Innovation at the Intersections...

of

Policy, Science, Technology and the Arts

AA247 Webinar

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Innovation Occurs at Discipline Intersections

• Four examples from personal experience will be presented:
  – Astrobiology, the scientific intersection of physics, chemistry, astronomy and biology
  – Bio-inspired nanotechnology
  – Rebuilding the Mars Program
  – The emerging entrepreneurial space business
Astrobiology: The Scientific Heart of Space Exploration

- Interdisciplinary study of life in the universe
- Three fundamental questions
  - How does life begin and evolve?
  - Does life exist elsewhere in the universe?
  - What is life’s future on Earth and beyond?
- NASA Astrobiology Institute
  - 16 lead member institutions

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Jonathan Trent in Kamchatka

Studying extremophiles

Harvesting Sulfulobus

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Nanoscale gold arrays

Bio/Info/Nano=Products

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Protein-templated patterned media

Nanoscale metal arrays = flash memory

1.5 terabits/in²
Biofuels Focus Areas

Bio-engineered protein enzyme to digest cellulose

Algae from a local treatment plant will become Biodiesel

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Optimized Energy Efficiency

• An existing Danish wind farm in the North Sea could solve 2 elements of turning algae into biodiesel fuel
  – Temperature control
  – Energy to run the system

• A hybrid fuel farm could take advantage of excess wind energy and easy cooling of the algae growth process

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Redefined in October 2000 after twin failures in 1999

A science-driven effort to characterize and understand Mars as a dynamic system, including its present and past environment, climate cycles, geology, and biological potential.

Central among the questions to be asked is…

“Did life ever arise on Mars?”

The science strategy is known as “Follow the Water.”
Program System Engineering

Science  Technology  Management

Program Trade Space
Aligning three strategies

Option(s) for Mission Queue  Re-Check for Science Traceability

Selected Mission Queue

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Innovation occurs at the intersections of disciplines.

Within the space exploration arena, two important intersections are:

– Earth - Life - and Space Science = Astrobiology
– Convergence of Biology - Information Technology and Nanotechnology

Provide strategic direction but also allow for serendipity.

Management as cat herding:
Herd the cats by strategically placing the cat food.
Mars Avalanche
Carbon Dioxide Levels in the Past 400K Years

Human activity

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Carbon Dioxide Levels in the Past 1000 Years

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Regional Climate Change is the Frontier

Think globally, Forecast regionally, Act locally:

Assessing and addressing the impacts of climate change in California is our next step

Beyond the capacity of today’s global models

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Our California Regional Climate Change Concept

Decide science questions--Follow the Water

Collect and fuse data at regional scale

–Fill in gaps with new platforms

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Our California Regional Climate Change Concept

- Develop models and analyze data at regional scale
- Provide results to policy makers

• Project Columbia at NASA Ames Research Center
• Peak capacity 61 TFLOPs
The New (Old) Dream - Personal Space Travel
Some of the New Players

Falcon I at SpaceX launch pad at Vandenberg Air Force Base
Founder/CEO-Elon Musk

Bigelow Aerospace inflatable habitats-artist’s conception
Founder/CEO-Bob Bigelow

Virgin Galactic has $20,000 deposits from > 100 tourists
Founder/CEO- Sir Richard Branson

SpaceDev develops commercial hybrid rocket motors and small space vehicles and subsystems.
CEO - Mark Sirangelo

Scaled Composites-Aerospace and specialty composites Winner of the X-prize
President- Burt Rutan

Investor and philanthropist Paul Allen

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The standard business approach:
$200,000 ticket price
5 passengers per flight
= $1 million per flight
365 flights per year =
$365 million annual revenue

However, in a $200+ billion market, the suborbital space tourism market is still small.

What is the true benefit and is there another business model?

• Spillover benefits of public interest
• Attracting capital for space businesses
• Attracting non-traditional space business people

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Tie-Ins, Advertising Revenue, Endorsements, Franchising, Product Placement

The Choice of Astro tourists everywhere*

*Reebok spaceshoes provided on all flights

This Coffee Served in Space

SpaceShip 1

The Latest Teams April, 2007

“Your logo here” (this image was NOT altered!)

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The Future of Space Exploration: Searching for Life with Humans and Robots Together
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