

The background is a vibrant space scene. On the left, a large portion of Earth is visible, showing blue oceans and white clouds. In the center, a bright sun or star is partially obscured by a comet's tail, which streaks across the frame. To the right, a spiral galaxy is visible against a dark starry sky. In the foreground, the reddish-orange surface of Mars and the banded atmosphere of Jupiter are shown. A small satellite or probe is visible in the upper left quadrant.

**DRAFT**

# *Emerging Commercial Space Opportunities*

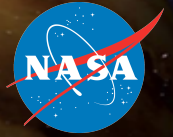
*Overview of OCT Activities  
to assess  
Emerging Commercial Space Industries*

**DATE:** April 29, 2011

**TO:** Technology & Innovation Committee of the  
NASA Advisory Council

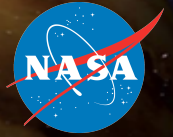
**FROM:** Charles Miller  
Senior Advisor for Commercial Space  
Office of the Chief Technologist

# Executive Summary



- Actively exploring non-traditional approaches/partnerships
  - per White House National Space Policy
- OCT-IPO leads NASA-wide Emerging Commercial activity
  - To energize, enable and facilitate new commercial space capabilities
  - Also provides “front door” for new emerging commercial space firms
- GOAL: Explore new opportunities beyond existing programs
  - This is **NOT** CCDEV, Commercial Crew, Commercial ISS cargo, CRuSR
- Conducted bottoms-up review of potential capabilities (2010)
  - Low-cost and Reliable Access to Space graded as the #1 top priority
  - Commercial In-Space Servicing is the #2 priority
    - e.g., Satellite servicing, orbital debris mitigation/removal, orbital transfer vehicles
- Based on studies, provide input to NASA leadership
  - Findings & Recommendations differ based on targeted commercial capability
  - Some recommendations already incorporated into OCT investment areas

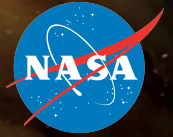
# Emerging Commercial Space Office Proposed in President's FY12 Budget



- Analyze and assess emerging space markets, bringing this data into Space Technology selection processes and providing to other Mission Directorates.
- Advocate for foundational research investments and collaboration models like those employed by NACA in sparking the growth and success of the American aviation industry.
- Provide a single, front door to NASA for new commercial space concepts and ideas, including a Level II Emerging Space Office at Ames Research Center.
- Interface with Mission Directorates, field Centers, entrepreneurs, early-stage ventures, traditional aerospace firms, and commercial space advocacy organizations.
- Explore public-private partnership approaches and strategies.
- Promote exchange of technology, innovative partnerships and ideas among the U.S. government and the emerging commercial space industry.
- Emerging Space activities will be coordinated with NASA's larger, on-going Commercial Space programs (such as COTS and CCDEV).

Project	Labor \$K	Proc. \$K	Travel \$K	Total \$K
Emerging Space	653	1,287	60	2,000

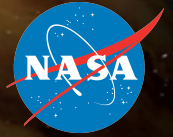
# Actively Exploring Non-traditional Arrangements Per National Space Policy on Commercial Space (June 28, 2010)



- **Principles:** A robust and competitive commercial space sector is vital to continued progress in space. The United States is committed to encouraging and facilitating the growth of a U.S. commercial space sector that supports U.S. needs, is globally competitive, and advances U.S. leadership in the generation of new markets and innovation-driven entrepreneurship.
- **Goals:** **Energize competitive domestic industries** to participate in global markets and advance the development of: satellite manufacturing; satellite-based services; space launch; terrestrial applications; and increased entrepreneurship.
- **Guidelines** (Selected excerpts):
  - **Purchase and use commercial space capabilities and services to the maximum practical extent ...**
  - **Actively explore the use of inventive, nontraditional arrangements** for acquiring commercial space goods and services to meet United States Government requirements, **including measures such as public-private partnerships, ...**
  - **Pursue potential opportunities for transferring routine, operational space functions** to the commercial space sector where beneficial and cost-effective.

# Commercial Space Opportunities Workshop #1

## June 8-9, Rosslyn, VA



- 50+ participants (from 10 NASA Centers & 4 MDs)
- Segmented new potential commercial capabilities into 8 areas
  - Low-cost & Reliable Access To Space (LCRATS)
  - Commercial In-Space Servicing (5 Segments: Propellant depot/transfer, satellite refueling/servicing, orbital transfer, orbital assembly, debris removal/mitigation)
  - Commercial Human Spaceflight, Entertainment, Education
  - Lunar/NEO
  - Orbital Space Laboratory Research/Microgravity
  - New space communication & navigation
  - Human habitation, accommodations, ECLSS
  - Power Infrastructure and delivery
- Evaluated all 8 potential commercial capabilities for ...
  - Outputs/Benefits to:
    - NASA, national security, economic growth, STEM education, social/cultural, environment
  - Inputs/Barriers
    - Investment, Markets/customers, Industry firm maturity, Tech maturity, Regulatory/Legal
  - Synergies and Linkages
- **RESULTS**
  - LCRATS unequivocally identified as #1 priority
  - Commercial In-Space Servicing (CISS) identified as clear #2 priority
  - Set up working groups to interview industry (LCRATS, CISS, 3 other areas)

# Commercial Space Opportunities Workshop #2

## July 27-28, NASA Headquarters



- Completed identification and prioritization of Top 3-5 barriers to closing commercial business case
  - for Low-Cost & Reliable Access to Space
  - for Commercial In-Space Servicing (CISS)
  - and for other areas
- Identified many potential solutions
  - Several dozen potential solutions, including many non-budgetary
- Mapped potential solutions to top barriers
  - Assess strengths, weaknesses, costs, benefits of potential solutions
- Developed options for leadership consideration
- Contracted with Near Earth LLC (investment banking firm)
  - Study completed.
  - Final report being reviewed.

# Emerging Commercial Forums/Events in 2011

to Promote, Enable and Facilitate Exchange of Technology and Innovation



- C/RASTE 2011:

- Commercial & Gov't Responsive Access to Space Technology Exchange
- FOCUS: Low-cost, reliable, and frequent access to space and the technologies and implementation strategies needed to meet this goal
- In partnership with USAF Research Laboratory
- October 24-27, 2011 in Atlanta, GA
- <http://www.usasymposium.com/craste/>

- NewSpace 2011

- FOCUS: Public-private partnerships between U.S. government and emerging commercial space industry; and exchange of innovative ideas
- Includes a commercial business plan competition
- Hosted at Ames Research Center
- July 28-31, 2011
- <http://spacefrontier.org/events/newspace-conferences/newspace-2011/>

# Space Technology Grand Challenges

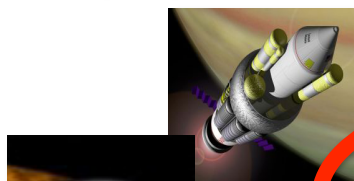
## What is the Overlap with Emerging Commercial Space?



*Make space part of humanity's natural environment...*

*...manage space as a natural resource...*

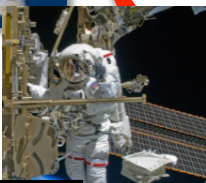
*...and blaze our trail into the universe.*



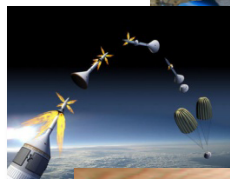
Achieve economical, on-demand space access



Enable in-space commercial/ marketable services



Improve spacecraft safety and protect astronaut health



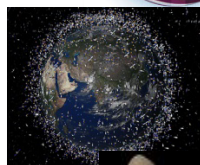
Enable publically accessible virtual presence and exploration



Fully understand climate change and natural disasters



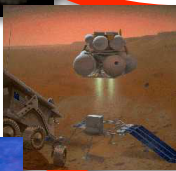
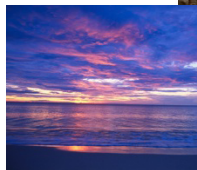
Portable and economical energy on demand



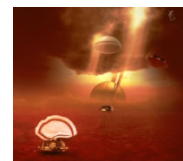
Understand and manage the near-Earth environment



Invent tools of exploration that exploit in-situ resources



Understand laws of the universe



Discover Earth-like worlds and life beyond Earth



Operate at the very limits of what is possible