Innovation in Aerospace and Space Exploration
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Innovation in Aerospace and Space Exploration is a new seminar offered by the Aero/Astro department, and sponsored in part by the WIRED initiative of the Department of Labor, Employment & Training Administration. Through interactive presentations and discussion, our goal is to connect those who need new technologies, and those who can create them. Through these interactions, we also hope to spark creativity and new ideas for inventing and deploying new and innovative technologies.

**Goal**

**Plan**

We will be asking prominent executives and scientists in the community to give us their vision of what critical technologies need to be developed within the next ten years to achieve missions planned or desired in the near-future. We will develop a technology wish-list and establish a working network between the needs and those that have technologies or research capabilities that can meet those needs.

Our speakers come from all areas of aerospace: government, industry, small businesses, and academia. They will share their experiences and stories from working in innovative environments.

**Class Description**

This seminar/webinar will provide an understanding of how advancing technology and process needs have stimulated innovation in the aerospace industry. We hope that students will be stimulated to develop their own thinking, either individually or in concert with others from varying disciplines, to new and innovative ideas that will accelerate the overall aerospace industry. Students will be able to collaborate with and encourage their peers to think of new and innovative ways to approach problems in his/her area of interest.

Speakers will address their own experiences and their vision for those needs which will only be satisfied by innovations. Innovative technology, innovative processes and the innovation process itself, including innovation drivers, will be explored and captured. Industry, including aerospace suppliers and academic participants are encouraged to attend.

The seminar will be presented in video-conference format, using WebEx software. Presenters and attendees alike can log in from home, work, or a coffee shop—anytime and anywhere in the world. Students on the Stanford campus can attend live. Sessions will be recorded and posted (along with the slides) on our website.

**Acknowledgments**

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**Bibliography**

Weiss, Stanley. “Innovation Preview Thoughts” Presentation, April 7, 2008
Hubbard, G. Scott. “Innovation at the Intersections” Presentation, April 14, 2008
Dyott, John. “Breaking Down the Barriers to the Best Technology” Presentation, April 21, 2008

**Further Information**

Contact Bob Twiggs, instructor, BobTwiggs@stanford.edu, or Emily Eelkema, course assistant, eelkema@stanford.edu

Visit our website at http://www.innovatecalifornia.net/innovationase

**“Necessity... the mother of invention.”**

-Plato

**“What is innovation, and how does it happen?”**

Innovation Stimuli:
- Crisis
- Expediency
- Adaptation
- Domain transfer
- Entertainment
- Counter-failure
- Competition
- Schedule pressure
- Incentives

**“Innovation at the Intersections”**

Innovation occurs at discipline intersections, for example:
- Astronautics: the scientific intersection of physics, chemistry, astronomy, and biology.
- By studying extremsophiles on Earth, scientists can get ideas of what to look for in space.
- Bio-inspired nanotechnology: Nano-scale metal arrays could produce memory storage of up to 1.5 terahits per square inch.
- Entrepreneurial space business: a combination of new technologies, exploration, tourism, and advertising.
- X-Prize SpaceShip One

**Recipe for Revolution**

- A demanding vision
- An appetite for change
- A technology-rich environment
- Appetite for risk
- Persistence
- An evolutionary approach
- Simplicity
- Implementation
- Risk tolerance

**Innovation Wish-list**

- Watch this space
- Break new ground
- Break new technologies
- Solve real problems
- Fly back boosters
- Space launch
- Your ideas here!

**“Breaking Down the Barriers to the Best Technology”**

John Doty has identified several cultural, institutional, and managerial barriers to innovation that have made their way into the aerospace industry.

- Parametric cost estimation for new technologies
- Produce overly large, project-stopping numbers.
- Old technology is used instead of space-qualifying new, ‘riskier’ parts.
- Radiation tolerance requirements are too high.
- Choose a low-dose orbit
- Trade margin for tolerance
- Design for easy recovery
- Need an improved review process
- Experts can spot problems, but often can’t relate to new approaches.
- Review by students! Un-biased review, will spark new ideas.
- Base project milestones on hardware demonstrations, not reviews
- Management: Innovation is too risky!
- Need to start importing technologies from other areas

**Speakers**

- **Dr. Stanley Weiss, Professor, Stanford University**
- **Dr. Scott Hubbard, Former Director, NASA Ames Research Center**
- **John Doty, PhD, President, Noqsi Aerospace, and Chief Engineer, HETE-2**
- **Dr. Owen Brown, DARPA FQ Program Manager**
- **Dr. Jeff Ward, Vice President of Avionics, SpaceX**
- **Dr. Chh Gupta, Director of Strategic Market Development, Iridium Satellite**
- **Dr. Burton H. Lee, PhD, MBA, Principal and Co-founder of the Space Angels Network, LLC**
- **Dr. S. Pete Worden, Director, NASA Ames Research Center**