FINAL PROGRAM

CANEUS 2009 WORKSHOPS

International Collaborative Aerospace Development
Micro Nanotechnologies: From Concepts to Systems

March 1-6, 2009
NASA Ames Research Center
Moffett Field, California

www.caneus2009.org

Welcome from Host NASA Ames Center Director and CANEUS 2009 Honorary Chair

Dear Workshops Participant:

Thank you for participating in the CANEUS 2009 Workshops! On behalf of NASA Ames Research Center, we are very pleased to host the CANEUS 2009 workshop and extend a warm welcome to you and urge you to participate fully in this event. I am sure this will be a very worthwhile and productive event.

NASA Ames plays a critical role in virtually all NASA missions in support of America's space and aeronautics programs. As a leader in small spacecraft, information technology research with a focus on supercomputing, networking and intelligent systems, Ames conducts the critical R&D and develops the enabling technologies that make NASA missions possible. Ames also is a leader in nanotechnology, fundamental space biology, biotechnology, aerospace and thermal protection systems, and human factors research. Ames research in astrobiology focuses on the effects of gravity on living things, and the nature and distribution of stars, planets and life in the universe.

In addition, Ames engages in information and education outreach, forms collaborative partnerships, and fosters commercial application of NASA technologies. Ames is developing NASA Research Park, an integrated, dynamic research and education community created to cultivate diverse partnerships with academia, industry and non-profit organizations in support of NASA's mission

The topics covered at CANEUS 2009workshop are very much synergistic with the activities and mission of Ames. The Workshop has an exciting program consisting of one-day short courses, five days of workshops, networking opportunities through social gatherings and exhibits designed to define and implement plans to infuse next-generation technologies within various aerospace industry segments.

As you are meeting at this workshop, the Aerospace industry worldwide is facing a major crisis: How to keep its new technology pipeline for future missions from drying up? Micro and Nano Technologies (MNT) promise advanced solutions in terms of ultra-low mass and low power systems with revolutionary capabilities. The CANEUS 2009 Workshops emphasize measurable deliverables with lasting impact for the aerospace industry. Participants of the CANEUS 2009 Workshops will collectively prepare implementation plans for well-defined projects, and identify new project concepts.

As a valued participant, it is critically important that you interact with panellists, poster session presenters, and other participants and provide your vital input to improving and thereby strengthening our mission.

It is our sincere hope that you will benefit tremendously from your participation and that you will have a technically, professionally, and socially enriching experience.

Welcome from CANEUS 2009 Chairs

Dear Workshops Participant:

As Chair and Co-Chairs of the CANEUS 2009 Workshops, it is our pleasure to extend a hearty welcome to all participants of the International CANEUS 2009 Workshops! We are very pleased to host this important event, which we believe addresses a critical need for the aerospace industry. Space and aeronautics need an infusion of new technologies and systems, which we believe can be particularly influenced by exciting worldwide developments in Micro and Nano -Technologies (MNT).

The topics covered at CANEUS 2009 Workshops are very much synergistic with the activities and mission of CANEUS and NASA. The Workshop has an exciting program consisting of one-day short courses, five days of workshops, networking opportunities through social gatherings and exhibits designed to define and implement plans to infuse next-generation technologies within various aerospace industry segments. The CANEUS 2009 Workshops are unique and different from many conferences and workshops, in that they emphasize measurable deliverables with lasting impact for the aerospace industry. Participants of the CANEUS 2009 Workshops will collectively prepare implementation plans for well-defined projects, and identify new project concepts. The end result will be a neutral virtual business model for international collaboration that brings the best solutions to the boardroom so that well-informed decisions on new program starts,-whether it be research, test and evaluation, or introduction of new products to the end user- can be made quickly and confidently.

Milind Pimprikar
Chair
CANEUS International

John Hines
Co-Chair
NASA Ames

Harry Partridge
Co-Chair
NASA Ames

	Sunday **March 1**			Monday **March 2 - Aerospace Needs and Lessons Learned**	Tuesday **March 3 - Aerospace Technology Assessment**
				Workshop Implementation Approach	State-of-the-art in Low TRL
0800-0830	Registration Opens		0800-0830	Welcome Opening Remarks / Plenary Address *Lew Braxton - NASA Ames* *Pete Klupar - NASA Ames*	Daily Overview
0830-0845	Golf Tournament + Short Course Registration	Short Course Introduction	0830-0900		Keynote Address *Howard Alper - Science, Technology and Innovation Council, Government of Canada*
0845-1015		**Short Course 1:** From Concept to Commercialization *Elias Carayannis*	0900-1015	CANEUS Mission, Vision, and Goals Aerospace Technology Gap: Case for Sector Consortia Implementation Approach and Success Criteria	**Panel 9:** Low TRL Materials (Bottom-up) **Panel 10:** Low TRL Devices (Sensors and Instrumentation)
1015-1045		Coffee Break	1015-1045	Coffee Break	Coffee Break
1045-1225		**Short Course 2:** Standards and Metrology for Micro and Nanotechnology *Jon Pratt*	1045-1200	**Panel 1:** Unmanned Space Needs **Panel 2:** Aeronautics Needs	**Panel 11:** Low TRL Materials (Top-Down) **Panel 12:** Low TRL Devices (Photonics)
				Aerospace Needs Assessment and Lessons Learned from Technology Infusion	State-of-the-art in Mid/High TRL
	Lunch		1200-1330	Working Lunch Topic: IP/Funding/ITAR issues for the Sector Consortia **Keynote Speaker:** *John Miller - US Army*	Technical Tours
1330-1400		Brief Overview of Tuesday's Short Course 3: Small Satellites: Past, Present, and Future *Henry Helvajian*	1330-1445	**Panel 3:** Manned Space Needs **Panel 4:** Defense Needs	Technical Tours (cont'd) **Short Course 3:** Small Satellites: Past, Present, and Future (Related to Micro, Nano and Pico Satellites) *Henry Helvajian and Siegfried W Janson*
1400-1530	Golf Tournament	**Short Course 4:** ITAR-Inter-Governmental Agreements, Flight Opportunities, Standards, Export policy restrictions, Environmental, Safety. *George Grammas*	1445-1600	**Panel 5:** Lessons Learned from Space **Panel 6:** Lessons Learned from Aeronautics	**Panel 13:** Mid TRL Materials **Panel 14:** Mid TRL Sub-Systems
1530-1600		Coffee Break	1600-1630	Coffee Break	Coffee Break
1600-1730		**Short Course 5:** Funding *David Oppenheimer*	1630-1745	**Panel 7:** Reliability Packaging **Panel 8:** Lessons Learcned from Defense	**Panel 15:** High TRL Materials **Panel 16:** High TRL Systems
		Short Course Conclusion	1745-1800	Poster Session	Poster Session
	Reception		1800-1930	Reception	Reception

	Wednesday **March 4 - Sector Consortia Development**	Thursday **March 5 - Programmatic Investment and International Collaboration**	Friday **March 6 - Sector Consortia Deliverables**
	Sector Consortia Tutorial	Sector Consortia Roadmap and Projects cont'd	Roadmap and Project Refinement
0800-0830	Daily Overview	Daily Overview	Daily Overview
0830-0900	Keynote Address *Reinhard Schulte-Braucks - European Commission*	Keynote Address *Michel Courtois - ESTEC/ Minoo Dastoor - NASA and NNI*	Keynote Address *General John Sheridan - US Air Force (TBC)*
0900-1015	Sector Consortia Tutorial and Sector Consortia Leaders Panel	Reliability: Mission, Goals, and Roadmap	Roadmap Refinement: Tasks, Responsibilities, and Timeline Devices · Materials · Small Satellite · Reliability · Fly-by-Wireless
1015-1045	Coffee Break	Coffee Break	Coffee Break
1045-1200	Small Satellite: Mission, Goals, and Roadmap Devices: Mission, Goals, and Roadmap	Reliability: Project Development and Framework Devices · Materials · Small Satellite · Reliability · Fly-by-Wireless	Project Refinement: Teaming, Budget, and Success Evaluation Devices · Materials · Small Satellite · Reliability · Fly-by-Wireless
	Sector Consortia Roadmap and Projects	Programmatic Investments and International Collaboration	Sector Consortia Reports
1200-1330	Lunch + Keynote Address *Doug Comstock - NASA IPP*	Lunch + Keynote Address *Gwynne Shotwell - SpaceX*	Sector Consortia Summary Presentation
1330-1445	Small Satellite: Project Development and Framework Standards · Launch · Stakeholder · Export Control Devices: Project Development and Framework HE Sensors · Photonics · Bio-Astra · Envi. Monitoring	Panel 17: Low-High TRL Governmental Investment Panel 18: Low TRL International Collaboration	Devices Report Materials Report Fly-by-Wireless Report Small Satellite Report
1445-1600	Fly-by-Wireless: Mission, Goals, and Roadmap Materials: Mission, Goals, and Roadmap	Panel 19: Low-High TRL Private Investment Panel 20: Mid/High TRL International Collaboration	
1600-1630	Coffee Break	Coffee Break	Coffee Break
1630-1745	Fly-by-Wireless: Project Development and Framework Less-Wire Technology · SVHM · Sensor-DAQ · Passive Sensor Materials: Project Development and Framework Micro-Energetics	Panel 21: CEO/CTO Panel	Reliability Report Workshops Conclusion
1745-1800	Poster Session		
1800-1930	Banquet and Competition Awards and Presentations		

Venue Information

The entire program of the CANEUS 2009 Workshops will be held at the NASA Ames Research Center in Moffett Field, California. NASA Ames is conveniently located only a short distance from several hotels as well as a host of industrial sites.

The address of the NASA Ames Conference Center (NACC) is:

NASA Ames Conference Center
Building 3
500 Severyns Rd.
(between North Akron and South Akron)
NASA Ames Research Center
Moffett Field, CA 94035
Tel. 650-604-2082

Transportation

There are two major airports near the NASA Ames Research Center: the San Jose Airport and the San Francisco International Airport. The San Jose Airport is located about 10 miles, or 15 minutes by taxi (about $25 fare) from the NASA Ames Conference Center. The San Francisco International Airport is located about 25 miles from the NASA Ames Conference Center (about $70 fare).

Public transportation (BART/Cal Train) from SFO is available at very low cost. Take the Bart train to the Millbrae stop, then transfer to Cal Train southbound and exit at the Mountain View stop. BART runs about every 10 minutes and the Cal Train schedule and fares are available at: http://www.caltrain.com/schedule.html

NASA provides van service between Cal Train Mountain View and NASA Ames. Alternately, you may take a taxi from the Mountain View train station to Ames. Once at Ames, you must present photo ID at the gate, then notify the guard you are staying at the NASA Lodge. If, when you registered, you requested Ames lodging, a room reservation will be waiting under your name. You must pay for the room upon arrival (All major credit cards are accepted. VISA, AMEX, DISCOVER, MASTERCARD). Cancellations must be phoned in advance at least 24 hours.

Mountain View is a 20 minute walk or 5 minute drive from Ames and there are many restaurants there. If you plan on eating in Mountain View, there are many good restaurants on **Castro Street**. For more information please visit: http://www.mountainviewca.net/

****Please note**: If you intend to drive in California, please be aware that California law prohibits all drivers from using a handheld wireless telephone - talking or texting - while operating a motor vehicle.

From North (San Francisco)

1. Take 101 South Exit to Moffett Field
2. Follow the overpass towards NASA-Ames Research Center
3. Park at the Badge Office, to the right of the Main Gate

4. Obtain Visitor Pass, (a Visitor Request form must be sent into the Visitor Pass and ID Office by your NASA sponsor prior to your arrival)
5. Get driving directions from Visitor office

From San Francisco International Airport

1. Start out going West on DEPARTING FLIGHTS towards DOMESTIC TERMINAL EXIT by turning left. (0.19 miles)
2. Turn SLIGHT RIGHT onto DOMESTIC TERMINAL EXIT. (0.04 miles)
3. Stay straight to go onto DOMESTIC TERMINAL EXIT. (0.17 miles)
4. Turn SLIGHT RIGHT onto AIRPORT EXIT. (0.15 miles)
5. Take the US-101 S ramp towards SAN JOSE. (0.67 miles)
6. Merge onto US-101 S. (23.09 miles)
7. Take the MOFFETT BLVD East exit. (0.25 miles)
8. Merge onto MOFFETT BLVD. (0.85 miles)

Total Estimated Time: 31 minutes
Total Distance: 25.40 miles

From South (San Jose)

1. 101 North
2. Exit at Moffett Field, bearing right, towards NASA-Ames Research Center
3. Park at the Badge Office, to the right of the Main Gate
4. Obtain Visitor Pass, (a Visitor Request Form must be sent into the Visitor Pass and ID Office by your NASA sponsor prior to your arrival)
5. Get driving directions from Visitor office.

From San Jose Airport

1. Start out going Southeast on TERMINAL A towards TERMINAL C by turning right. (0.12 miles)
2. Stay straight to go onto AIRPORT EXIT. (0.04 miles)
3. Turn LEFT onto AIRPORT PKWY. (0.13 miles)
4. Turn LEFT onto GUADALUPE PKWY. (0.40 miles)
5. Take the US-101 N ramp towards SAN FRANCISCO. (0.28 miles)
6. Merge onto US-101 N. (7.76 miles)
7. Take the MOFFETT BLVD exit East. (0.16 miles)
8. Merge onto MOFFETT BLVD. (1.01 miles)

Total Estimated Time: 14 minutes
Total Distance: 9.92 miles

Shuttle Service

Airport Commuter
(408) 730-5555

Airport Shuttle Service
http://www.sfgate.com

Bayporter Express (SF only)
(415) 467-1800
http://www.bayporter.com

Santa Cruz Airporter
(831) 423-1214

South & East Bay Shuttle
(408) 559-9477

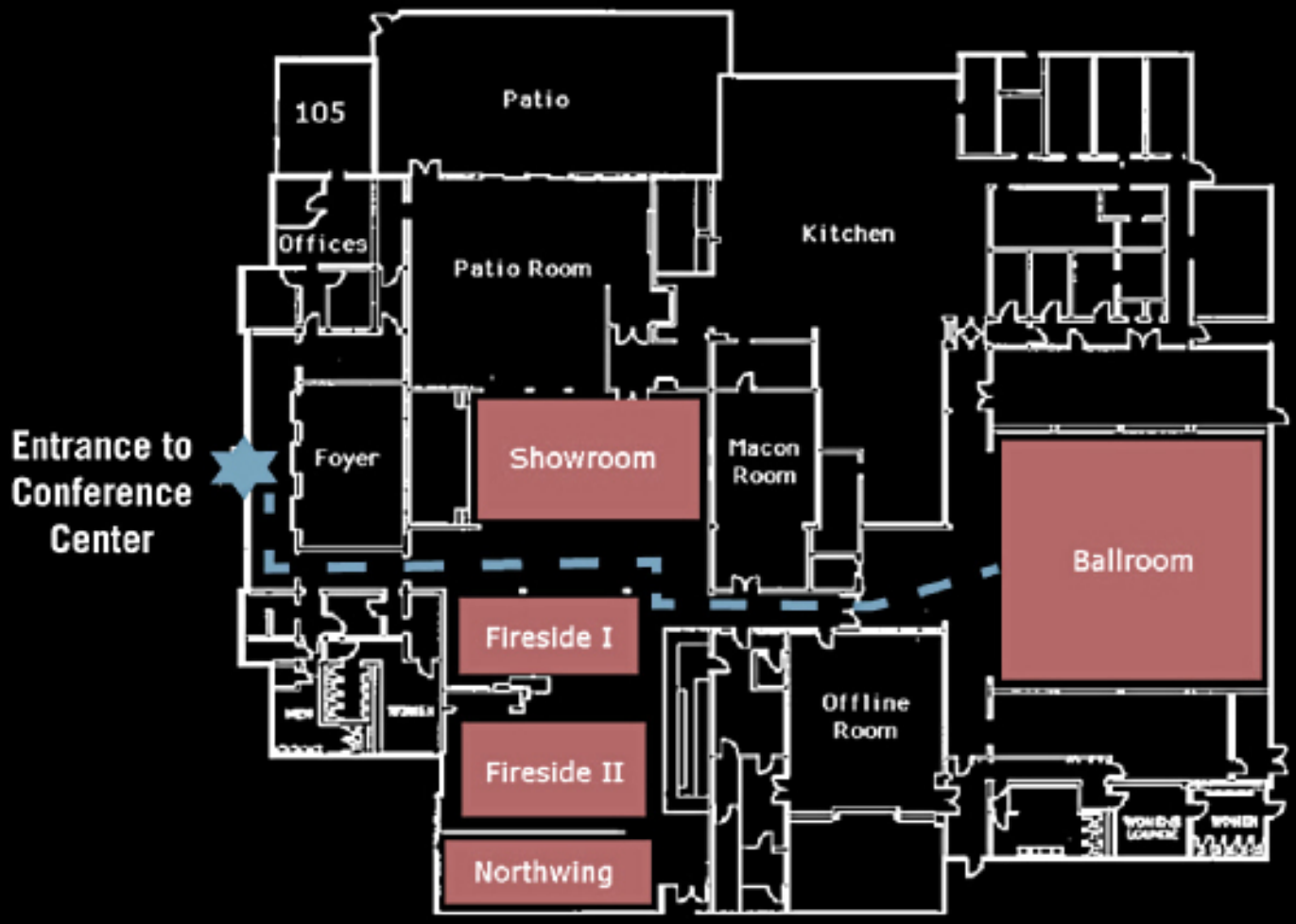
Super Shuttle (SFO Only)
(415) 558-8500
http://www.supershuttle.com/

Taxi Service

Please fill in the Taxi request form if you need taxi from NASA Ames

Yellow Cab Co. (408) 293-1234
Yellow Cab (650) 254-0100 / (650) 964-1234
USA Shuttle Svc (650) 940-1228

Location of the Workshop



CANEUS 2009 Workshops: An Overview

CANEUS 2009 is the world's premier international forum dedicated to fostering international collaboration on the development of advanced micro and nanotechnologies (MNT) from concepts to ultimate infusion into next generation aerospace systems. The NASA Ames Research Center in Moffett Field, California will host the entire event from March 1 to 6, 2009.

The CANEUS 2009 Workshops take a practical approach to efficiently overcoming the challenges associated with matching aerospace application needs with the new capabilities offered by emerging micro and nanotechnologies. The program emphasizes measurable deliverables with lasting impact for the aerospace industry. Over 350 world experts from Europe, the Americas, and Asia will address the current and future needs of the aerospace industry, state of the art in micro and nanotechnologies, government and private investment for concepts-to-systems development, and policies such as ITAR and export control regulations that affect international collaborations. Participants of the CANEUS 2009 Workshops will also collectively prepare implementation plans for well-defined projects and identify new project concepts in the areas of small satellites, fly-by-wireless, aerospace reliability, devices, and materials.

A wide range of organizations representing developer, user, and funding communities will participate in these activities, including NASA, EADS, ESA, CSA, Space X, NRC, LMCO, United Launch Alliance, Boeing, Airbus, Bombardier, and the U.S. Air Force, among many others.

The 2009 event will include five short courses, twenty-one thematic Panel Sessions, twelve Sector Consortia workshop sessions, three poster sessions, exhibits, and technical tours.

Mission

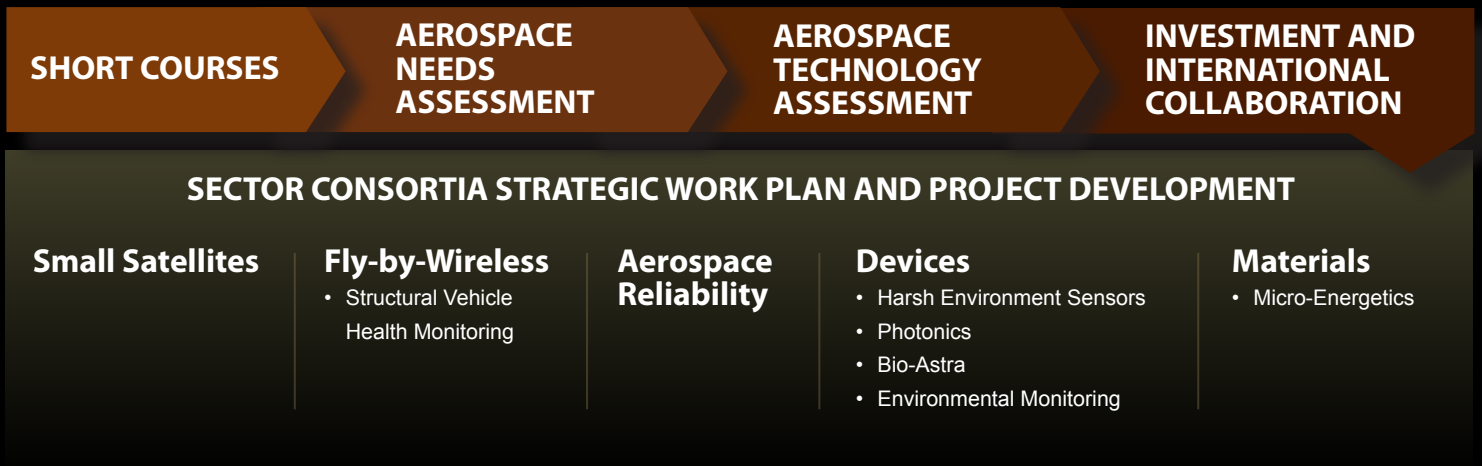
The CANEUS 2009 Workshops are chartered to oversee the formation of international public/private partnerships within the aerospace community by fostering a collaborative environment aimed at the adoption, adaptation, and accelerated commercialization of micro and nanotechnologies.

Background

Many new micro and nano technology (MNT) concepts are generated by the basic research technology push. Once infused into and im¬plemented by the aerospace industry, they promise to enable exciting applications. However, the cost of acquiring and implementing new technology is prohibitive, and most emerging technology concepts do not survive the mid Technology Readiness Level (TRL) system devel¬opment stage. In order to reap the potential of emerging MNT concepts and increase the number of concepts that reach the system prototype demonstration stage, an industry-wide solution for overcoming the mid-TRL "valley of death" and for smoothly transitioning MNT concepts to aerospace applications becomes essential.

CANEUS International, a non-profit organization, proposes a rapid and cost-effective method of technology transition via the creation of international collaborative sector consortia. These international pub¬lic/private partnerships between industry, university, and government stakeholders will pool membership's resources to define and execute high-risk, high-cost projects and initiatives. Sector Consortia will thus constitute smoothly functioning development "pipelines" for emerging technology concepts.

CANEUS currently coordinates Sector Consortia dedicated to Small Satellites, Reliability, Fly-by-Wireless (with Structural Vehicle Health Monitoring, Less-Wire Technology, Sensor-DAQ and Passive Sensor TAG Systems), Devices (with Harsh Environment Sensors, Photonics, Environmental Monitoring, and Bio-Astra), and Materials (with Micro-Energetics).



This is the fourth CANEUS world event of its kind: The first CANEUS world event was held in Montreal, Canada, in 2002; the second in Monterey, U.S., in 2004; and the third in Toulouse, France, in 2006. The CANEUS 2002 Conference witnessed the creation of the international collaborative aerospace development community. At the CANEUS 2004 Conference, a call for promising MNT concepts resulted in the submission and evaluation of 14 innovative concept topics, five of which evolved into the mature Sector Consortia that exist today. The CANEUS 2006 Conference in France generated tremendous interest within Canada, Europe, the US, and Japan for the development of a smoothly functioning technology development pipeline.

The CANEUS 2009 Workshops, so called for its focus on measurable deliverables within its Sector Consortia, will solidify the foundation that was laid in past conferences.

Objectives

CANEUS 2009 aims to:

- Provide participants and potential team members with an interac¬tive in-depth assessment of current aerospace end-user needs as well as state-of-the-art developments in micro and nano technolo¬gies.
- Articulate well-defined technology infusion projects and create their implemen¬tation plans within each of the Sector Consortia through the leadership of Sector Consortia Directors and the active contributions of participants
- Facilitate public and private partnership by addressing challenges to collaborative innovation: Issues to be discussed include Intel¬lectual Property, Funding Mechanisms, Export Control, and other regulations affecting International Collaboration;
- Build upon the achievements of the previous CANEUS world con¬ferences held in 2002, 2004, and 2006 that have successfully es¬tablished a global aerospace collaboration.

The CANEUS 2009 Workshops have a unique format which emphasiz¬es, as its primary deliverable, the definition and implementation plans for technology infusion projects within each of the Sector Consortia. During the workshop sessions of the program, participants in each consortium will (a) identify projects important to their organizations; (b) define a project concept, be it a product development, a process de¬velopment, or an initiative; (c) identify work teams; and (d) assign tasks and subsequent meeting dates to further develop these projects. It is expected that this process of project definition and development will subsequently lead to the submission of teaming agreements and proj¬ect proposals to the CANEUS organization, with cost estimates, a work breakdown structure, and proposed funding strategies. Ultimately, the event aims to make significant advances in realizing each Sector Consortium's vision for its particular technology focus.

Schedule

Short Courses

The CANEUS 2009 program includes five topical Short Courses to provide the necessary background – learning tools – in key areas such as inter-governmental agreements, intellectual property (IP)-related issues, MNT missions and the product/system development process from concept to system, which are pertinent to the conference sessions and workshops. Taught by world-class experts, the Short Courses help participants fully engage in discussions throughout the week of the CANEUS 2009 Workshops. The titles and objectives of the CANEUS 2009 Short Courses follow.

Short Course 1 – From Concept to Commercialization

Sunday, March 1st , 0845-1015

INSTRUCTOR: Elias Carayannis, *George Washington University, USA*

COURSE OBJECTIVE: The objective of this course is to help participants understand the key issues and challenges in transitioning proposal concepts into mil-std prototypes. It will cover the triggers, catalysts, and accelerators of the twin, mutually complementary and reinforcing phenomena of entrepreneurship and innovation that are found at the nexus of people, culture, and technology. The related concepts of strategic knowledge serendipity and strategic knowledge arbitrage will also be discussed. This review will also include cases of several multi-regional high technology ventures with a global/local focus – that are university and other R&D centers spin-offs. The challenges and opportunities of a more systematic architecting and leveraging of a country's human and intellectual capital via innovation networks and knowledge clusters and the accruing geo-economic and geo-political implications for the country and its periphery will also be discussed.

WHO SHOULD ATTEND: Program managers; business development; engineering researchers; small business personnel.

Short Course 2 – Standards and Metrology for Micro and Nanotechnology

Sunday, March 1st, 1045-1225

INSTRUCTOR: Jon Pratt, *National Institute of Standards and Technology*

COURSE OBJECTIVE: The course is intended to help researchers who must measure the mechanical behavior of materials and devices at the micro and nanoscale keep abreast of the latest developments and emerging standards in this field.

Short Course 3 - Small Satellites: Past, Present, and Future (Related to Micro, Nano and Pico Satellites)

Tuesday, March 3rd, 1330-1445

INSTRUCTORS: Henry Helvajian, *The Aerospace Corporation, USA* and Siegfried Janson, *The Aerospace Corporation*

COURSE OBJECTIVE: Over the last fifty years, more than 860 microsatellites, 680 nanosatellites, and 38 picosatellites have been launched worldwide. This workshop provides a brief record of the past, a snapshot of the present, and what may be possible in the future with respect to small satellites. It is a brief synopsis, given by the editors, of a recent book with the same title. This workshop will start with the Russian Sputnik, US Explorer, and US Vanguard satellites, discuss the historical, political, technical, and economic drivers for small satellite development, and provide some details on specific small satellite efforts such as Clementine, PCSAT, ANDE, RAFT, PANSAT, NPSAT1 SNAP-1, MOST, TUBSAT, PROBA-1, ORBCOMM, INDEX, REIMEI, Mini AerCAM, and MEPSI. It will also provide a glimpse into the near, mid, and far future for small satellite missions and manufacturing technologies.

Short Course 4 – ITAR: Inter-Governmental Agreements, Flight Opportunities, Standards, Export Policy Restrictions, Environmental Considerations and Safety

Sunday, March 1st , 1400-1530

INSTRUCTOR: George Grammas, *Squire, Sanders & Dempsey LLP, USA*

COURSE OBJECTIVE: This course will explain fundamental concepts of international trade controls on nano-technology and provide a framework to determine if U.S. government approval is required. The course will also explain basic administrative requirements for complying with regulations, and ramifications and penalties for noncompliance.

WHAT YOU WILL LEARN: This course will provide an insight as to how Inter-Governmental Agreements can facilitate participants of multi-national MEMS and NEMS projects to address and accommodate the requirements, concerns and restrictions of specific national jurisdictions and policies.

Short Course 5 – Funding and Financial Management for The CANEUS-Initiated Projects / Initiatives

Sunday, March 1st, 1600-1730

INSTRUCTOR: David Oppenheimer, *RAMP, USA*

COURSE OBJECTIVE: This course will provide attendees with a current and in-depth understanding of the financial strengths and needs of each CANEUS member along with their marketing reach, countries within which they are performing work, and their technical project strengths. The goal of the course is to be able to match member capabilities to present a unified services platform to our customers.

Panel Sessions

The CANEUS 2009 Workshops program features twenty-one thematic Panel Sessions addressing three broad themes:

Aerospace Needs and Lessons Learned (P01 - P08)

These Panel Sessions will review the needs of the aerospace industry in manned space, unmanned space, aeronautics, defense, and reliability, as well as the lessons learned in space, aeronautics, and defense. Projects identified in Sector Consortia Development will incorporate the needs and the lessons learned from these sectors.

Aerospace Technology Assessment (P09 - P16)

These Panel Sessions will review the state-of-the-art in micro and nanotechnologies for aerospace applications and their technology readiness levels, and identify drivers for inclusion in Sector Consortia projects.

Programmatic Investment and International Collaboration (P17 - P21)

These Panel Sessions will address programmatic investment and international collaboration issues. The solutions offered in these panels will guide participants in the implementation process of their Sector Consortia projects.

The end result will be a neutral virtual business model for international collaboration that brings the best solutions to the boardroom so that well-informed decisions on new program starts, whether it be research, test and evaluation, or introduction of new products to the end user can be made quickly and confidently.

Panel Session P01: Unmanned Space Needs

Monday - March 2
1045-1200

Invited speakers will discuss technological capabilities required for enabling the next generation of unmanned spacecraft for earth orbiting and planetary missions. Speakers are encouraged to make the link between the challenges faced by future unmanned missions and how the recent developments in MNT-based materials and devices can meet them.

The following questions can be used as a guideline for the discussion of the issues connected to Panel 01:

- What emerging advanced technologies are you and your organization interested in for enabling the next generation of unmanned spacecraft for earth orbiting and planetary missions?
- How do you and your organization propose to integrate these technologies into unmanned spacecraft design?
- How could MNT-based materials and devices potentially meet the needs of future unmanned missions?

Sector Consortia Projects related to Panel P01: Small Satellites, Fly-by-Wireless, Micro-Energetics, Photonics, Harsh Environment Sensors, and Reliability.

CHAIRS:

Louis Friedman, Planetary Society, USA
Bob Meurer, ATK, USA

SPEAKERS:

Al Tadros, Space Systems Loral.

Johan Kohler, European Space Agency (ESA,) The Netherlands
"Microsystem-based small spacecraft initiatives from the European Space Agency"

Linda Herrell, JPL, NASA, USA

James Garvin, NASA Goddard, USA

Panel Session P02: Aeronautics Needs

Monday - March 2
1045-1200

Invited speakers will discuss technological capabilities required for enabling the next generation of civilian and military aircraft. Speakers are encouraged to make the link between the challenges faced by future aircraft development and how MNT-based materials and devices can meet them.

The following questions can be used as a guideline for the discussion of the issues connected to Panel 02:

- What emerging advanced technologies are you and your organization interested in for enabling the next generation of civilian and/or military aircraft?
- How do you and your organization propose to integrate these technologies into the design of civilian and military aircraft?
- How could MNT-based materials and devices potentially meet the needs of future aircraft development?

Sector Consortia Projects related to Panel P02: Structural Vehicle Health Monitoring, Fly-by-Wireless, Materials, Reliability, Harsh Environment Sensors, and Photonics.

CHAIRS:

Keith McIver, Boeing, USA
Jose Martin Manuel Hernandez, European Commission

SPEAKERS:

Sharon Smith, Lockheed Martin, USA
"A look into the needs of tactical aircraft"

Daniel Kovach, Boeing, USA
"Micro nano technology interests at Boeing"

Bruno Foucher, EADS, France
"MNTs in Aerospace as seen by an end user"

Hugo Resende, Embraer, Brazil (TBC)

Panel Session P03: Manned Space Needs

Monday - March 2
1330-1445

Invited speakers will discuss the challenges faced by future manned missions, both Earth orbiting and planetary. Speakers can suggest technological capabilities of MNT-based materials and devices to support manned missions.

- What are some of the key challenges faced by future manned missions, both orbiting and planetary?
- If you are employing MNT-based materials and devices to meet these needs, what are their technological capabilities and how will this help support future manned missions?

Sector Consortia Projects related to Panel P03: Bio-Astronautics, Environmental Monitoring, Materials, Reliability, and Fly-by-Wireless.

CHAIRS:

Chris Moore, NASA Headquarters, USA
Bill Atwell, Boeing, USA

SPEAKERS:

Victor Schneider, NASA, USA
"Space Exploration Medical Care: Autonomous and Semiautonomous Diagnosis and Therapy"

Juergen Drescher, DLR, Germany

Jitendra Joshi, NASA, USA

James Duncan, NASA, USA

Panel Session P04: Defense Needs

Monday - March 2
1330-1445

Invited speakers will discuss the technological capabilities required for enabling the next generation of military space missions. Speakers are encouraged to make the link between the needs of these missions with the capabilities offered by MNT-based materials and devices.

- What emerging advanced technologies are you and your organization interested in for enabling the next generation of military space missions?
- How do you and your organization propose to integrate these technologies to support military space missions?
- How could MNT-based materials and devices potentially meet the needs of these missions?

Sector Consortia Projects related to Panel P04: Small Satellites, Micro-Energetics, Fly-by-Wireless, Harsh Environment Sensors, Materials, Structural Vehicle Health Monitoring, Reliability, Photonics, and Bio-Astronautics.

CHAIRS:

Roberta Ewart, The Aerospace Corporation, USA
Amit Lal, DARPA , USA (TBC)

SPEAKERS:

Peter Wegner, ORS, USA

Rick Williams, National Department of Defense, Canada
"Identifying the Military Need: Micro and Nano Technologies for Space Applications"

Jay Middour, Naval Research Lab (NRL), USA
"A Concept for an International Small Satellite Constellation to Monitor Unattended Ground Sensors"

V.S. Rao, Institute for Nanotech Defense, India (TBC)

Panel Session P05: Lessons Learned from Space

Monday - March 2
1445-1600

Invited speakers will discuss “lessons learned” during the infusion of new technologies into space missions. Each speaker will present the approach taken by his/her organization to have a cost-effective and rapid technology infusion process. Speakers can address potential pitfalls to be avoided by the up and coming MNT-based materials and devices developments.

- What are some of your organization’s “lessons learned” on infusing emerging technologies into space missions?
- What approach did your organization take to have a cost-effective and rapid technology infusion process?
- If applicable, what are some potential pitfalls to be avoided by integrating emerging MNT-based materials and devices in space missions?

Sector Consortia Projects related to Panel P05: Bio-Astronautics, Structural Vehicle Health Monitoring, Environmental Monitoring, Harsh Environment Sensors, and Reliability.

CHAIRS:

Pedro Medelius, KSC, NASA, USA
Johan Kohler, European Space Agency (ESA), The Netherlands

SPEAKERS:

Carl Walz, Orbital Corporation, USA

Scott E. Parazynski, NASA, USA (TBC)

Alexei Korostelev, Roscosmos, Russia (TBC)

Panel Session P06: Lessons Learned from Aeronautics

Monday - March 2
1445-1600

Invited speakers will discuss “lessons learned” during the infusion of new technologies into civilian and military aircraft applications. Each speaker will present the approach taken by his/her organization to have a cost-effective and rapid technology infusion process. Speakers can address potential pitfalls to be avoided by the up-and-coming MNT-based materials and device developments.

- What are some of your organization’s “lessons learned” on infusing emerging technologies into civilian and military aircraft applications?
- What approach did your organization take to have a cost-effective and rapid technology infusion process?
- If applicable, what are some potential pitfalls to be avoided by integrating emerging MNT-based materials and devices in civilian and/or military aircraft applications?

Sector Consortia Projects related to Panel P06: Structural Vehicle Health Monitoring, Materials, Fly-by-Wireless, Reliability, Harsh Environment Sensors, and Photonics.

CHAIRS:

David Morgan, Boeing, USA
Jim Arnold, NASA, USA.

SPEAKERS:

Brian McCabe, Sikorsky, USA
“Spectrum/WAIC initiative”

James Siekkinen, Goodrich, USA
“Synergistic Applications Drive Success in MEMS Products at Goodrich Sensors and Integrated Systems”

George Studor, NASA
“Fly-by-Wireless, Updates and Needs?”

Somen Chowdhury, Bell Helicopter, Canada (TBC)

Panel Session P07: Reliability/ Packaging

Monday - March 2
1630-1745

Reliability is of paramount importance for the aerospace industry. MNT has demonstrated that it has the inherent reliability required for aerospace applications. Invited speakers will discuss reliability issues to be considered during the development of low-maturity MNT-based materials and devices. Each speaker will present the approach taken by his/her organization to address issues related to reliability testing and characterization of new materials and devices to ensure suitability for aerospace applications.

- What are key reliability issues to be considered during the development of low-maturity MNT-based materials and devices?
- What approach did your organization take to address issues related to reliability testing and characterization of emerging MNT-based materials and devices to ensure suitability for aerospace applications?

Sector Consortia Projects related to Panel P07: Reliability, Harsh Environment Sensors, Photonics, Bio-Astronautics, Environmental Monitoring, Micro-Energetics, and Materials.

CHAIRS:

Francis Pressecq, Centre National d'Etudes Spatiales (CNES), France
Rajeshuni Ramesham, NASA Jet Propulsion Laboratory (JPL), USA

SPEAKERS:

Ernest Garcia, Sandia, USA

Bruno Foucher, European Aeronautic Defense and Space Company (EADS), France
"Advancement of the EDA Research Programme Polynoe. Implementation of Physics of Failure for MEMS"

Yeh Jyi-tyan, Industrial Technology Research Institute (ITRI), Taiwan

Dean Wiberg, JPL, NASA, USA

Panel Session P08: Lessons Learned from Defense

Monday - March 2
1630-1745

Invited speakers will discuss “lessons learned” during the infusion of new technologies into defense missions. Each speaker will present the approach taken by his/her organization to have a cost-effective and rapid technology infusion process. Speakers can address potential pitfalls to be avoided by the up and coming MNT-based materials and devices developments.

- What are some of your organization’s “lessons learned” on infusing emerging technologies into defense missions?
- What approach did your organization take to have a cost-effective and rapid technology infusion process?
- If applicable, what are some potential pitfalls to be avoided by integrating emerging MNT-based materials and devices in defense missions?

Sector Consortia Projects related to Panel P08: Small Satellites, Harsh Environment Sensors, Micro-Energetics, Materials, Photonics, and Reliability.

CHAIRS:

Alok Das, AFRL, USA
Oudea Coumar, EADS, France

SPEAKERS:

Colonel Thomas A. “Dingo” Doyne, OSD, USAF

Daniel Jean, NATO, Europe
“Lessons Learned From Defense. NATO Collaborations and Micro-Detonator Based Fuzing”

Roberta Ewart, The Aerospace Corporation, USA

Michel Riffiod, MBDA, France (TBC)

Dennis Polla, DARPA, USA (TBC)

Panel Session P09: Low TRL Materials (Bottom-Up)

Tuesday - March 3
0900-1015

Invited speakers will discuss exciting developments in new MNT-based materials to meet the challenging requirements of next generation aircraft and spacecraft. Materials that have been engineered from the “bottom up” offer exciting new possibilities for these applications. Each speaker will present recent advances in his/her organization within the context of worldwide developments in MNT-based materials, to a proof-of-principle level of maturity. Potential aerospace application areas for the specific MNT-based materials will be discussed and speakers will speculate on the path and timeframe for future system-level development.

- There are many emerging Micro and Nanotechnology-based materials engineered from the “bottom-up” that offer exciting new possibilities to enable the next generation of aircraft and spacecraft. What are the most recent advances in composite materials that you and your organization have been working on, within the context of worldwide developments? What are their capabilities?
- What are the potential aerospace application areas for these materials, and what benefit will this have? Please speculate on the path and time frame for future system-level development.

Sector Consortia Projects related to Panel P09: Materials and Micro-Energetics.

CHAIRS:

Enrique Barrera, Rice University, USA
Federico Micciulla, INFN, Italy

SPEAKERS:

Joseph Schwab, Highbrid Plastics Inc.
“Use of the Poss1 Nanostructured Chemical Platform for Performance Enhanced Materials”

Mairead Stackpoole, NASA Ames, USA

Mathias Brust, University of Liverpool, UK

Nobby Kobayashi, UC Santa Cruz, USA

Panel Session P10: Low TRL Devices (Sensors and Instrumentation)

Tuesday - March 3
0900-1015

Invited speakers will discuss exciting developments in new MNT-based electronic sensors and instrumentation for aerospace applications, to a proof-of-principle level of maturity. Each speaker will present recent advances in his/her organization within the context of worldwide developments in MNT-based devices. Potential aerospace application areas for the specific MNT-based devices will be discussed and speakers will speculate on the path and timeframe for future system-level development.

- What emerging advanced developments in new MNT-based electronic sensors and instrumentation for aerospace applications are you and your organisation?
- What advances have taken place in your organisation organisation in the context of worldwide developments in MNT based devices?
- What is the path and time frame for future system based development?

Sector Consortia Projects related to Panel P10: Harsh Environment Sensors, Bio-Astronautics, Environmental Monitoring, and Micro-Energetics.

CHAIRS:

Jih-Fen Lei, NASA Glenn Research Center (GRC), USA
Carles Ferrer, CNM-IMB, Spain

SPEAKERS:

Chih-Ming Ho, UCLA, USA

Connie Chang, Berkeley University, USA
"High Contrast Grating Photonics"

Bertrand Rue, Université de Catholique Louvain, Belgium
"Low power circuits and microsystems for MEMS co-integrated interfaces, temperature sensing and power management applications"

Newton Frateschi, UNICAMP, Brazil
"Quantum well and quantum dot microcavity resonators fabricated by focused ion beam"

Panel Session P11: Low TRL Materials (Top-Down)

Tuesday - March 3
1045-1200

Invited speakers will discuss exciting developments in new “top down” MNT-based materials for aerospace applications. Each speaker will present recent advances in his/her organization within the context of worldwide developments in MNT-based materials, to a proof-of-principle level of maturity. Potential aerospace application areas for the specific MNT-based materials will be discussed and speakers will speculate on the path and timeframe for future system-level development.

- What exciting developments in new “top down” MNT-based materials for aerospace application have emerged in the context of worldwide development?
- Has your organisation played a part in these developments? If so, what part did it play?
- What are potential aerospace application areas for the specific MNT-based materials, and what is the time frame and path for future system level development?

Sector Consortia Projects related to Panel P11: Materials and Micro-Energetics.

CHAIRS:

Deepak Srivastava, NASA Ames, USA
Sylvia Johnson, NASA Ames, USA

SPEAKERS:

Ali Shakuri, UC Santa Cruz, USA

Emilie Siochi, NASA Langley Research Center (LaRC), USA

Federico Micciulla, Isituto Nazionale di Fisica Nucleare (INFN), Italy

Wei Jun, Singapore Institute of Manufacturing Technology

Panel Session P12: Low TRL Devices (Photonics)

Tuesday - March 3
1045-1200

Invited speakers will discuss exciting developments in new MNT-based optoelectronic devices for aerospace applications, to a proof-of-principle level of maturity. Each speaker will present recent advances in his/her organization within the context of worldwide developments in MNT-based devices. Potential aerospace application areas for the specific MNT-based devices will be discussed and the speakers will speculate on the path and timeframe for future system-level development.

- What new developments (to a proof of principle level of maturity) in new MNT-based optoelectronic devices for aerospace applications have emerged?
- What part has your organisation played in these new developments?
- What are potential aerospace application areas for the specific MNT-based materials, and what is the time frame and path for future system level development?

Sector Consortia Projects related to Panel P12: Photonics and Harsh Environment Sensors.

CHAIRS:

Sylvain Charbonneau, National Research Center - Insitute for Micro-Structural Sciences (NRC-IMS), Canada
Glenn Unger, NASA Goddard Space Flight Center (GSFC), USA

SPEAKERS:

Stan Williams, Hewlett-Packard (HP), USA
"The Memristor - the fourth fundamental passive device, Photonic interconnect from the micron to the meter scale, and Quantum information devices"

Cun-Zheng Ning, Arizona University, USA

Harish Manohara, Jet Propulsion Laboratory, NASA, USA (TBC)

Francis Tay, Institute of Bioengineering and Nanotechnology (IBN), Singapore
"Polymeric piezoelectric materials and devices applications"

Paul Rudy, Mondulight, USA

Panel Session P13: Mid TRL Materials

Tuesday - March 3
1445-1600

Invited speakers will discuss “mid-maturity” issues facing materials development for aerospace applications. Each speaker will present the approach taken by his/her organization to address issues related to validation of new materials technology initially within the laboratory and ultimately within the relevant aerospace environment. Data and experience related to system/sub-system level demonstrations in an aerospace environment will be discussed.

- What “mid-maturity” issues are facing materials development for aerospace applications?
- What approach has your organisation taken to address the issues related to the validation of new materials technology within the laboratory and within the relevant aerospace environment?
- Discuss data and experience related to system/sub-system level demonstrations in an aerospace environment.

Sector Consortia Projects related to Panel P13: Materials, Structural Vehicle Health Monitoring, and Small Satellites.

CHAIRS:

Linruo Zhao, National Research Council - Institute for Aerospace Research (NRC-IAR), Canada
Charles Smith, NASA Ames, USA

SPEAKERS:

Michael Meador, NASA Glenn Research Center (GRC), USA
“Enhancing the Properties of Aerospace Materials through Nanotechnology”

Mohan Aggarwal, AAMA, USA
“Development of Triboluminescent Materials for Space Applications”

Carlos Cabrera, University of Puerto Rico
“Advanced Nanoscale Materials for Aerospace Applications”

Jacques Lyrette, Innovative Materials, Canada.

Panel Session P14: Mid TRL Sub-Systems

Tuesday - March 3
1445-1600

Invited speakers will summarize “mid-maturity” issues facing aerospace sub-system development. Each speaker will present the approach taken by his/her organization to address issues related to validation of sub-systems based on new technologies, initially within the laboratory, and ultimately within the relevant aerospace environment. Data and experience related to system/sub-system level demonstrations in an aerospace environment will be discussed.

- What “mid-maturity” issues are facing materials development for aerospace applications?
- What approach has your organisation taken to address the issues related to the validation of new materials technology within the laboratory and within the relevant aerospace environment?
- Discuss data and experience related to system/sub-system level demonstrations in an aerospace environment.

Sector Consortia Projects related to Panel P14: Small Satellites, Fly-by-Wireless, Harsh Environment Sensors, Photonics, Environmental Monitoring, and Reliability.

CHAIRS:

Jim Miller, NASA Marshall Space Flight Center (MSFC), USA
Francesco Svelto, Agenzia Spaziale Italiana (ASI), Italy

SPEAKERS:

James Lyke, Air Force Research Laboratory (AFRL), USA (TBC)

Fredrik Bruhn, Angstrom Aerospace Corporation (AAC), Sweden
“Two spaceflights in 2009 validating state-of-the-art MEMS on system and subsystem level”

Chang Guey-Shin, NSPO, Taiwan
“Development of a MEMS-Based Micro-Thruster in Taiwan”

Mahadevan Krishnan, Alameda Applied Sciences Corporation, USA

Guillermo Albaladejo, INTA, Spain

Panel Session P15: High TRL Materials

Tuesday - March 3
1630-1745

Invited speakers will discuss “high-maturity” issues facing materials development for aerospace applications. Each speaker will present the approach taken by his/her organization to address issues related to the initial system prototype demonstrations, followed by “flight qualification” through test and demonstration in a relevant ground or space environment. Data and experience related to “flight-proving” new materials through successful mission operations will be discussed.

- What “high-maturity” issues are facing materials development for aerospace applications?
- What approach has your organisation taken to address the issues related to the initial system prototype demonstrations through to a”flight qualification” in a relevant ground or space environment?
- Discuss data and experience related to “flight-proving” new materials through successful mission operations.

Sector Consortia Projects related to Panel P15: Materials, Structural Vehicle Health Monitoring, and Reliability.

CHAIRS:

Peter Lillehei, NASA, USA
Matt Gasch, NASA, USA

SPEAKERS:

Steve Winzer, Lockheed Martin, USA
“High TRL Materials”

Raj Venkatpathy, NASA, USA

Alan Cassel, University of California, Santa Cruz, USA

Anthony Calomino, NASA, USA

Panel Session P16: High TRL Systems

Tuesday - March 3
1630-1745

Invited speakers will discuss “high-maturity” issues facing system development for aerospace applications. Each speaker will present the approach taken by his/her organization to address issues related to the initial system prototype demonstrations, followed by “flight qualification” through test and demonstration in a relevant ground or space environment. Data and experience related to “flight-proving” new technological systems, through successful mission operations, will be discussed.

- What “high maturity” issues are facing materials development for aerospace applications?
- What approach has your organisation taken to address the issues related to the initial system prototype demonstrations through to a “flight qualification” in a relevant ground or space environment?
- Discuss data and experience related to “flight-proving” new technological systems, new materials through successful mission operations.

Sector Consortia Projects related to Panel P16: Small Satellites, Fly-by-Wireless, Structural Vehicle Health Monitoring, and Reliability.

CHAIRS:

Marco Villa, SpaceX, USA
Claude Drevon, Thales Alenia Space, France

SPEAKERS:

Hannah Goldberg, NASA Jet Propulsion Laboratory (JPL), USA

Max Vozoff, SpaceX, USA
“SpaceX DragonLab: Fast-track to Flight Heritage”

Ian McKenzie, European Space Agency (ESA), The Netherlands

Anthony Lai, Aitech, USA.
“High TRL Radiation Tolerant Computing Systems”

Panel Session P17: Low-High TRL Governmental Investment

Thursday - March 5
1330-1445

Investment provides the life-blood for initiating, maturing and implementing new MNT-based systems. Invited speakers will discuss the priorities of government program managers in developing and funding new MNT programs, as well as high maturity materials and systems, leading to procurement actions. Speakers will describe the selection criteria, metrics used for assessing progress, program duration, and strategies for infusing these technologies into aerospace applications.

- What priorities do government program managers have when developing and funding new MNT programs, high-maturity materials and systems?
- What selection criteria and metrics are used when assessing progress, program duration, and strategies for infusing these technologies into aerospace applications?

All Sector Consortia Projects relate to Panel P17.

CHAIRS:

Hon. Marc Lepage, Consul General, Foreign Affairs and International Trade Corporation, Canada
Jenny Servo, Dawnbreaker, USA

SPEAKERS:

Jeff Bingham, US Senate Committee on Spacestaff, USA

Gary Martin, NASA Ames Research Center (ARC), USA

Johan Kohler, ESA, The Netherlands

Panel Session P18: Low TRL International Collaboration

Thursday - March 5
1330-1445

Invited speakers will summarize international collaborations, bringing together complementary core competencies from across organizations from many countries, in developing new MNT concepts to a proof-of-principle level of maturity. Speakers will describe the issues to be considered in protecting intellectual property rights, moving material, data and products across nations. Both successful and failed collaborations will be examined to review the respective root causes of success or failure.

- What international collaborations (bringing together complementary core competencies from across organizations from many countries) have taken place in developing new MNT concepts to a proof-of-principle level of maturity?
- What issues are to be considered in protecting intellectual property rights, moving material, data and products across nation?
- In order to review the respective root causes of success or failure, can these issues be examined in the context of both successful and failed collaborations?

All Sector Consortia Projects relate to Panel P18.

CHAIRS:

Clayton Teague, NNI, USA
Peter Eggleton, Telligence Group, Canada

SPEAKERS:

Jose M Martin Hernandez, European Commission

Rafaella Borzi, IMEC, Belgium

Elias Carayannis, George Washington University, USA

Keith Cowing, NASA Watch

Panel Session P19: Low-High TRL Private Investment

Thursday - March 5
1445-1600

Private investors and program managers will discuss the priorities of private fund managers in the selection and funding of early stage MNT business plans, as well as late stage (high-maturity) technology business plans. Invited speakers will describe the selection criteria, metrics used for assessing progress, typical funding cycle duration, and exit strategy for investment.

- What are the priorities of private fund managers in the selection and funding of early stage MNT business plans, as well as when funding late stage technology business plans?
- Please describe the selection criteria, metrics used for assessing progress, typical funding cycle duration, and exit strategy for investment.

All Sector Consortia Projects relate to Panel P19.

CHAIRS:

David Oppenheimer, Ramp Equity, USA
Paul Coleman, Girvan Institute of Technology, USA

SPEAKERS:

Gary Webb, Commercial Space Tech, UK

Kuni Takahashi, Near Earth, USA

Steve Maebius, Foley and Lardner, USA

Michael Kelly, VC, USA

Panel Session P20: Mid/High TRL International Collaboration

Thursday - March 5
1445-1600

Invited speakers will summarize international collaborations, bringing together complementary core competencies from across organizations from many countries, in developing high-maturity materials and systems for aerospace applications. Speakers will describe the issues to be considered in protecting intellectual property rights, moving material, data and products across nations. Both successful and failed collaborations will be examined to review the respective root causes of success or failure.

- What international collaborations (bringing together complementary core competencies from across organizations from many countries) have taken place in developing new MNT concepts to a proof-of-principle level of maturity?
- What issues are to be considered in protecting intellectual property rights, moving material, data and products across the nation?
- In order to review the respective root causes of success or failure, can these issues be examined in the context of both successful and failed collaborations?

CHAIRS:

Benjamin Neumann,Director, Advanced Capabilities Division, NASA, USA
Eike Kircher, European Space Agency, The Netherlands.

SPEAKERS:

Bretton Alexander, Personal Spaceflight Federation, USA (TBC)

Owen Browne, DARPA, USA

Daniel Ludwig, Galileo Consortium, Europe

Chris Deacon, Co-operative Research Centre for Satellite Systems, Australia (TBC)

Panel Session P21: CEO/CTO Panel

Thursday - March 5
1630-1745

The discussions and findings of CANEUS 2009, are aimed at stimulating adoption of the CANEUS International Collaboration Virtual Technology Powerhouse (CICVTP) to reduce risk and cost of new aerospace projects. By assembling the worldwide Best of Breed in MNT/aerospace technology, in systems integration, and in corporate (Industry, Small Business, and Government) decision-making, CANEUS demonstrates a means to influence the policy and direction of the aerospace industry worldwide. With weakening economic trends, new world leadership, and the increasing influence of the younger creative generation, the time is perfect for readying industries and laboratories worldwide to combine talent to drastically influence the future. CANEUS provides a unique neutral Forum to exchange technology and market trends outside day-to-day competition. CANEUS is creating a Virtual Powerhouse able to react quickly to provide a critical mass on any given issue. The speakers will address the application of CANEUS in their respective businesses.

MEMBERS:

Bob Richards Founder, Odyssey Moon

Debra Lepore President, AirLaunch LLC

Peter Wilhelm, Director of the Naval Center for Space Technology, US Navy

Michel Fiat, CEO Thales Alenia Space

Jeff Bingham, US Senate Sub-Committee on Space Aeronautics & Related

Alexis Livanos, CEO Northrop Grumman

Sector Consortia Workshop Sessions

Wednesday (March 4) to Friday (March 6)

The topics covered in the panel sessions will feed into the third part of these workshops: participants will apply the knowledge acquired during the panels towards formulating and implementing Sector Consortia roadmaps and projects. Finally, as a measure of success of the event, each Sector Consortium will present the findings and outcome from the previous five days of workshops.

Sector Consortia Workshops Tutorial and Sector Consortia Leaders Panel

March 3 - Wednesday
0900-1015

This plenary session aims to guide workshop participants in understanding the CANEUS process for formulating missions, goals, roadmaps, and projects for the Sector Consortia, as well as the ROI and the business justification for each project. In this session, Sector Consortia leaders will give a brief overview of the current status of their consortium.

SECTOR CONSORTIA SESSION GUIDELINES

Each Sector Consortia has two sessions: 1) Mission Goals & Roadmap, and 2) Project Development and Framework. Each session is 75 minutes in length (please reconfirm exact times by referring to the Workshop Schedule), and has one chair, 3-10 panellists, and a few presenters.

Panellist scheduled for the Roadmap sessions of the Sector Consortium will participate in two sessions:

1. **Mission Goals & Roadmap**
   Objective of session: The goal is for participants to create and/or formalize the mission, goals, and roadmap for CANEUS Sector Consortium for the next three years. Participants will specify the scope of work and the vision of both the short and long-term activities of the Consortium. The chair of the session will provide a brief overview of the Consortium's past activities and achievements.
2. **Roadmap Refinement**
   Objective of session: Participants in this session will specify tasks and assign responsibilities with timelines to execute the Roadmap.

The role of panellists in both of these sessions is to lend their expertise and experience in visualizing the future of the industry, providing their perspective on what the goals and roadmap should look like, and identifying the milestones needed to implement the roadmap.

Panellist scheduled for the Project sessions of the Sector Consortium will participate in two sessions:

1. **Project Development & Framework**
   Objective of session: Two to three invited participants will present a project currently being undertaken within their organization. A general project plan coherent with the roadmap outlined in the previous Roadmap session will be drafted (6 months, 1 year, 2 years). Participants will address business development issues, such as NDA, IP, and government regulations.

2. **Project Refinement**
   Objective of session: Participants will refine the projects previously reviewed: participants will outline teaming and funding schemes, plan project oversight and execution, and establish milestones from which to gauge success of the project.

The role of panellists in both of these sessions is to lend their expertise and experience and evaluate the projects presented, and provide comments as to their improvement, feasibility, etc.

Small Satellites

Small Satellites Sector Consortia – Mission, Goals, and Roadmap

Wednesday - March 3, 1045-1225

The goal of these breakout sessions is to create and formalize the Roadmap of each of the Sector Consortia. The roadmaps will include each Sector Consortium's goals and missions, in addition to its scope of work and the vision of both its short- and long-term activities. An overview of each Consortium's past activities and achievements will precede discussion.

Small Satellites Sector Consortia – Project Development and Framework

Wednesday - March 3

Standards Development

1330-1445

The Standards Development initiative aims to provide a platform for developing satellite subsystems standards to ensure interoperability among international partners. This will result in small satellites that are cheaper to develop with a shortened development time to launch.

Launch Services

1330-1445

The Launch Services initiative is mandated to establish a set of specifications consistent with a variety of launch systems and to ensure the compatibility of secondary payloads with these specifications. The initiative aims to provide secondary satellite developers with a current list of candidate launches detailing carrier type, carrying capacity, and key contact information.

Educational Outreach and Strategic Development

1330-1445

The Educational Outreach and Strategic Development initiative is chartered to compile the necessary critical processes, procedures, and needs documents from the community of SSSC stakeholders. These will ultimately be of value to all stakeholders who aim to benefit from a streamlined international collaboration.
The Education/Outreach establishes a global academic network, develop an offer short courses that support aerospace applications, global web portals with academic capabilities, and a global student web portal.

Intellectual Property and Export Control

1330-1445

The Intellectual Property and Export Control initiative aims to establish a clear process for defending intellectual property rights and a streamlined process for members of the CANEUS SSSC to resolve export control issues. The goal of the initiative is primarily a clear process outcome. The outcome for intellectual property will be a guideline for how smaller companies can address intellectual property concerns while engaging with larger firms or government agencies.

	Standards	Launch	Edu./Outreach	IP and Export
Chair	**John Hines** NASA Ames	**Jake Szatkowski** United Launch Alliance Al Tadros Space Systems/Loral	**William Edmonson** University of North Carolina **Andrew Quintero** Aerospace Corporation	**George Grammas** Squire Sanders and Dempsey **George Grammas** Squire Sanders and Dempsey **Bob Pugh** AFRL
Panellists/ Participants	**Francesco Svelto** ASI **Craig Day** AIAA **Johan Kohler** ESA **Adarsh Deepak** STC **Todd Mosher** Microsat Systems (TBC) **Chad Fish** **Space** Dynamics Lab **James Lyke** AFRL **Linda Herrell** NASA JPL **Wanping Zheng** CSA **Michael Enoch** LMCO, USA **Donald Knight** General Dynamics **Jordi Puig-Suari** CalPoly **Hannah Goldberg** JPL-NASA **Leon Alkalai** NASA JPL **Marcello Romano** NPS	**Stuart Waterman** Alliance Space Systems **Max Vozoff** SpaceX **Gary Rodriguez** sysRAND **David Zimcik** NRC-IAR **Bob McCoy** ORS **Steve M. Francois** NASA KSC (TBC) **Dino Laurenzini** SpaceQuest **Marco Villa** SpaceX **Jean-Marie Muylaert** ESA (TBC) **Jason Armstrong** TriSept Corp **Bruce Yost** NASA Ames **Debra Lepore** Airlaunch **John Garvey** Garvey Spacecraft **Amanda Mitskevich** NASA KSC (TBC) Gerry Murphy Design Net Engineering	**Bob Meurer** ATK Space **Henry Helvajian** Aerospace Corporation **Jenny Servo** Dawnbreaker **Rick Earles** CANEUS USA **Jacques Lyrette** CANEUS **Roland Coelho** CalPoly **John Davey** BNSC (TBC) **Carles Ferrer** CNM-IMB **Norman Fitz-Coy** University of Florida Bob Twigs Stanford University Robert Weigel George Manson University	**Representative from Pentagon** **Bob Pugh** AFRL **Jay Middour** NRL **Adam Baker** SSTL (TBC) **Donna Avila** Aerospace Corp **Raj Shea** NASA Ames
Presenters	**Fred Slane** Space Infrastructure **Peter Mendham** STAR-Dundee	**Gil Moore** Project POPACS & STARSHINE **Jake Szatkowski** United Launch	**Bob Twiggs** Stanford University	**Raj Shea** NASA Ames **George Grammas** Squire Sanders and Dempsey **Bob Pugh** AFRL

Small Satellites – Roadmap Refinement: Tasks, Responsibilities, and Timeframe

Friday - March 6

These breakout sessions aim to refine the Roadmaps previously laid out. Participants in each Sector Consortium will specify tasks and assign responsibilities with timelines to execute the Roadmap.

Standards Development - 0900-1015
Launch Services - 0900-1015
Stakeholder Liaison and Strategic Development - 0900-1015
Intellectual Property and Export Control - 0900-1015

	Standards	Launch	Stakeholder	IP and Export
Chair	**John Hines** NASA Ames	**Jake Szatkowski** United Launch Alliance Al Tadros Space Systems/Loral	**William Edmonson** University of North Carolina **Andrew Quintero** Aerospace Corporation	**George Grammas** Squire Sanders and Dempsey
Panellists/ Participants	**James Slavin** NASA GSFC (TBC) **Peter Mendham** STAR-Dundee **Chad Fish** Space Dynamics Lab **Dino Laurenzini** SpaceQuest **Eric Bobinsky** Terasphere **Jim Lyke** AFRL **Siegfried Janson** Aerospace Corporation **Rick Groom** Aerospace Corporation **Wanping Zheng** CSA	**Stuart Waterman** Alliance Space Systems **Johan Kohler** ESA **David Zimcik** NRC-IAR **Bob McCoy** ORS **Marco Villa** SpaceX **Max Vozoff** SpaceX **Gary Rodriguez** sysRAND **Bill Wrobel** NASA SMD (TBC) Johan Kohler ESA	**Bob Meurer** ATK Space **Bob Meurer** ATK Space **Jenny Servo** Dawnbreaker **Bob Twiggs** Stanford University **Carles Ferrer** CNM-IMB **Roland Coelho** CalPoly **Jacques Lyrette** CANEUS	**Raj Shea** NASA Ames **Bob Pugh** AFRL **Jay Middour** NRL **Peng Zong** Nanjing University

Small Satellites – Project Refinement: Tasks, Responsibilities, and Timeframe

Friday - March 6, 1045-1200

These breakout sessions aim to refine the well-defined projects previously reviewed: participants will outline teaming and funding schemes, plan project oversight and execution, and establish milestones from which to gauge success of the project.

Small Satellites: Chairs, Panellists, and Speakers for Project Refinement are the same as the Roadmap Re-

finement Sector.

Devices – Mission, Goals, and Roadmap

Wednesday - March 4, 1045-1200

The goal of these breakout sessions is to create and formalize the Roadmap of each of the Sector Consortia. The roadmaps will include each Sector Consortium's goals and missions, in addition to its scope of work and the vision of both its short- and long-term activities. An overview of each Consortium's past activities and achievements will precede discussion.

Devices – Project Development and Framework

Wednesday - March 4

This sub-discipline is mandated to address the key challenge of Harsh Environment Sensors, especially for low volume and high reliability applications in various fields. End-users of the aircraft, spacecraft, and defense industries join technology developers from Europe, Canada, USA, Brazil, and other countries to pool their resources and create a collaborative environment. The focus is on high-risk, high-cost aerospace Harsh Environment Sensors Initiatives.

Harsh Environment Sensors

1330-1445

Photonics

1330-1445

Fiber-optic communications offer a low power, high-bandwidth solution that is robust against electrical interference effects, and is subject to graceful degradation rather than catastrophic failure that electrical systems are often prone to during in-space operations. This initiative proposes to design, fabricate, assemble and test an integrated, fiber-optic, inter-subsystem communications system that will be ultimately be demonstrated in space via a near-term launch opportunity.

Bio-Astra

1330-1445

The Bio-Astra sub-discipline aims to explore the feasibility of developing MNT-based devices and instruments for bio-astronautics applications. While spin-off applications for these technologies are possible for terrestrial applications, the group adopts a project-based business model, with a 3-year development period to demonstrate system-level prototypes. A promising MNT-based product selected for development is a sensor-on-chip (SOC) with novel properties for specific bio-astronautic needs.

Environmental Monitoring

1330-1445

	HE Sensors	Photonics	Bio-Astra	Envi. Monitoring
Co-Chairs	**Jan Suski, Memsfield** France **Nico de Rooij** University of Neuchatel	**Iain McKenzie** ESA **Glenn Unger** NASA	**Sumitra Rajagopalan** **Chih-Ming Ho** UCLA	**Meyya Meyyappan** NASA Ames **Harry Partridge** NASA Ames
Panellists/ Participants	**Harish Manohara** JPL-NASA **Jih-Fen Lei** NASA GRC **Tay Eng Hock** NUS **Newton C. Frateschi** State University of Campinas	**Alan Scott** Comdev **Dean V. Wiberg** NASA-JPL **Lun Cheng** TNO **Martin Seifert** Nufern **Raj Gupta** CEO, TeraHz **Caterina Ciminelli** Politecnico di Bari **Connie Chang-Hasnain** University of California **Cun-Zheng Ning** Arizona State University **Paul Rudy** Modulight **Carles Ferrer** CNm Spain	**Juergen Drescher** DLR **Francis Tay** Institute of Bioengineering and Nanotechnology (IBN) **Chih-Ming Ho** UCLA	
Presenters	**Bertrand Rue** UCL, Belgium	**Stan Williams** HP, USA **Wiliam Tang** University of California	**Sumitra Rajagopalan**	**Jing-Li** NASA Ames

Devices – Roadmap Refinement: Tasks, Responsibilities, and Timeframe

Friday - March 6

These breakout sessions aim to refine the Roadmaps previously laid out. Participants in each Sector Consortium will specify tasks and assign responsibilities with timelines to execute the Roadmap

Harsh Environment Sensors - 0900-1045
Photonics - 0900-1045
Bio-Astra - 0900-1045
Environmental Monitoring - 0900-1045

Devices – Project Refinement: Tasks, Responsibilities, and Timeframe

Friday - March 6, 1045-1200

These breakout sessions aim to refine the well-defined projects previously reviewed: participants will outline teaming and funding schemes, plan project oversight and execution, and establish milestones from which to gauge success of the project.

Devices: Chairs, Panellists, and Speakers for Project Refinement are the same as the Roadmap Refinement Sector.

Fly-By-Wireless

Fly-By-Wireless – Mission, Goals, and Roadmap

Wednesday - March 4, 1445-1600

The goal of these breakout sessions is to create and formalize the Roadmap of each of the Sector Consortia. The roadmaps will include each Sector Consortium's goals and missions, in addition to its scope of work and the vision of both its short- and long-term activities. An overview of each Consortium's past activities and achievements will precede discussion.

The CANEUS Fly-by-Wireless Sector Consortium is chartered to precipitate cooperation and partnerships between industry/government customers, system innovators, and technology developers, while exchanging public and published information on wireless alternatives and new innovations, such as no-power sensor-tag systems. Ultimately, the Consortium's efforts will contribute to minimizing cables and connectors across the aerospace industry by providing reliable, lower cost, and higher performance alternatives for a vehicle's or program's life cycle.

	Sensor DAQ Miniaturization	
Chair	**Rodger Magness** Aerospace-Wireless, USA	
Leader-SHVM	**Robab Safa-Bakhsh** SVHM, Boeing, USA	
Panellists/ Participants	**David Russel** NRC-IAR	**Clément Fortin** École Polytechnique, Canada
	Ali Abedi University of Maine	**Sharon Smith** LMCO, USA
	Wanping Zheng CSA	**David Morgan** Boeing, USA
	Brian McCabe Sikorsky Aircraft	**Bruce Donham** Boeing, USA
	Marc Lienard L-3 Communications	**Bruce Swanson** Invoncon Inc.
	Gary Palfreyman Gulfstream (TBC)	**Don Malocha** University of Florida
	Jim Castellano Industry Canada, Co-Leader of SVHM Initiative	**Craig Weich** Visible Assets
	Ion Stiharu Concordia University, Canada (TBC)	

Fly-By-Wireless – Project Development and Framework

Wednesday - March 4, 1630-1745

The goal of these breakout sessions is to define projects and project concepts. A general project plan coherent with the roadmap outlined in the previous session will be drafted (6 months, 1 year, 2 years). Participants will address business development issues, such as NDA, IP, and government regulations.

	Sensor DAQ Miniaturization	Passive Wireless Sensor Tag	Less-Wire / Architectures	SHVM
Chair	**David Russel** NRC	**Ali Abedi** University of Maine	**Brian McCabe** Sikorsky Aircraft	**Robab Safa-Bakhsh** Boeing **Jim Castellano** Industry Canada
Panellists/ Participants	**Ion Stiharu** CRIAQ, Canada (TBC) **Peng Zong** Nanjing University **Clément Fortin** École Polytechnique, Montreal **Bruce Donham** Boeing **Bruce Swanson** Invoncon Inc.	**Cy Wilson** NASA LaRC **Carles Ferrer** CNM, Spain **Serdar Sezen** University of Minnesota **Don Malocha** University of Florida	**Marc Lienard** L-3 Communications **Gary Palfreyman** Gulfstream (TBC) **Craig Weich** Visible Assets	**Sharon Smith** LMCO **Bruno Foucher** EADS **David Morgan** Boeing, USA

Fly-By-Wireless – Roadmap Refinement

Friday - March 6, 0900-1015

These breakout sessions aim to refine the Roadmaps previously laid out. Participants in each Sector Consortium will specify tasks and assign responsibilities with timelines to execute the Roadmap.

Fly-By-Wireless – Project Refinement

Friday - March 6, 1045-1200

These breakout sessions aim to refine the well-defined projects previously reviewed: participants will outline teaming and funding schemes, plan project oversight and execution, and establish milestones from which to gauge success of the project.

Materials

Materials – Mission, Goals, and Roadmap

Wednesday - March 4

The goal of these breakout sessions is to create and formalize the Roadmap of each of the Sector Consortia. The roadmaps will include each Sector Consortium's goals and missions, in addition to its scope of work and the vision of both its short- and long-term activities. An overview of each Consortium's past activities and achievements will precede discussion.

This mission of this consortium is:

- Identify the main technological roadblock (or gaps) and possible solutions to overcome them
- Build demonstrator prototypes of integrated devices using the multifunctional (meta)material of choice
- Suggest a metric to measure the real technological and economic impact of the novel materials proposed Identify and design multifunctional materials and materials systems (heterostructures, composites, metamaterials), especially micro- and nanostructured ones, which will lead to miniaturization of various devices by combining various functionalities, while at the same designed to withstand the harsh high altitude & outer space environments

The visions and objectives of the Materials Consortium are as follows:

- Plays a pivotal role among the CANEUS consortia in that it will support and provide advanced materials solutions for various areas such as micro-and nano-satellites, structural health monitoring, fly-by-wireless, bioastronautics and energetics (including micropropulsion)
- Will focus on high-risk, high-reward materials development with a special emphasis on smart, multifunctional materials and structures for the aerospace sector.
- Will bring together materials scientists spanning a range of disciplines and will be conducted in close collaboration with end-users in the aerospace sector.
- Will co-ordinate the materials R&D in a rigorous and structured framework with clear objectives, milestones and a timeframe, in response to the needs of the end-user.
- Will, through CANEUS, seek adequate funding for each of these projects, given the high cost associated with the design and manufacture of materials at the micro- and nano-scale.
- In addition to developing new materials, create, as research progresses, an expert database containing structure-property relationships of micro and nanostructured materials, as well as who and where to find the related expertise. [The Material Sector Consortium expert database of identified functional materials

and related technical and scientific expertise will be part of a larger relational database fed by each Sector Consortium]

- Help develop an academic concentration in aerospace/MNT materials within an existing materials science degree program at INRS. This program one piloted and tested at INRS can be extended to other institutions.
- Offer an aerospace materials program as part of the summer school offering at the International Space University.
- Create a co-op study program for students in materials science to pursue internships at participating space agencies and aerospace companies.
- Create alliances with other key aerospace organizations such as CRIAQ (CREER) to gain visibility and reach out to end-users.

	Microenergetics	
Chair	**Alain Pignolet** INRS, CANADA - Materials **Eugene Zakar** US Army – Microenergies	**Lars Stenmark** Uppsala University, Sweden – Micro-Hydrogen Storage
Panellists/ Participants	**Chuck Smith** NASA Ames, USA **Les Lee** AFOSR, USA **Karla Strong** AFRL (TBC) **Max Lake** APSCI **Osman Levent Eryilmaz** Argonne National Laboratory **Ozden Ochoa** ASC **Katie Weihong Zhong** University of Washington and Boeing **Suraj Rawal** LMCO **Mia Siochi** NASA **Jim Arnold** NASA Ames **Michael Meador** NASA Glenn **Amish Desai** Tanner Research **Demetris Lagoudas** Texas University **Sylvia Johnson** NASA Ames **Abdel Abusafieh** Cytec, USA **Wei Jun** SIMTech, Singapore	**Robert Plana** LAAS, France **Mohan Aggarwal** Alabama A&M University **Deepak Srivastava** NASA Ames **Carlos R. Cabrera** University of Puerto Rico at Río Piedras **Jacques Lyrette** Innovative Materials **Ali Shakuri** UC Santa Cruz **Federico Micculla** Uni. Roma La Sapienza **Stefano Bellucci** Isituto Nazionale di Fisica Nucleare **Linruo Zhao** IAR-NRC **Peter Lillehei** NASA Langley **Matt Gasch** NASA Ames **Steve Winzer** Lockheed Martin **Raj Venkatpathy** NASA Ames **Alan Cassel** NASA Ames **Anthony Calomino** NASA Ames
Presenters	**Alain Pignolet** INRS, CANADA **Eugene Zakar** US Army	**Lars Stenmark** Uppsala University, Sweden

Microenergetics - 1630-1745

Materials – Roadmap Refinement

Friday - March 6, 0900-1015

These breakout sessions aim to refine the Roadmaps previously laid out. Participants in each Sector Consortium will specify tasks and assign responsibilities with timelines to execute the Roadmap

Materials – Project Refinement

Friday, March 6 | 1045-1200

These breakout sessions aim to refine the well-defined projects previously reviewed: participants will outline teaming and funding schemes, plan project oversight and execution, and establish milestones from which to gauge success of the project.

Reliability

Reliability – Project Development and Framework

Thursday - March 5, 1045-1200

The goal of these breakout sessions is to define projects and project concepts. A general project plan coherent with the roadmap outlined in the previous session will be drafted (6 months, 1 year, 2 years). Participants will address business development issues, such as NDA, IP, and government regulations.

The CANEUS International Reliability Sector Consortium is the steward of the aerospace industry's strategic and technology roadmap for reliability technologies. It provides an international forum for the advancement of reliability issues and technical solutions. It is open to participation from the global aerospace industry. Membership in the Consortium includes all the primary industry stakeholders.

The Consortium also acts as the broker for licensing intellectual property jointly developed by its collaborative consortia. System integration efforts focus on the development of the appropriate supply chain organizations. The Consortium is the premier advocacy group addressing regulations and the development of standards and certification requirements for RF and other MEMS devices. It manages an industry portal for members' technologies.

	Microenergetics		
Chair	**Bruno Foucher** EADS Innovation Works		
Radiation Co-Chairs	**Oudea Coumar** EADS	**Bill Atwell** Boeing	
Panellists/ Participants	**Jean-Claude Tual** Astrium	**Raffaella Borzi** IMEC	**Jeffrey DeNatale** Rockwell Scientific
	Bill Atwell Boeing	**Bruno Levrier** IMS Bordeaux	**Sammy Kayali** Sandia
	Francis Pressecq CNES	**Robert Plana** LAAS	**Ernest Garcia** Sandia
	Alan Scott Comdev	**Rajeshuni Ramesham** NASA JPL	**Claude Drevon** Thales Alenia Space
	Wanping Zheng CSA	**Dean Wiberg** NASA JPL	**Wanping Zheng** CSA
	Remi Gaillard EADS	**Alan Johnson** NASA JPL	**Laurent Francis** UCL
	Laurent Marchand ESA		

Reliability –Mission, Goals, and Roadmap

Thursday - March 5, 0900-1015

The goal of these breakout sessions is to create and formalize the Roadmap of each of the Sector Consortia. The roadmaps will include each Sector Consortium's goals and missions, in addition to its scope of work and the vision of both its short- and long-term activities. An overview of each Consortium's past activities and achievements will precede discussion.

Reliability – Roadmap Refinement

Friday - March 6, 0900-1015

These breakout sessions aim to refine the Roadmaps previously laid out. Participants in each Sector Consortium will specify tasks and assign responsibilities with timelines to execute the Roadmap.

Reliability – Project Refinement

Friday - March 6, 1045-1200

These breakout sessions aim to refine the well-defined projects previously reviewed: participants will outline teaming and funding schemes, plan project oversight and execution, and establish milestones from which to gauge success of the project.

Sector Consortia Reports

These plenary sessions aim to summarize the output of each of the Sector Consortia workshop sessions. In these sessions, workshop participants have the opportunity to learn about the activities and roadmaps of other Sector Consortia.

SSSC, FBW, Devices, & Materials
Friday - March 6, 1330-1600
Reliability
Friday - March 6, 1630 - 1745

Workshops Conclusion

This plenary session will summarize the output of the CANEUS 2009 Workshops.

Conclusion
Friday - March 6, 1630-1745

Exhibits (Ongoing event)

International technology providers and end-users specializing in areas closely related to the projects of the Sector Consortia will participate in the exhibits. A broad range of exhibits covering the latest developments in MNT for aerospace systems representing end-user applications, technology products, and business development organizations will be held concurrently with the Workshop sessions.

Poster Sessions

Monday (March 2) - Wednesday (March 4), 1745-1800

- Poster presentations will cover:
- Exciting early research results in MNT materials, devices, and systems.
- MNT system development including packaging and reliability testing results.
- Perspectives of end-users from aerospace and defense sectors, including “lessons learned” from the implementation of emerging MNT-systems in aerospace applications.
- Investment perspectives, both private and government, of early, mid-maturity and late-stage (system-level) investment into MNT development.
- Examples of international, cross-border collaborations leading to joint development of MNT at various maturity levels ranging from the concept to system stage.

List of Poster Session Titles

- **TREADS – Incorporating a Test Flight into the Standard Development Cycle**
  Steve Wichman; Redefine Technologies, Inc
  Mike Pratt; Redefine Technologies, Inc
  Richard Alena; NASA Ames Research Center
  Gerry Murphy; Space Access Technologies

- **Wafer level packaging technology for harsh environment aerospace pressure sensors**
  JF Leneal, Esterline Sensor Group, Bourges, France

- **Networking Strategies for Structural Health Monitoring with Autonomous Sensors**
  Hichem Boulkenafet, Tahar Kenzai, Pierre Gerard, Bertrand Rue, Université Catholique de Louvain, Belgium

- **Development of a dual-durometer dynamic seal (hard-soft) for a landing gear in an airplane**
  Benabdallah Chouchaoui. Windsor Industrial Development Laboratory.

- **Design of colony of Nanorobots for Mars suit repair**
  Gautham Dharuman , Department of Electrical Engineering, National Institute of Technology, Warangal, India.
  Krishna Das, Department of Biotechnology, National Institute of Technology, Warangal, India.

- **USE OF THE POSS1 NANOSTRUCTURED CHEMICAL PLATFORM FOR PERFORMANCE ENHANCED MATERIALS**
  Joseph Schwab, Highbrid Plastics Inc

- **Integrating a Modular Smart Tool into the Space Exploration Infrastructure through Small Satellite Systems Protocols**
  Gary Rodriguez, sysRAND Corporation

- **High Temperature SOI CMOS Low Power circuits and micro systems for MEMSco-integrated interfaces, temperature sensing and power management applications.**
  B. Ruea, N. Andréa, B. Olbrechtsb, J.-P. Raskinb and D. Flandre, Microelectronics Lab., Université catholique de Louvain, Belgium

- **Low-loss InP-based ring resonators for integrated optical gyroscopes**
  Caterina Ciminelli, Francesco Dell'Olio, Vittorio M. N. Passaro, and Mario N. Armenise , Dipartimento di Elettrotecnica ed Elettronica, Politecnico di Bari, Italy

- **PICO-SATELLITES: HOW MUCH CAN YOU LOAD INSIDE? OPTOS PROJECT.**
  Mrs. Fany Sarmiento-Ares, Mr. César Martínez-Fernández, Mr. Guillermo Albaladejo, Instituto Nacional de Técnica Aeroespacial (INTA), Madrid, Spain

- **Control Strategy to Minimize Acoustic Emission of Jet Turbines**
  Yosef Gavriel Tirat-Gefen, Aerospace Division, Castel Research Inc.& George Mason University

- **Nanostructured Ceramic Coatings as High Temperature Thermal Barriers and Abradables**
  Basil Marple and Rogerio Lima, National Research Council of Canada

- **Development of Triboluminescent Materials for Space Applications**
  M.D. Aggarwal, Department of Physics, Alabama A&M University.

- **High TRL Radiation Tolerant Computing Systems**
  Anthony Lai, Aitech Defense Systems Inc

- **Advanced Micro Pump Development for Satellite Thermal Control Application**
  Chia-Ray Chen, NSPO, Taiwan.
  Shih-Chi Chan, Department of Power Mechanical Engineering, National Tsing Hua University.
  Cheng-Hsien Liu, Department of Power Mechanical Engineering, National Tsing Hua University, Hsinchu, Taiwan.

- **A Concept for an International Small Satellite Constellation to Monitor Unattended Ground Sensors**
  Jay W. Middour, Dr. John Mittleman, James Tugman, CAPT Jeff Graham, Stefan Thonnard, Frederick Helrich, NRL, US Navy.

- **A novel Actuation Scheme at the Nanoscale inherited from Spintronics**
  Kevin Garello, Laurent Duraffourg, Bernard Viala, P. Andreucci, Italy

- **Use of Electron beam irradiation for tailoring Vapor Grown Carbon Nanobibers interface**
  Maria Cecilia Evora, Instituto de Estudos Avançados, São José dos Campos, Brasil
  Donald Klosterman, University of Dayton, Dayton, Ohio, USA
  Khalid Lafdi, University of Dayton, Dayton, Ohio, USA
  Odair Lelis Gonçalez, Instituto de Estudos Avançados, São José dos Campos, Brasil

- **A NOVEL MULTISIGNALING OPTICAL-ELECTRICAL ACCELEROMETER**
  Sergio Lopera, Integrated Systems Laboratory ,Polytechnic School,University of São Paulo.
  Carmem Lucia Barbosa, Institute of Advanced Studies - Aeronautic Technology Institute
  Milton Sergio Fernandes Lima, Institute of Advanced Studies - Aeronautic Technology Institute
  Rudimar Riva, Institute of Advanced Studies - Aeronautic Technology Institute
  Luis da Silva Zambom, Faculdade de Tecnologia de São Paulo
  Ronaldo D. Mansano, Integrated Systems Laboratory – Polytechnic School - University of São Paulo

- **Use of Electron beam irradiation for tailoring Vapor Grown Carbon Nanobibers interface**
  Maria Cecilia Evora, Instituto de Estudos Avançados, São José dos Campos, São Paulo, Brasil
  Donald Klosterman, University of Dayton, Dayton, Ohio,USA
  Khalid Lafdi, University of Dayton, Dayton, Ohio,USA
  Odair Lelis Gonçalez, Instituto de Estudos Avançados, São José dos Campos, São Paulo, Brasil.

- **Oxide Coating Materials on Rapid Prototyping Parts by Sol-Ge**l
  Beatriz M. de Campos, Universidade de Franca, Lucimara C. Bandeira, Paulo S. Calefi, Katia J. Ciuffi, Eduardo J. Nassar, Universidade de Franca. Jorge V.L. Silva, Marcelo Oliveira, Izaque Alves Maia, Centro de Pesquisas Renato Archer

- **Microwave and optical communication and radar systems with tunable and nonreciprocal photonic crystals and components: a review of the latest achievements**
  Victor Dmitriev, Department of Electrical Engineering, University Federal of Para, Brasil.

- **Development of SixCy thin-film resistors for high-temperature strain gauges**
  M. A. Fraga, S. Wakavaiachi, R. S. Pessoa, M. Massi-
  Plasmas and Processes Laboratory, Technological Institute of Aeronautics, SJ dos Campos, Brazil And, H. Furlan, Faculty of Technology of São Paulo, São Paulo, Brazil

- **Modeling of Energy Storage Cells for Hardware-In-the-Loop Validation of Aerospace Power Systems: A Case Study**
  Julio C. G. Pimentel, Dept. of Electrical and Computer Eng., Laval University, Quebec, Canada.
  Yosef G. Tirat-Gefen, Aerospace Division, Castel Research Inc., Fairfax, VA, USA Antonio C. Mesquita, COPPE/PEE – Federal University of Rio de Janeiro, RJ, Brazil Paulo E. V. de Miranda, COPPE/PEMM – Federal University of Rio de Janeiro, RJ, Brazil

- **Nanocrystalline diamond/carbon felt composite as hybrid electrode for supercapacitor and lithium ions battery.**
  Adriana F. Azevedo, Erica C. Almeida, Leonardo I. Medeiros, Mauricio R. Baldan and Neidenêi G. Ferreira. Instituto Nacional de Pesquisas Espaciais – São José dos Campos, São Paulo, Brazil

- **Space Reliability issue for Electrostatically actuated RF-MEMS Components**
  G. Papaioannou, University of Athens. F. Coccetti , LAAS-CNRS, Toulouse. R. Plana, University of Toulouse

- **MEMS METHODOLOGY TAKES MICROPROPULSION TO SPACE 2009**
  Håkan Johansson, Kerstin Jonsson, Johan Bejhed, Maria Björklund, Pelle Rangsten, Tor-Arne Grönland, NanoSpace AB

- **Development of a MEMS-Based Micro-Thruster in Taiwan**
  National Applied Research Laboratories, Taiwan.

- **METHODOLOGY of ADDITIVE PRODUCTION IN THE NANOSTRUCTURED BaNbXFe2-X04 FERRITE BY LASER ABLATION CuHBr**
  C.A. Reis de Freitas, G. Vasconcelos ,IEAV, Sao Jose dos Campos. M.R.da Silva, M.R.F.Gontijo, UNIFEI, F.C.L. Melo, IAE

- **SpaceX Dragon: Fast-track to Flight Heritage**
  Max Vozoff & Marco Villa, Space X, USA

- **Direct conversion Radisotope Micro Battery**
  Peng Gao, Wei Z. Yuan, Da Y. Qiao, Xiao Y. Li, University Xian, China

- **Satellite in cube**
  Christian Val, CEO 3D Plus, France

- **MNT of Laser Beam Machining for Surface Finishing at Submicrometer Level of Thermal Resistant Materials**
  Niculae Ion Marinescu, Daniel Ghiculescu, University Politehnica of Bucharest, Romania

- **Tribo-coatings for Friction Contol in Space and Industrial Devices**
  L.F. Bonetti, LV Santos, G Capote, PA Radi, RPCC Statuti, EJ Corat, and VJ Trava-Airoldi, INPE, Italy

Technical Tours

Tuesday - March 4, 1745-1800

Vertical Motion Simulator

The Vertical Motion Simulator (VMS) is a unique flight simulation complex that provides researchers with exceptional tools to explore, define, and solve issues in both aircraft and spacecraft design. It offers fast and cost-effective solutions using real-time piloted simulation, realistic sensory cues, and the greatest motion range of any flight simulator in the world.

More information at: www.aviationsystemsdivision.arc.nasa.gov/facilities/

Unitary Wind Tunnels

NASA Ames Research Center is pleased to offer the services of our premier wind tunnel facilities that have a broad range of proven testing capabilities to customers from industry, DOD, other government agencies, and academia. Recent facility modernization efforts have also resulted in significant improvements to systems directly affecting both data quality and testing productivity.

The Unitary Plan Wind Tunnel Complex offers two test sections. The 11-foot is an 11 ft by 11 ft test area, Mach number from 0.20 to 1.45, unit Reynolds number from 0.30 to 9.6 million per foot, and pressures from 3.0 to 32.0 psia. The 9-foot is a supersonic wind tunnel with a test section of 9 by 7 ft, Mach numbers from 1.55 to 2.55, Reynolds numbers from 0.50 to 5.7 million per foot, pressures from 2.8 to 29.5 psia, and a maximum stagnation temperature of 600°R.

More information at: http://www.windtunnels.arc.nasa.gov/

Ceramics Lab / Arc Jet Complex

The Ames Arc Jet Complex is a key enabler for customers involved in the three major areas of Thermal Protection System (TPS) development: selection, validation, and qualification. The arc jet data are critical for validating TPS thermal models, heat shield designs and repairs, and ultimately for flight qualification.

The Thermophysics Facilities Branch of the Space Technology Division operates four Arc Jet test facilities of differing configurations that are serviced by common facility support equipment. These are the Aerodynamic Heating Facility (AHF), Turbulent Flow Duct (2x9), the Panel Test Facility (PTF) and the Interactive Heating Facility (IHF). The support equipment includes two D.C. power supplies, a steam ejector driven vacuum system, a water-cooling system, high-pressure gas systems, data acquisition system, and other auxiliary systems.

Highlights include:

- High power (75 MW and 20 MW continuous DC power supplies)*
- Large test articles (up to 60 x 60 cm)*
- Continuous high enthalpy flows (2 to 40 MJ/kg in air)
- Test times up to 60 minutes
- Spectroscopic and LIF flow diagnostics available

- Several tests per day
- Up to 5 articles plus diagnostic swing-arm per test run (AHF)
- Large continuous vacuum pumping capacity (100 g/s at 67 Pa)* capable of handling air flow rates from 0.04 to 2.3 kg/s
- Ames-developed and designed segmented constricted arc heaters of 2.54, 6 and 8-cm bore
- Largest within NASA and the U.S.

More information at: http://thermo-physics.arc.nasa.gov

Supercomputing

Supercomputing resources are critical to mission success and that is why the agency has invested in additional systems to augment the Columbia supercomputer. NASA's Advanced Supercomputing Division at NASA Ames includes the 10,240-processor Columbia system, was recently expanded to include a 4,096-processor SGI® Altix® ICE cluster, a 2,048-processor single-system image SGI® Altix® 4700 system, and a 640-processor IBM® POWER5+™.

Investigators can show a selection of model results on the nine-screen "mini-hyperwall," a traveling version of NASA's 49-screen hyperwall visualization tool. Model simulations generated using a NASA Center for Computational Sciences supercomputer helped support the most recent assessment of the Intergovernmental Panel on Climate Change (IPCC), co-recipient of this year's Nobel Peace Prize.

More information at: http://www.nas.nasa.gov/

Competition Awards

Wednesday - 4, 1900-2200

CANEUS Outstanding Student Award for MNT for Aerospace
As the membership of CANEUS has discovered, overcoming the tremendous challenges facing the successful transition of emerging MNT concepts to system level products often requires a special motivation and drive by individuals who can serve as an inspiration to our community. The Visionary Awards aim to recognize these talents and accomplishments, which are very synergistic with the overall CANEUS mission.

The CANEUS Outstanding Student Award for MNT for Aerospace is given in recognition of those exceptional student individuals or teams (of up to 3 persons) who have made important contributions in the arena of transitioning Micro and Nano Technologies (MNT) from the laboratory into aerospace systems.

Nominations must be submitted by filling out the Nomination Form available from CANEUS 2009 website. The nominations must include a brief summary of the contributions of the nominee, describing how their outstanding achievements and vision helped influence the development and infusion of emerging MNT concepts within the Aerospace industry. Submitted nominations will be evaluated by a peer review panel.

Recipients of the CANEUS Medal for Vision and Leadership in MNT for Aerospace will be awarded a plaque, and will be honoured at the Awards Ceremony. Award recipients will be invited to present their work at the workshop.

CANEUS 2009 Grand Challenge

On March 4th, 2009 during the CANEUS 2009 Workshops, CANEUS will officially launch the 2009 Grand Challenge Competition. The winning team will be part of a unique launch opportunity manifested on board the SpaceX DragonLab spacecraft targeted for the end of 2010, with a follow-up opportunity available for late 2011. CANEUS is also exploring opportunities for rides on other launchers as part of this competition.

CANEUS encourages interested parties to formulate virtual, international teams comprised of university and industry representatives. Teams are requested to submit a proposal highlighting the nature of the experiments and technology trials, including the preferred integration method and concept of operations.
Teams' submittal

To be eligible, teams must:

- **Propose a project related to one or more of the five CANEUS Sector Consortia-**
  - Micro and nano technology implementation, coordination, and standardization of small satellites
  - Multi-functional materials with MNT embedded sensors
  - Fly-by-Wireless applications
  - Advancement of reliability issues and technical solutions
  - Harsh Environment Sensors, Photonics, Bio-Astra, and Environmental Monitoring
  - And oriented toward Plug-and-Play implementations for both HW and SW
- Identify one or more sponsors to co-fund the project, and ensure the financial ability for the complete realization of the project, including its on-orbit operations

To ensure a cost-effective solution, and to attempt a truly collaborative experience, CANEUS will have to select a unique solution to integrate the various projects. Within the available solutions, three were recognized as optimal:

1. Integration of all the experiments within a single satellite. The satellite will be carried in the unpressurized section and separated into its orbit. In order to exercise this option, CANEUS will have to identify a bus developer and integrator.
2. Integration of the experiments within an available enclosure similar to the Shuttle middeck locker. The locker could be located within the DragonLab pressurized section and hence recovered upon landing.
3. Leverage on P-PODs and integrate the experiments within cubesats to be deployed on-orbit. This option offers a natural solution to the request of collaboration with a university. Each group could team-up with a cubesat team for the construction of the bus and integration of their payload. The California Polytechnic Institute (CalPoly) has volunteered to help this process by identifying the closest universities worldwide with a cubesat program, that are nearest to any participant location, or that have vested technical interest in a specific project.

Once the proposal is submitted, the CANEUS Competition Panel will evaluate the proposals and allocate funding to support project development based on multiple criteria.

Within the proposal, each team shall express the desired method of integration by explaining the reasons why each option could or could not be used. CANEUS will then evaluate and select the optimal solution based on available resources and technical constraints.

Teams will be bound to specific milestones to monitor both financial and technical progress. Failure to meet one or more milestones will automatically result in exclusion from the challenge and redistribution of funding originally allocated by CANEUS.

Dr. Marco Villa
Chairman CANEUS Grand Challenge Competition Committee
marco@spacex.com

SPEAKER AND CHAIR GUIDELINES

Typically, each session will be 75 minutes in length.

Each speaker will be given 15 minutes to discuss their topic.

We request that the talks be developed along the following lines:

1. Highlight the relevant issues of the Panel Session topic to be considered as part of the overall technology development pipeline. For example, if your session addresses low Technology-Readiness-Level (TRL) materials development, then, in addition to providing a description of the particular materials technology, address the end-user requirements for these materials and some of the key issues affecting the implementation of these materials in aerospace systems.
2. Each presentation can be roughly divided into the following three parts (as applicable):
    - Applications of the technology
    - Description of the technology
    - Path to infusion into aerospace systems and the challenges to be overcome
3. Describe solutions attempted within the speaker's home organization to address these issues, particularly in the context of other innovative approaches being developed elsewhere in the world. We request you to address the progress of individual organizations in a global context in order to make these developments more meaningful to the audience.
4. Sector Consortia Workshops input: CANEUS measures its success by the number of emerging MNT concepts that it has helped transition to aerospace systems. Therefore, comments pertaining to the transition/infusion process are encouraged.

Contributors

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NASA Ames

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CANEUS 2009 Short Course instructors

- **Elias Carayannis**
  European Union Research Center
- **Jon Pratt**
  National Institute of Standards and Technology
- **George Grammas**
  Squire, Sanders & Dempsey LLP
- **Henry Helvajian**
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- **David Oppenheimer**
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Keynote Speakers

- **Lew Braxton**
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- Pete Klupar, Director of Engineering, NASA Ames Research Center, USA
- **John Miller**
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- **Mihail Roco**, Senior Advisor for Nanotechnology at the National Science Foundation, USA (TBC)
- **Lt. Gen. John Sheridan** , U.S. Air Force, USA (TBC)

Dear CANEUS 2009 Conference Organizing Committee Members:

Our sincere thanks to you for volunteering your valuable time to serve on this important mission. Due to your dedication and hard work, we have succeeded in achieving our ambitious goal of creating an international network devoted to identifying promising concepts that have been proven in the laboratory, and subsequently transitioning them for application into aerospace systems.

As a result of your efforts, we have put together a series of workshops that have proved unparallel in terms of the focus of topics presented by world-class speakers. For this significant achievement, you should all be very proud. We are honoured to have had the opportunity to work side-by-side with you in coordinating this trendsetting event that will continue to shape and influence our community in this critically important area.

Finally, I would like to extend my gratitude to the 2009 CANEUS Workshops Planning Committee and to the Integrated Planning Team at NASA for all their assistance with the organization of the Workshops.
I would like to especially thank the CANEUS International team in Montreal and Dionna Seuss, CANEUS 2009 Event Manager, for all their help and expertise in making the CANEUS 2009 Workshops a success.

Thank you once again for your vital contributions, and we look forward to working with you in the future.

Best regards,

Milind Pimprikar
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