PSDS 2013-2022 Mission Studies

Authors	Title	Summary	Panel Selection
John Spencer	Jupiter Europa Orbiter Component of EJSM	Some 400 years ago, discovery of the four large moons of Jupiter by Galileo Galilei changed our view of the universe forever. Today Jupiter is the archetype for the giant planets of our solar system, and for the numerous giant planets now known to orbit other stars, and Jupiter"s diverse Galilean satellites -- three of which are believed to harbor internal oceans -- are central to understanding the habitability of icy worlds.	Satellites
Elizabeth Turtle	Io Observer	The Jovian moon Io is likely the most geologically active body in the solar system, offering insight into tidal heating, volcanic processes, and other phenomena. However, its location within Jupiter"s radiation belt presents significant engineering challenges that must be addressed to enable future missions to Io. Under the direction of NASA, and with direct guidance from the National Research Council"s (NRC"s) Satellites Panel, the Jet Propulsion Laboratory"s (JPL"s) Advanced Project Design Team (Team X) looked at the feasibility of a remote observational mission to Io as a possible future New Frontiers concept.	Satellites
Krishan Khurana	Ganymede Orbiter	As part of NASA"s support to the National Research Council (NRC) and its current Planetary Decadal Survey, JPL was assigned the task of developing a mission and flight system architecture suitable to perform a scientifically viable Ganymede Orbiter (GO) mission responsive to science traceability matrix (STM) requirements formulated by NASA"s science panel. This report documents the results of that study.	Satellites

John Spencer	Titan Saturn System Mission	Titan is a high priority for exploration, as recommended by NASA"s 2006 Solar System Exploration (SSE) Roadmap (NASA 2006), NASA"s 2003 National Research Council (NRC) Decadal Survey (NRC Space Studies Board 2003) and ESA"s Cosmic Vision Program Themes. Recent revolutionary Cassini-Huygens discoveries have dramatically escalated interest in Titan as the next scientific target in the outer solar system.	Satellites
John Spencer	JPL Rapid Mission Architecture (RMA) Enceladus Study Final Report	At the request of the Satellites Panel of the Planetary Science Decadal Survey, a Rapid Mission Architecture (RMA) study of possible missions to Saturn"s moon Enceladus was conducted at the Jet Propulsion Laboratory (JPL) in January and February of 2010. Fifteen mission architectures were examined that spanned a broad range of potential science return and total estimated mission cost. This report documents the findings of that study.	Satellites
John Spencer	Enceladus Orbiter	The Enceladus Orbiter (EO) mission would explore Saturn"s moon Enceladus, investigating the following in order of priority: -The nature of Enceladus"s cryovolcanic activity -The internal structure and chemistry of Enceladus -The geology of Enceladus -The interaction of Enceladus with the Saturn system -The surfaces and interiors of Saturn"s moons Rhea, Dione and Tethys -Preparation for potential future landing on Enceladus	Satellites

J. Hunter Waite	JPL Team X Titan Lake Probe Study Final Report	This study focused on an in-situ examination of a hydrocarbon lake on the Saturnian moon Titan -- a target that presents unique scientific opportunities as well as several unique engineering challenges (e.g., submersion systems and cryogenic sampling) to enable those measurements. Per direction from the National Research Council (NRC) 2012SS Planetary Decadal Survey Satellites Panel, and after an initial trade-space examination, study architectures focused on three possible New Frontiers" class missions and a more ambitious Flagship-class lander intended as a contributed portion of a larger collaborative mission.	Satellites
Erik Asphaug	Near Earth Asteroid Trajectory Opportunities in 2020-2024	Near Earth objects (NEOs) are attractive targets for spacecraft missions with the purpose of obtaining greater insight to the nature of the original bodies from which the terrestrial planets formed, without having to visit the Main Belt itself. Greater knowledge of NEOs directly sheds light on the origin and evolution of the asteroid belt, the formation of planets, and the history of the solar system.	Primitive Bodies
Mike Brown	Trojan Tour Decadal Study	The purpose of this study was to define a preferred concept approach along with the risk/cost trade space for a Trojan Tour Mission launched in the 2019-2023 time frame and targeted to be within the New Frontiers mission class envelope of less than $900M in FY15 dollars. The study was conducted by a team led by Mike Brown with members of the Primitive Bodies Panel working with the JHU/APL Space Department as the design center.	Primitive Bodies

Marc Buie **Co-Author:** Joe Veverka	Chiron Orbiter Mission	The National Research Council"s Planetary Science Decadal Survey: Primitive Bodies Panel has commissioned NASA"s Goddard Space Flight Center (GSFC) with a rapid architecture study conducted under NASA Headquarters leadership. The purpose of the study is to determine whether a mission to orbit the Centaur Object Chiron can be achieved within a New Frontiers cost range with a limited supply of Advanced Stirling Radioisotope Generators (ASRGs).	Primitive Bodies
Joe Veverka	Comet Surface Sample Return (CSSR) Mission	The National Academy of Science"s Decadal Survey (New Frontiers in the Solar System: An Integrated Exploration Strategy, 2003) recommended that NASA develop a medium-class mission to return a comet surface sample to Earth for laboratory analysis. NASA tasked the Applied Physics Laboratory to refine the concepts described in the Decadal Survey.	Primitive Bodies
Joe Veverka	Cryogenic Comet Nucleus Sample Return (CNSR) Mission Technology Study	This report documents the results of a study commissioned by the 2012 Decadal Report Primitive Bodies Panel to provide inputs to six key technological issues that need to be addressed to facilitate a Cryogenic Nucleus Sample Return (CNSR) mission and that will likely not be solved by other primitive bodies missions.	Primitive Bodies

Raymond Arvidson	Mars 2018 MAX-C Caching Rover	The proposed 2018 Mars Astrobiology Explorer-Cacher (MAX-C) caching rover would be a NASA-built mid-class rover that would be the first component in a Mars sample return campaign strategy. NASA is projecting to launch the proposed MAX-C rover with the European Space Agency"s (ESA"s) ExoMars mission on a U.S.-provided launch vehicle in mid 2018; the entry, descent, and landing systems would use the "Sky Crane" approach developed for Mars Science Laboratory (MSL) to land a pallet with both rovers secured onboard onto the surface of Mars.	Mars
Phil Christensen	MSR Orbiter Mission (Including Mars Returned Sample Handling)	The Mars Sample Return (MSR) concept is a campaign of three missions: a sample acquisition/caching rover mission, a lander mission to fetch the cache and deliver it to Mars orbit via a rocket, and an orbiter that would capture the orbiting sample (OS) container and deliver it to Earth via an Earth entry vehicle (EEV). A fourth component is the Mars Returned Sample Handling (MRSH) element that would include a sample receiving facility (SRF) and a curation facility.	Mars
Phil Christensen	MSR Lander Mission	The Mars Sample Return (MSR) concept is a campaign of three missions: a sample acquisition/caching rover mission, a lander mission to fetch the cache and deliver it to Mars orbit via a rocket, and an orbiter mission that would capture the orbiting sample (OS) container and deliver it to Earth via an Earth Entry Vehicle (EEV). A fourth component is the Mars Returned Sample Handling (MRSH) element that would include a sample receiving facility (SRF) and a curation facility.	Mars

Bobby Braun	Mars 2018 Sky Crane Capabilities Study	The purpose of the Mars 2018 Sky Crane Capabilities Study was to "explore the full range of science capabilities that could be delivered to the surface of Mars in 2018 by an MSL-derived Sky Crane EDL system". NASA commissioned the Jet Propulsion Laboratory (JPL) to perform this study. The Planetary Science Decadal Survey Mars Panel was particularly interested in the following science pathways: a surface field geology/astrobiology pathway, a subsurface geology/astrobiology pathway and a network science pathway.	Mars
Lindy Elkins-Tanton	Mars Geophysical Network Options	Several trade study sessions were conducted to survey a wide range of mission architectures that could meet, to varying degrees, the National Research Council (NRC) Mars Science Panel"s proposed science objectives of a Mars Geophysical Network (MGN) mission. Nine architectures in total were investigated, five of which were targeted at New Frontiers class missions. Two Discovery class missions and two Missions of Opportunity (MOOs) were also considered.	Mars

Lindy Elkins-Tanton	Mars Geophysical Network	The science objectives of the Mars Geophysical Network (MGN) mission study were divided into two categories: primary (the science floor that would need to be addressed to justify the mission) and secondary (additional goals that prospective principal investigators would reasonably add, given sufficient resources). By request from the Planetary Science Decadal Survey Mars Panel, this study addressed only the primary objective -- to characterize the internal structure of Mars to better understand its early history and internal processes affecting its surface and habitability.	Mars
Wendy Calvin	Mars Polar Climate Concepts	Architectural survey study sessions were conducted to explore the degree to which science objectives, related to the study of the Martian climate via the record preserved in the polar-layered deposits, could be pursued by small (Discovery-class) to moderate (New Frontier"s class) missions.	Mars

Steven Hauck, II	Mercury Lander Mission Concept Study	The purpose of this study was to determine the feasibility of a landed mission to Mercury. It was conducted by the JHU/APL Space Department in partnership with Marshall Space Flight Center, Glen Research Center, and Steven Hauck from Case Western Reserve University. This was conducted as a concept maturity level (CML) 3 study focusing on feasibility trades and options for concepts with a goal of determining whether such a mission could be accomplished within a Principal Investigator (PI)-led mission cost cap (See Appendix B for CML definitions). The mission focuses on fundamental science questions that can be best, or only, achieved by surface operations such as determining Mercury"s bulk composition, the nature of the magnetic field, surface history, internal structure, and surface-solar wind interactions.	Inner Planets
Lori Glaze	Venus Mobile Explorer	NASA Headquarters commissioned the Goddard Space Flight Center"s (GSFC) Architecture Design Lab with a rapid mission architecture study to support the National Research Council"s 2010 Planetary Decadal Survey Inner Planets Panel. The purpose of the study was to determine whether a Venus mission with surface, or near surface, mobility and realistic operational lifetime could achieve meaningful surface science at two or more independent locations separated by several kilometers on a budget comparable to a New Frontiers cost envelope.	Inner Planets

Martha Gilmore **Co-Author:** Lori S. Glaze	Venus Intrepid Tessera Lander	The National Research Council"s 2010 Planetary Decadal Survey Inner Planets Panel commissioned the Goddard Space Flight Center"s (GSFC) Architecture Design Lab (ADL) to do an enhanced rapid mission architecture study, conducted under NASA Headquarters leadership. The charge was to conceive a Venus mission architecture capable of safe landing in one of the mountainous tessera regions of the planet on a budget comparable to New Frontiers. Using the ADL"s five step process (see Appendix), the study accomplished a systematic exploration, down-selection and optimization of the best architecture concepts for the Venus Intrepid Tessera Lander (VITaL).	Inner Planets
David Grinspoon	Venus Climate Mission	The National Research Council"s 2010 Planetary Decadal Survey Inner Planets Panel commissioned the NASA Goddard Space Flight Center (GSFC) and the California Institute of Technology Jet Propulsion Laboratory (JPL) to perform a point design study, conducted under NASA Headquarters leadership. The charge is to mature a Venus mission concept capable of studying the Venus climate within a New Frontiers cost range. The NASA Ames Research Center also participated in this study, providing expertise in planetary atmospheric entry.	Inner Planets

Chip Shearer	Lunar Geophysical Network (LGN)	The purpose of this study was to determine the feasibility of a Lunar Geophysical Network (LGN) mission to the Moon. It was conducted by Marshall Space Flight Center"s, Robotic Lunar Lander Development Project team in partnership with the Johns Hopkins University/Applied Physics Laboratory (JHU/APL). This study was documented based on previous trades, analysis and options for concepts developed by the team over the last 18 months, with a goal of determining whether such a mission could be accomplished within a Principal Investigator (PI)-led mission cost cap (e.g. New Frontiers). The mission focuses on the scientific rationale for deploying a global, long-lived network of geophysical instruments on the surface of the Moon to understand the nature and evolution of the lunar interior from the crust to the core.	Inner Planets
Chip Shearer	Lunar Polar Volatiles Explorer (LPVE) Mission Concept Study	The purpose of this study was to determine the feasibility of a mission to investigate the possibility of volatiles in permanently shadowed areas of the lunar poles -- the Lunar Polar Volatiles Explorer (LPVE). The overall science goals and objectives were provided as guidelines by the Decadal Survey Inner Planets Panel, with the goal of determining whether such a mission could be accomplished within a Principal Investigator (PI)-led mission cost cap (i.e., New Frontiers).	Inner Planets
Reta Beebe	Saturn Atmospheric Entry Probe Trade Study	This study found it might be possible to implement a Saturn probe mission in which a flyby carrier-relay spacecraft (CRSC) would deliver a single probe within the resource constraints of NASA"s New Frontiers Program. Achievement of this goal would require a small and focused set of science objectives.	Giant Planets

Reta Beebe	Saturn Atmospheric Entry Probe Mission Study	The science objectives of the Saturn Atmospheric Probe Mission Study are divided into two groups:"Tier 1," the science floor objectives that would need to be addressed to make the mission worthwhile, and "Tier 2," the next highest priority level, with objectives that prospective Principal Investigators could reasonably add, given sufficient resources.	Giant Planets
Phil Nicholson **Co-Authors:** Matthew Tiscareno, Linda Spilker	Saturn Ring Observer Study Report	The Saturn Ring Observer (SRO) study was requested by the Giant Planets Panel of the 2012 Planetary Science Decadal Survey (PSDS). The panel specified two study objectives: -Investigate the method(s) by which a spacecraft might be placed in a tight circular orbit around Saturn, using chemical or nuclear-electric propulsion or aerocapture in Saturn"s atmosphere. The critical issue is trajectory. -Identify technological developments for the next decade that would enable such a mission in the post-2023 timeframe (after the next Saturnian equinox), with a particular focus on power and propulsion.	Giant Planets

William Hubbard **Co-Author:** Mark Marley	Ice Giants Decadal Study	The purpose of this study was to define a preferred concept approach along with the risk/cost trade space for a Uranus or Neptune Mission launched in the 2020-2023 time frame and within a cost range of $1.5B-$1.9B in FY15$. The study was conducted by a team led by William Hubbard with members of both the Giant Planets and Satellites Panels working with the JHU/APL Space Department as the design center. NASA Glenn Research Center's COMPASS team made significant contributions as part of the design team in the areas of mission design, solar electric propulsion stage concept development, and Advanced Stirling Radioisotope Generator performance.	Giant Planets
Mark Marley	JPL Rapid Mission Architecture Neptune-Triton-KBO Study Final Report	This JPL Rapid Mission Architecture (RMA) study was not a mission concept study of a single mission, but instead was an architectural-level study of a set of missions to the Neptune system and, for some, continued travel to a Kuiper Belt Object (KBO). It was commissioned by three Planetary Science Decadal Survey Panels: Giant Planets, Satellites, and Primitive Bodies, whose diverse sets of science priorities made tailoring architectures to the science priorities particularly challenging.	Giant Planets

John Casani	Small Fission Power System Feasibility Study Final Report	In early March 2010, the Decadal Survey Giant Planets Panel (GPP) requested a short-turnaround study to evaluate the feasibility of a small fission power system (FPS) for future unspecified National Aeronautics and Space Administration (NASA) science missions. FPS technology was considered a potential option for power levels that might not be achievable with radioisotope power systems. A study plan was generated, and a joint NASA/Department of Energy (DOE) study team was formed.	Giant Planets