection of existing and emerging standards relevant to the sector, establish onboard data interface requirements, and

ensure interoperability for international operations. Tactical goals include identifying task-groups around technology/platform areas, such as electrical interfaces, physical form factors, plug-and-play formats, data formats, and systems engineering; defining technical requirements for each technology/platform area; surveying the existing standards landscape within other subgroups, and performing gap analysis.

Launch Services

The Launch Services initiative hopes to advocate to the primary launchers (PP) to fly secondary payloads (SP) by appealing to the funding sources of those primary launchers and acquiring agency-level mandates (directives) to fly secondary payloads. This initiative aims to assist SPs in getting rides on primary missions. To this end, it must establish an executive committee to rank and recommend SPs for rides, acting as a broker between the PP and SP communities to manage the SP roster; certify an evaluation agency to score SPs for competencies; help fund SP standards for development and verification; acquire funds to assist in the integration costs for SPs, and fund CANEUS-sponsored SP missions in the future.

Stakeholder Liaison and Strategic Development

Objectives of this initiative include bringing together all the stakeholders, individuals, and organizations that could benefit from a sustainable Small Satellite industry sector; identifying and prioritizing the key technology elements required for the Small Satellite sector, and developing and maintaining the supply chain infrastructure.

The goals are oriented to benefiting governmental laboratories and university research groups. This initiative shall ensure greater mission assurance through improved reliability; provide an alternate means to rapidly qualify new technologies; lower the cost of demonstrating new technologies in space; expand launch opportunities; support plug-and-play developmental efforts; advance concepts in modular design methods; accelerate technology maturity up the TRL curve; enable university TRL 3 projects to get flight experience and facilitate moving to TRL 6 and beyond; help with efforts to shorten the acquisition timelines; improve the alignment with the emerging technology development cycle; enhance the space industrial base, and support educational outreach and human capital for future jobs in the space industry.

PROJECTS IN THE WORKS

Two new projects/initiatives are being formed. The framework of the total of five initiatives will provide a comprehensive support infrastructure from satellite developer through launch certification.

Intellectual Property and Export Control

The objective of this initiative is to leverage the consortia community and develop a streamlined support mechanism for addressing the intellectual property issues. One focus will be related to patent related technology development, while the other effort will address the formal process on handling International Traffic in Arms Regulations (ITAR) and Export Administration Regulations.

Launch Certification

This initiative aims at addressing launch certification services. Many launch organizations and government

customers will require a certification sign off process and this initiative will compile a list of certification organizations and help facilitate the introduction and interactions.

COLLABORATIVE SECTOR CONSORTIA

The broader mission of CANEUS International allows for collaboration not only among interested players within the Small Satellite industry, but also between actors involved in various sectors of the wider aerospace industry. The organizational structure provided below demonstrates how members of the Technology, Stakeholder, and Applications Boards of CANEUS International (consisting of system developers, end-users, governmental and academic organizations, and investors) may initiate sector consortia and subsequently proceed to develop individual projects that respond to their needs.

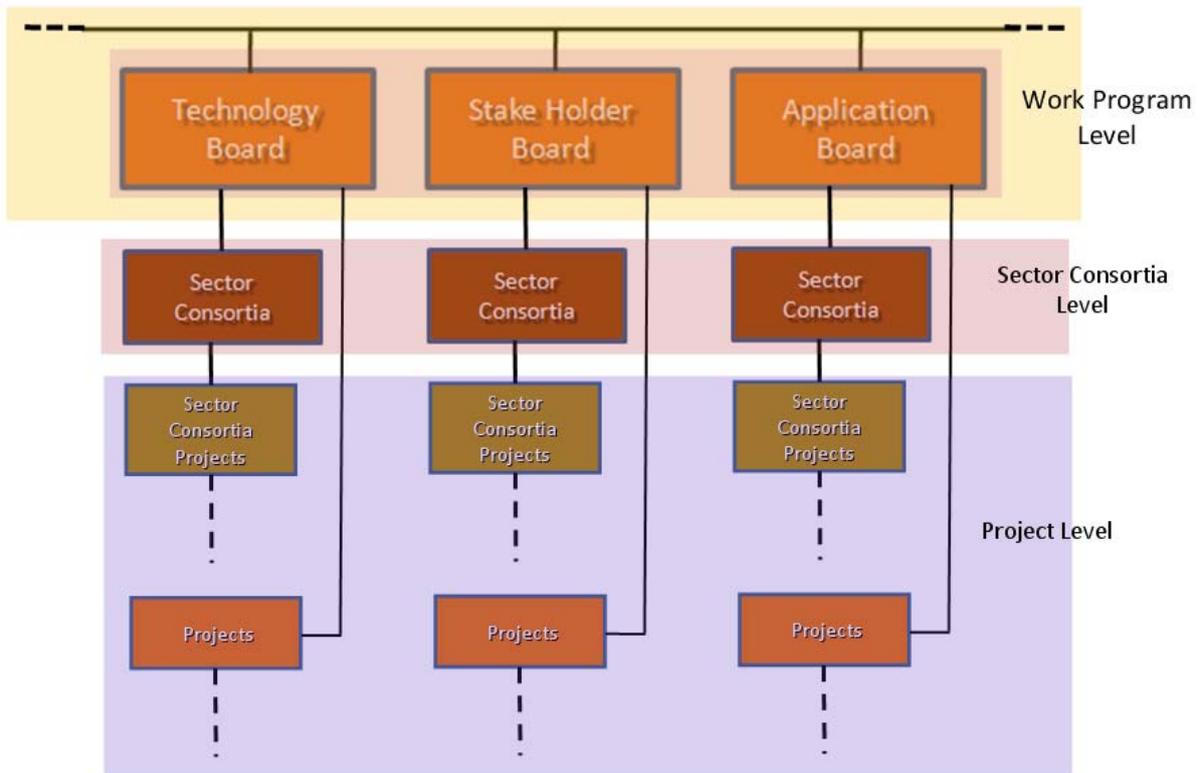


Figure 1: CANEUS Sector Consortia and Project Working Levels

CANEUS’ sector consortia are spawned by project concepts so far-reaching that they require a broad program of initiatives, developments, and industry coordination. Each sector consortium establishes a Sector Consortium Work Program that defines project

teams and interactions with the other Work Program Boards to provide the broad program of initiatives, developments and industry coordination defined by the CANEUS Members.

The sector consortium is established after a number of industry workshops have been held to gather input from interested CANEUS members and other aerospace businesses. This input guides the development of a Strategic Work Plan for the Group. First, a Sector Consortium Director is appointed from the membership; then, interested parties come together to create the Strategic Work Plan. Once the Strategic Work Plan is established, the non-members of the group join CANEUS and become members in order to be covered by the requisite terms of confidentiality, intellectual property management, and regulatory policies. The group is then responsible for defining the projects and initiatives necessary to implement the Strategic Work Plan.

The cost- and risk-mitigating rationale behind CANEUS International’s activities translates into a project matrix that seeks to recognize and benefit from the overlapping interests and needs of stakeholders operating within various sector consortia (Figure 2). The ideal project is a collaboration of members that provides a solution for a number of applications, involving a portfolio of technology development with the resources to create and support the resulting product or process in the market place. A project involving many “columns,” joining MNT impacted technologies and MNT embedded applications with a supply chain formed by stakeholders, is thus desirable.

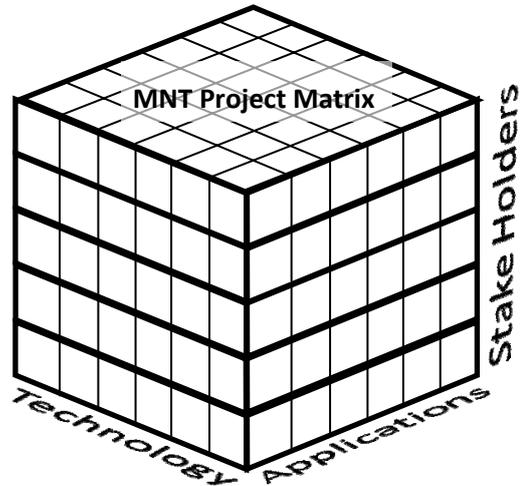


Figure 2: CANEUS Project Matrix

Within this framework, the CANEUS Small Satellite Sector Consortium currently operates in collaboration with five other consortia (Figure 3). This enables the sharing of benefits with projects and initiatives undertaken in MNT reliability testing (“Reliability”), developing wireless alternatives (“Fly-by-Wireless”), responding to aerospace needs for harsh environment sensors (“Harsh Environment Sensors”), integrating microfluidics with nano-fabrication (“Materials”), and developing MNT-based micropropulsion and micro batteries for aerospace and defense applications (Micro-Energetics”).

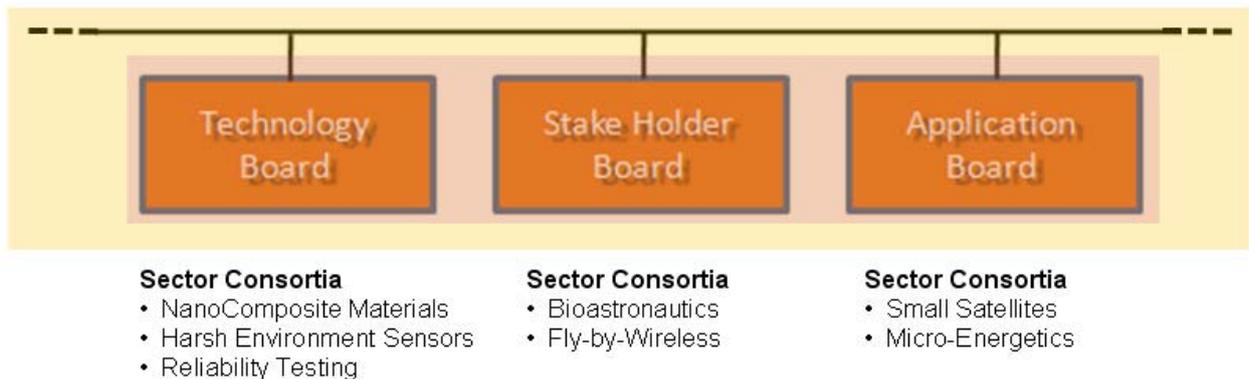


Figure 3: Sector Consortia as Initiated by Board

CONCLUSION

An important goal of the CANEUS Small Satellite Sector Consortium is to mitigate risk by pooling the financial resources and developments from several countries to rapidly gain acceptance for small satellites as a viable space mission platform. It will apply the CANEUS principles of coordinated development to

create a SEMATECH-like structure to promote the growth of the Small Satellite industry sector by bringing together all of the stakeholders, individuals, and organizations that can benefit from a sustainable Small Satellite industry sector. The Small Satellite Sector Consortium will consider and prioritize the key technological elements required for the Small Satellite sector. These elements will be defined in the context of

compelling business models for creating and sustaining the sector.

Workshops in France, Canada, and the United States gave rise to a formalized consortium structure, mission and objectives, and implementation plans for the resulting projects and initiatives. These include standards development, launch opportunities and services, stakeholder liaison and strategic development, Intellectual Property and ITAR issues, and launch certification services. Furthermore, the array of consortia coordinated by CANEUS International allows for cross-sector collaboration and the funding and development of cost- and risk-mitigating projects

responding to a variety of needs by developers and end-users in technology and applications.

By making use of recent breakthroughs in nanotechnologies and micro-electrical mechanical systems, the small satellites developed through the coordination efforts of the CANEUS Small Satellite Sector Consortium would be considered a 'disruptive technology' on par with the information technology revolution that has propelled new industries, services and capabilities for society.