

# CANEUS

2004

## CANEUS Conference on Micro-Nano-Technologies for Aerospace Applications

*From Concepts to Systems*

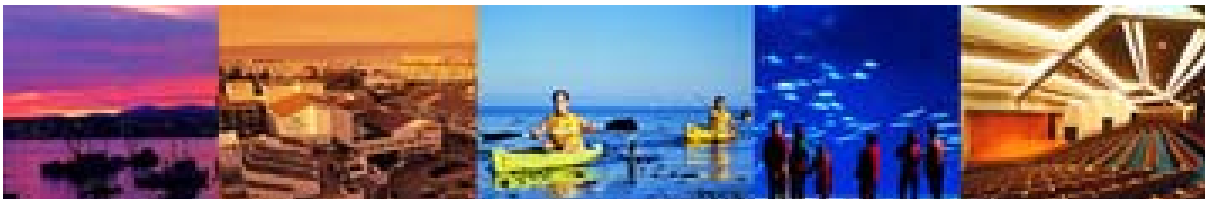
Monterey, CA, USA  
October 30 - November 5, 2004

- **Overview**

CANEUS 2004 is the world's premier international conference devoted to Micro-Nano-technology (MNT) development for Aerospace Applications. Given the success of the first CANEUS 2002 workshop, which was initiated, organized and hosted by the Centre for Large Space Structures and Systems (CLS3) of Montreal, Canada; once again the CLS3 together with the CANEUS organization and AIAA are planning the second CANEUS Conference on Micro-Nano-Technologies for Aerospace Applications. The CLS3 was also responsible for pioneering the formation of the joint Canada-Europe-USA-Asia (CANEUS) organization for the advancement of MNT for aerospace applications. The CANEUS 2004 conference will build on the theme developed during the CANEUS 2002 workshop, namely addressing the challenge of efficiently transitioning aerospace MNT development from a mostly low TRL (Technology Readiness Level) stage to system-level implementations. The creation of an Aerospace MNT development "pipeline" would necessarily involve the active participation and buy-in from several important constituencies, notably from among those involved in Low, Mid and High TRL development as well as end-users and investors. Given the small size of the overall Aerospace MNT community, a key objective of the conference is to foster international partnerships aimed at MNT-based aerospace products by bringing together complementary core competencies.

CANEUS 2004 will bring together key scientists, engineers, program managers, investors and policy-makers from America, Europe and Asia, representing the MNT developer community and the aerospace end-users. CANEUS 2004 is thus a unique conference examining all aspects of end-to-end development from MNT concepts to aerospace system implementations. The conference will conclude with the development of "blueprints" for a set of pilot programs aimed at Aerospace MNT development. These pilot programs will coordinate complementary core-competencies of the participating organizations and involve collaborative investment, facilitated at the highest inter-governmental level.

The conference will consist of sessions, workshops, short courses, posters and exhibits and will be held on beautiful Monterey Peninsula at the Hyatt Regency Resort. While staying at the Hyatt, you are minutes away from some of the most prestigious golf courses in the world including Pebble Beach, Poppy Hills, Quail Lodge and 14 other challenging courses. If golf is not your cup of tea, there is plenty of adventure and activities waiting for you at historic Fisherman's Wharf and Cannery Row, the street made famous by John Steinbeck's 1945 novel. These two renowned attractions are full of shops, restaurants, and pubs giving you an ideal environment to shop, dine or meet with colleagues as you take in the sights and sounds of this unique area. If this is not enough, be sure to stop by the famous Monterey Bay Aquarium and marvel at some of the bay area's sea life or try your luck in the sea by renting a kayak and taking it for an extreme adventure in Monterey Bay. This conference location will provide you the perfect opportunity to blend new information with an abundance of new activities and pleasure.



Organized by:

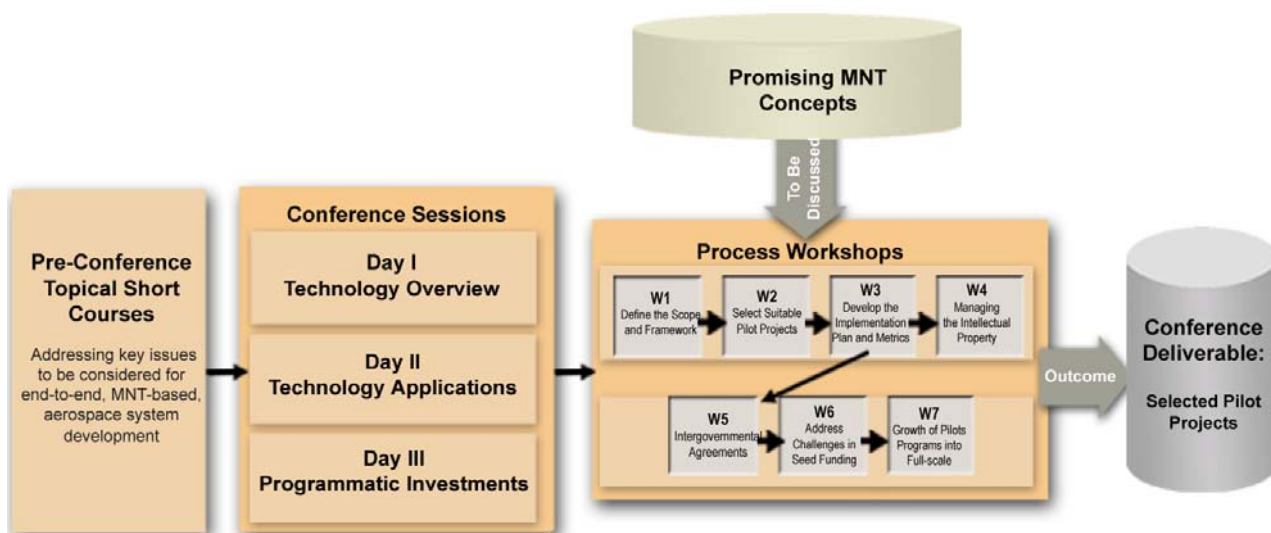


• **Objectives**

1. Provide participants with a complete understanding of the process for transitioning new and exciting MNT concepts to Aerospace system implementations.
2. Bring together Aerospace MNT communities from Canada, Europe, USA and Asia and identify areas of complementary core competencies.
3. Select promising MNT concepts and develop plans for pilot programs to advance their maturity to the system level.

• **CANEUS 2004 Structure**

(6 Pre-Conference Short Courses, 22 Thematic Conference Sessions, 7 Process Workshops covering 14 Concepts Studies to identify potential Pilot Projects, 3 Poster Sessions and Relevant Technical Exhibits)



A “flow-down” structure has been adopted for the 5-day CANEUS 2004 conference covering 3-day sessions and 2-day workshops, with additional 2-days of topical short courses to support the conference. The first three days contain 22 technical sessions addressing key issues involved in three broad topical areas: (a) Technology Overview, (b) Technology Applications, and (c) Programmatic and Investments. Each speaker at the conference is essentially a leader in the field, describing his or her organization's work in the context of the broader global picture. Preferably each speaker would be the representative for the participating CANEUS regions of Canada, Europe, USA and Asia Pacific

## ● Scope

The conference will consist of sessions, workshops, short courses, posters and exhibits:

1. Individual sessions address key issues (see below) to be considered for end-to-end, MNT-based, aerospace system development.
2. General participation in the "Contributed" and "Invited" paper categories as well as for poster presentations, consistent with the defined scope and theme of the conference.
3. Workshops (see below) will select promising MNT concepts and develop plans for system-development pilot programs.
4. Technical exhibitions will cover the state-of-the-art in MNT related tools and resources as well as end-user' applications.
5. Topical Short Courses will provide the technical background in key areas pertinent to the conference.

## ● Conference Sessions

The conference sessions are the means for "feeding" the workshop sessions with sufficient data for the participants to be able to make informed decisions. The three broad topical areas for the conference are: Technology Overview, Technology Applications and Considerations and finally Programmatic. These topical areas have been subdivided into the 26 conference sessions that you see in the program.

The conference sessions will consist of selected invited presentations, contributed paper presentations, and posters. Be sure to specify if you would prefer to have your paper considered for an oral presentation or as part of the poster session.

## ● Topics

The following list of topics is intended to provide ideas for papers and is not meant to limit papers to specifically mentioned topics. In addition, papers dealing with **lessons learned in transitioning new technologies to applications** are highly sought after and encouraged.

The conference sessions will include MNT applications for **Aeronautics, Unmanned Space (Civilian and Defense), and Human Space Exploration**, and will cover the following topics:

### ● Novel MNT-based concepts

MNT-based systems promise what Aerospace applications are looking for namely, ultra-low mass, size and power consumption. We are soliciting revolutionary MNT concepts that are applicable to Aeronautics and Space missions.

- Fault tolerant, self-organizing and assembling, and self-healing materials,
- Devices and systems;
- Evolutionary design and operations; group intelligence and functions for nano- and pico-satellites;
- Swarms; MNT based concepts for detection of life, energy and waste management

### ● Micro- and nanostructured materials

There is a need for new materials to meet the challenging requirements of next-generation air- and spacecraft, such as, the hypersonic space plane and RLVs. Materials that have been engineered from the "bottom up" offer exciting new possibilities for these applications.

- Impact on launch vehicles and autonomous maintenance
- Nanotubes, nanowires, fullerenes, quantum dots,
- Clusters, nano- and micro particles,
- Self-assembled nanomaterials,
- Nano- and microstructured surfaces and features,
- DNA, Nano-biological and soft-materials,
- Mesoscale materials, nano- and microphase composite materials

- **Micro-nano-devices and systems**  
 Considerable investment and effort has gone in already into MEMS/NEMS (Micro/Nano Electro Mechanical Systems) for new sensors and actuators. We would like to encourage papers covering lessons learned in the development of MEMS/NEMS for Aerospace.
  - Micro-nano-electronics and control systems, computing and communication
  - MEMS/NEMS based micro-instruments,
  - Fuel Cells and Energy Storage Devices,
  - Rocket fuel and propellants,
  - Micro/Nanofluidic devices and biomolecular machines,
  - Micropropulsion systems,
  - Self-assembly and re-organization at the system level
  
- **Challenges with MNT-based system development**  
 Transitioning innovative technologies from the laboratory to the manufacturing floor is not without its challenges. These challenges run the gamut from technological factors, to investment related factors, to psychological factors such as perception issues.
  - Various factors influencing the transition of innovative technologies from the laboratory to the manufacturing environment
  - MNT-enabled system architectures
  - Demonstrating long-term, stable operation
  - Methodology for retiring system level risk
  
- **Reliability considerations for MNT infusion in space missions**  
 There is no question that reliability is of paramount importance for aerospace applications. More so for space missions since it is impossible in most cases to send a human to repair the problem. MNT has demonstrated that it has the inherent reliability required for space applications.
  - Challenges with demonstrating MNT-based system reliability in a laboratory environment
  - Challenges with demonstrating MNT-based system reliability in a relevant (aerospace) environment
  
- **Governmental and private investment into MNT-based systems and Application development**  
 Investment provides the lifeblood for initiating, maturing and implementing new MNT-based systems.
  - Perspectives from seasoned investors and program managers are invited, describing their expectations and experience in managing MNT development.
  
- **Coordinated international collaborations**  
 MNT development, specifically for Aerospace applications is still in its infancy. In order to avoid wastage of resources and “re-inventing wheels”, it is critical that we bring together complementary core competencies from across international borders.
  - Inter-governmental agreement
  - Examples of existing collaborative projects that bring together complementary core competencies from across international borders (e.g. environmental (dual use) application)
  
- **End-user perspectives**  
 The “customer” has the last word in whether a promising new technology will ever be implemented. The dominant cliché is that the customer does not care what’s in the “black box” as long as it delivers the required functionality in a cost-effective and reliable manner.
  - Lessons learned by aerospace end users of MNT based materials,
  - Lessons learned by aerospace end users of MNT based devices and systems

● **Process Workshops**

The two-day workshop sessions covering 7 process workshops will use a step-by-step approach to first evaluate the chosen 14 candidate MNT concepts based on the concept papers/studies and then identify and select the one that could lead ultimately to the identification of candidate pilot programs, while focusing on fostering international partnerships that bring together complementary core competencies. The pilot project blueprints are essentially business plans covering all aspects of prototype development and demonstration, prior to full-scale implementation. The workshop background paper for each process workshop will guide the discussion by highlighting the principal issues to be considered for a particular aspect of technology development.

● **Process Workshop Format**

**Functions:**

Each of the proposed seven workshops will be divided in two segments;

- Whereas, the first half @ 100 minutes will cover the specific workshop topics and discussion on outcome from the 14 concept studies;
- The second half @ 75 minutes duration will review the discussion and findings from the first half to arrive at the specific deliverables.

**Composition:**

Each process workshop will be composed of:

- A moderator to lead the workshop;
- 3 to 4 panellists;
- 2 rapporteurs, one to present the analysis from the first half and the second to report the final findings of the specific workshop; and
- A Coordinator responsible to organize the workshop and present the final deliverables.

● **Process Workshops Topics:**

ID Number	Workshop Topics
2004-B01	Define the Scope and Formulate the Framework to Achieve Collaborative Developments of MNT
2004-B02	Select Suitable Projects to Develop MNT Systems Based on the Framework Defined in Workshop 1
2004-B03	Develop the Implementation Plan and Metrics for Each of the Projects
2004-B04	Managing the Intellectual Property
2004-B05	Address Challenges in Implementing the Pilot Programs: Intergovernmental Agreements
2004-B06	Address Challenges in Implementing the Pilot Programs: Putting Together the Seed Funding Through Government/Venture Investment
2004-B07	Growth of Pilots Programs into Full-scale Efforts

● **Process Workshop Background Papers**

The CANEUS 2004 conference will include workshops addressing the various aspects of the process for successfully transitioning promising MNT concepts to aerospace applications. The CANEUS conference committee is soliciting well-researched "Background Papers" for each process workshop. These background papers will set general guidelines for the discussion of the Pilot Project Concept Papers by educating the attendees in the important steps of pilot project definition, intergovernmental agreements, intellectual property management, obtaining funding and issues related to end-user production implementation. The responder will draw from the knowledge base acquired by various international organizations as well as previous attempts at conducting international collaborations aimed at technology development. For more information, please see: <http://www.caneus.org/RFP2004/>

- **Pilot Project Concept Papers/Studies**

The concept studies are part of the initial process for defining potential pilot projects that could be developed through prototyping and eventually productization and commercialization. The Conference Organizing Committee has selected a number of novel MNT concepts, which it believes could be transitioned to aerospace systems. Each concept paper will provide the conference participants with the technical and programmatic background necessary to evaluate the current status in terms of technological maturity, key players in a particular technology arena, potential investors, aerospace end-applications and users, market potential, and the challenges involved in the development. For more information, please see: <http://www.caneus.org/RFP2004/>

ID Number	Pilot Projects Concept Topics
2004-A01	Development of Micro Attitude & Orbit Control Systems ( $\mu$ AOCS)
2004-A02	Reliability Testing of Micro-Sensors, Micro-Actuators and Micro-Switches
2004-A03	Effects of Space Radiation on MNT Devices
2004-A04	Nano/Pico-Satellite constellations for earth orbit or space exploration
2004-A05	Nano-composite Materials for Thermal Protection and Radiation Shielding Systems
2004-A06	Nanofiber Composite Materials for Load Bearing Structural Applications
2004-A07	Multifunctional Composite Materials with MNT Embedded Sensors
2004-A08	MNT based Space Transportation & Re-entry Technologies
2004-A09	Nanosensors and Devices
2004-A10	Nano-Optoelectronic Detectors and Lasers
2004-A11	MNT-based Sensors for Aircraft/Spacecraft Structural Health Monitoring
2004-A12	MNT-based Sensors for Astronaut Health Monitoring and Environmental Control
2004-A13	MNT for Miniaturized Scientific Instruments for Planetary Exploration
2004-A14	MNT Based Harsh Environment Sensors

- **Pre-Conference Topical Short courses**

Topical Short Courses will help provide necessary background – learning tools - in key areas, which are pertinent to the conference sessions and workshops

ID Number	Short courses Topics
2004-C01	MEMS and Nano Technologies for Space Missions
2004-C02	Planning and Managing Technology Development with a Stage-Gate Process
2004-C03	Reliability of MEMS and NEMS for Space
2004-C04	International MNT Collaboration: ITAR and Export Compliance Considerations
2004-C05	IP Issues Involved with MNT Concepts to Systems
2004-C06	The Advanced Technology Program: Overview, Eligibility, Rules, Selection Criteria and Funded Projects

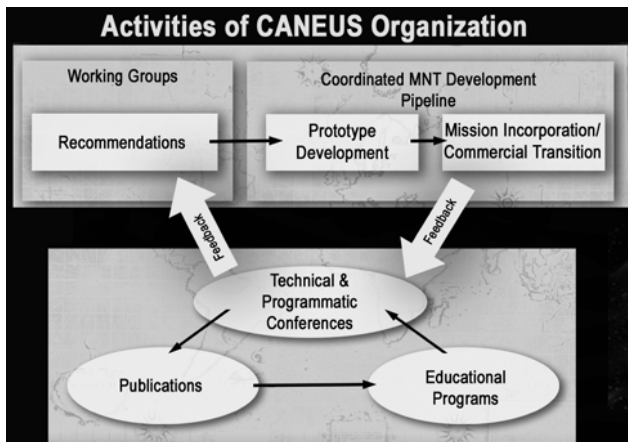
- **Hosts and Partner Organizations**

**Organized and hosted by:**

CANEUS Organization  
 American Institute of Aeronautics and Astronautics (AIAA)  
 National Aeronautics and Space Administration (NASA)  
 Centre for Large Space Structures and Systems (CLS3)

**In cooperation with:**

Government of Canada  
 Institute of Electrical and Electronics Engineers (IEEE)  
 The International Society for Optical Engineering (SPIE)  
 American Society of Mechanical Engineers (ASME)  
 Universities Space Research Association (USRA)  
 Space Studies Institute (SSI)  
 American Astronomical Society (AAS)  
 International Astronautical Federation (IAF)  
 International Academy of Astronautics (IAA)  
 United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)  
 Micro and Nanotechnology Commercialization Education Foundation (MANCEF)



● **CANEUS 2004 Program**

Session Time	Saturday		Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Workshop Time
	Short Courses		Short Courses		Technology Overview (Low TRL)		Technology Applications Applications Sessions		Programmatic Investments		Focused Workshops		Focused Workshops		
8:20 to 8:50	...		....		Opening Speech		Keynote Speaker 2		Keynote Speaker 4		Keynote Speaker 7		Keynote Speaker 9		8:20 to 8:50
8:50 to 9:10	...		....		Daily Review		Daily Review		Daily Review		Workshop 1 (Findings and Recommendations)		Workshop 3 (Findings and Recommendations)	Workshop 6 (Findings and Recommendations)	9:00 to 10:10
											Coffee Break		Coffee Break		10:10 to 10:30
9:20 to 10:40 (4 Speakers)	Short Course 1 MEMS and Nano Technologies for Space Missions	Short Course 2 Planning and Managing Technology Development w/ Stage-Gate	Short Course 5 IP Issues Involved with MNT Concepts to Systems	Short Course 6 Advanced Technology Program Overview, Eligibility, etc.	Session 1 Low TRL Materials	Session 2 Low TRL Devices	Session 9 Unmanned Space Needs	Session 10 Aeronautics Needs	Session 17 Governmental Investment Low TRL	Session 18 Private Investment Low TRL	Workshop 2 (Review and Analysis) Select suitable projects based on the framework defined in workshop 1	Workshop 5 (Review and Analysis) Address challenges in implementing the pilot programs: Inter-governmental agreements	Workshop 4 (Review and Analysis) Managing the Intellectual Property Coffee Break	Workshop 7 (Review and Analysis) Growth of Pilots Programs into Full-Scale Efforts Initiation of the Next Round of Pilot Programs	10:30 to 12:10
10:40 to 11:00	Coffee Break		Coffee Break		Coffee Break		Coffee Break		Coffee Break						
11:00 to 12:20 (4 Speakers)	Short Course 1 Continue	Short Course 2 Continue	Short Course 5 Continue	Short Course 6 Continue	Session 3 Low TRL Materials	Session 4 Low TRL Devices	Session 11 Manned Space Needs	Session 12 Defense Needs	Session 19 Governmental Investment Mid / High TRL	Session 20 Private Investment Mid / High TRL	Workshop 2 (Question and Answers)	Workshop 5 (Question and Answers)	Workshop 4 (Question and Answers)	Workshop 7 (Question and Answers)	12:10 to 12:20
12:20 to 13:30	....		....		Lunch and Keynote 1		Lunch and Keynote 3		Lunch and Keynote 5		Lunch and Keynote 8		Lunch + Keynote 10 (Closing Remarks)		12:20 to 13:30
Afternoon	Short Courses		Short Courses / Opening Banquet		Technology Overview (Mid/ High TRL)		Technology Applications Reliability and Lessons Learned		Programmatic Coordinated International Collaborations		Focused Workshops		Focused Workshops		Afternoon
13:30 to 14:50 (4 Speakers)	Short Course 3 Reliability of MEMS and NEMS for Space	Short Course 4 International MNT Collaboration: ITAR and Export Compliance	....	....	Session 5 Mid TRL Materials	Session 6 Mid TRL Sub-Systems	Session 13 Low TRL Reliability	Session 14 Lessons Learned from Aeronautics)	Session 21 International Collaboration Low TRL	Session 22 International Collaborations Mid / High TRL	Workshop 2 (Findings and Recommendation)	Workshop 5 ((Findings and Recommendation)	Workshop 4 (Findings and Recommendations)	Workshop 7 (Findings and Recommendations)	13:30 to 14:40
14:50 to 15:10	Coffee Break		Coffee Break		Coffee Break		Coffee Break		Coffee Break		Coffee Break		Coffee Break		14:40 to 15:00
15:10 to 16:30 (4 Speakers)	Short Course 3 Continue	Short Course 4 Continue	....	....	Session 7 High TRL Materials	Session 8 High TRL Systems	Session 15 Mid- High TRL Reliability	Session 16 Lessons Learned from Space)	Workshop 1 Define the scope and formulate the framework to achieve collaborative developments of MNT		Workshop 3 (Review and Analysis) Develop the implementation plan and metrics for each of the pilot programs	Workshop 6 (Review and Analysis) Address challenges in implementing the pilot programs: Putting together the seed funding through venture/government investment	Finalize each of the selected prototypes / pilot development projects leading to potential mission incorporation and commercial transition		15:00 to 16:30
16:30 to 18:00	....		....		Poster Session		Poster Session		Poster Session		Review of the Day		....		16:30 to 17:00
18:30 to 23:00	....		Opening Banquet		Reception		....		Banquet + Keynote 6		....		....		...