

PLUTO-KUIPER BELT MISSION Written Questions and Answers

Last updated 3/16/01

In the Launch Services Information Summary document you state that:

“Both the Delta IV and Atlas V (EELV) class vehicles are still in development and have not yet flown. As a consequence, there exist uncertainties regarding development schedules, readiness dates, and demonstrated successful flight rate relative to the reference December 2004 launch date. Because of the uncertainty in the EELV development schedule and projected demonstrated launch rate, it is recommended that dual compatibility between the Delta and Atlas families of LV be maintained as far into development as practical, at least until first flight of each vehicle configuration. The EELV-Heavy launch vehicle (Delta IV-Heavy) is projected to have a lower flight rate than the EELV-Medium launch vehicles. Likely lower demonstrated flight rate for this configuration will be factored into the total risk of the mission.”

General note: We have revised the Launch Vehicle Appendix, which is currently under review by NASA HQ and should be available on the web prior to February 1, 2001. The revisions offer further clarity on questions posed. These comments are consistent with those in the upcoming revision.

1. What is the policy and what are the requirements for flight certification of a launch vehicle for this mission, given that it carries an RTG?

Response: NPD 8610.7 (http://nodis.hq.nasa.gov/Library/Directives/NASA-WIDE/Policies/Program_Management/N_PD_8610_7.html) covers NASA's policy for flight certification. For this mission, the criteria for a Category 3 mission apply. In addition to, but separate from, this policy, the Launch Service organization must provide input to the Nuclear Launch Approval (NLA) process. We have included a wedge in the Launch Service Class cost figures for the Launch Vehicle databook development efforts to support the NLA process. However, all other support to NLA process should be estimated and provided separately in the cost proposal.

2. How many successful flights are required?

Response: Per NPD 8610.7 and K-ELV-10.2, KSC Program Management Instruction for Launch Vehicle Qualification, Category 3 Qualification requires the Launch Service Provider (LSP) to achieve a minimum of 14 consecutive, successful flights of a common vehicle configuration. There is also an Alternate Cat 3 Qualification process as well. For a vehicle derived from a launch vehicle previously qualified to launch Category 3 payloads to achieve a Payload Risk Category 3 qualification, the LSP must perform six (6) successful flights of the new common vehicle configuration and participate with NASA in a review of vehicle characteristics and LSP processes. The KSC ELV Program Office will perform an

assessment considering vehicle design, manufacturing processes, test philosophy, risk mitigation, quality systems, documentation systems, and program management.

3. Can the upper stage be certified by ground tests or by flights on a different launch vehicle?

Response: This situation would need to be handled on a case-by-case basis and would depend on the heritage of the subject hardware and the similarity of the test to actual use on this mission.

4. Does the complete stack require the full number of successful flights for certification?

Response: The intent of this solicitation is not for the Offerors to perform a detailed analysis/study of the ELV heritage and/or try to predict the number of EELV flights prior to the proposed launch date. The Offerors should not expend effort in evaluating the relative risk of the different ELV configurations/brands within each Launch Service Class. The ELV technical risk discussion should be kept at a relatively high level. The revised AO narrative provides some insight into NASA's position on the relative risk between the three Launch Service Classes.

We also request performance and vehicle information (specific and proprietary to our proposal) as follows:

5. What is the exact lift mass for each of the AO options for C3's of 127 and 144 km²/sec²?

Response: See Below

6. What is the exact mass breakdown of the STAR 48V that are included in your performance numbers? We need these to compare with an all up STAR 48V mass estimate that we will obtain from THIOKOL.

Response: See Below

7. You indicate that the STAR 48V option payload systems mass includes the adapter between the spacecraft and kick stage. Does that mean that the adapter and separation system between the launch vehicle and the kick stage is accounted for and not required to be in the payload system mass?

Response for Items 5, 6, & 7:

First, some general comments/clarification regarding use of the performance curves, Figures 1 and 2 reflect the NLS Contract Performance figures for the Standard Launch Service (i.e., the 1st and 2nd stage) without a Kick-stage. For purposes of this AO, Figures 1 and 2 should be considered **FIRM** numbers and Offerors should not deviate from these numbers. Regarding Figures 3 and 4, these curves are intended to

be guidelines/estimates and are based on studies that KSC has performed in the past. Please keep in mind, the kick-stage is the responsibility of the Offeror and will not be procured through NLS. Therefore, if a vendor (in this case, Thiokol) provides better/more accurate information on the kick-stage performance, then the Offeror is welcome to use that information just as if it were another Spacecraft sub-system. If different figures are used, please do provide substantiation. However, if this vendor data is used, the Offeror should still use Figures 1 and 2 for the LV input to the overall performance analysis.

Figures 3 and 4, as well as the figures below, reflect the capacity available for **separated Spacecraft mass + the adapter between the Spacecraft and the Star 48V + any ancillary hardware (e.g., spin-table, avionics, etc.)** regardless of the Star48 configuration (i.e., 48V or spinner). For purposes of this AO, it can be assumed that everything below this adapter is already accounted for in generating these curves.

As requested, the assumed figures for Loaded Star48 (including casing, prop, igniter, and nozzle) is 2166 kg, for the burned-out Star48 (no prop) is 143kg. Again, if the Offeror decides to use a different kick-stage or obtains more accurate info from the Kick-stage vendor, the Offeror is welcome to refine these numbers in their performance assessment. The assumed mass for the adapters between the LV 2nd stage and the Star48 vary for each ELV. The intent is for the Offeror to use these figures unless a different adapter configuration is required, please do not attempt to refine the individual adapter mass figures. If the Offeror requires a different adapter arrangement, please request additional information from KSC on the performance impacts. Here are the assumptions:

- Atlas IIIB (DEC) and Atlas V 400 series – C1/B2 adapters => 88 kg
- Atlas V 500 series – C2/B2 adapters => 109.6 kg
- Delta III PAF => 297 kg
- Delta IV PAF => 482 kg

NLS LV	C3 = 127 km ² /s ²	C3 = 144 km ² /s ²
Atlas IIIB w/ Star48V	424	318
Delta III w/ Star48V	323	No data available
Atlas V 401 w/ Star48V	414	305
Atlas V 501 w/ Star48V	337	250
Atlas V 511 w/ Star48V	473	357
Atlas V 521 w/ Star48V	567	435
Atlas V 531 w/ Star48V	670	512
Atlas V 541 w/ Star48V	748	573
Atlas V 551 w/ Star48V	815	626
Delta IV 4040 w/ Star48V	No data available	No data available
Delta IV 4240 w/ Star48V	No data available	No data available
Delta IV 4450 w/ Star48V	497	No data available
Delta IV 4050H w/ Star48V	930	656

8. What is the possibility and the C3 performance at 127 and 144 km²/sec² of a DELTA 4440 and an ATLAS V 411?

Response: While KSC and the NRO have performed studies with both Boeing and Lockheed Martin regarding these ELV configurations, they are not offered for use on this AO. The primary reason is cost. These configurations are not standard, commercially available configurations; therefore, in order to qualify these configurations for flight, it would require significant non-recurring engineering and analysis by the Launch Service Provider at cost to this mission.

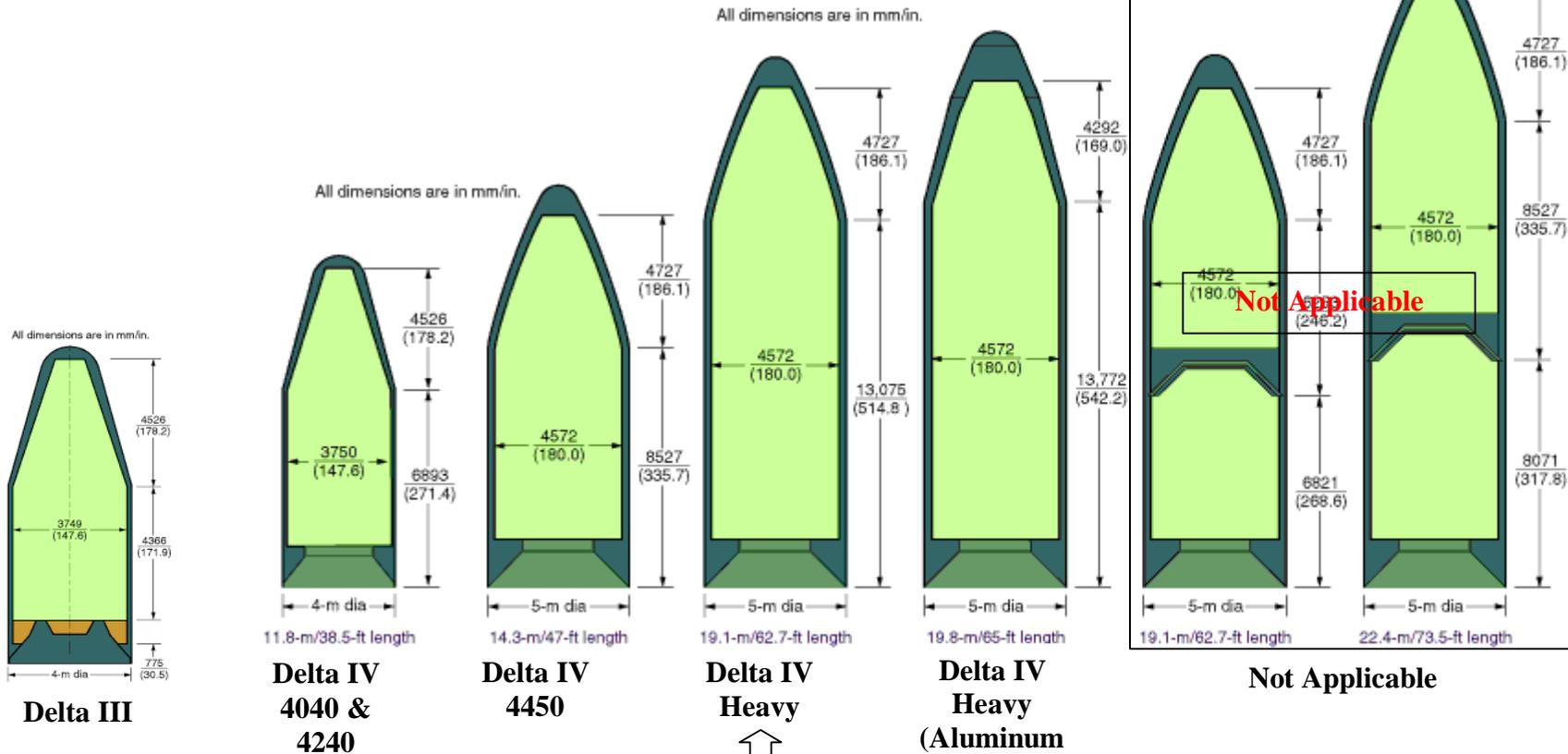
9. What are the latest/official internal fairing dimensions for the 4m and 5m ATLAS IIB & V and DELTA III & IV?

Response: See attached figures below

10. Are there any heritage, multi-solid upper stage, options that could provide more performance on a given launch vehicle or equal performance on a lesser launch vehicle? If so, what is their lift mass performance at C3's of 127 and 144 km²/sec²?

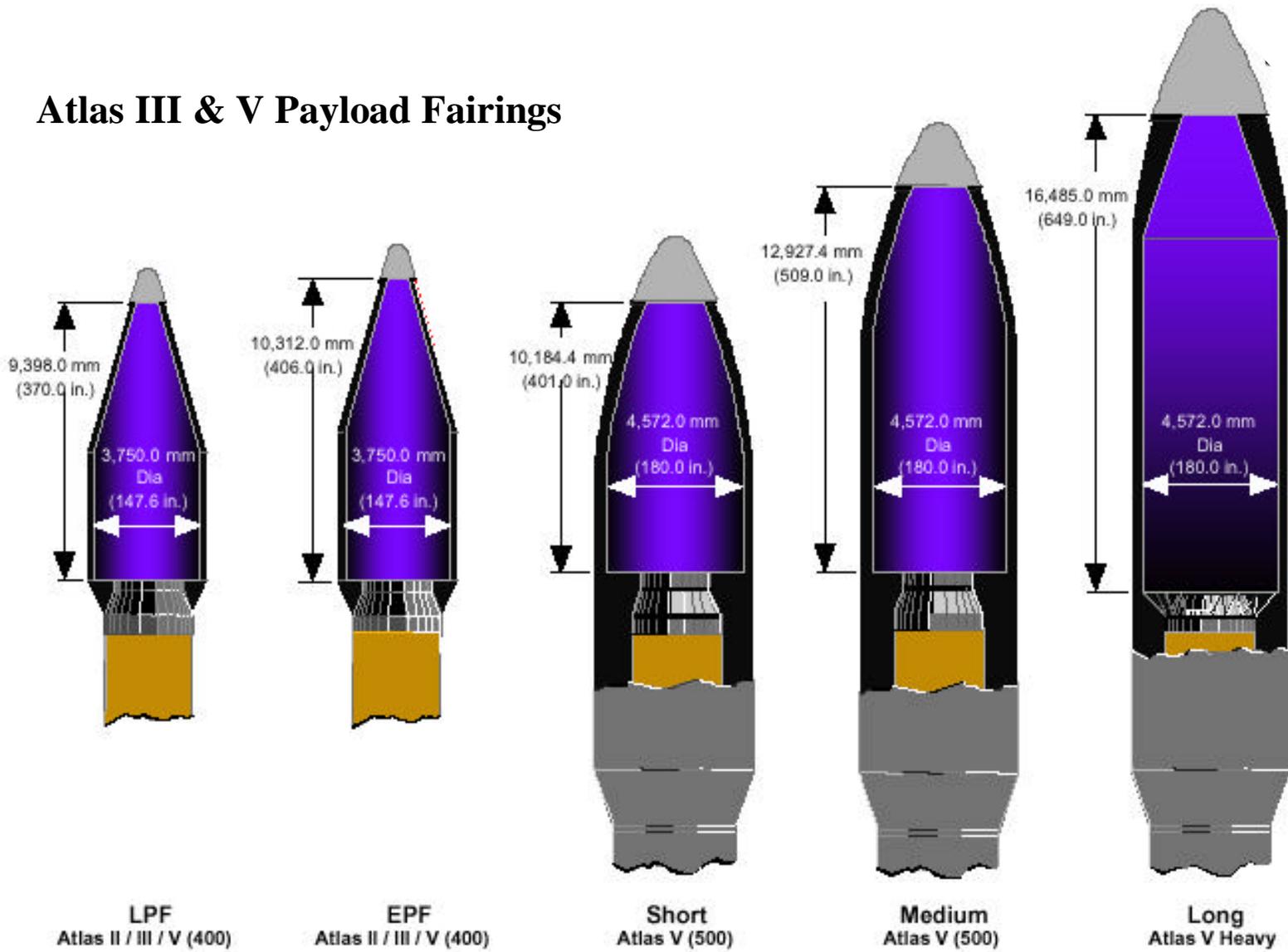
Response: All of the NLS ELVs are two-stage vehicles and there are no pre-priced options available on NLS for a 3rd stage. We do not have any further recommendations that have any more heritage than those configuration that have already been provided.

Delta IV Payload Fairings



↑
The D-IV Heavy performance figures are based on this config

Atlas III & V Payload Fairings



- 11. The file, Pluto_AO_ELV_Consolidated_Pkg_wo_Prices.doc, does not have any prices associated yet for the basic EELV launch options. Are more detailed cost figures available?**

The PKB Library document, *Pluto-Kuiper Belt Launch Services Information*, contains the cost figures that should be used for this AO. There is currently not a 3rd stage option for this class of LV's on the NLS Contract. The Star 48 kick stage is the responsibility of the proposer and therefore, no cost estimates were provided. While the proposer must address any proposed upper stage along with costs, we did, however, provide some performance estimates with the Star 48.

- 12. Is pricing information available for the various Medium EELV options (specifically, discount pricing information for two vehicles configured identically with Star 48 kick stages)?**

Cost figures for the AO proposers are included in the latest version of the ELV Appendix. Discounts for multiple vehicles are not considered at this time. Upper stages, such as the Star 48 is the responsibility of the proposer.

- 13. What launch pad is planned for Delta IV? Are there plans for a second launch pad?**

The Delta IV program is planning to utilize Launch Complex 37 for Eastern Test Range launches. There is currently only one pad available at that location. There are no plans in the foreseeable future to add another pad.

- 14. Is Atlas V planned to fly only out of Pad 41?**

The Atlas V program plans to utilize Launch Complex 41 for Eastern Test Range launches.

- 15. What are the time constraints for launching two flights in a row with the Delta IV and Atlas V?**

The Delta IV class LV incorporates off-line preparations to minimize pad processing time. Current plans show 12 workdays (i.e., 2 calendar weeks) between the Booster erection and the post launch refurbishment activities. The Payload is encapsulated in an off-line facility in parallel and is mated approximately one week prior to launch. EELV is a new system and processing timelines have not been demonstrated. Additional schedule contingency is recommended if approach requires use of RTG's on the Spacecraft.

For the Atlas V, the booster erection occurs approximately 15 workdays prior to launch, with approximately 5 workdays after launch allocated for pad refurbishment activities for a total of 20 days between launches. Again, theoretically, they plan on being able to support about 20 days between launches. Again, EELV is a new

system and processing timelines havenot been demonstrated. As with the Delta vehicles, additional schedule contingency is recommended if approach requires use of RTG's on the Spacecraft.

16. For long-lead items procured during Phase B, can these be shown as a Phase C/D task and thus be bookkept as a Phase C/D cost? This was permitted in the past Discovery AO, but that language is absent from the Pluto AO.

The PKB Mission AO contains no Phase C/D cost cap, as was included in the most recent Discovery AO. Therefore, all individual phase (Phase B, C/D, and E) costs should be tracked per the traditional activities for each of these phases. The only absolute cost constraint is the total cap. However you must be able to defend your budget breakdown as well at the total price tag.

17. **Will more detailed requirements or goals for Kuiper Belt Object (KBO) encounters be provided?**

Section 3.2, Science Requirements, states the goals for KBO encounters.

18. **Given that the current funding profile is heavily weighed to the right, it is possible that a launch prior to year five (as is inferred in the Appendix F text) may not be feasible? Is it NASA's intent to have this funding profile be the determining factor in when the Pluto launch occurs?**

Appendix F of the AO, "Program Planning Budget Profile" is hereby rescinded. No overall budget profile is suggested. The launch vehicle budget profiles given in the Program Library document, "Pluto-Kuiper Belt Launch Services Information Summary" must be followed. Other costs will, of course, be added to that profile.

19. **When will the complete launch services documentation (showing cost and performance for both ELV's and STS) be finalized and placed in the PKB library?**

The documents, *Pluto-Kuiper Belt Launch Services Information* and *Pluto-Kuiper Belt Space Shuttle Launch Opportunities*, include cost and performance data. These documents have been placed in the PKB Library.

20. **How much does the STS cost for purposes of the proposal?**

Per the document, *Pluto-Kuiper Belt Space Shuttle Launch Opportunities*, "the STS cost for launch is \$90M. This cost does not include any mission unique costs, such as special requirements for nuclear materials on the Shuttle, including unique separation systems, data books, etc."

21. What are the performance data for STS?

Per the document, *Pluto-Kuiper Belt Space Shuttle Launch Opportunities*, “the Shuttle can carry payloads in orbits with an inclination ranging from 28.5 degrees to 57.0 degrees. Altitudes at which spacecraft and/or carriers can be deployed depend on a variety of factors, but can vary from 110 nautical miles to over 300 nautical miles. However, there are Shuttle performance reductions associated with higher inclination and/or higher altitude missions. Nominal mission parameters are 110 – 170 nautical miles in altitude and 28.5 degrees inclination. Spacecraft and/or free flyers can carry orbit adjust systems to modify orbit parameters.”

22. Are fonts less than 12 point acceptable for tables other than the cost table? (Page B-1, General Guidelines, is worded in such a way as to not permit this.)

The General Guidelines section of Appendix B states the font requirements. It states, “Single- or double-column format is acceptable. In complying with the page limit, no page should contain more than 55 lines of text and the type font should not be smaller than 12-point (i.e., less than or equal to 15 characters per inch). Figure captions should be in 12 point. Smaller font is allowed within figures and in the cost table.”

23. Are color "art" covers allowed in addition to the AO required cover/summary?

Yes, provided the color “art” covers are placed immediately following the required Cover Page and Proposal Summary.

24. When will all the library material be frozen and how will updated material be announced to the teams?

Updates to the PKB Library following the February 16, 2001 deadline for answering questions received through the Preproposal Conference will be announced via the “Announcements” section of PKB Mission Additional Information Homepage. The PKB Library will be utilized as an online resource throughout both the Selection and Downselection Steps. Documentation updates will be posted as they become available; however, no updates will be posted after March 7, 2001 affecting proposals for the Selection Step.

25. Section 4.5.1 states launch date flexibility must be specified. What exactly is meant by "flexibility"?

Per Section 4.5.1, “The launch date and launch date flexibility (if any) must be specified.” Launch date flexibility is the capability to launch over a range of launch dates versus a requirement for a specific launch date.

- 26. The referenced funding profile is currently stated in percentages rather than absolute dollars. Should we assume that corresponding dollar cost ceilings can be computed from these percentages, using the \$500M absolute cost cap? If this is not correct, what are the dollar cost ceilings by year?**

See Question 18, above.

- 27. Appendix F refers to a "typical" mission funding profile and uses the words "for planning purposes" when referring to the funding profile. Do the defined percentages in the funding profile table represent "typical" suggested values for guidance, or hard limits based on NASA's current available funds? What, if any, flexibility does a proposer have to exceed the limits for any individual year as long as the total cap is not exceeded?**

See Question 18, above.

- 28. In section 6.2, Evaluation Criteria, scoring criteria (either adjectival or numerical or both) are described in each area except cost. What is the scoring scheme for cost?**

Per Section 6.2.1b, NASA Office of Space Science Cost, "the proposed cost to NASA OSS will be a significant consideration in the Selection decision. As noted below (in Section 6.2.1d), an assessment of the feasibility of completing the investigation within the estimated cost (i.e., realism of cost) will be part of the evaluation of feasibility of mission implementation." Section 6.2.1d, Feasibility of the Mission Implementation Scheme, further states, "The proposal must discuss the methods and rationale (cost models, cost estimating relationships of analogous missions, etc.) used to develop the estimated cost and must include a discussion of cost risk." **Therefore, the cost evaluation will be included and reported as a part of the feasibility of the mission implementation scheme, and no separate cost grade will be assigned to the proposals evaluated.**

- 29. Should proposers carry cost reserves for any of the AO launch vehicles (as previously recommended for Discovery proposals), and if so, what level should be carried?**

The launch costs included in the AO for STS and ELV's do not include any reserves, they are for nominal missions. The ELV costs are based on existing fixed price launch service contracts and do include funding for mission uniques, consistent with planetary class missions. Some reserves may be added at discretion of PI, in event their mission design would require unusual launch vehicle considerations.

- 30. How are STS launch services to be costed and how will their use be scored in the proposal evaluation process? The AO implies that the STS is free, but also**

states that the cost of the Shuttle to NASA will be weighed in the evaluation. How and by what weighting will it be scored?

The document, *Pluto-Kuiper Belt Space Shuttle Launch Opportunities*, includes launch cost funding requirements. Launch cost for the Shuttle or ELV as applicable will be included in the cost evaluation of the proposal as discussed in the AO. OSS has included domestic ELV's, foreign ELV's, and the Space Shuttle as launch options for this AO solicitation without a preference for any one option.

31. What funding profiles are to be used for budgeting Launch Vehicle and RTG costs? These are needed to develop payment schedules in the cost plan.

The funding profiles to be used for budgeting launch vehicle costs are included in the PKB documents, *Pluto-Kuiper Belt Launch Services Information* and *Pluto-Kuiper Belt Space Shuttle Launch Opportunities*. RTG funding information is included in the PKB Library document, *Technical Specifications for Radioisotope Thermal Generators (RTG's) for Pluto-Kuiper Belt Mission*.

32. Please provide a breakdown of elements to be provided by the proposer and those to be provided by the government for the necessary Environmental Impact Assessment process and the Nuclear Safety Launch Approval process.

The proposer is responsible for all mission-specific information necessary to support the preparation of NEPA compliance documentation. This includes launch vehicle accident probabilities and conditions. An Environmental Impact Statement would be prepared as a NASA HQ document with the preparation costs borne by the project. The proposer should anticipate participating in document preparation, reviews, and meetings. A nuclear risk assessment, if required, in support of an EIS would be prepared by the DOE, which would bear the costs for that specific assessment.

The Nuclear Safety Launch Approval process requires a project Safety Assessment and an independent Safety Evaluation to support NASA's request for launch approval. Typically, the DOE bears the costs for the Safety Assessment for the RTG's and RHU's, and the participating agencies share the cost for the Interagency Nuclear Safety Review Panel, who evaluates the Safety Assessment. The project is responsible for any additional costs associated with supporting the launch approval effort.

33. Please provide cost guidelines for those government-provided elements for the necessary Environmental Impact Assessment process and the Nuclear Safety Launch Approval process which count against the cost cap.

Cost guidelines will not be provided. The proposer should scope their effort by reviewing publicly available documentation on previous missions such as Ulysses, Galileo, and Cassini. Sources for public documentation include, but are not limited

to, the Center for Aerospace Information (CASI) and the National Technical Information Service (NTIS).

- 34. Does the "Program Planning Budget Profile" (Appendix F) allow flexibility to move funds among the years indicated (e.g., more spending in earlier years compensated by less spending later years, giving the same end-to-end total spending)? If so, please provide a guideline.**

See Question 18, above.

- 35. Earlier NASA/ Pluto Mission lift mass curves (for the suggested launch vehicles) appear to provide more spacecraft separated mass than is indicated in the new curves associated with AO 01-OSS-01. The older curves are shown below and were part of presentations made by NASA study team members during Solar System Exploration Subcommittee meetings in 1999-2000. These older curves provide a spacecraft separated mass nearly equivalent to the payload system mass in the new curves presented for AO 01-OSS-01. Please confirm or clarify that, if we use the new payload system mass numbers, we must subtract the "adapter between the spacecraft and kick stage and all kick stage hardware (avionics, attitude control system, structural support hardware, etc.)" in order to arrive at an allowable spacecraft mass.**

Regarding the curves "w/o Star 48V", the figures reflect the LV capability to lift any hardware which is above the separation plane. For those curves "w/ Star 48V", the figures reflect LV capability to lift that which is above the Star 48; therefore, yes, the user must subtract (or allocate mass for) any required hardware between the Star 48 and the Spacecraft to determine the allowable Spacecraft mass.

- 36. Is there any experience using small nuclear warming packs, spread throughout the craft, to generate a small amount of electricity?**

Small power generator concepts have been proposed in the past; however, none of these concepts have been built or flight qualified by the U.S.

- 37. What are the publicly releasable costs for launches on Delta IV's and Atlas V's?**

The PKB Library document, *Pluto-Kuiper Belt Launch Services Information*, contains cost information on the Delta IV and Atlas V.

- 38. The Launch Vehicle cost data is not yet available. When do you think it will be published?**

The documents, *Pluto-Kuiper Belt Launch Services Information* and *Pluto-Kuiper Belt Space Shuttle Launch Opportunities*, include cost and performance data. These documents have been placed in the PKB Library.

- 39. Please confirm that the 62-page limit includes 5 fold-out pages, each of which counts as one page (assuming print on one side only).**

The 62-page limit including no more than five fold-out pages announced in Appendix B of the AO was amended at the Preproposal Conference to be 62 pages plus no more than five fold-out pages.

- 40. The Pluto Kuiper Belt Library lists "NASA Online Directives Information System (NODIS) II" (listing No. 29). This reference cannot be accessed without permission. Please provide for access approval for all prospective proposal teams as soon as possible.**

Access has been enabled to NODIS II.

- 41. Is Uranium 235 fission reactor power a preclusion for spacecraft power?**

The United States flew one experimental fission reactor over 35 years ago. There are no U.S. fission reactors currently qualified for space power.

- 42. Are STS marginal costs and EELV not-to-exceed costs treated in the same way and should reserves be added to these costs? (i.e., do they already include reserves?)**

See answer to Question 30. PI must make judgement as to any unique mission costs/reserves they need to add to cover unique requirements. The STS and EELV launch costs are adequate to equitably evaluate the basic launch requirements.

- 43. Do the RTG costs include reserves or should reserves be added?**

The RTG cost estimates in Appendix G included minimal reserves based on the maturity of the hardware design.

- 44. If an upper stage is necessary for a proposer's technical solution, must an upper stage meeting the Category 3 launch vehicle requirements (either the original or modified requirements) be used?**

The proposer is responsible for identifying compliance with NASA Risk Management Policy, including how they would propose mitigating risk associated with an upper stage with limited flight history. Intent of Category 3 requirements is to document and assess the risk of proposed launch options.

- 45. What are the flight heritage requirements for an upper stage for the PKB mission? Can a mission-unique design be used with proper qualification testing and NASA insight (but no prior flight history)? Please address the requirements for the following scenarios: a) Existing (flight-proven) SRM with**

new avionics, b) New, derivative design SRM with new avionics, c) New liquid propulsion design using heritage components

See response to Question 44. The proposer should address the costs, schedule, and residual risks associated with the new development items such as a kick stage on an EELV class launch vehicle.

46. Please try to make the Preproposal Conference attendance list available to attendees, at a minimum. The availability of this list will facilitate the ability for SDB's and WOSB's to contact PI's and proposal teams.

We have obtained an opinion from Legal and we will release this information upon request.

47. Please clarify that the 20% program cost growth margin must stay within the \$500M program cost cap. In other words, total proposed cost to NASA OSS must be under \$415M ($\$415M + 20\% = \$500M$)?

Yes. Proposals can be for any amount up to but not exceeding the \$500M total NASA OSS cost. Following selection, proposals can grow a maximum of 20% in cost, but must not exceed the \$500M NASA OSS cost cap. For example, a mission costing \$490M would only have a \$10M growth capability following selection before reaching the \$500M NASA OSS cost cap (less than a 20% growth capability).

48. Assuming that a NASA-provided EELV will be used, at what point in the program will a decision between the Atlas V and Delta IV be made by KSC?

Nominal authority to proceed with a launch service selection under the NLS contract is 27-30 months prior to desired launch date. Due to the complexity of mission requirements, the nominal setback can be adjusted at the Enterprises request and coordinated with KSC.

49. Do the Space Shuttle cost figures in the AO already include the cost of developing the Shuttle RTG Data Book? If not, how much should proposers include for this?"

The Space Shuttle cost figures shown in the AO do not already include the cost of developing a Shuttle RTG Data Book. Proposers should include an additional \$1M in real year dollars in each of the two years preceding launch (total of \$2M additional). The preceding cost figures are based on a launch in December 2004. An annual inflation factor of 3.5% should be calculated for later launch dates.

50. Does the Pluto-Kuiper Belt Mission require a Risk Category 3 qualified launch vehicle?

Pluto-Kuiper Belt Mission requirements are consistent with a Category 3 mission risk level. The proposer is responsible for identifying compliance with Risk Qualification Policy and any proposed mitigation strategy for specific launch systems being proposed.

51. Does a mission carrying radioisotopes require full Category 3 qualification, or is "Modified Risk Category 3" qualification sufficient?

See answer to Question 50.

52. By what years does NASA expect, with "low risk," the various different (launch) vehicles to achieve "Modified Category 3" or "Full Category 3" qualification?

Please review launch projections provided at the Preproposal Conference, which will be used to equitably compare launch systems timeline for potential flight demonstration.

53. What is the cost and cost profile of using "surplus" IUS with the Shuttle?

The proposer is responsible for identifying any proposed upper stages costs planned for launch on the STS. MSFC may be contacted for information on IUS.

54. Is the cost of the Modified Category 3 qualification process included within the "Launch Services Cost Figures to be used for Evaluation Purposes," Table 1 in the ELV Launch Services Information Summary. If not, how much, if any, should be included for this by the proposers?

Independent of the Pluto AO, KSC is responsible for enabling NASA use of EELV launch services. There are no cost estimates available/required in the proposal for modified Category 2 qualification process at this time.

55. I guess it could be read such as the bidders have to propose a specific vehicle and it's said that enough launch vehicle data needed to be included in the proposal so that a risk evaluation could be made.

Who does the launch vehicle risk assessment? NASA will assess launch vehicle risk as part of the evaluation process. Proposers all have available the same basic flight projections for consideration of the various launch options.

56. In the ELV launch services information that was on the web, it refers to a demonstrated successful flight rate relative to the referenced December 2004 launch date. Does that have any particular significance?

The launch date is left unconstrained in the final (January 19, 2001) version of the AO. Arrival at Pluto must be by 2020.

57. Do those costs include reserves and you have to have reserves on top of those costs?

Reserves on the basic launch service for either STS or ELV are not required. Proposers should identify any unique requirements and include costs and proposed reserves to cover mission unique hardware/analysis, etc., that may be required.

58. Covers the cost of plutonium?

Fuel costs are included in the Appendix G estimates.

59. Is the cost for the launch vehicle portion environmental and nuclear approval accounted for in the price numbers that NASA has defined in the attachment?

See Question 33.

60. The option of using U-235 nuclear efficient power, has that been precluded?

See Question 41. The only current U.S. space-qualified nuclear power source is the RTG.

61. I am assuming these are spare or engineering isotope units and flight spare or engineering enclosures and such left over from the Cassini and Galileo missions. Is there anything about these two units (F-5 and E-8) which is particularly critical from an engineering perspective?

F-5 is a spare from the Galileo and Cassini programs. E-8 is about 90% complete, unfueled converter remaining from the Cassini program. Proposed designs should not exceed the dynamic limits experienced during the Galileo and Cassini launch environments.

62. Is there a collection of the Galileo and Cassini EIR engineering analysis and support documentation for getting flight approval for this type of unit?

See answer to Question 33.

63. Page 22 states that the Project Manager (PM) must be named. Page B-10 says naming a PM is not required and Page B-12 does not provide for a PM resume. Please clarify.

Per Page 22, the specific roles and responsibilities of the PI and Project Manager (PM) must be described and the PM named. Appendix B Page B-10 and B-12 have been amended to be consistent with Page 22.

64. Page G-1 says the prices for the RTG's include “any analysis or data necessary for the launch approval process.” Is this correct? If not, what other funds must be budgeted by the PI to assist NASA in the approval process?

See Question 32. The proposer should budget for the acquisition or preparation of mission-specific supporting documentation.

65. Is the cost of the Plutonium included? If not, how much should the PI budget?

The cost of fuel is included in the Appendix G estimate.

66. What is the price of RHU's? Does this price include the plutonium and Launch Approval required analysis or data?

The price of RHU's was an omission from the AO. An RHU will cost approximately \$30K, including fuel. The supporting data and analysis is also required for RHU's, but does not need to be duplicated if RTG's are also used.

67. Launch Approval and Environmental Impact. Since these NASA/Government responsibilities will most likely not be delegated to the PI, please provide budgetary estimates for those support/analysis/documentation costs over and above those included in the Launch Vehicle and RTG price estimates that will come out of the \$500 million program cost cap.

See Question 33.

68. As the plots are small and difficult to accurately read, and since curve fits are not available, please provide tabular list of separated spacecraft mass/payload systems mass for Delta and Atlas families to C3=10,20,30,40,50 km²/s² for no Star 48, and to C3=100,110,120,130,140,150,160,170,180,190,200 km²/s² for Star 48.

Answer updated with new data on March 16, 2001.

Delta Maximum ELV Capability W/O Star48V

C ₃ (km ² /s ²)	D-III	D-IV	D-IV	D-IV	D-IV
	3940	4040	4240	4450	4050H
10	2095	2115	3275	3685	7810
20	1635	1565	2590*	2895	6435
30	1235	1085	1990*	2200*	5225
40	885	660*	1465*	1580*	4190
50	580	290*	1010*	1030*	3295

* Indicates figures are purely estimates and are not contractually included in NLS, which means these values are subject to change. In addition, these situations would

require further analysis by the KSC and Boeing structural loads group to ensure adequate compatibility with the respective Launch Vehicle.

Delta Maximum ELV Capability W/ Star48V (* updated as of 16-Mar-01)

C ₃ (km ² /s ²)	D-III 3940	D-IV 4040	D-IV 4240	D-IV 4450	New* D-IV 4450	D-IV 4050H
100	505	No Data	No Data	770	659	1660
110	430	No Data	No Data	655	542	1390
120	360	No Data	No Data	555	443	1165
130	305	No Data	No Data	470	360	975
140	255	No Data	No Data	400	288	815
150	No Data	No Data	No Data	No Data	227	675
160	No Data	No Data	No Data	No Data	No Data	No Data
170	No Data	No Data	No Data	No Data	No Data	No Data
180	No Data	No Data	No Data	No Data	No Data	No Data
190	No Data	No Data	No Data	No Data	No Data	No Data
200	No Data	No Data	No Data	No Data	No Data	No Data

“No Data” indicates that the figures for those respective points are not readily available and/or not likely practical for this application.

Atlas Maximum ELV Capability W/O Star48V

C ₃ (km ² /s ²)	A-III SEC	A-III DEC	A-V 401	A-V 501	A-V 511	A-V 521	A-V 531	A-V 541	A-V 551
10	2450	2580	2840	2145	3100	3765	4345	4865	5295
20	1995	2065	2310	1685	2525	3100	3605	4055	4425
30	1595	1625	1855	1285	2030	2530	2975	3360	3680
40	1245	1245	1455	940	1595	2030	2425	2765	3040
50	935	910	1100	635	1220	1590	1950	2250	2490

Atlas Maximum ELV Capability W/ Star48V

C ₃ (km ² /s ²)	A-III SEC	A-III DEC	A-V 401	A-V 501	A-V 511	A-V 521	A-V 531	A-V 541	A-V 551
100	600	640	650	525	730	850	1015	1135	1235
110	515	550	550	445	620	735	870	970	1060
120	440	470	465	375	530	630	745	830	905
130	375	400	390	320	450	540	635	710	775
140	315	340	325	265	380	460	545	610	665
150	265	285	270	220	320	390	465	520	570
160	220	230	220	180	265	330	395	440	485
170	180	190	180	150	220	275	330	375	410
180	145	150	140	120	180	225	280	315	350
190	115	125	110	90	145	185	235	265	295
200	95	105	80	70	115	150	195	220	245

69. Please clarify whether the Atlas IIIB curves are for SEC or DEC.

The AO curves are based on Dual Engine Centaur (DEC) configuration. However, we have provided additional Single Engine Centaur (SEC) figures in the response to Question 68.

70. For the purpose of eliminating unreasonable subjectivity in the evaluation process, please specify, as a function of launch year (2004-2010), when each LV can be expected to be NASA-certified.

Please refer to the Preproposal Conference package that was presented by K. Poniatoski. We have provided what we expect the Qualification Certification status to be at certain timeframes. But keep in mind, these are projections based on a very fluid commercial market and manifest; it is not possible to predict exactly when each ELV configuration will be certified for Category 3 missions. The evaluation of the LV risk as a portion of the overall mission risk should be kept at a relatively high level. Any evaluation by the proposer over and above the risk trades between the “Launch Service Classes” as a whole is not necessary at this stage of the game.

71. The launch vehicles shown in the ELV Launch Services Information Summary do not include the Delta II and Atlas II, which are the only ELV’s that are in Category 3. Can these launch vehicles be considered for the Pluto-Kuiper mission?

Delta II information was not provided because the past studies that have been done on Pluto and other Outer Planets missions over the past decade have all required Intermediate or greater class performance. However, if you have a feasible concept that can utilize the Delta II LV, there is no restriction from using that LV. If you are planning to propose the Delta II, please specify what information you need so that NASA can provide it.

As for the Atlas II, Lockheed Martin is phasing-out the Atlas II line of LV's, and they have recently sold the last one in production. Therefore, we are not able to procure anymore Atlas IIA or IIAS LV's.

72. Could you please get the injection accuracy for both the Atlas-V 521 and Delta-IV 4450 with C3 of 127 & 144 km²/s²? We need this data for estimating the Delta-V budget.

The requested information for these two exact points for either LV is not readily available. However, the following are figures from the NLS Contract that can be used for estimating purposes:

Atlas V 521 - C3 (km²/sec²) Standard Insertion Accuracy
for a C3=100 => RLA 0.05, DLA 0.05, C3 0.12

Delta IV 4450 3 Sigma Orbit Dispersions for High Energy Missions
for a C3=50 => Injection Velocity (mps) +/- 6.5, in-plane (deg) +/- 0.13, out-of-plane (deg) +/- 0.06
Note: 3 sigma injection altitude = +/- 10 km

73. Can you provide a cost profile in Real Year Dollars for a PKB launch date of December 2005?

Use the Cost Escalation Guideline provided in the AO for the total Cost and then use the same relative proportions for the FY breakdown.

74. For a proposal to satisfy the cost reporting requirements of the AO, a funding profile for the RTG is necessary. Please provide for a F-5 only, F-8 only, and (F-5 + F-8) as soon as possible.

The RTG funding profile is dependent on the development schedule. Proposers may show that the fuel payment will be made during the launch year and the development costs will be spread across the development years. (The funding estimates contained in Appendix G of the AO are in real year dollars from FY 00 through FY 05.) This funding plan will be subject to negotiation with DOE when the selected mission is defined.

**75. I'd appreciate it if you could provide injection capability for the Atlas IIIB launch vehicle equipped with Star 48 at the following C3's:
113.9, 116.6, 116.7, 118.6, 120.4, 121.9, 124.2, 127.4, 142.4, 145.9, 146.8, 148.1, 150.9, 153.6, 153.9, 156.9, 161.9**

In question #68, we have provided C3 values for the AtlasLV's with Star 48 for $c_3=100$ through 200 at increments of 10. Our recommendation is to use these figures to generate a curve fit, and use that curve to generate the specific points that you need for your application.

76. What is the additional cost that needs to be added to the launch service budget for KSC fueling services, or would this already be included in the launch services costs you have listed in the Appendix of the AO?

The KSC fueling services have been accounted for in the Launch Service Cost Estimates. No additional reserves should be necessary.

77. Would a non-conventional means of propulsion be looked at favorably, or is this not what you are looking for?

The AO does not restrict the propulsion approaches that may be used. The AO does specify that proposals must be for a complete mission, including launch vehicle, spacecraft, and science payload. Proposals that are for less than a complete mission will be declared non-compliant and returned to the proposer.