



The Crew Exploration Vehicle will be developed in an evolutionary program that emphasizes demonstrated performance in preparation for lunar test missions and future Mars exploration. Shown above is a representation of a possible configuration for the vehicle during a human lunar mission. As of Feb 1, 2004, NASA has not selected a design for the Crew Exploration Vehicle.

Transportation Systems

MAJOR EVENTS IN FY 2005

Transportation Systems has been established as a new Theme in FY 2004 in response to the President's Vision for U.S. Space Exploration. Major activities for FY 2005 will be developed prior to the start of FY 2005.

Theme: Transportation Systems

OVERVIEW

The Transportation Systems (TS) Theme will address crew transfer capabilities and launch requirements unique to NASA's needs within a developing architecture that supports exploration missions to the Moon, and later Mars and other destinations. The activities of the TS Theme will be focused on the space transportation requirements unique to NASA's human and robotic exploration activities. The TS Theme's primary near-term objective will be the development and demonstration of an exploration vehicle that can transport and support human crews traveling to destinations beyond low Earth orbit (LEO). With multi-purpose utility for the Agency, this human exploration vehicle will be developed in a "spiral" approach under the "Crew Exploration Vehicle" Budget line. Such an approach will commence with requirements formulation guided by the requirements of a space transportation architecture that will be tested on human-robotic lunar missions in preparation for future exploration of Mars and other destinations. In the spiral approach, unmanned prototypes first verify the outer moldline and ascent, re-entry, and abort modes of operation. These prototypes will then be evolved into manned flight systems with the addition of the subsystems and architectural elements required to support human life, put through a rigorous test program, and ultimately assigned to human exploration flights. In addition to developing and demonstrating prototypes of vehicles required for human exploration beyond LEO, the TS Theme will also analyze and assess possible requirements for heavy-lift launch systems to support exploration missions.

Missions	Goals supported by this Theme	Objectives supporting those Goals
Exploration Capabilities	9. Extend the duration and boundaries of human space flight to create new opportunities for exploration and discovery.	9.5 Develop crew transportation systems to enable exploration beyond low Earth orbit (LEO).

RELEVANCE

By developing and demonstrating a vehicle that will transport and support human crews during exploration of the solar system, the Transportation Systems Theme provides a critical element of the exploration architecture that NASA will use to explore the solar system. This vehicle will be developed in stages, with the first test flight in 2008, and a fully operational capability no later than 2014. Through the use of existing commercial expendable launch vehicles, and the execution of a "spiral" development predicated on incremental test and demonstration, the Transportation Systems theme will emphasize affordable engineering practices and demonstrated returns on public investment.

Education and Public Benefits

As an integral element of NASA's new approach to human-robotic solar system exploration, the Transportation Systems Theme will provide the technologies and systems that allow humans to travel to distant locations where their flexibility and insight will enable new discoveries and inspire the public.

IMPLEMENTATION

The managerial structure that will develop and manage demonstration of systems and vehicles in the Transportation Systems theme has not yet been determined. Where possible, contracts for the Orbital Space Plane and Next Generation Launch Technology programs—which will complete termination activities during 2005—will be restructured to ensure that research, development, and technological lessons learned will contribute to the cost-effective development of a Crew Exploration Vehicle and a space transportation architecture for exploration.

The NASA Enterprise official is Craig Steidle, Associate Administrator for Exploration Systems. The Program Executive Officer is Jim Nehman, Program Executive Officer for Exploration Systems. The Theme Director has not yet been determined.

IMPLEMENTATION SCHEDULE

The programs within the Transportation Systems Theme will be managed to be compliant with NPG 7120.5B.

STATUS

The Transportation Systems Theme is new in FY 2005. An in-depth review of past vehicle systems development activities within NASA and other agencies will be conducted during calendar 2004 to ensure that engineering and design processes incorporate lessons learned and existing research to the maximum extent possible.

Theme: Transportation Systems

PERFORMANCE MEASURES

Outcomes/Annual Performance Goals (APGs)	
<i>Outcome 9.5.1</i>	<i>By 2014, develop and flight-demonstrate a human exploration vehicle that supports safe, affordable and effective transportation and life support for human crews traveling from the Earth to destinations beyond LEO.</i>
5TS1	Conduct a detailed review of previous vehicle programs to capture lessons-learned and appropriate technology maturation; incorporate results into the human exploration vehicle requirements definition process.
5TS2	Develop and obtain approval for human exploration vehicle Level 1 and Level 2 Requirements and the resulting Program Plan.
5TS3	Complete preliminary conceptual design(s) for the human exploration vehicle, in conjunction with definition of an integrated exploration systems architecture.
5TS4	Develop launch vehicle Level 1 Requirements for human-robotic exploration within an integrated architecture, and define corresponding programs to assure the timely availability of needed capabilities, including automated rendezvous, proximity operations and docking, modular structure assembly, in space refueling, and launch vehicle modifications and developments.
<i>Outcome 9.5.2</i>	<i>By 2010, identify and develop concepts and requirements that could support safe, affordable and effective transportation and life support for human crews traveling from the Earth to the vicinity or the surface of Mars.</i>
5TS5	Conduct a preliminary conceptual design study for a human-robotic Mars exploration vehicle, in conjunction with definition of an integrated exploration systems architecture.
Uniform Measures	
5TS6	Distribute at least 80% of allocated procurement funding to competitively awarded contracts, including continuing and new contract activities.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
TBD				

BUDGET

Budget Authority (\$ millions)	FY 2003	FY 2004	Change	FY 2005	Comments
Transportation Systems		966.5	-277.8	688.7	--
<u>Technology and Advanced Concepts</u>		<u>966.5</u>	<u>-277.8</u>	<u>688.7</u>	--
Crew Exploration Vehicle			+428.0	428.0	--
Space Launch Initiative		966.5	-705.8	260.7	Termination Activities

	Indicates changes since the previous year's President's Budget Submit
	Indicates budget numbers in full cost.

Theme: Transportation Systems

Technology and Advanced Concepts: Crew Exploration Vehicle

PURPOSE

Objectives	Performance Measures
9.6	5TS1-5

The CEV Program will provide crew transfer capabilities within a developing architecture to support exploration missions to the Moon, and later Mars and other destinations. With multi-purpose utility for the Agency, the CEV will be developed in a "spiral" approach. Such an approach will commence with requirements formulation for a vehicle defined within a larger space transportation architecture. In the spiral approach, unmanned prototypes first verify the outer moldline and ascent, re-entry, and abort modes of operation. The prototypes will then be evolved into manned flight systems with the addition of the subsystems and architectural elements required to support human life, put through a rigorous test program, and ultimately assigned to human exploration flights.

OVERVIEW

The CEV Program spiral development plan is initially comprised of three distinct vehicle development blocks: (1) prototype test vehicles, (2) Block I (unmanned) systems development, and (3) Block II (manned) systems development. For each block a design, development, and production element plan will be defined. Per NASA Guidelines, the formulation phase will be utilized to establish the Program schedule and budget plans. The current budget planning is based on formulation concept studies to be conducted in FY04, preliminary design activities conducted in FY05 and FY06, a System Design Review in FY05, and a Preliminary Design Review in FY06. A decision whether to enter into implementation (proceed with the full scale development) of the CEV is scheduled to be made at the end of FY06 following the System Design Review, completion of the Non-Advocate Review, and completion of an independent cost review including a Cost Analysis Requirements Document. At that point, a decision to proceed will result in the CEV Program transitioning from formulation to implementation.

The objective of the prototype block is to provide the necessary flight demonstrations and technology development activities to enable the CEV development. The purpose of the first block is to develop the fundamental capability to test a CEV moldline during ascent and re-entry as well as to test the crew escape technologies required during all phases of atmospheric flight. Prototype vehicles will be fully instrumented to provide data on crew environments, Launch Vehicle health and status, parachute systems, orientation and landing techniques, and external aeroshell configurations. The CEV Program will not proceed to Block I development until it has implemented a strategy for mitigating systems and safety risk to levels acceptable for crewed test flight. The second step in the spiral will be to develop the Block I vehicles with the systems required to extend CEV operations beyond ascent/re-entry. Life support and long mission duration support systems will be added and interfaces to other operational elements (e.g., Service Modules) will be tested and verified. Lessons learned from development of this intermediate test platform will be incorporated into manned flight vehicles developed in the third spiral block. When combined with other architectural elements, the CEV will then become available for assignment to specific missions of exploration or possibly ISS crew transport.

PROGRAM MANAGEMENT

The NASA Enterprise official is Craig Steidle, Associate Administrator for Exploration Systems. The Program Executive Officer is Jim Nehman, Program Executive Officer for Exploration Systems. The Theme Director and Program Managers are not yet determined.

TECHNICAL COMMITMENT

There is no baseline for this Program. This Program is a new start in FY2005.

Schedule	FY 2005 President's Budget	Change from Baseline
CEV Options and Trade Studies	2004	--
System Design	2005	--
System Development	2006	--
Integration and Test	2007	--
Boilerplate demo flight	2008	--
Block I demo flight	2011	--
Block II demo flight	2013	--

Theme: Transportation Systems

Technology and Advanced Concepts: Crew Exploration Vehicle

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	%	Full & Open Competition	%	Industry	%
Cost Reimbursable	%	Sole Source	%	Government	%
Fixed Price	%		0%	NASA Intramural	%
Grants	%			University	%
Other	%	Sci Peer Review	%	Non Profit	%
*As of FY 2003 direct procurement	0%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	0%

Future Acquisition	Selection	Goals
TBD	TBD	100% Full and Open Competition

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Exploration. External: TBD.

RISK MITIGATION

Risk Date: 1/31/2004

Top Risks	G	Overall	G	Cost	G	Schedule	G	Technical	Probability	Impact	Mitigation Plan
G		TBD: Risks will be assessed when this Project enters the Formulation phase.							TBD	TBD	TBD

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
TBD				

BUDGET

Budget Authority (\$ millions)	FY 2003	FY 2004	FY 2005	Comments
<u>FY2005 PRESBUD</u>			428.0	--
Crew Exploration Vehicle			428.0	New Program
<u>Changes since 2004 PRESBUD</u>				--
<u>FY2004 PRESBUD.</u>				--

- Indicates changes since the previous year's President's Budget Submit
- Indicates budget numbers in full cost.