



Office of the Chief Technologist Town Hall Meeting

Dr. Robert Braun
NASA Chief Technologist
May 25, 2010

Themes of the President's FY11 NASA Budget Request



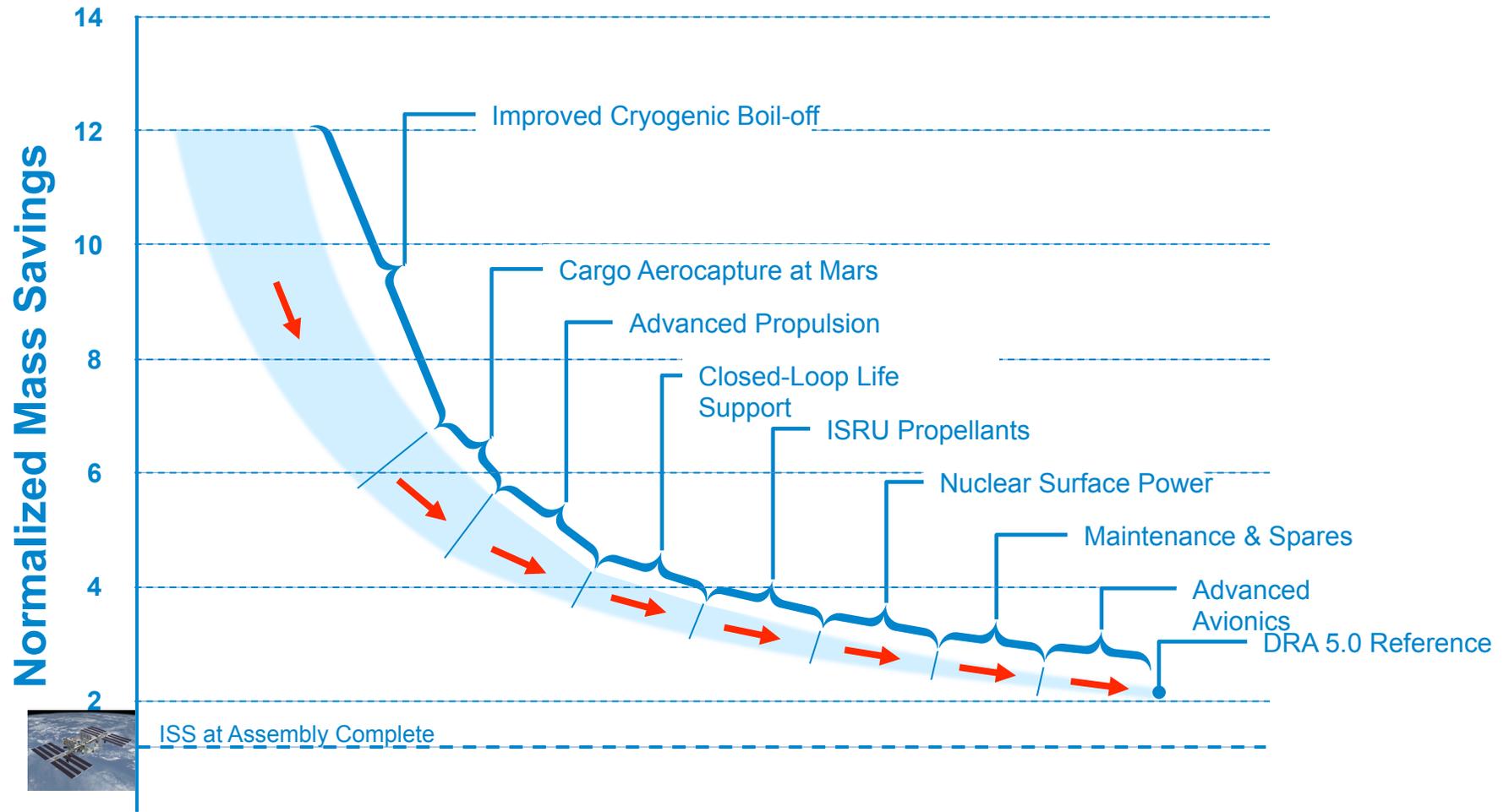
- **Top-line increase of \$6B over 5 years** -- National investment in NASA is \$100B over 5 yrs
- **Increase for Science (\$2.5B over 5 years)** -- Largely focused in Earth science
- **Reverse past decline and provide modest increase for Aeronautics (~15% or \$75M/yr)**
- **Shift in approach for Human Exploration program. The goal remains the same.**
 - Additional \$600M to complete 5 remaining Shuttle flights (3 as of today)
 - Extension of International Space Station to at least 2020
 - Commercial approach to Low Earth Orbit access (\$6B over 5 years)
 - Modernization of the Kennedy Space Center launch complex (\$2B over 5 years)
 - Flexible Path strategy to extend human presence beyond Low Earth Orbit
 - Restructure of Constellation Program; Modified Orion development continues
- **Significant focus on Technology Development to reposition NASA on the cutting-edge**
 - Central principle of new Human Exploration strategy
 - New DARPA-like Space Technology Program (\$5B over 5 years)
- **Increased emphasis on partnerships and STEM education**
 - Other government agencies, academia, industry and international

External Input Has Driven Development of NASA's Technology-Enabled Approach



- **NASA Authorization Act of 2008:** *“A robust program of long-term exploration-related research and development will be essential for the success and sustainability of any enduring initiative of human and robotic exploration of the solar system.”*
- **NRC report, A Constrained Space Exploration Technology Program: A Review of NASA’s ETDP, 2008:** *“NASA has created a supporting technology program very closely coupled to the near-term needs of the Constellation Program. This program contains only incremental gains in capability and two programmatic gaps. NASA has effectively suspended research in a number of technology areas traditionally within the agency’s scope. This could have important consequences for those portions of the VSE beyond the initial short-duration lunar missions, including extended human presence on the Moon, human exploration of Mars, and beyond.”*
- **NRC report, America’s Future in Space, 2009:** *“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.”*
- **NRC report, Fostering Visions for the Future: A Review of the NASA Institute for Advanced Concepts, 2009:** *“To improve the manner in which advanced concepts are infused into its future systems, the committee recommends that NASA consider reestablishing an aeronautics and space systems technology development enterprise. Its purpose would be to provide maturation opportunities and agency expertise for visionary, far-reaching concepts and technologies.”*
- **Augustine Committee, 2009:** *“The Committee strongly believes it is time for NASA to reassume its crucial role of developing new technologies for space. Today, the alternatives available for exploration systems are severely limited because of the lack of a strategic investment in technology development in past decades.”*
- **NRC report, Capabilities for the Future: An Assessment of NASA Laboratories for Basic Research, 2010:** *“To restore the health of the fundamental research laboratories, including their equipment, facilities, and support services, NASA should restore a better funding and leadership balance between long-term fundamental research/technology development and short-term mission-focused applications.”*

The Value of Technology Investments Mars Mission Example



- Without technology investments, the mass required to initiate a human Mars mission in LEO is approximately twelve times the mass of the International Space Station
- Technology investments of the type proposed in the FY 2011 budget are required to put such a mission within reach

Office of Chief Technologist Roles/Responsibilities

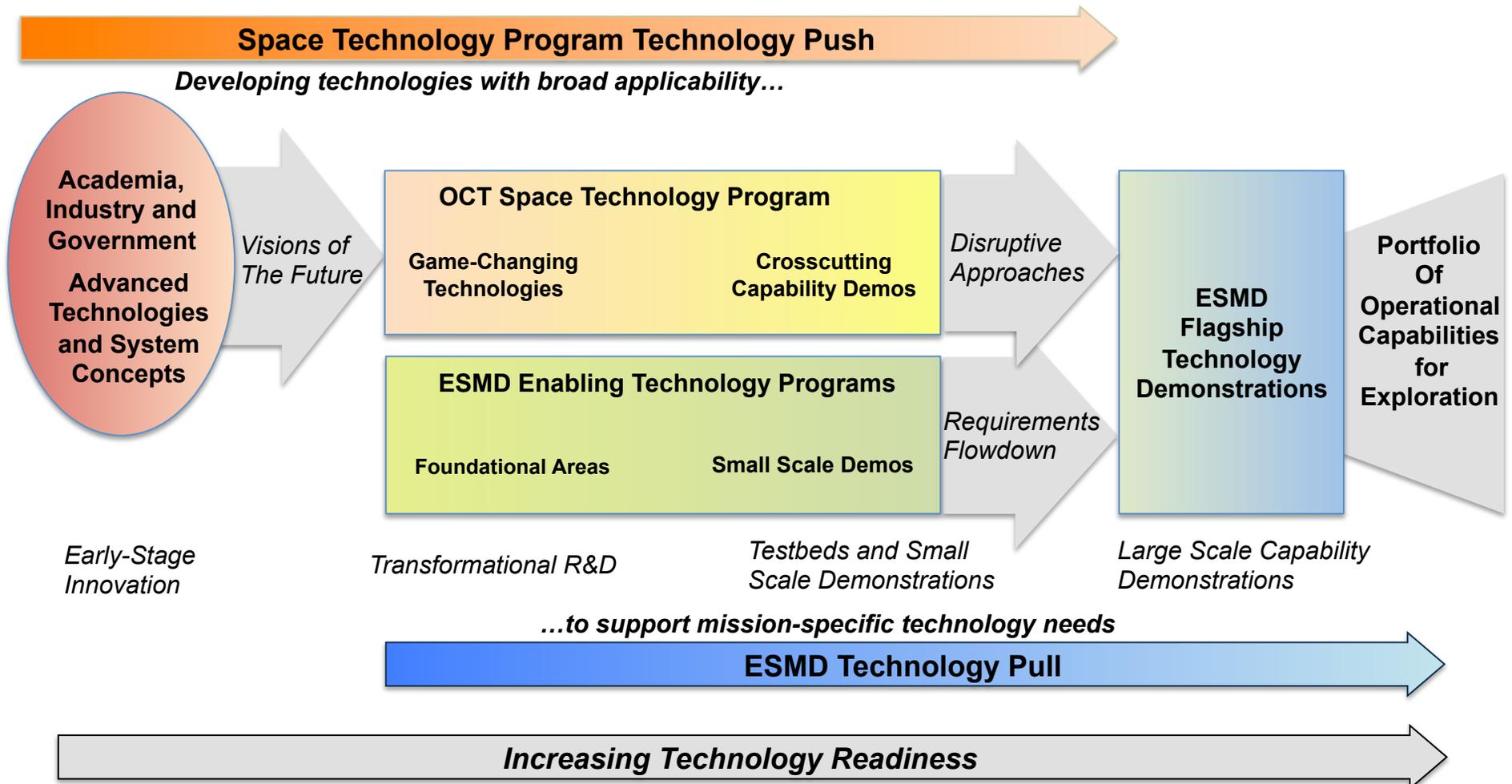


- **OCT established in February 2010**
- **OCT has six main goals and responsibilities:**
 - 1) Principal NASA advisor and advocate on matters concerning Agency-wide technology policy and programs.
 - 2) Up and out advocacy for NASA research and technology programs. Communication and integration with other Agency technology efforts.
 - 3) Direct management of Space Technology Programs.
 - 4) Coordination of technology investments across the Agency, including the mission-focused investments made by the NASA mission directorates. Perform strategic technology integration.
 - 5) Change culture towards creativity and innovation at NASA Centers, particularly in regard to workforce development.
 - 6) Document/demonstrate/communicate societal impact of NASA technology investments. Lead technology transfer and commercialization opportunities across Agency.
- Mission Directorates manage the mission-focused technology programs for directorate missions and future needs
- Beginning in FY 2011, activities associated with the Innovative Partnerships Program are integrated into the Office of the Chief Technologist

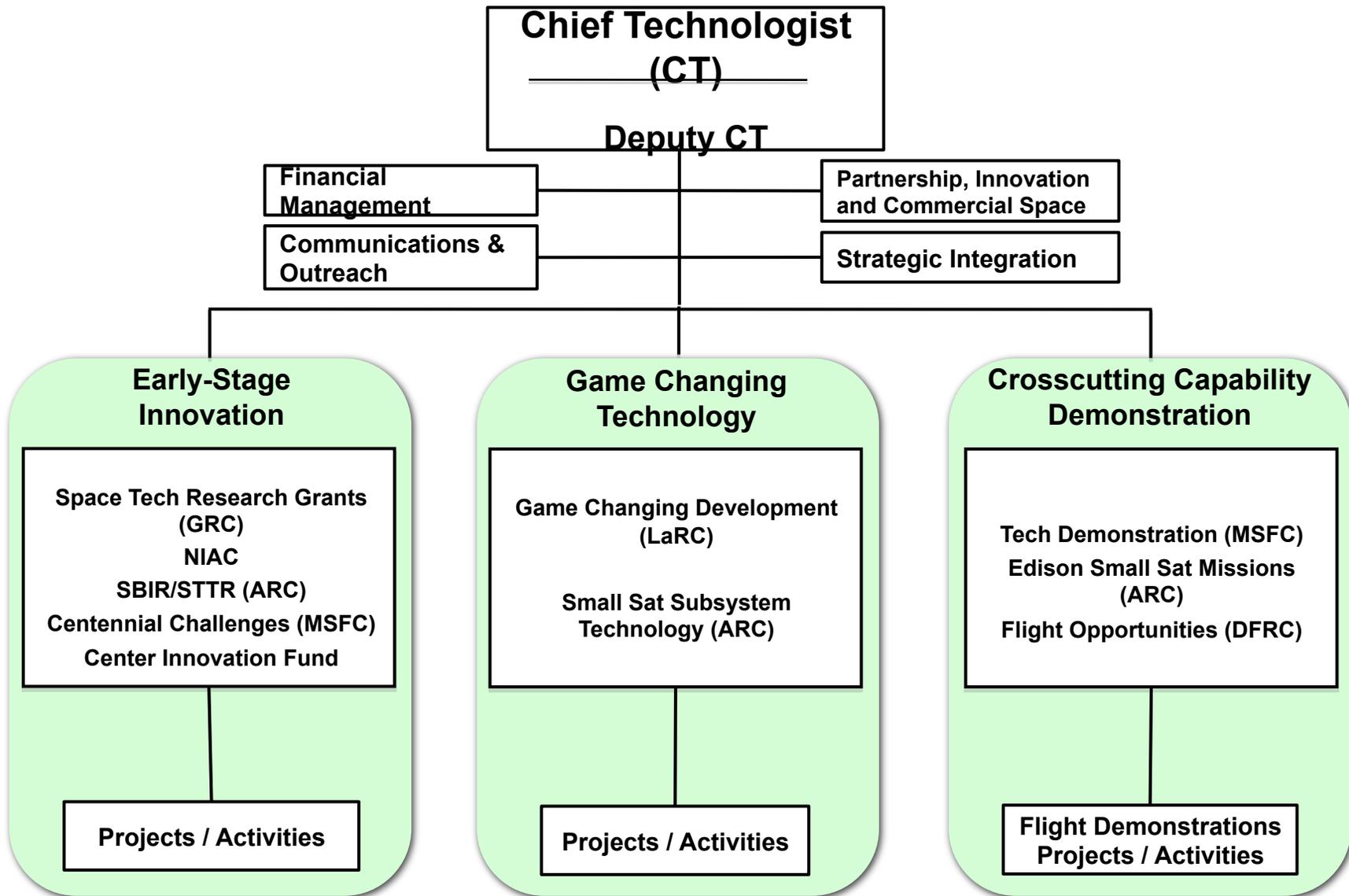
NASA's Integrated Technology Programs



A portfolio of technology investments which will enable new approaches to NASA's current mission set and allow the Agency to pursue entirely new missions of exploration and discovery.



Office of the Chief Technologist Organization



Space Technology Program Foundational Principles



The Space Technology Program shall:

- Advance non-mission-focused technology.
- Produce technology products for which there are multiple customers.
- Meet the Nation's needs for new technologies to support future NASA missions in science and exploration, as well as the needs of other government agencies and the Nation's space industry in a manner similar to the way NACA aided the early aeronautics industry.
- Employ a portfolio approach over the Technology Readiness Level spectrum.
- Competitively sponsor research in academia, industry, and the NASA Centers based on the quality of the research proposed.
- Leverage the technology investments of our international, other government agency, academic and industrial partners.
- Establish a deliberative panel of internal and external stakeholders, including industry and other government agencies, to review and advise OCT on technology development priorities through a transparent and balanced process.
- Result in new inventions, new capabilities and the creation of a pipeline of innovators trained to serve future National needs.

Supporting NASA Grand Challenges



OCT will support technology development and demonstrations that address NASA's Grand Challenges by providing a steady cadence of advanced space technology demonstrations allowing the infusion of flexible path capabilities for future exploration.



Make space access economical



Provide economical energy on demand



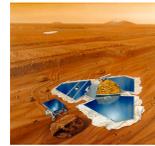
Develop routine satellite servicing



Forecast natural disasters



Manage climate change



Provide participatory exploration



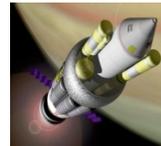
Improve spacecraft safety and reliability



Provide carbon-neutral mobility



Protect astronaut health



Engineer faster space vehicles



Unleash machine intelligence



Utilize space resources to explore



Prevent orbital debris



Secure the planet from space threats



Understand physics governing the universe



Establish conditions for permanent humans in space



Develop personalized STEM learning

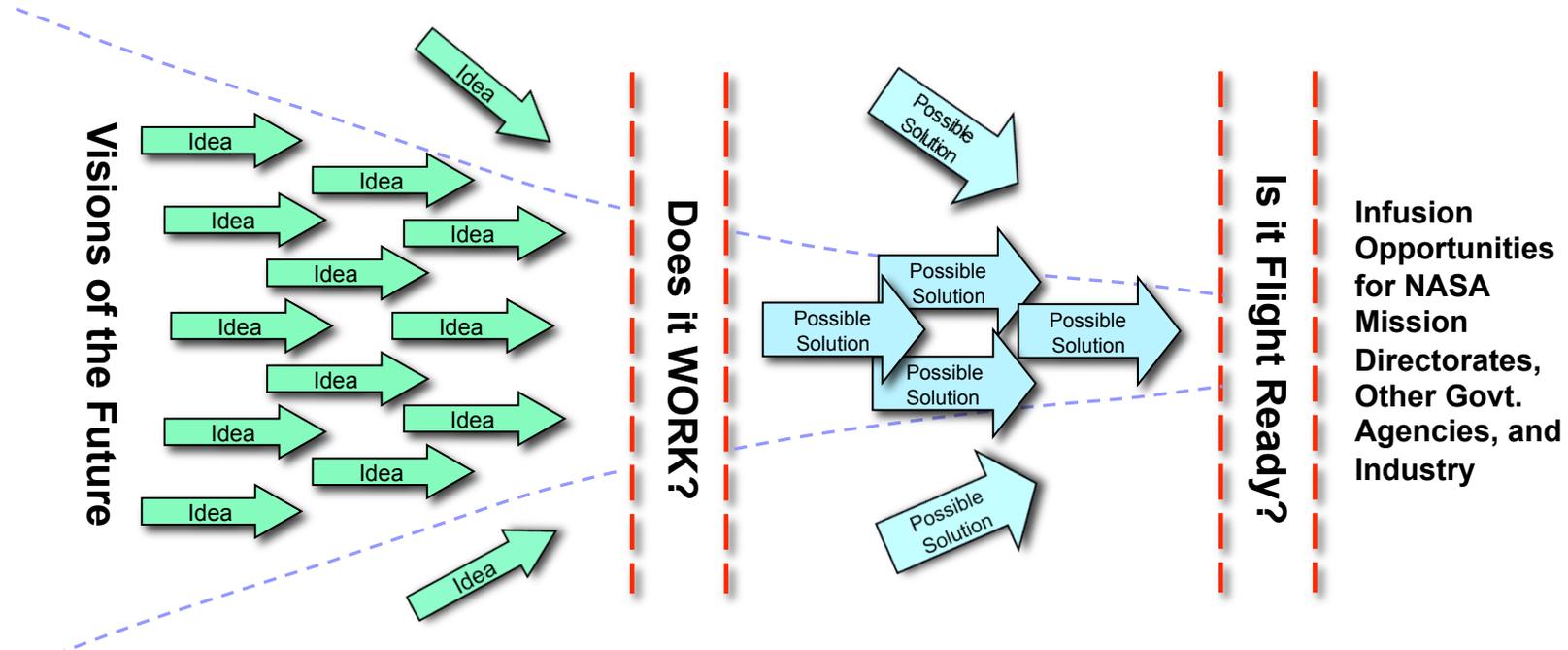


Engineer the tools of scientific discovery



Discover life beyond earth

NASA Space Technology Program



Creative ideas regarding future NASA systems or solutions to national needs.



Prove feasibility of novel, early-stage ideas with potential to revolutionize a future NASA mission and/or fulfill national need.



Mature crosscutting capabilities that advance multiple future space missions to flight readiness status



Early Stage Innovation



The Early-Stage Innovation Division sponsors a wide range of low TRL efforts for advanced space system concept and initial technology development across academia, industry and at the NASA field Centers.

Early-Stage Innovation includes:

- **Space Technology Research Grants Program** that focuses on innovative research in advanced space technology & graduate fellowships for student research in space technology
- **NIAC Program** that focuses on innovative aeronautics and space system concepts for future NASA missions.
- **Center Innovation Fund Program** to stimulate aerospace creativity and innovation at the NASA field Centers
- **SBIR/STTR Program** to engage small businesses in our Nation's space enterprise and infuse these products across NASA missions
- **Centennial Challenges Prize Program** to address key technology needs with new sources of innovation outside the traditional aerospace community.

All Early Stage Innovation selections will be made competitively.

Game Changing Technology Division



- *The Game Changing Technology Division focuses on maturing advanced space technologies that may lead to entirely new approaches for the Agency's future space missions and solutions to significant national needs.*
- *Through significant ground-based testing and/or laboratory experimentation, the Game Changing Technology Division matures technologies in preparation for potential system level flight demonstration. Success is not assured with each investment; however, on the whole and over time, dramatic advances in technology, enabling entirely new NASA missions and potential solutions for a variety of society's technological challenges are expected.*
- *A broad spectrum of space system technologies will be developed ranging from launch vehicle subsystems, spacecraft technologies, in-space capabilities, and surface systems that support robotic and human exploration.*

Game Changing Technology Division includes:

- **Game Changing Development Program** which focuses on innovative ideas enabling new capabilities or radically altering our current approaches to space systems
- **Small Satellite Subsystem Technology Program** which enables small satellites to provide game changing capabilities for the government and commercial sectors

Greater than 70% of GCT selections will be made competitively

Crosscutting Capability Demonstrations Division



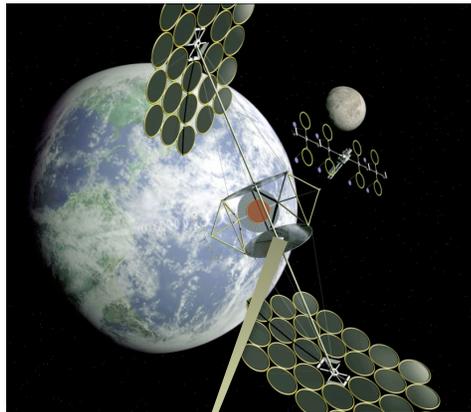
- *The Cross-Cutting Capability Demonstrations Division focuses on maturation to flight readiness of cross-cutting capabilities that advance multiple future space missions, including flight test projects where in-space demonstration is needed before the capability can transition to direct mission application.*
- *Matures a small number of technologies that benefit multiple customers to flight readiness status (TRL 6) through Projects that perform relevant environment testing*

Crosscutting Capability Demonstrations Division includes:

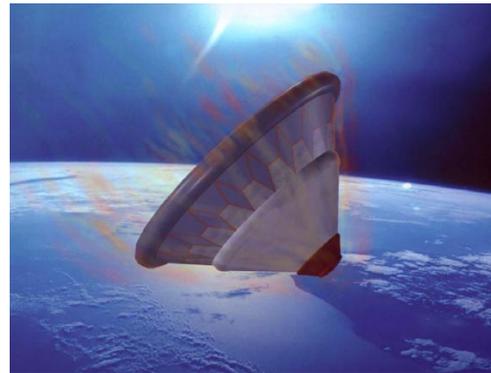
- **Technology Demonstration Missions Program** which matures, through flight demonstrations, a small number of Agency crosscutting technologies in partnerships with the Mission Directorates
- **Edison Small Satellite Missions Program** which develops and operates a series of NASA-focused small satellite demonstration missions in collaboration with academia and small business
- **Flight Opportunities Program** which provides flight opportunities of reduced-gravity environments, brief periods of weightlessness, and high-altitude atmospheric research

Greater than 70% of CCD selections will be made competitively

Potential Space Technology Demonstrations



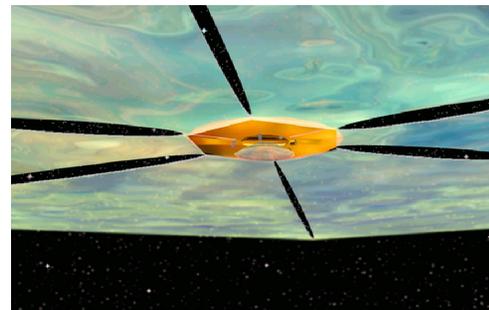
**Space Solar Power:
In-Space Power
Transmission**



Inflatable Decelerators



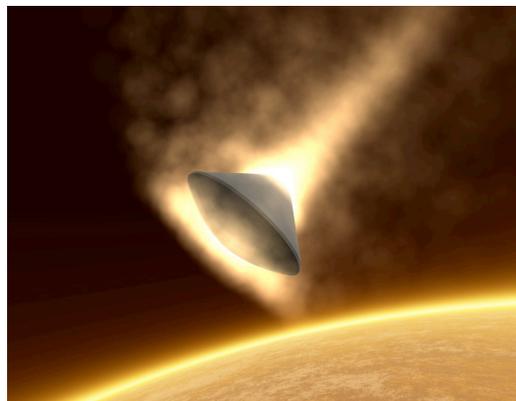
25-40 m Class Telescopes



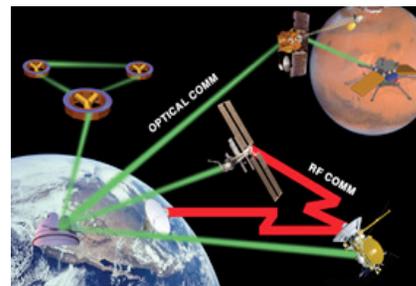
Solar Sail Propulsion



**Electrodynamic
Tether Propulsion
Artist Concept of ISS
Reboost**



Aerocapture



Optical Communications

Space Technology Budget



Space Technology (Major Elements)	FY 2011 PBR	FY 2012	FY 2013	FY 2014	FY 2015	FY11-15 Total
Partnership Development & Strategic Integration	42.0	46.5	48.2	47.7	55.0	239.4
Early Stage Innovation	298.6	304.4	300.4	305.1	314.7	1523.2
Game Changing Technology	129.6	359.3	349.1	349.1	424.2	1611.3
Crosscutting Capability Demonstrations	102.0	302.0	362.0	362.0	424.0	1552.0
TOTAL	572.2	1012.2	1059.7	1063.9	1217.9	4925.9

Space Technology	FY 2011 PBR	FY 2012	FY 2013	FY 2014	FY 2015	FY11-15 Total
Partnership Development & Strategic Integration						
Partnership Development & Strategic Integration	42.0	46.5	48.2	47.7	55.0	239.4
Early Stage Innovation						
(1) Space Tech Res Grants	70.0	70.0	70.0	70.0	70.0	350.0
(2) NIAC	3.0	6.0	7.0	7.0	8.0	31.0
(3) Center Innovation Fund	50.0	50.0	50.0	50.0	50.0	250.0
(4) SBIR/STTR	165.6	168.4	163.4	168.1	176.7	842.2
(5) Centennial Challenges	10.0	10.0	10.0	10.0	10.0	50.0
Game Changing Technology						
(6) Game Changing Developments	123.6	329.3	319.1	319.1	394.2	1485.3
(7) Small Satellite Subsystems Tech	6.0	30.0	30.0	30.0	30.0	126.0
Crosscutting Capability Demonstrations						
(8) Technology Demonstration	75.0	265.0	325.0	325.0	387.0	1377.0
(9) Edison Small Satellite Demo	10.0	20.0	20.0	20.0	20.0	90.0
(10) Flight Opportunities	17.0	17.0	17.0	17.0	17.0	85.0
TOTAL	572.2	1012.2	1059.7	1063.9	1217.9	4925.9

Budget numbers are preliminary and may be changed as the NASA FY 2011 request is updated (to accommodate the Orion ERM)

Space Technology Solicitation Schedule



Division	Programs	Subject	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CY 2011	CY 2012	CY 2013	
Early Stage Innovation	Space Technology Grants & Fellowships	Suggestions on research topics for Fellowships			RFI								RFI	RFI	RFI	
		Targeting graduate students for the Winter 2010/ Spring 2011 semester for Fellowships				Fellowship Call										
		Solicitation posted for Space Technology Grants				NRA							NRA	NRA	NRA	NRA
		Targeting graduate students for Aug 2011 start for Fellowships									Fellowship Call			NRA	NRA	NRA
	NIAC	Call for concept or system studies				NRA							NRA	NRA	NRA	
	Center Innovation Fund	No external calls				Center Guidance							Center Guidance	Center Guidance	Center Guidance	
	SBIR / STTR	Standard cycle		STTR Ph1 Awards			RFP Ph		SBIR Ph1 Awards	Both Ph Awards				RFP	RFP	RFP
Centennial Challenges	Unfunded SAAs to manage each of the new prize challenges			RFP/ SAA									RFP/ SAA	RFP/ SAA	RFP/ SAA	
Game Changing Technology	Game Changing Development	Industry Day/Workshop to roll out GCD				ID										
		Request Ideas for PM led seed fund ideas					NRA						NRA	NRA	NRA	
		Request for ideas for systems, subsystems & concepts									NRA			NRA	NRA	NRA
		AO for proposals on down-selected concepts												AO	AO	AO
	Small Satellite SubSystem Technologies	Solicit ideas for Small Satellite Technologies				RFI										
		AO for proposals on down-selected concepts											AO	AO	AO	
Crosscutting Capability Demonstrations	Technology Demonstration Missions	Identify potential technical areas for cross-cutting demos				RFI							RFI	RFI	RFI	
		Primary Call for Cross-Cutting capability demonstrations						AO (Step 1)			AO (Step 2)		AO	AO	AO	
	Edison Small Satellite Demonstrations	Identify potential technical areas for Edison Small Sat demos				RFI								RFI	RFI	RFI
		Primary Call for Edison Small Sat demonstrations							AO					AO	AO	AO
	Flight Opportunities		FAST Call for Proposals											RFP	RFP	RFP
		Identify potential technical areas for Flight Opportunities											RFI	RFI	RFI	
		Primary Call for Flight Opportunities	AO			RFP		AO					AO/RFP	AO/RFP	AO/RFP	

ID - Industry Day

AO - Announcement of Opportunity

BAA - Broad Agency Announcements

NRA - NASA Research Announcement

RFI - Request for Information

RFP - Request For Proposal

SAA - Space Act Agreement

Earliest dates shown for planning/formulation purposes only. Actual RFP/AO release subject to approval.



NASA Technology Executive Council

- The NASA Technology Executive Council (NTEC) is organized and chaired by the NASA Office of the Chief Technologist. Council membership includes the Mission Directorate AAs (or their designees), and the NASA Chief Engineer (or designee). The function of NTEC is to perform Agency-level technology integration, coordination and strategic planning. NTEC does not perform programmatic management for the OCT Space Technology programs or Mission Directorate technology programs. NTEC will hold regular status meetings and time-critical decision meetings on as needed basis, as well as quarterly assessment and yearly strategic decision meetings.

Center Technology Council

- The Center Technology Council (CTC) is organized and chaired by the NASA Office of the Chief Technologist. Council membership includes the Center Chief Technologist (CCT) from each NASA Center, and a representative from OCE. The CTC will focus upon institutionally funded activities and development of OCT programs. The CTC will meet on a regular, approximately quarterly, basis to discuss program status, and on an as needed basis for decisional meetings.

NASA: Part of a Broader National Strategy



- Through its FY11 budget request, the Obama administration is committed to a research, technology and innovation agenda for the Nation as a means of stimulating the economy and building our Nation's global economic competitiveness through the creation of new products and services, new business and industries, and high-quality, sustainable jobs
- The NASA budget request is aligned with this National strategy.
 - The renewed emphasis on technology in the President's FY11 budget request balances the long-standing NASA core competencies of R&T, spaceflight hardware development, and mission operations.
- In addition to providing a more more vital and productive aerospace future than our country has today, a NASA focused on technology and innovation,
 - Drives our Nation's economic competitiveness.
 - Serves as a strong inspiration for young people to pursue STEM education and career paths.
 - Allows NASA to apply its intellectual capital to the develop technological solutions addressing broader National needs in energy, weather & climate, Earth science, health & wellness, and National security.

I am 100 percent committed to the mission of NASA and its future. Because broadening our capabilities in space will continue to serve our society in ways we can scarcely imagine. Because exploration will once more inspire wonder in a new generation: sparking passions, launching careers. And because, ultimately, if we fail to press forward in the pursuit of discovery, we are ceding our future. President Obama, April 15, 2010.

Back Up Slides



Space Technology Divisions



	Early-Stage Innovation	Game-Changing Technology	Crosscutting Capability Demos
Development Stage	Concept Validation (TRL 1-2)	Tech Demonstration (TRL 3-4/5)	System Qualification (TRL 6)
Programs	Space Tech Research Grants NIAC Center Innovation Fund SBIR/STTR Centennial Challenges	Game Changing Development Small Satellite Subsystem Technology	Technology Demonstration Missions Edison Small Satellite Missions Flight Opportunities
Number of Projects	100+	10-20	TDM: 3-8 ESSM: 1-3 FO: 20-40
Typical Project Cost	\$50K-\$800K	GCD: Large: \$25M; Small: \$6M SSST: \$6M	TDM: \$150M from OCT ESSM: \$10M FO: < \$5M
Project Duration	6 months – 2 years	2 yrs w/potential 1 yr extension	TDM: < 3 years ESSM: < 2 years FO: 6 months – 2 years
Performer Selection	100% Competed	> 70% Competed	> 70% Competed
Typical Performers	Academia, NASA, Industry	NASA, Fed Labs, Industry, Academia	Industry, NASA
Funding Mechanisms	Grants, Contracts, Cooperative Agreements, Prize Competitions	BAAs, Contracts	Contracts, Space Act Agreements
Cost-Sharing	Encouraged	Preferred	Required, 25% min for TDM
Partners	Academia Federal: NASA MDs, DARPA, DOD, DOE, NOAA, NSF, Other Industry: Aerospace, Non-Aerospace International Partners		

Space Technology Research Grants



- **Level II Program Office: GRC**
- **Objective:** The Space Technology Research Grants Program will accelerate the development of push technologies to support the future space science and exploration needs of NASA, other government agencies, and the commercial space sector. Innovative projects with high risk/high payoff will be encouraged. Program composed of two competitively awarded components.
- **GRANTS:** This low TRL technology portfolio focuses on foundational research in advanced space systems and space technology performed by academia, NASA field Centers, and not-for-profit R&D labs, with the option of including small business and industry partners.
 - **Acquisition Strategy:** NRA calls anticipated once or twice annually.
 - **Awards:** Typical 12 months awards at \$250K. 100+ per year
 - **Collaboration:** Academia, not-for-profit R&D labs & NASA Centers lead proposals; others team.
- **FELLOWSHIPS:** Competitive selection of U.S Citizen or permanent resident graduate student research that shows significant promise for future application toward NASA missions and strategic goals
 - **Acquisition Strategy:** Selected candidates will perform graduate student research on their respective campuses, at NASA Centers and not-for-profit Research and Development (R&D) labs. Each student matched with a technically relevant and community engaged researcher who will serve as the student's professional advisor.
 - **Awards:** Building up to 500 active students per year.
 - **Collaboration:** Strong collaboration is anticipated between NASA Centers/R&D Labs & Academia

NASA Innovative Advanced Concepts (NIAC)



- **Objective:** NIAC is focused on early studies of visionary, long-term concepts
 - Aerospace architecture, system, or mission concepts (TRL 1-2, 10+ years from application)
 - OCT is re-establishing this effort as the *NASA Innovative Advanced Concepts* program
 - Still called “NIAC” to link to the original intent/spirit and build on its success
 - Run internally from HQ, and allowing internal NASA/JPL participation
- **Acquisition Strategy / Awards: Two Phases**
 - Phase I (up to 1 year, \$100k): to examine the overall viability of an innovative system or concept; competitively selected (NASA, OGAs, academia, industry, or partnerships)
 - Phase II (up to 2 years, \$500k): to study major feasibility aspects (cost, performance, development time, key issues) and potential infusion path; competitively selected from successful Phase I awards



Studies exploring future space missions



Involve industry, academia & NASA to revolutionize space access, operations & utilization

Center Innovations Fund



- **Objective:** To stimulate and encourage creativity and innovation from within the NASA Centers. The activities are envisioned to fall within the scope of NASA Space Technology or technology addressing a significant National need.
- **Acquisition Strategy:** Through the Center Chief Technologist, Centers will conduct competitions to select ideas/projects and provide appropriate oversight. Detailed feedback on these activities will be required before the end of each FY.
- **Awards:** The funds will be distributed among the ten NASA centers to provide seed funding for new ideas and idea generation activities. These funds will allow Centers to support low TRL innovative technology initiatives that leverage Center talent and capability.
- **Collaboration:** Partners will be sought out by the Centers for the pursuit of innovation that is of common interest, as demonstrated by the willingness of partners to contribute with technologies, resources, and expertise. Partners will include private sector firms, universities, other government agencies and FFRDCs.

SBIR/STTR (Small Business Innovation Research/ Small Business Technology Transfer)



- **Level II Program Office: ARC**
- **Objective:** To engage and provide opportunity to small businesses to participate in Federal Research activities and encourage cooperative research and development with non-profit research institutions, respectively such as a university; with a primary objective of developing and facilitating the transfer of technology from research institutions through the entrepreneurship of small business contracts that result in technology to meet NASA's needs.
- **Acquisition Strategy:** Reporting to OCT, SBIR and STTR acquisition strategy is unchanged.
- **Awards:**
 - Consistent with pending reauthorization, current authorization provides for SBIR funding at a minimum of 2.5% of NASA's extramural research and development expenditures.
 - STTR is a separately funded activity. STTR is smaller than SBIR, with funding set at a minimum of 0.3% of the extramural research and development budget, approximately one-eighth of the amount for SBIR.
- **Collaboration:** The percentage of new firms participating in NASA's SBIR/STTR programs each year has been in the 30-50% range, yielding new applicants each year. New participants have submitted between 20-35% of the total number of proposals in any given year.

Centennial Challenges



- **Level II Program Office: MSFC**
- **Objective:** Seeks innovative solutions to technical problems that can drive progress in aerospace technology of value to NASA's missions in space operations, science, exploration and aeronautics.
 - Enables broad participation by innovators across our nation and across generations.
- **Acquisition Strategy:** Yearly announcement of new Challenges
- **Awards:** Typical prize award (from OCT): \$1-5M
 - Note: 100% of funds identified is for prizes. No funding for labor or travel
 - FY 2011 PBR (+\$6M) will allow NASA to pursue new and more ambitious prize competitions.
- **Collaboration:** In selecting topics for prize competitions, NASA consults widely within and outside of the Federal Government.



Achieve breakthrough tech development via prizes & non-traditional aerospace



Reduce the cost of space Hardware development

Game Changing Development

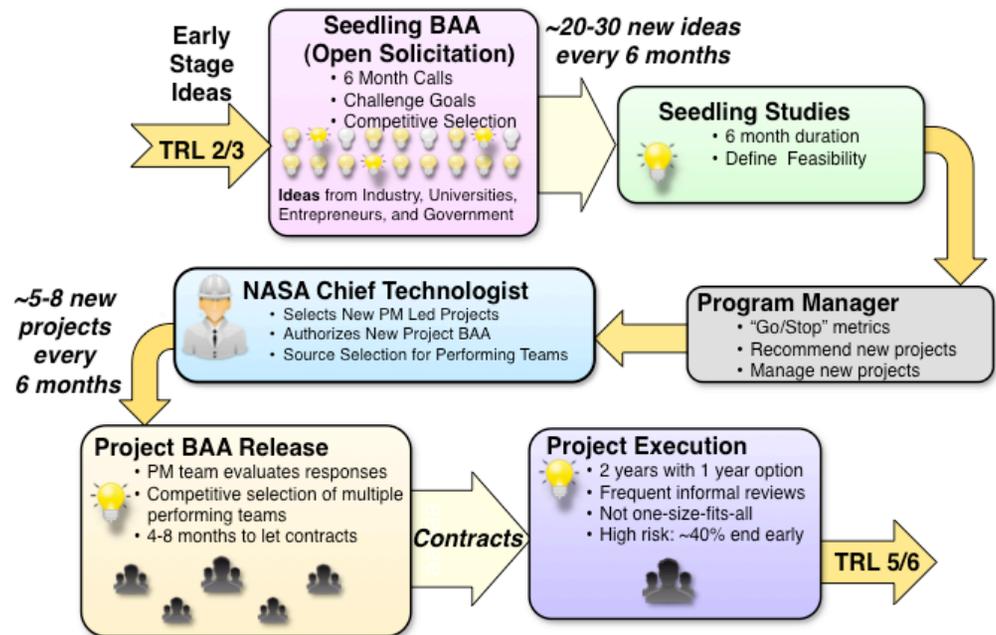


- **Level II Program Office: LaRC**
- **Objective:** The Game Changing Development Program will solicit innovative ideas enabling new capabilities or radically altering our current approaches to launch, build, and operate space systems.
- **Acquisition Strategy:** Ideas or “seedling studies” will be competed to flesh out the details of the idea(s), quantify their challenges and identify approaches to overcome them

After completion of the seedling feasibility studies, a subject matter expert “Program Manager” (PM) may or may not choose to recommend the idea for a new project start. If the PM provides a compelling case with metrics (that if achieved will be “*game changing*”) the NASA Chief Technologist may authorize the PM to release a BAA.

The BAA does not ask for bids on a single, predetermined approach, but rather asks for as many ideas for how to achieve the project goals as the community might imagine. The PM and a committee of experts assesses the ideas for how well they satisfy the project goals.

- **Awards:** Each year, the Program will award several new implementation phase projects, each lasting for 2 to 3 years and under the guidance of the PM
- **Collaboration:** In most projects, multiple performing teams will work in parallel to mature the technologies according to the project plan. Teams will include Govt Agencies, academia and industry

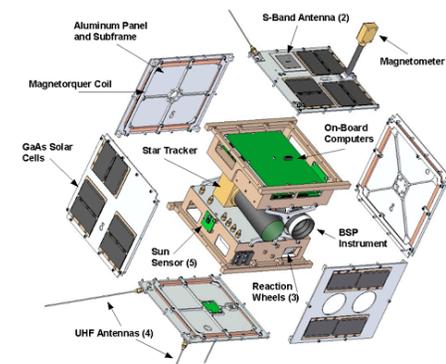
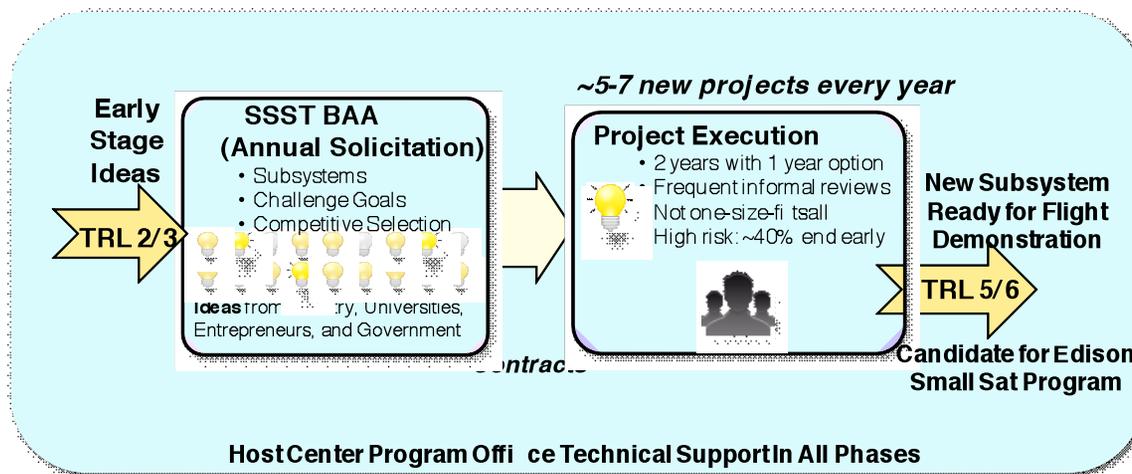
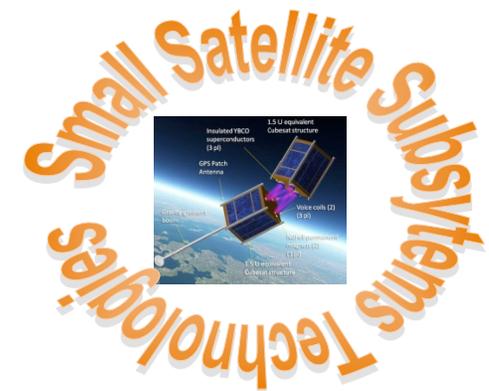


Level II Program Office Technical Support In All Phases

Small Satellite Subsystem Technology



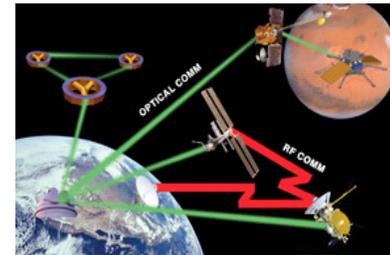
- **Level II Program Office: ARC**
- **Objectives:** The SSST Program will mature technologies that enable small satellites to provide game changing capabilities for the government and commercial sectors will be developed. At completion, the subsystem deliverables should be ready for demonstration in space within the Edison Program under Crosscutting Capability Demonstrations Division.
- **Acquisition Strategy / Awards:** Yearly BAAs will result in 5-7 new competitively selected awards. These two year activities with a possible third year will be regularly assessed using planned review gates (possible early cessation of projects due to high risk/high payoff).
- **Collaboration:** Competitions for technology maturation will be open to NASA Centers, Govt. Agencies, Industry and Academia, with partnership strongly encouraged.
- **Examples:** Transformational subsystem technologies and system interoperability will be considered (e.g. *small safe propulsion system*, or a *small entry probe for de-orbit and recovery*).



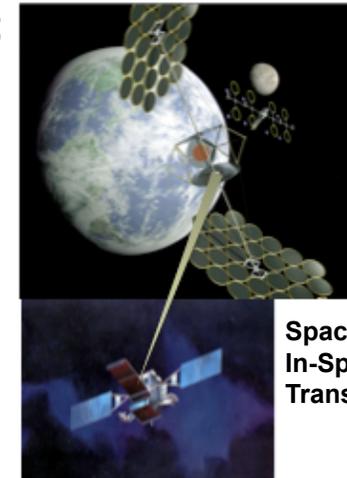
Technology Demonstration Missions



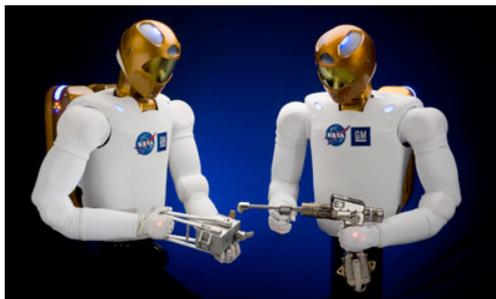
- **Level II Program Office: MSFC**
- **Objectives:** Matures a small number of technologies that benefit multiple customers to flight readiness status (TRL 6) through Projects that perform relevant environment testing. Projects must be crosscutting, defined as technology with potential to benefit multiple Mission Directorates, other government agencies, or the aerospace industry. Orbital and suborbital flight demonstrations should capture significant public interest and awareness
- **Acquisition Strategy:** Yearly calls for proposed flight test demonstrators; goal - several openly competed proposals selected per year
- **Awards:** Maximum three years development schedule. Typical project life cycle cost (from OCT): \$150M
 - Funding cap includes all elements of the flight test demonstration: planning, hardware development, software development, launch costs, ground ops, post test assessments
- **Collaboration:** Minimum 25% partner contribution to demonstrate infusion interest. Proposal teams may include NASA Centers, Govt. Agencies, Industry and Academia, with partnerships strongly encouraged



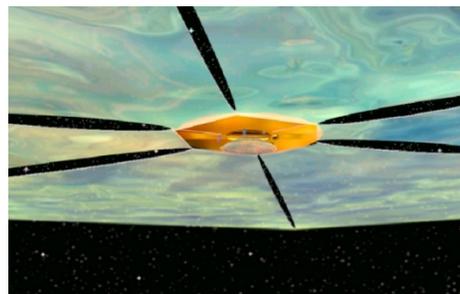
Optical Communications



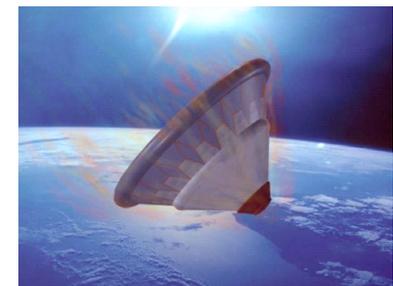
Space Solar Power:
In-Space Power
Transmission



Robotic Surrogates



Solar Sails



Inflatable Decelerators

Edison Small Satellite Demonstration Missions



- **Level II Program Office:** ARC
- **Objectives:** Develop and operate a series of NASA-focused small satellite demonstration missions. Provide targets of opportunity on small satellites for earth, physical, and life experiments (including research in fundamental biology). Seeks to serve the small satellite community by improving the affordability of small payload launch through secondary payload process improvements and other launch availability developments.
- **Acquisition Strategy / Awards:** Yearly calls for proposals with expectation that between 1 to 2 small satellite missions will be conducted per year. Emphasis on competitive selections. Technologies developed via OCT's SSST Program and must be re-competed for SSDM awards
- **Collaboration:** NASA will pursue these missions in collaboration with small business, other government agencies, and academia
 - Significant emphasis on NASA-university collaborative efforts to enable university students to gain hands-on experience within these project activities.
 - FY11 initiation of Small Satellite Virtual Institute involving academic organizations across the globe
- **Examples:** Technology examples could include formation flying, payload recovery, orbital debris removal, autonomous/collaborative/close proximity operations, advanced power systems (long life or space-to-space transmission), advanced propulsion, miniaturized remote sensors, deployable apertures, autonomous swarm, robotics, and interoperable systems



Demo technologies on small sats

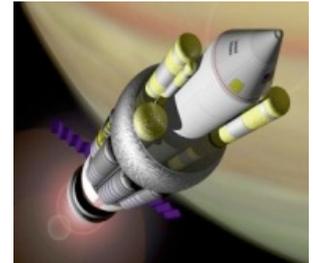


Leverage secondary payload opportunities

Flight Opportunities



- **Level II Program Office: DFRC**
- **Objectives:** NASA to provide flight opportunities for technology development, science and education efforts to reduced-gravity environments, brief periods of weightlessness, and high-altitude atmospheric research. The Flight Opportunities Program combines the FY10 FAST and CRuSR efforts previously managed by NASA's Innovative Partnership Program. Goal of expanding program to other platforms and test environments in FY12.
- **Acquisition Strategy / Awards:** The Flight Opportunities Program will competitively secure commercial suborbital flight services;
 - Access to 3-4 minutes of microgravity for these flight opportunities;
 - Focus on payloads that reduce risk for use of new technologies in future missions.
- The Flight Opportunities Program will also test technologies on parabolic aircraft flights that can simulate microgravity and the reduced gravity environments of the Moon or Mars
 - Each flight provides 40-60 parabolas, each with 25 seconds of microgravity; participants typically receive several flights;
 - NASA pays for flight time, participants pay for their own project preparations;
 - 5 projects flown in FY2008 and 19 flown in FY2009, 15-20 planned for FY2010
- **Collaboration:** Open to companies, universities, and government labs. Call for proposals targeted for late summer.



Make space access economical



Provide participatory exploration



Low Gravity tech testing

Partnerships, Innovation and Commercial Space



- **Partnerships:** Partnerships are an integral part of NASA's strategy for reinvigorating technology and innovation. Partnerships will:
 - Leverage the technology investments of other government agencies
 - Engage universities in STEM educational and career paths
 - Connect with industry technologists to permit utilization of NASA facilities
 - Communicate standards used by NASA facilities and assets
- **Innovation:** Innovation activities will increase the exchange of ideas between NASA employees and the most innovative segments of the private sector and government.
 - Innovation Ambassadors: placing technical employees at external innovative organizations for up to 12 months
 - Innovation Scouts: 1-2 day workshops to exchange information on innovation
 - Entrepreneurs in Residence (EIR): bringing proven start-up entrepreneurs to NASA Centers, developing business cases for promising NASA technologies.
- **Commercial Space:** OCT will work with entrepreneurs across the aerospace industry to enable new capabilities that will spur growth in commercial space activities in a manner similar to the way NACA aided the early aeronautics industry

Strategic Integration



- **Technology Governance:** Define and implement guidelines for technology development roles and responsibilities
- **Coordination and Planning:** Perform Agency level technology development planning activities yielding:
 - Commitments and agreements between Mission Directorates
 - Synergies across technology plans
 - Elimination of capability gaps and overlaps
- **Roadmapping and Prioritization:** Define and manage an open and transparent process to create Agency level technology roadmaps and prioritizations
- **Technology Portfolio Tracking:** Define and manage an Agency Level process to capture and track NASA's technology development portfolio
- **Technology Studies:** Perform necessary Agency assessments, trade studies and special studies for key technology areas
- **Technology Councils:** Administer the NASA Technology Executive Council (NTEC) and the Center Technology Council (CTC), both chaired by the Chief Technologist
- **Reporting:** Document technology performance and planning information in quarterly and yearly reports
- **Agency Strategic Planning:** Participate in Agency level strategic planning activities

Technology Roadmapping



- The Aero-Space Technology Area Roadmap (A-STAR) is a set of roadmap documents that provides recommendations covering NASA's current and planned technology investments over a 20-year horizon, with greater detail provided over the first 10 years.
- These documents provide recommendations regarding the identity and prioritization of technology pathways needed to meet NASA Strategic Goals, Outcomes and Objectives, as well as National needs.
 - The A-STAR scope will not cover all technology work within the NASA. The approximately 15 chosen A-STAR technology areas will focus upon capability areas where significant technology investments are anticipated, and where substantial enhancements in NASA mission capabilities are needed.
- NASA will establish the TA teams by including, as appropriate, members from NASA, other Agencies, academia and industry.
- OCT will organize a thorough peer review of the A-STAR technology roadmaps through an open and transparent process. This process will include internal and external review teams.