

National Aeronautics and Space Administration



OFFICE OF THE CHIEF TECHNOLOGIST

SPACE TECHNOLOGY
INDUSTRY FORUM

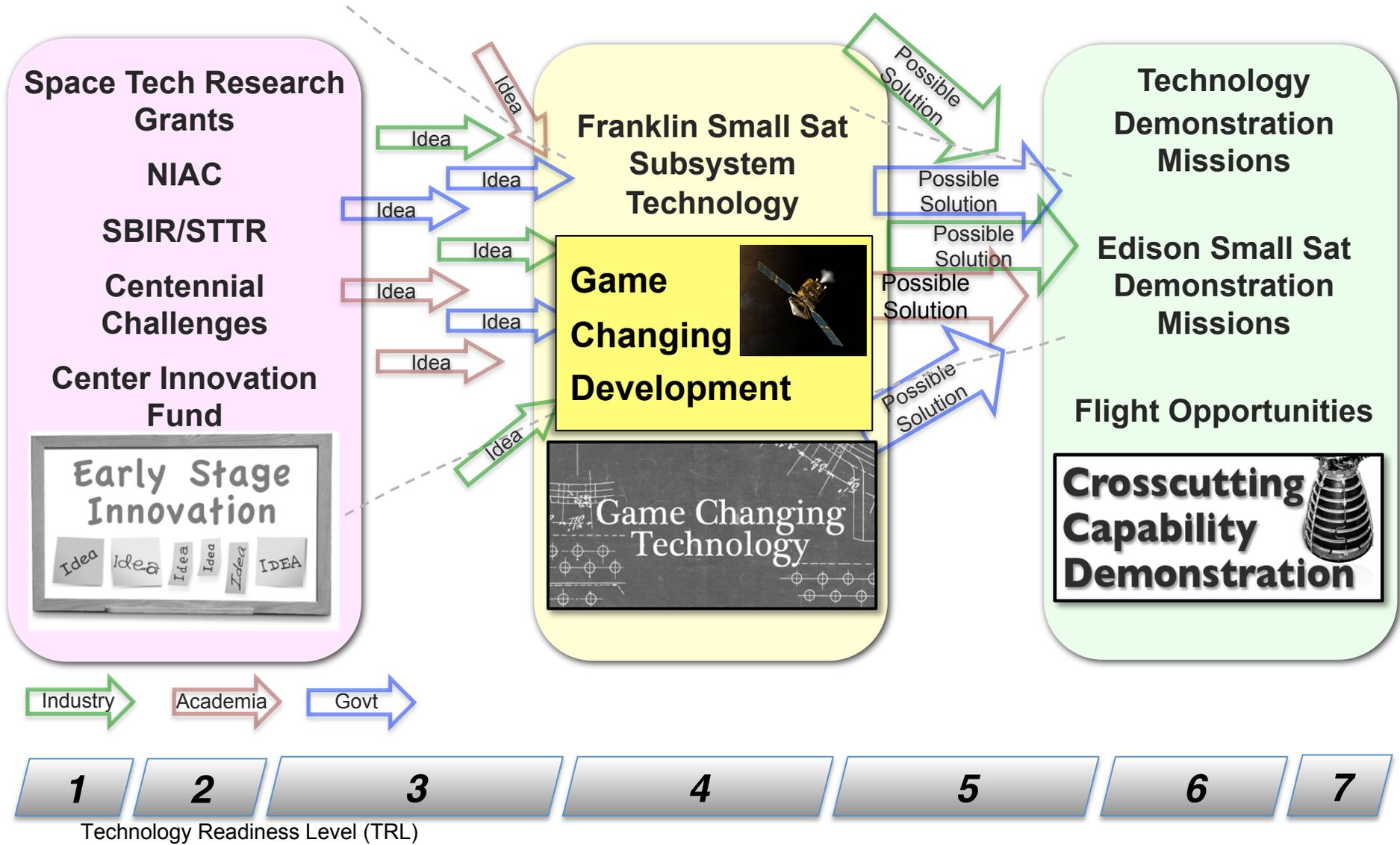


Game Changing Development Program

Jean-François Barthelemy
Program Manager (Acting)
July 13, 2010



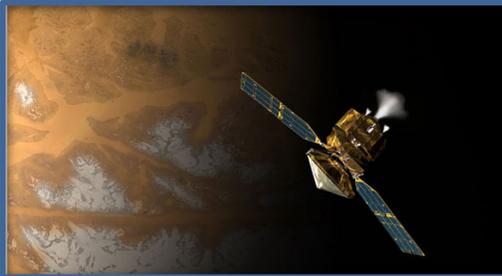
OCT Program Overview



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Game Changing Development (GCD) Program



GCD fosters:

- *Creation of disruptive capabilities and supporting technologies*
- *Rapid advancement at the subsystem and/or system level*
- *Technology infusion for mission or commercial applications*

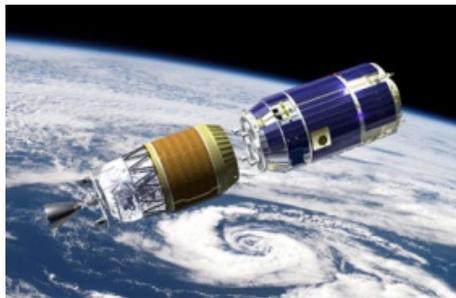
- GCD matures technologies through the mid-TRL regime to enable useful game changing capabilities for scientific discovery, and human and robotic exploration
- Projects are intended to be capability-oriented and to move ideas from discovery to use.
- GCD emulates the outcomes of the DARPA approach at technology development



A Different Approach at NASA R&T Management



- Program focused by strategically defined Grand Challenges
- Projects and projects' content are selected based on competition
- Peers engaged in selections and reviews
 - *NASA Chief Technologist is selection official*
- Of limited duration (2yrs nom., 3yrs max.), with defined start and end
 - *Completion conditional on passing critical gates, at least yearly*
- Project Manager has full authority, and responsibility
 - *Project implementation tailored to specific project*
 - *Project Manager is on a term appointment*



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Sample Thematic Challenges



Make space part of our routine environment...

Manage space as a natural resource...

Quests of the future...

Achieve fast and economical space transportation

Enable in-space commercial/ marketable services

Improve spacecraft safety and protect astronaut health

Communications that enable virtual presence

Gain knowledge of climate change and natural disasters

Provide economical energy on demand

Improve knowledge of the near-Earth environment

Invent the materials of exploration using in-situ manufacturing

Exploit machine intelligence / robotic autonomy

Understand laws of the universe

Discover life and Earth-like worlds



Example Automated In-Space Construction/Serviceing



Capability: In-space construction/serviceing enables new classes of missions, effectively removing launch mass and size constraints from consideration during device design.

Assembly occurs via a precision robotic assembly and jiggig system that is expanded, upgraded and reused over the course of multiple missions. The same system supports periodic inspection, service, repair and upgrade of the devices constructed.

State of the Art: Space station assembly, Hubble repair, automated assembly of tetrahedral structure, Bigelow inflatable modules, EVA neutral buoyancy, assembly of precision segmented reflectors

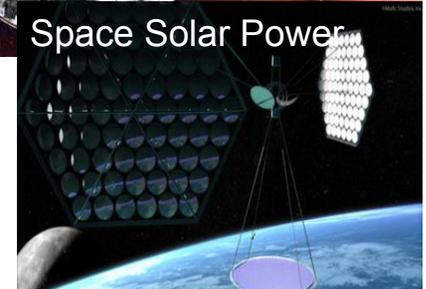
Innovation Areas:

Deployable Space Structures	Reliable & Affordable Exploration Sys.
Space Robotic Assembly	Surface Robotic Construction
Lightweight Structures & Materials	Nanotube-based Structural Materials
Large Aperture Antennae & Telescopes	Print Manufacturing & Rapid 3D Proto.
Lightweight, Low Transit Volume Space Structures, Fabrication, Assembly	

Sample Innovative Technologies Required:

- Robotic Assembly
- E-beam Welding and Free-form Fab
- Automated Planning & Optimization
- High Performance Composites
- Modular Structural Architectures

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GCD Process Elements



Program Office Located at the *Langley Research Center*

Objective: solicit innovative ideas enabling new capabilities or radically altering our current approaches to launch, build and operate space systems.



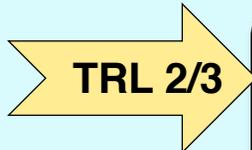
- **Competitions** for “*Concept Studies*” NRAs and *New Project BAAs* will be open to NASA Centers, other government agencies, academia, and industry; teaming is encouraged.
- **Concept Studies** will be competed to flesh out the details of ideas/concepts, assess their feasibility, quantify their challenges and identify approaches to overcome them. **(Results made public)**
- **GCD Project Managers** (PMs) will periodically be approved to define *New Projects* based on *Concept Studies*, but also on inputs from Early Stage Innovation and other sources.
- **New Project Solicitations** will ask for many ideas on how to achieve the project goals as the community might envision, rather than ask for bids on a single, predetermined approach. In most projects, multiple performing teams will work in parallel to mature the technologies according to the project plan.
- **Awards:** Each year, the Program will award both *Concept Studies* lasting generally 6 months and *New Projects* lasting for 2 to 3 years under the direction of a PM.

GCD Process



~20-30 new ideas every 6 months

Concept Studies



Early Stage Ideas

New Idea NRA

- 6 Month Calls
- Challenge Goals
- Competitive Selection



Ideas from Industry, Universities, Entrepreneurs, and Government

Contracts

Concept Studies



- 6 month duration
- Define Feasibility



- *Early Stage Innovations*
- *Advanced Research Projects*
- ... other sources

~5-8 new projects every 6 months

Projects Formulation



NASA Chief Technologist

- Selects New PM Led Projects
- Authorizes New Project BAA
- Source Selection for Performing Teams

Project Manager/GCDPO

- New Project Formulation
- "Go/Stop" metrics
- Manage approved projects

~several activities for each project

Projects Execution

New Project BAA Release

- PM team evaluates responses
- Competitive selection of multiple performing teams
- 4-8 months to let contracts



Contracts

Project Execution



- 2 years with 1 year option
- Frequent informal reviews
- Not one-size-fits-all
- High risk: ~40% end early



New Capability Ready for Flight Demonstration

TRL 5/6

Initial Resources

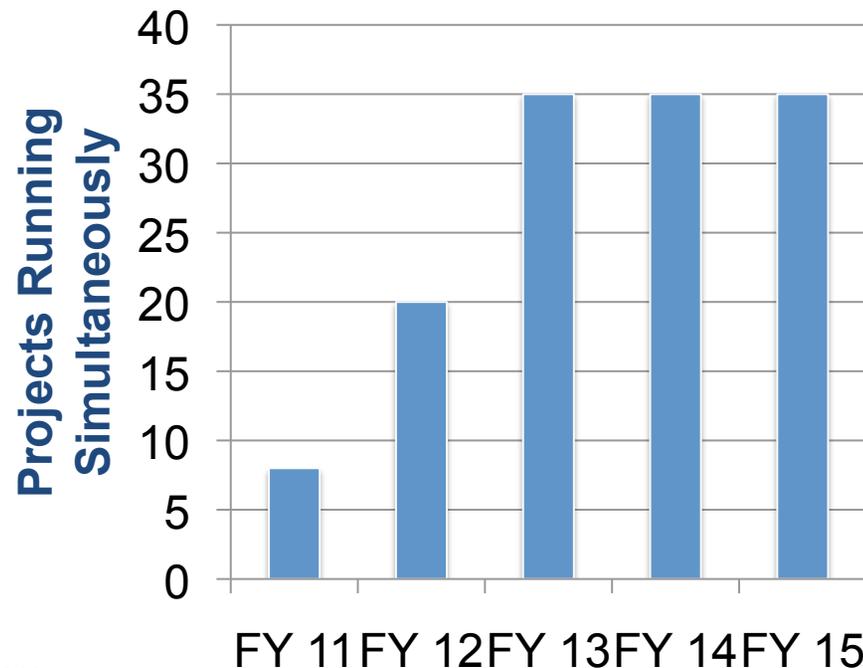


For FY 11, expect up to:

- 30 concept studies
 - ~\$300-500K/study
- 5-8 new projects
 - small projects ~ \$3M/yr
 - large projects ~ \$12M/yr
- *several activities per project*

For FY 12+, expect up to:

- 40-60 concept studies each year
- 10-16 new projects each year
- *several activities per project*



Timetable for Initial Release



Milestone for NRA	Date
Concept Study NRA release	TBD
Notice of Intent to Propose	+ 15 days
Proposals Due	+ 45 days
Awards Issued	+ 6 months



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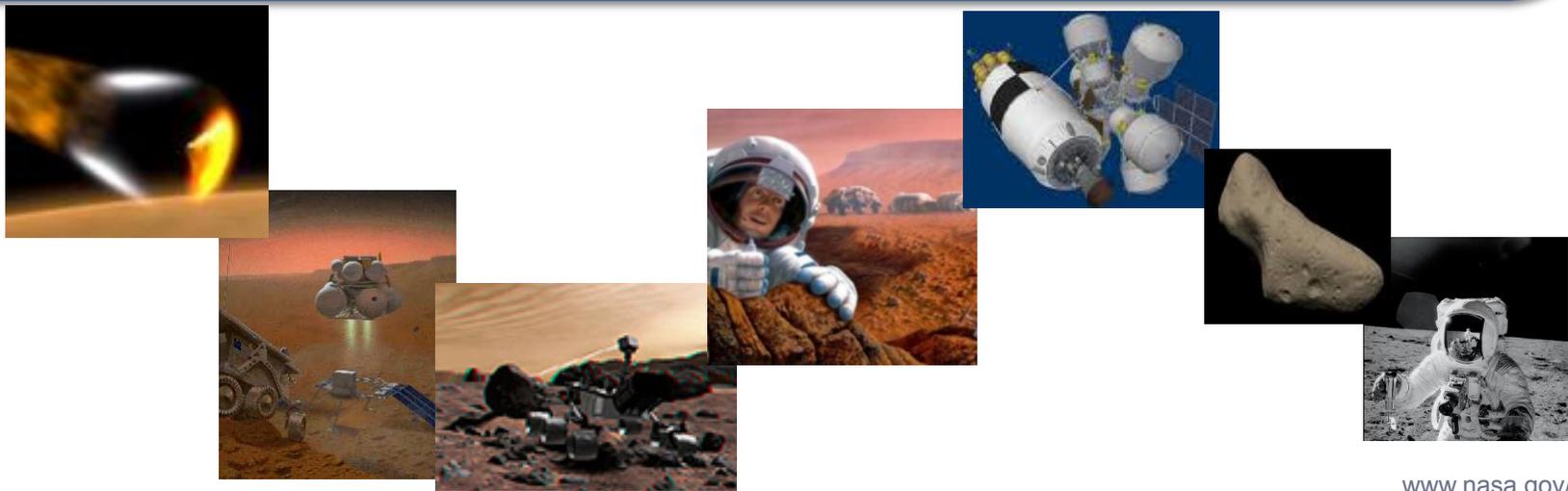
Game Changing Development Program - Summary



The Game Changing Development Program (GCD) bridges the technology maturation gap, maturing advanced space technologies that provide innovative capabilities enabling entirely new NASA missions for scientific discovery, and human and robotic exploration.

GCD competes its research. It encourages teaming with participation from industry, academia and government. International collaborations are accepted.

GCD is preparing for a fast-paced series of *concept studies* followed by *selected projects* carried out by multiple performing teams.



Questions?



J.-F. Barthelemy, Program Manager (Acting)
NASA Langley Research Center
Hampton, VA 23681-2199

j.f.barthelemy@nasa.gov

(d) 757/864-2809

(c) 757/642-3465

Heilmeier's Catechism



George H. Heilmeier	
Born	May 22, 1936 (age 73)
Residence	United States
Nationality	American
Fields	Electrical engineering
Notable awards	IEEE Medal of Honor

George Harry Heilmeier - American engineer and businessman, who was a pioneering contributor to liquid crystal displays. In 1975, named Director of DARPA – stealth aircraft, space-based lasers and infrared technology and artificial intelligence

A set of questions credited to Heilmeier that anyone proposing a research project or product development effort should be able to answer.

- 1. What are you trying to do? Articulate your objectives using absolutely no jargon.**
- 2. How is it done today, and what are the limits of current practice?**
- 3. What's new in your approach and why do you think it will be successful?**
- 4. Who cares?**
- 5. If you're successful, what difference will it make?**
- 6. What are the risks and the payoffs?**
- 7. How much will it cost?**
- 8. How long will it take?**
- 9. What are the midterm and final "exams" to check for success?**