The 7th Mission Idea Contest for Deep Space Science/Exploration

March 17, 2020 Ver.3

Please propose an innovative mission idea which contributes to deep space science and exploration in the following conditions:

1. Spacecraft envelope size is less than **1.0 m x1.0 m x1.0 m size with less than 100 kg in weight.** （Multiple satellites are acceptable within the envelope area.）

2. The launcher delivers the spacecraft into cis-lunar orbit or deep space trajectory orbit with the relative velocity to the Earth (excess velocity) greater than 0 km/s, and the relation between C3 (square of the excess velocity) and the deliverable spacecraft mass is shown in Fig. 1.

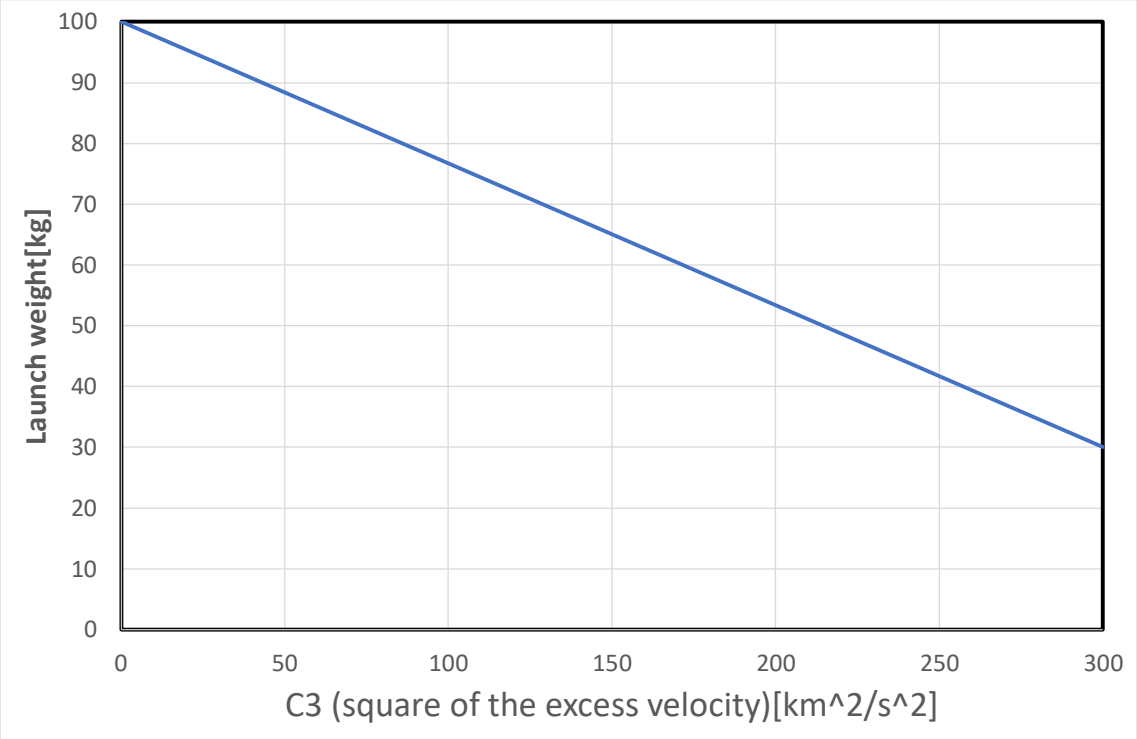

Figure 1 C3 vs. Launch Weight (TBD)

3. You can use a transponder onboard of PROCYON, the first deep space micro-spacecraft developed by the Univ. of Tokyo and JAXA. Its communication system is primarily comprised of XTRP (transponder) and XSSPA (power amplifier). The total

required power and output RF power of the communication system is roughly 50 W and 15W respectively. The detail specification is shown in Table 4. of the reference [1)].
(If you cannot find the paper, please contact the MIC office.)

4. You can assume you can use earth ground stations for deep space missions like DSN (Deep Space Network), about which the detailed specifications are obtained from the reference[2)].

The position of the spacecraft can be assumed to be determined by RARR（Range and Range Rate）, and the accuracy of the determination can be assumed to be 1 microradian.

5. You can take continuous 8 hours for spacecraft operation every day.

6. The lifetime is a free parameter.　But you should consider the effect of radiation for the proposed lifetime.

7. The proposed launch date should be before 2030.

Reference

1) Kobayashi, Y., Tomiki, A., et al., "Low-cost and ultimately-downsized X-band deep-space telecommunication system for PROCYON mission", IEEE Aerospace Conference, MT, USA, 2016. DOI: 10.1109/AERO.2016.7500745 https://ieeexplore.ieee.org/document/7500745

2) Deep Space Network Services Catalog https://deepspace.jpl.nasa.gov/files/820-100-F1.pdf

Bibliography List

1) Deep Space Communications and Navigation Series, Jon Hamkins, Editor-in-Chief, JPL　https://descanso.jpl.nasa.gov/monograph/mono.html

2) Deep Space Telecommunications Systems Engineering, Joseph H. Yuen, Editor, JPL https://descanso.jpl.nasa.gov/dstse/DSTSE.pdf

3) Deep Space Communications, Jim Taylor, Editor, JPL
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