

# NASA's Technology Programs in Recent ASEB Reports

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# Recent ASEB Reports

- NIAC - Technology Program that NASA cancelled
  - Covered by Brant
- ETDP - The remnants of NASA's space technology programs
  - *A Constrained Space Exploration Technology Program, 2008*
    - Crawley/Dunbar
- Civil Space Program - Space technology programs in context
  - *America's Future in Space, 2009*
    - Lyles

# A Coherent Story

- ETDP Report assesses **WHAT** is being researched, and **HOW** the research is being performed, managed, and transitioned.
- Lyles Report describes **WHY** space technology research is a vital part of the civil space program.
- Both reports make recommendations for improving NASA's space technology enterprise.

# A Constrained Space Exploration Technology Program

- Responding to the 2007 CJS Appropriations Bill, NASA asked the NRC to review the Exploration Technology Development Program (ETDP).
- Review based on 3 criteria:
  - Alignment with the VSE
  - Gaps in the research portfolio
  - Quality of the research
    - NASA asked for additional comments and recommendations on the mechanics of the program

# ETDP Key Findings

- ETDP will enable the ESAS architecture, but not the full VSE
- ETDP is NASA's principal space technology program (the remnant of the old Code R) and has been focused as a supporting technology effort for the Constellation Program
  - As a result, ETDP is supporting very little research at TRL<4
- ETDP is highly constrained
  - Budget, schedule, workforce

# ESAS vs. VSE

- Committee found that the program was tightly coupled with the Constellation Program, and through that coupling was responsive to the VSE.
- However, the VSE was broader than the ESAS architecture
  - Wider range of robotic activities
  - Stimulation of commercial space efforts
  - Etc.
- VSE proposed a broad technology program that would “Support decisions about... destinations”
  - This is where the report found the program lacking

# Principal Space Technology Program

- ETDP structured to be a supporting technology program for the Constellation program
  - Focused on moving technologies from TRL 3-4 to TRL 6
- Would be OK, except that there is no other broad space technology program at NASA
  - ETDP is the remnant of the old Code R
- Committee did not believe that ETDP was fully responsive to either the full VSE, or to the agency's space technology responsibilities as laid out in the Space Act

# Program Constraints

- Budget
  - FY 2005 budget had \$1B, ramping to \$1.35B in FY 2008
  - FY 2008 budget had \$326M, falling to \$244M in FY 2009
- Schedule
  - As a supporting technology program, ETDP is pressed to deliver technologies to meet the aggressive Constellation development schedule
- Resources
  - ETDP structured to support the “ten healthy centers”



# Recommendations

- Identify long-range technology needs for the VSE and seed a few low TRL concepts into the ETDP portfolio, thus reopening the technology pipeline
  - Committee used 20% of budget as a rule of thumb for the right amount of low TRL work in a portfolio
- Bring in experts from academia and other government agencies to advise and/or work on the existing projects

# America's Future in Space

- Study requested and sponsored by NAS/NAE/IOM Presidents, not an agency
- Tasked to provide a rationale for a 21<sup>st</sup> century civil space program, and goals for that program
  - Civil Space defined more broadly than NASA by the committee
- Committee Report includes
  - Goals for the Civil Space Program
  - Foundational Elements of the Civil Space Program
  - Recommendations for the USG in implementing a strong Civil Space Program
  - *Technology plays a role in all three areas!*

# Goals for Civil Space Program

- Stewardship of the Earth
- Scientific Inquiry
- Expand Human Frontiers
- Provide *Technological*, Economic, and Societal Benefits
- Inspire Current and Future Generations
- Enhance U.S. Strategic Leadership
- No priority order of the goals. Committee stated that a program which suitably addresses the first four goals, in such a way as to address the fifth goal, will be a strategic asset for the nation (6<sup>th</sup> goal).

# Technological Benefits

- The technologies demanded by the harsh environment of space push the nation's technological base, and in some instances are applicable to terrestrial needs
  - Historical - metal forming, chemical milling
  - Future - water purification/recycling, prevention of bone loss
- NASA's technology pipeline should also support private sector space efforts, whether in support of NASA directly or not. Role should be similar to that of ARMD in Aeronautics
- *Create and maintain a continuous space technology pipeline and use the challenges presented by space exploration to create new technologies, contributing to the technological, scientific, and overall advancement of the nation*

# Foundational Elements

- Coordinated national strategies
- A competent technical workforce
- An effectively sized and structured infrastructure
- *A priority investment in technology and innovation*

# Priority Investment

- A strong technology development program can make future missions more capable, more cost-effective, (both?)
- Space research should be able to communicate back and forth with other fields, taking new technologies and applying them to space and disseminating new space technologies into the broader economy
- Need a “DARPA-like” program that focuses on technologies beyond the immediate sight of program managers and pulls the best ideas regardless of where they exist
- Space program is living off of investments made in the past and has an obligation to replenish its technological base.

# Recommendation 4 – Advanced Space Technology

- *NASA should revitalize its advanced technology development program by establishing a DARPA-like organization within NASA as a priority mission area to support preeminent civil, national security (if dual-use), and commercial space programs*
  - Organizationally independent of development programs
  - Serve ALL civil space customers
  - Conduct extensive assessment of current and potential space technology
  - Conduct cutting-edge fundamental research to support the technology base
  - Find talent where ever it exists!

# Other recommendations!

- Rec 2 - Climate and Environmental Monitoring
  - NASA and NOAA should aggressively pursue technology development that supports high-priority Earth observation missions and foster innovative approaches to meeting future space system needs
- Rec 5 - International Cooperation
  - [Engage] the nations of the developing world in educating and training their citizens to take advantage of space technology for sustainable development



# More recommendations!

- Recommendation 6 - Human Spaceflight
  - [Set] challenging objectives that advance the frontier, scientific and *technological*, understanding, and the state of the art
  - [Focus] use of the ISS on advancing capabilities for human space exploration
- Recommendation 7 - Organizing for National Needs
  - NSC and OSTP should identify, develop, and coordinate initiatives to address long-range technological needs for future programs

# Summary

- A Constrained Space Exploration Technology Program
  - ETDP captured by Constellation
  - Dramatically reduced technology funding
  - No other broad space technology effort at NASA
- America's Future in Space
  - Technology development is a vital component of the civil space program
  - Technology both necessary in and of itself, and enabling of other goals
  - NASA needs new organization and recommitment to technology development

# Questions?

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