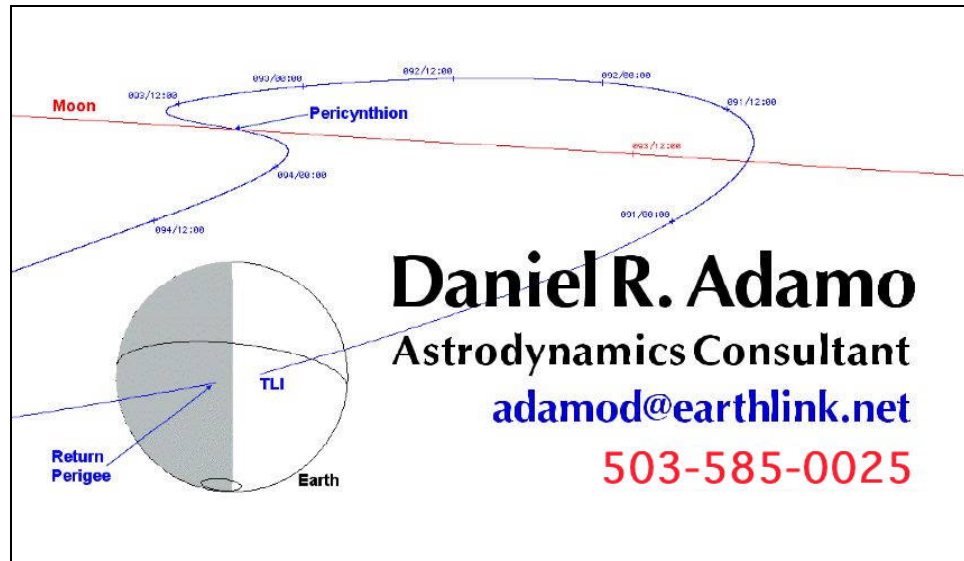


# ***The Future of NHATS & Follow-On Capabilities*** **An SBAG Community Discussion**



**SBAG #21, College Park, MD**  
24 June 2019

# The Future of NHATS & Follow-On Capabilities

## Discussion Topics

- 01) (Chodas) In late 2018, NHATS was being modified to slip the Earth departure window such that few (if any) NHATS-compliant missions will have Earth departure dates in the past with respect to the NHATS processing date. Since this mod has not gone operational yet, what is its status? Are there any unresolved issues with the mod or NHATS operations using it? Are there any outright showstoppers? Can an operational date for this new capability be estimated with confidence?
- 02) (Adamo) In a HSF context, loiter time at the NEO destination is a primary justification for risks and costs a specific roundtrip from Earth incurs. Does it make sense to add loiter time as a NHATS output parameter? Should the NHATS-compliant mission with the longest loiter time be output? Should NHATS produce another TOF versus Earth departure date "icicle plot" in which color is driven by loiter time?
- 03) (Adamo) In a HSF context, mission abort options on the outbound trajectory leg following Earth departure will be a primary consideration in programmatic decisions ultimately selecting NHATS-compliant mission opportunities to actually fly. Does it make sense to add an outbound point-of-no-return elapsed time since launch (PONR) as a NHATS output parameter? Should the NHATS-compliant mission with the latest PONR be output for each NHATS-compliant destination? Should NHATS produce another icicle plot in which color is driven by PONR?

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## Discussion Topics (continued)

- 04) (Adamo) For any NHATS output parameter (TOF, Earth departure date, roundtrip  $\Delta v$ , destination loiter time, PONR, ...) is there value in displaying a "compliant power spectrum"? Consider TOF as an example. The spectrum is quantized into TOF bins (0-50 d, 50-100 d, ..., and 400-450 d would be a plausible implementation). For each bin, the number of NHATS-compliant missions is tallied to form the TOF power spectrum.
- 05) (Adamo) Currently, NHATS weights every compliant mission equally when tallying all such missions associated with a specific destination. Would there be value from a weighted tally in which shorter TOF/lower  $\Delta v$  missions contribute more to the tally than longer TOF/higher  $\Delta v$  missions? If compliant power spectra are available in NHATS output, is this weighted tally necessary?
- 06) (Adamo) Can public access to all NHATS-compliant missions be provided for any specific NEO destination after it's processed? If so, would it then be possible for end users to "weed out" compliant missions according to reduced maximum TOF, narrowed Earth departure date window, reduced maximum roundtrip  $\Delta v$ , extended minimum loiter time, delayed earliest PONR, ...? How would remaining uber-compliant missions be sorted/displayed/accessed?
- 07) (Adamo) To assess Mars-like HSF mission roundtrip durations by flying NEO missions with progressively longer TOFs, is it advisable to increase NHATS maximum TOF from 450 d to 550 d or more?

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## Discussion Topics (concluded)

- 08) (Chodas) Should there be any relationship/interface/evolutionary path between NHATS and other mission design tools dealing with one-way, multi-destination, planetary defense, low-thrust, or gravity-assisted trajectories?
- 09) (Chodas) What's the rationale behind excluding known NECs in the SBDB from NHATS processing? Is this rationale consistent with ISRU interests or with potential low-latency telepresence exploration missions to NECs?