16.682 The Aerospace Industry

April 6 Class

Special Guests:

Prof. Ray Leopold

Prof. Annalisa Weigel

Plan for the Class

3:05-3:10 Announcements and Introductions

3:10-3:25 Discussion on focus for rest of semester

     Shall we concentrate on human space exploration plan?

3:25-3:55 LEV Discussion (Ch 7-8)

3:55-4:05 Break

4:05-4:50 Av Week Article Discussions

     As a satellite program manager, should I choose Falcon I?
     As the USAF Space Architect, should I commit to TC?

4:50-4:55 Muddy cards

     Introduction to next week's special guest

4:55   Adjourn

- Should we focus the remaining 3 classes, starting with today, on the question: "Is there a viable value proposition for human space exploration?"

- Should we sponsor a "forum" on this topic?

- Pros
  - A current issue of national debate
  - Ties in directly with Part III of the book
  - Frequent topic in Aviation Week
  - Aligns with current student interests
  - The class could produce a valuable "output"
  - ….

- Cons
  - Could increase workload (student and faculty)
  - Would limit discussion of other topics
  - ….

Human Space Flight Program Value

- Thinking about a "program" (a la Apollo) to return humans to the Moon, and eventually onto Mars,
  - Who would be the key program stakeholders?
  - What might be their value expectations?
  - What key features would need to be addressed to develop a value proposition?

Stakeholders and Value Expectations

- Taxpayers: New technologies/inventions, inspiration for students, stimulus for the economy
- Congress: Prestige, Jobs, Unfinished business (China)
- Scientists: Science opportunities
- US Military: Affordable space access
- Students and Professors: Funding, educational benefits
- NASA: Prestige, funding, job satisfaction
- Investors: Return on investment
- Worldwide aerospace community: Financial return
- Industry contractors: Job and $$, program management techniques
- Astronauts: Fun
- Industry in general: strengthen the industrial engineering base.

- Ray's comment: This will be a policy driven proposition, not a market driven proposition.
  - Policy driven things are input oriented
  - Market driven driven things are output oriented

AvWeek Article Discussion

- As a satellite program manager, should I choose the Falcon I for my next LEO launch?
  - Led by Prof. Leopold
- As the USAF Space Architect, should I commit to the Transformational Communications (TC) Architecture?
  - Led by Prof. Weigel
- For each question, one group take the *advocacy* role and one group take the *red team* role.

Points Captured from Class Discussion

As a satellite program manager, should I choose the Falcon I for my LEO launches?

- Pros
  - Cheap and inexpensive, $6M
  - Mobil launch platform
  - Based upon proven technology
  - Good team expertise
  - Supply chain
  - Elon Musk is good bet
  - Focused enterprise, compared with competitors

- Cons
  - Higher risk endeavor - no track record
  - Vehicle haven't been tested
  - Higher likely hood of going out of business
    - Only $$ for two failures
    - Could miss launch window
  - Less customer support than Boeing or others
  - Less experience
  - Untied engines Merlin engines

Ray's Response

- Untried vehicle is a big concern
  - Bought insurance for both sat and launcher
  - For Iridium, had deductible for 2-3 failures
- Can't insure business plan
- For one time launch would not go with untried launch system
- But for multiple launch, would buy a portion of launches once it was proven.

Points Captured from Class Discussion

As the USAF Space Architect, should I commit to the Transformational Communications (TC) Architecture?

- Pros: Great program
  - Change to a new set of standards, but can't have a gap in capability.
  - Cheaper to do it now rather than later
  - Can move specialized functionalities from individual units to central units
  - Information will have many users (gov't agencies).
  - Uniform protocols will give integrated seamless system
  - New technologies with improved capability

- Cons
  - Upfront costs
  - Realignment of training, etc.
    - Upper mgmt' turnover
  - Limits flexibility for future
  - Could stifle innovation
  - Will funding stability de-incentive team
  - What will happen in the interim?
  - Robustness. All eggs in one basket.

Annalisa's Comments

- Reliability and putting eggs in one basket.
  - Would take out some bad aspects like multiple protocols
- Balance long term strategy vs short term pain.
  - Space architects need to make some tough choices.
  - Need to fundamentally rethink how systems work today.
- TC is a way to get us to focus on SoS approach.
- How can one make a network that doesn't go down with failure of one component?
  - Network architecture can be more robust.

Next Week's Guests

- Col John Keesee, MIT
- Heidi Wood, Senior Aerospace and Defense Analyst, Morgan Stanley. Her contribution to the dust jacket of LEV:
  - *"Lean Enterprise Value* addresses the right questions and should catalyze thoughts from leaders both in government and in industry as to how lean can create sustainable value, attracting valued human and financial resources and thus re-ignite Aerospace's ability to inspire. Aerospace is a pioneering sector – the challenge is to direct its vast resourcefulness in ways that translate into value metrics relevant to this generation (for both scientists and investors) and thus securing its health into the next century."