

NASA
PROGRAM MANAGEMENT COUNCIL
Meeting Summary, Decisions and Actions

VITAL MEETING DATA

Date: 15 February 2017
Time: 12:30 p.m. – 4:45 p.m. (EST)
Location: NASA Headquarters (HQ), 8Q40 & ViTS
Agenda: See attached.
Attendance: See attached.

Opening Comments

Robert Lightfoot, National Aeronautics and Space Administration (NASA) Associate Administrator (AA), made the following brief opening comments:

- The next Capability Days will be held in March. This will be a follow-up to some of the other capability briefings we have done. A Capability Day cadence will be proposed from the Office of the Chief Engineer (OCE) to establish a schedule for this going forward. Presentations should be submitted by March 7th.
- I put out a memo on transition. During the transition process, we will occasionally get requests from the administration that we will need to address. We are first looking into Exploration Mission 1 (EM-1) in terms of technical issues, schedule, etc. This is a big one for both the Space Launch System (SLS) and Orion programs. That doesn't mean we have changed anything anywhere else. We are continuing operations as normal. I briefed this at the SLS/Orion supplier's conference. There will be more of those kinds of memos as I get more guidance when the administration establishes its policies.

First Item of Business: Europa Clipper KDP-B

The belief in the science community is that Europa is the most likely place, other than Earth, to harbor life, which is why it was selected as a mission target. The Europa Flyby Mission will test key habitability hypotheses related to water, chemistry, energy, and geological activity. This is a Category 1 project with mission risk class A, and therefore considered a flagship-class mission. It is compliant with NASA Procedural Requirement (NPR) 7120.5 (no waivers) and the spacecraft design is compatible with both the SLS and Evolved Expendable Launch Vehicle (EELV) candidates. The mission overview and Clipper spacecraft components were described, along with the NASA-selected Europa remote sensing and in situ instruments. Interplanetary trajectories were reviewed for each launch vehicle (LV) option, showing the EELV will take five years longer due to the additional fly-by gravity assists required to reach SLS-level velocity.

Since KDP-A, there have been significant Level 1 requirement changes, including the addition of a lander relay capability, a science requirement for plume research, receipt of planetary protection classification (Category III), and finalization of the Europa Clipper mission risk classification. Science Level-1 requirements have matured based on the NASA-selected payload.

Project schedule and cost estimates were reviewed. The current schedule estimates are “in family” with the Jet Propulsion Laboratory (JPL) rules. The current cost estimate is \$2.736B. Lightfoot commented that when the original mission study was done, the estimate was \$4.7B and the project

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was asked to cut that in half. Now, with the estimate at \$2.7B without a LV, close attention is needed to determine if the mission will end up costing \$4B. The project agreed that this should be watched closely.

The project discussed Earned Value Management (EVM) progress and planning activities for the project with all of the project partners.

The significant project risk was summarized and the early Prop Module (PM) design freeze risk (Risk ID 353) was reviewed. If the propulsion module design changes as a result of the Mechanical Critical Design Review (CDR), the project launch will slip from 2022 to 2023.

Independent Cost & Schedule Assessment

Cost Estimation and Pricing (CE&P) prepared a Probabilistic Range Estimate and an Independent Cost Estimate and Independent Schedule Estimate (ICE/ISA). Europa Phase A-D cost estimate is \$2,243M (Project Phase A-D (Most Likely) = \$ 1,753M and a Reserve/Project Unallocated Future Expenses (UFE)= \$ 490M). Compared to other missions at the Mission Definition Review (MDR) milestone, Europa is putting forth a mature and conservative risk posture with identified and thorough mitigation plans. With \$394M in project risks and \$833M in uncertainty, the combination of project risks and uncertainty extends the maximum of the probabilistic cost range out +\$1.2B. The Europa Project Estimate (with UFE) currently plots at the 62nd percentile confidence level of the cost range.

Europa's integrated master schedule has about 11,200 tasks, and the analysis schedule includes about 8,200 tasks, resulting in a launch readiness date (LRD) of June 4, 2022. Currently, the project LRD is at the 44th percentile. NASA Schedule Health Check (STAT) is green. The overall development schedule for Europa is in line with comparable missions.

Since KDP-A, the Europa life cycle cost (LCC) has increased by \$330M due to payload cost and mass growth, spacecraft cost and mass growth, and puts/takes throughout the estimate that contribute to the remaining growth.

The JPL ICE 70th percentile estimate for Phase A-E is \$2.900B real year (RY). The project's LCCE at \$2.736B RY falls at the 57th percentile of the ICE S-curve. Europa's project estimate is within 6% of the ICE, which is within the error bounds of the model and approach used. The largest variance is in the payload (\$90M). The JPL ICE and the AEROSPACE ICE are both at \$2.9B (Phase A-E) at the 70th percentile. Cross-checking with history, the Europa Project estimate for flight system and integration and testing (I&T) is within 17% of the historical extrapolation.

SRR/MDR Review Board Report

The Standing Review Board (SRB) found that the project met the stated success criteria for the combined System Requirements Review (SRR)/(MDR), has adequate plans, knows what needs to be done, and is ready to proceed into Phase B. The scope, complexity, immaturity, close coupling, and demands on the system by the science payloads, coupled with the uncertainty of LV availability and schedule, make it highly likely that the estimated cost and schedule range will be exceeded unless scope and/or complexity is reduced. Altogether, the SRB found 11 strengths, three issues, four concerns, and 12 observations.

The SRB found the Europa team is exceptional, with a robust science payload and investigation plans that offer ample redundancy to deliver on Level 1 requirements. The systems engineering processes are in place, rigorously applied, and supported by a rich and well thought-out suite of models/simulations that enable architecture, engineering, and resource trades to be conducted efficiently and effectively. The spacecraft is mature and has dealt with changes in configuration to integrate the challenges of the selected payloads very well. Additionally, the SRB noted good partner cooperation, requirements flow down, risk mitigation planning, design, business management, and a comprehensive Integrated Master Schedule (IMS).

The SRB identified three issues:

- **Issue 1: Schedule and Cost Estimates** - The integrated schedule and cost estimates are insufficient. Programmatic models show that although the upper end of the \$3 to \$4 billion range identified at KDP A for the mission (including mission concept, launch vehicle, and HQ UFE) may be doable, experience and uncertainties suggest success is unlikely. Additional schedule and cost margins are needed unless scope and/or complexity is reduced.

The SRB recommends the project:

- o Develop a strategy for addressing the likely escalation of cost and schedule with the science payload.
- o Expand the current redundancies for answering the science objectives to include quantitative answers down to Level 2.
- o Develop decision trees for answering science objectives based on the measurements the instruments can make, so that redundancies are more obvious and the most important measurements are highlighted.
- o Develop a realistic descope list based on the above

The project team concurs with the SRB and recommends accepting all recommendations.

- **Issue 2: LV Selection** - Settling the LV selection by mission Preliminary Design Review (PDR) is a critically important milestone. The project has done an admirable job at developing a design and project plan that are flexible enough to make use of the SLS Block 1B or Delta IV Heavy, and potentially other vehicles, such as Falcon Heavy or Vulcan. The SRB recommends that, in the next few months, the project establish clear value-based decision criteria based on balance of cost, schedule, earlier science return, risk, and other strategic concerns to settle the LV selection by PDR.

- **Issue 3: Fiscal Years (FY) 17/18 Staffing** - FY 17 and 18+ are stressful staffing years in terms of full-time employee (FTE) numbers and expertise needed (total and surge) at JPL, and possibly the Applied Physics Lab (APL), to maintain commitments to plan. The SRB recommends:

- o Reconsider acquisition strategies to include qualified suppliers for subsystems or capabilities and/or revisit plans and adjust the schedule to match available capability.
- o Develop an integrated strategy on an approach to EVM with the Principal Investigator institutions to monitor performance after their respective PDRs.
- o JPL's Engineering and Science Directorate has performed a detailed audit of the Phase B commitments and supports the agreed-to project plan. APL senior management has reviewed a list of individuals needed to meet Phase B requirements. APL will continue to work with Goddard Space Flight Center (GSFC) for surge support.

Lightfoot commented that resolving issues 2 and 3 will help resolve issue 1. The SRB agreed.

The SRB Independent Cost Estimate (ICA) cost risk analysis estimates a range of \$2,214M to \$3,140M for Phase A – D. The project’s P85 estimate of \$2,596M is approximately P48 on the SRB risk curve. The Phase B basis of estimate (BOE) is well documented, while Phases C and D BOEs appear to be appropriate for the maturity of the project but are lacking detail in some areas. The SRB ICA schedule risk analysis estimates an additional one- to three-month schedule slip over project analysis. The project analysis schedule is appropriate for the level of maturity.

The Europa Project has done an excellent job at preparing for and addressing all that is required and the SRB recommended it proceed into Phase B.

Center Readiness Assessment

The project team conducted a comprehensive MDR and the SRB did an outstanding job assessing the project’s status. The project can and will be managed to fit within cost commitments. The project will work with HQ to determine whether payload descopes are necessary and realistic. Although the option of using the SLS is a programmatic and technical challenge for the project, the benefits of flying on the SLS to Clipper and future missions warrant retaining that option through Phase B.

JPL has the workforce, contracting support, and facilities required to support Europa Clipper through Phase B and beyond. JPL recommends that the Europa Clipper Project continue into Phase B. Missions of this class leave a legacy for the agency and for JPL.

Program Readiness Assessment

The project has met the criteria for KDP-B and the required products have been produced at the specified level of maturity per NPR 7120.5E. The project and/or the SRB have identified the significant risks and issues, and the project has mitigation plans identified for those items within its purview. The program office has reviewed the various cost and schedule analyses, as well as completing its own independent estimate, and recommends the project be allowed to proceed into Phase B.

SMD Readiness & Recommendation

Understanding the habitability of Europa remains one of the most important upcoming science missions as prioritized by the Decadal Survey. An excellent team has been put in place, with a mission concept that is likely to achieve the science within the estimated budget. SMD held a Directorate Program Management Council (DPMC) on Feb. 7, 2017, and recommended that the mission was ready to come forward for KDP-B approval from the APMC.

SMD recommends that NASA HQ work to resolve the LV uncertainty for this mission. Also, diligence will be required to ensure that this flagship mission does not grow to exceed the estimated cost range. SMD has directed Planetary Science Division (PSD) to develop an actionable descope plan for cost and complexity control. SMD recommends that the Europa Clipper Mission be approved to enter Phase B, with the estimated LCC ranging from \$3.1 - \$4B.

Lightfoot agreed and assigned an action to SMD to develop a descope plan that considers spacecraft resource utilization and science prioritization.

Lightfoot stated that it seems as though everything is pointing to baselining SLS. If the agency uses SLS for more than crew, it could open up a cadence of missions. An action was assigned to SMD and Human Exploration and Operations (HEO) to develop a recommendation for the LV in 30 days.

Members wondered whether more could be done with agency resources rather than ramping up the support contractor at JPL. Lightfoot agreed and raised concerns about bringing on a contractor at JPL when there are many people in the agency who could help. Members agreed and said the issue is often the particular mix of skill and expertise. An action was assigned to SMD and JPL to address this workforce issue, as it continues to pop up in different parts of JPL.

Members were polled and the project was approved to proceed into Phase B.

Second Item of Business: Program and Project Tailoring

NASA policy enables tailoring of project management (PM) requirements (NPR 7120.5) in recognition of the need to accommodate the unique aspects of each program or project to achieve mission success in a safe, efficient, and economical manner within acceptable risk.

The Program Project Management Board (PPMB) is a support resource to assist programs and projects with PPM policy (NPR 7120.5) tailoring guidance, and serves as forum to adjudicate tailoring issues. Tailoring guidance and expectations for small projects are provided in NASA AA letter issued September 26, 2014: *Guidance and Expectations for Small Cat3/Class D Space Flight Projects with a Life Cycle Cost Under \$150M*. Some examples of tailoring from SMD, HEOMD, Space Technology Mission Directorate (STMD), and Aeronautics Research Mission Directorate (ARMD) were discussed relating to KDP and life cycle review tailoring as well as EVM tailoring.

Actions:

New and existing actions were reviewed.

Closing

Meeting was adjourned.

Prepared by:

(b) (6)

Anthony D. Griffith, Sr.

3/09/2017

APMC Executive

Agenda

**Agency Program Management Council
February 15, 2017 12:30pm – 4:45pm ET
NASA Headquarters, Room 8Q40 & ViTS**

12:30	Roll Call and General Admin	PMC Exec/T. Griffith
12:35	Opening Remarks	AA/R. Lightfoot
12:45	Europa Clipper KDP-B	
	Introduction and Purpose	J. Salute
	Project Overview	B. Goldstein
	Independent Cost & Schedule Assessment	F. Doumani
	SRR/MDR Review Board Report	O. Figueroa B. Goldstein
	Center Readiness Assessment	M. Watkins
	Program Readiness Assessment	A. BacsKay B. Mulac
	SMD Response and Readiness Assessment	D. Schurr T. Zurbuchen
	Decision Memo Review/Discussion	J. Salute
3:45	Program and Project Tailoring	
	Overview	E. Stigberg
	SMD Examples of P&P Tailoring	J. Pellicciotti
	ARMD Examples of P&P Tailoring	S. Hirshorn
4:30	Review Actions	PMC Exec/T. Griffith
4:35	Closing remarks and summary	AA/R. Lightfoot
4:45	Adjourn	

AGENCY PROGRAM MANAGEMENT COUNCIL
NASA Headquarters - 8Q40/VITS
15-Feb-2017
MEMBERS

Position	Name	Signature
General Counsel	Sumara Thompson-King	
ARC Center Director	Tina Panontin (for)	
AFRC Center Director	David McBride	
GRC Center Director	Janet Kavandi	
Deputy Center Director	Marla Perez-Davis	
GSFC Center Director	Chris Scolese	
JPL Center Director	Michael Watkins	
JSC Center Director	Melanie Saunders (for)	
KSC Center Director	Janet Petro (for)	
LaRC Center Director	Clayton Turner (for)	
MSFC Center Director	Paul McConnaughey (for)	
SSC Center Director	Ken Human (for)	
Associate Administrator, Mission Support	Krista Paquin	
Associate Administrator, STMD	Jim Reuter (for)	
Associate Administrator, SMD	Thomas Zurbuchen	
Associate Administrator, HEOMD	Greg Williams (for)	
Associate Administrator, HEOMD	Jim Norman (for)	
Associate Administrator, ARMD	Tony Springer (for)	
Chief Technologist	Douglas Terrier, Acting	
Chief Scientist	Gale Allen (for)	
Chief Engineer	Ralph Roe	
Deputy Chief Engineer	Dawn Schaible	
Chief Information Officer	Faith Chandler (for)	
Chief Financial Officer	Andrew Hunter, Acting	
Chief Safety & Mission Assurance	Terry Wilcutt	
Deputy Chief Safety & Mission Assurance	Hal Bell (for)	
Chief Health & Medical Officer	James (J.D.) Polk <i>fl</i>	
Deputy Associate Administrator	Lesia Roe	
Associate Administrator	Robert Lightfoot	
APMC Executive	Tony Griffith	
Incoming APMC Executive	Stephanie Sowards	

**AGENCY PROGRAM MANAGEMENT COUNCIL
NASA Headquarters - 8Q40/VITS
15-Feb-2017**

Other Attendees and Presenters

Position	Name	Signature
MSFC Program Manager	Sof Alan Bacskay	 (b) (6)
Programmatic Analysis Lead for the SRB	Andy Prince	[Redacted]
JPL Project Manager	Barry Goldstein	[Redacted]
JPL Project Scientist	Bob Pappalardo	[Redacted]
JPL Project System Engineer	Brian Cooke	[Redacted]
MSFC Mission Manager	Brian Mulac	[Redacted]
Europa Review Manager	Chet Sasaki	[Redacted]
Program Scientist	Curt Niebur	[Redacted]
Program Director	David Schurr	[Redacted]
OSMA	Deirdre Healey	[Redacted]
Deputy AA, SMD	Dennis Andrucyk	[Redacted]
Director, OACS	Dennis Boccippio	[Redacted]
Office of Chief Engineer (OCE)	Ellen Stigberg	[Redacted]
JPL/Independent Cost & Schedule	Fred Doumani	[Redacted]
OSMA	Gerald Schumann	[Redacted]
SMD DAAP	Greg Robinson	[Redacted]
JPL Division Director	Jakob Van Zyl	[Redacted]
Division Director	James Green	[Redacted]
Special Assistant to the Associate Administrator	James Ortiz	[Redacted]
STMD Chief Engineer	Jeff Sheehy	[Redacted]
Presidential Appointments Team	Jeff Waksman	[Redacted]
Program Executive	Joan Salute	[Redacted]
SMD Chief Engineer	Joe Pellicciotti	[Redacted]
SMD HQ	John Gagosian	[Redacted]
HEOMD Chief Engineer	John Mcmanamen	[Redacted]
JPL Project Business Manager	Juliana Murphy	[Redacted]
OCFO support to Acting Chief Fin Officer	Kevin Gilligan	[Redacted]
JPL Deputy Division Director	Keyur Patel	[Redacted]
OCIO	Lara Petze (for)	[Redacted]
Office of the Deputy Associate Administrator	Lisa Guerra	[Redacted]
APL, Sector Head	Mike Ryschkewitsch	[Redacted]
SRB Chair	Orlando Figueroa	[Redacted]

