

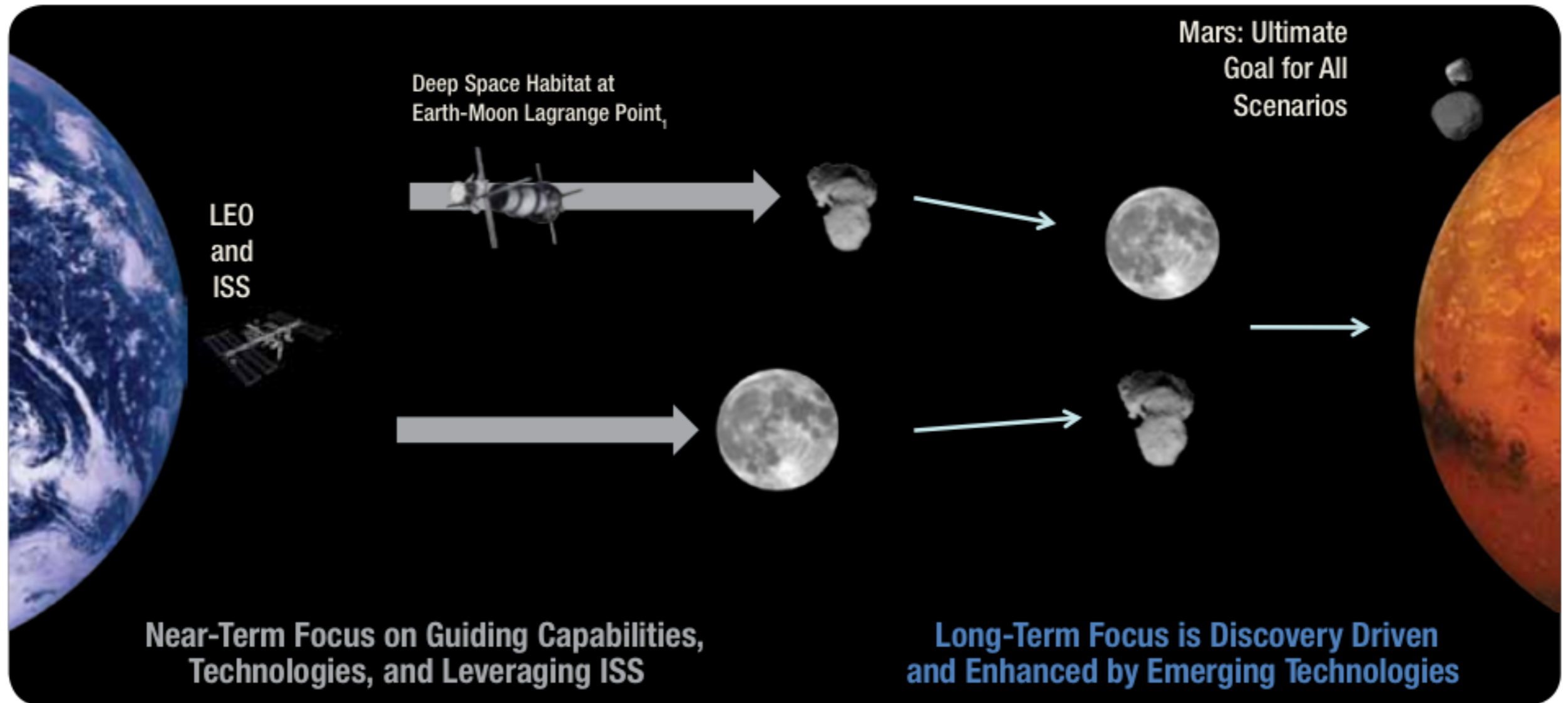
The Future of Human Exploration and the Role of NEOs

– JAXA perspective –

Jun'ichiro Kawaguchi,
Senior Fellow, Japan Aerospace Exploration Agency (JAXA)

ISECG discussion looks at Moon or Asteroid

Optional Pathways in a Common Strategy



Surrounding Environment around Japan's Space Activity

Japan still faces the tough economy.

Japan's Space Basic Law effective in 2007 stipulates the emphasis be in utilization rather than research & development.

Besides, DPJ was reluctant in spending.

Even Hayabusa-2 was threatened these years.

Especially in Exploration, while Japan needs to retain its status in Asia, J government attitude is not positive enough.

We are expecting some plus by LDP new government.

Current Perspective to Exploration at JAXA

JAXA sees Human Exploration through International Collaboration.

JAXA has taken part in ISECG trans-agency activity.

JAXA has two exploration approaches:

- 1) Advancing already reached destinations such as moon.
- 2) Challenging to unexplored destinations such as primitive bodies.

JAXA looks at two robotic missions now:

- 1) Hayabusa-2 for C-type asteroid sample & return.
- 2) SELENE-2 for Lunar surface missions.

Study of the origin of the solar system

4.6 billion years ago...

私たちの地球は何から生まれたのか、私たちを形づくるものはどこから来たのか

Molecular cloud

分子雲

原始太陽系
星雲

Proto solar system disk

太陽系

Solar system

構成物質と内部構造

LL コンドライト？
ラブルパイル？

マイクロメテオロイド降下
惑星間塵（彗星・小惑星）

宇宙風化

他の小惑星との比較

“イトカワ” の位置づけ

メテオロイド衝突

クレーター形成

岩礫の起源？

「はやぶさ」による小惑星
イトカワの近接画像
©ISAS/JAXA

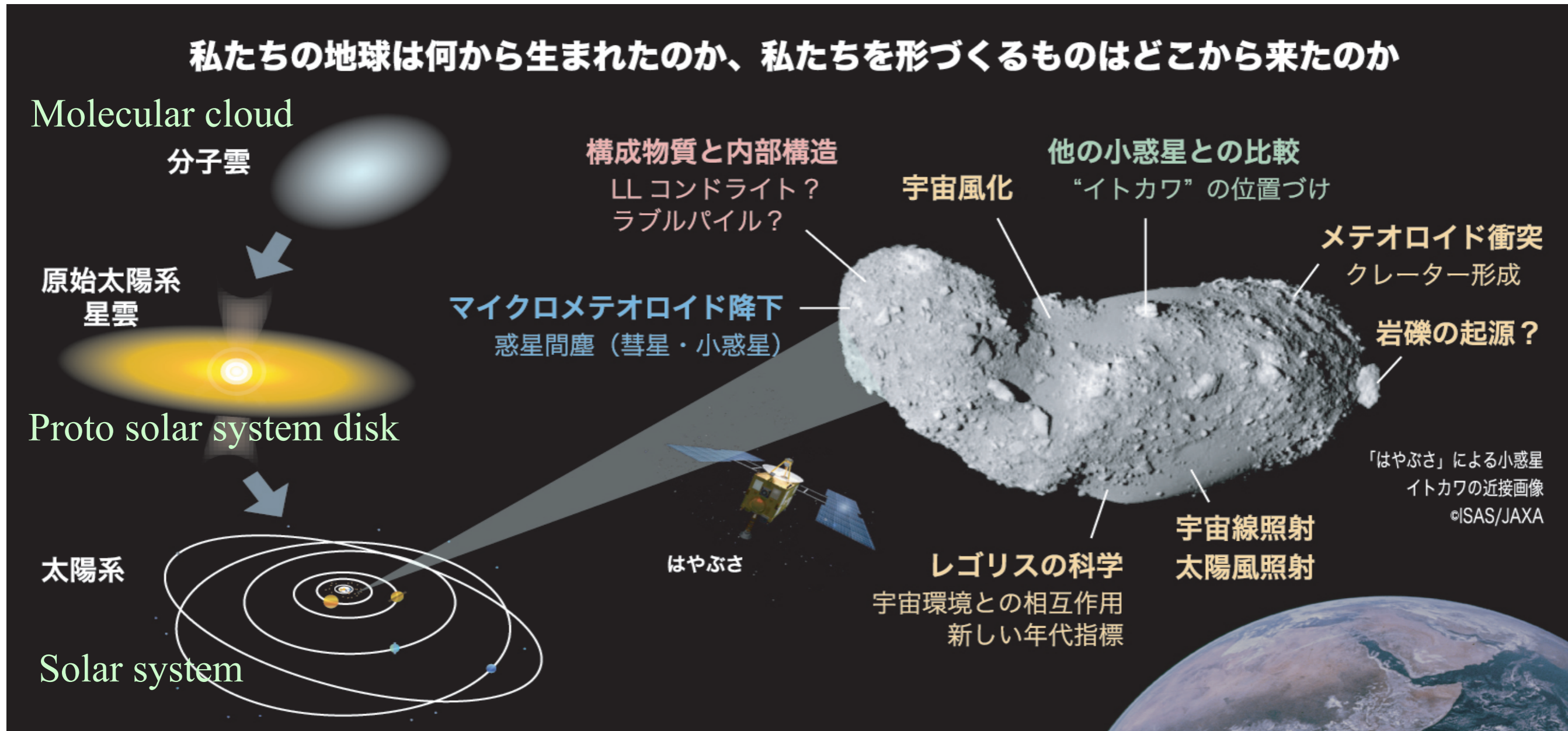
宇宙線照射

太陽風照射

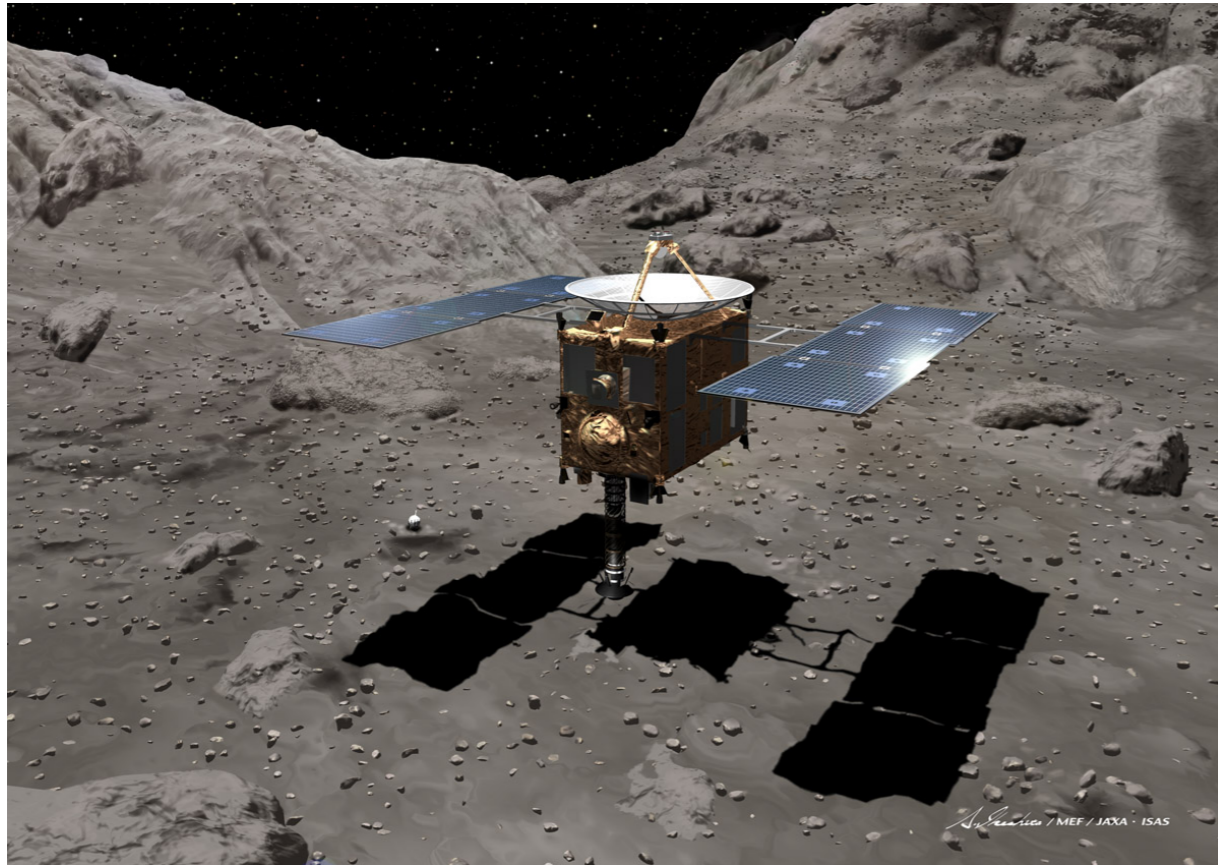
レゴリスの科学

宇宙環境との相互作用
新しい年代指標

はやぶさ



Asteroid Explorer “HAYABUSA”



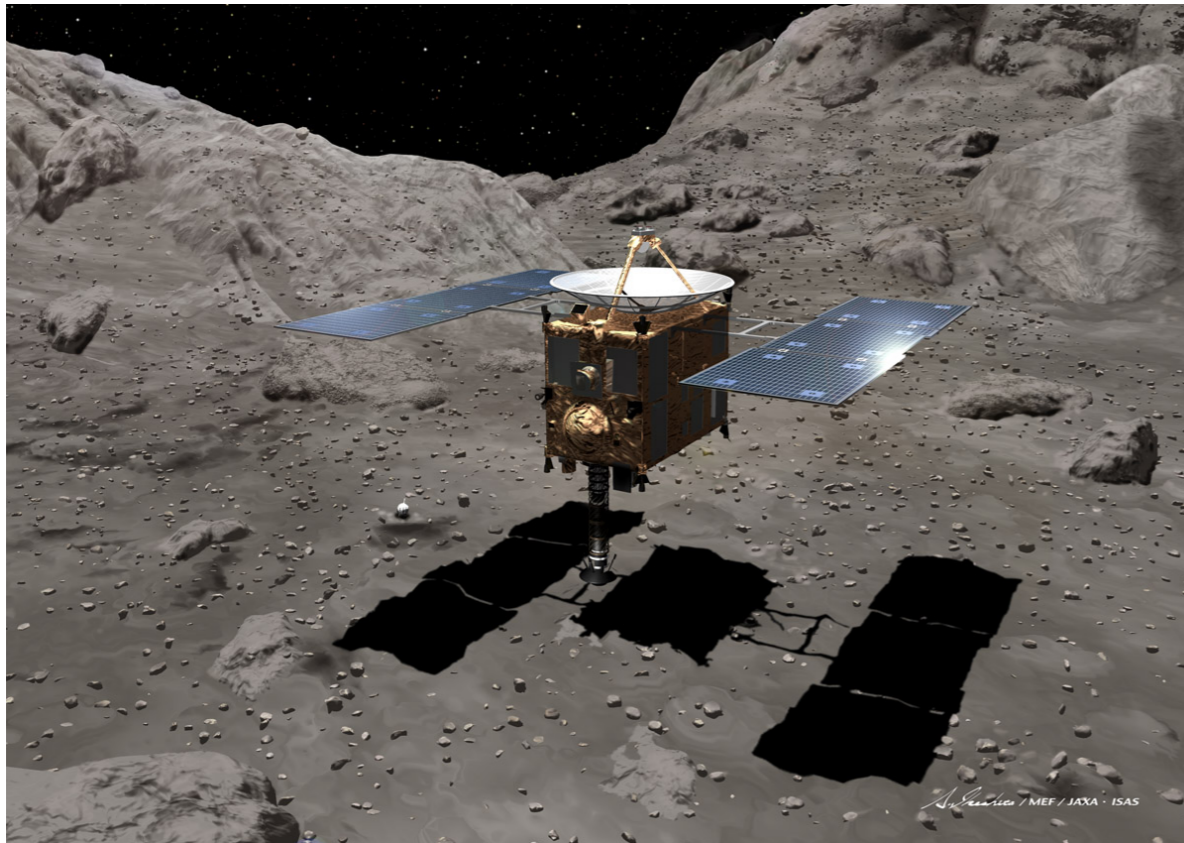
Dimensions : 1.0m x 1.6m x 1.1m
Weight : 380kg(Dry)
Chemical Fuel 70kg
Xe Propellant 60kg
Total 510kg



Five Key Technology demonstrated :

1. Interplanetary Cruise via Ion Engines as Primary Propulsion comprising Microwave driven & CC Grid Ion Engines,
2. Autonomous Navigation and Guidance using Optical Measurement,
3. Sample Collection from Asteroid Surface under Micro Gravity,
4. Direct Reentry for Sample Recovery from Interplanetary Orbit,
5. Combination of Low Thrust and Gravity Assist.

Asteroid Explorer “HAYABUSA”



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Five Key Technology demonstrated :

1. Interplanetary Cruise via Ion Engines as Primary Propulsion comprising Microwave driven & CC Grid Ion Engines,

2. Autonomous Navigation and Guidance

3. Landing Optimal

4. Sample Recovery

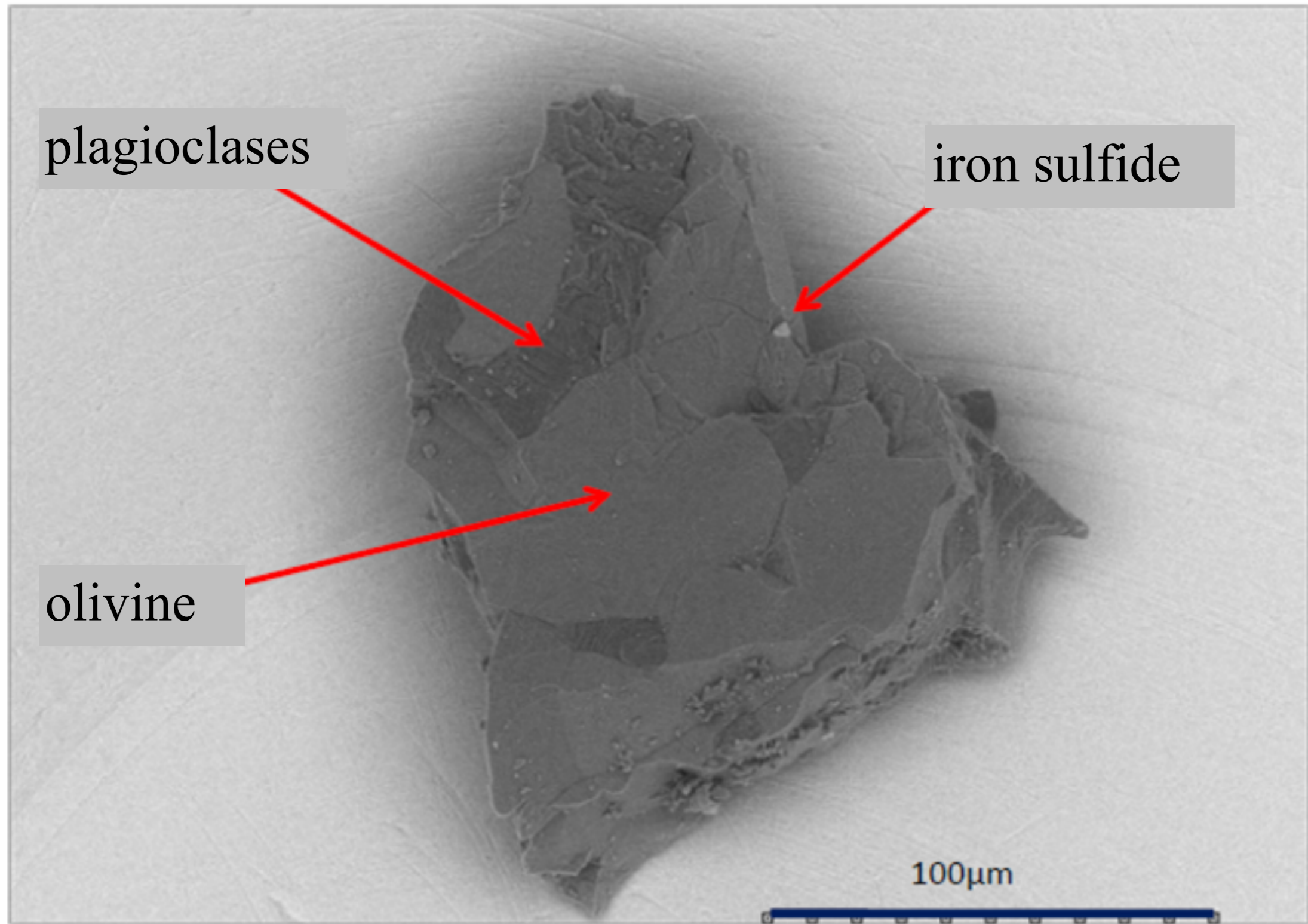
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Above All, it aimed at a round-trip flight to an extra-terrestrial object.

Discovered and Localized Just within 1 hour,...

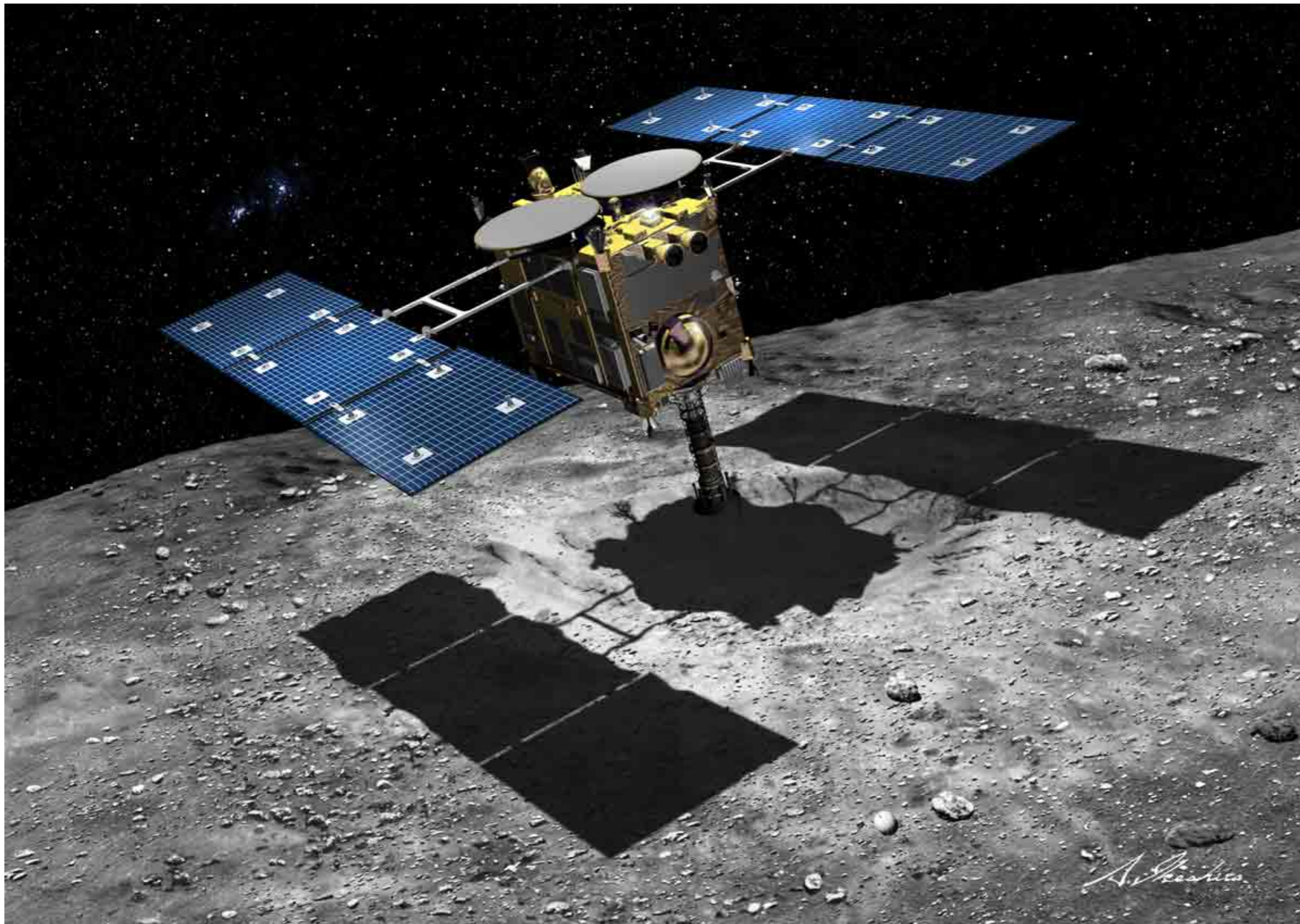


岩石質粒子の一例(走査型電子顕微鏡による画像)



LPSC: March 10th Morning, 2011.
There was a specialized session on Hayabusa analysis.
11 Initial and Key Reports on the Samples recovered.

Next Asteroid Sample Return Mission - Hayabusa2



Human mission to NEO or Mars?

Discussion may as well look into staging point.

No. There will be Disposal Discrete Missions such as NEO missions, first.

Mars is the ultimate destination goal?

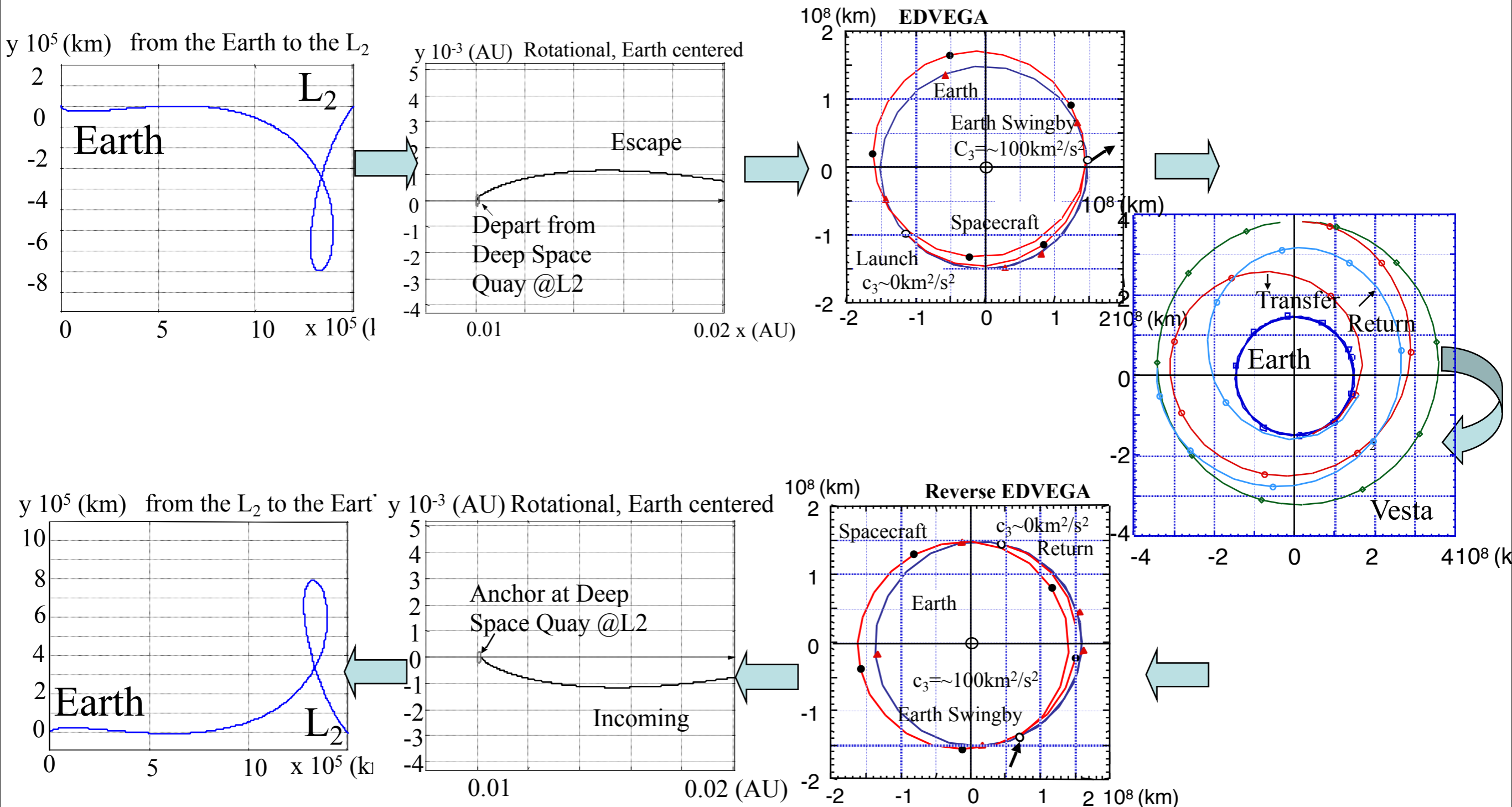
No. It is just a **Symbol as a goal**, in view of the flight period affordable for current technology.

That is why, I believe :

NEO fits for next human exploration destination,

SEL2, A Staging Point, may be a precursor destination for multi-purpose demonstration.

Entire Trajectories : Human Flight Segments Infrastructure :



Ref) IAC-02-A.7.03 "On A Representative Solar Sail Deep Space Flight Based at the Quay around L2 Point"

How NEO can play a role in Human Exploration?

Mars is conceived as a ultimate goal, but it is just regarded as at destination that can be reached within potentially affordable flight period. Flight period is several hundred days and beyond current capability.

Moon is supported by ISECG and others. It is an immediate destination but is an old destination and does not sound frontier so much.

NEO is practical with full science and resource survey objective. It is reached with affordable flight period of half a year or less than a year. It should pave the way to real frontier that has not be visited by human. It is achievable by SLS plus MPCV.

And it can provide practices toward future exploration.

I am **personally** for NEO as a next destination, while ISECG may have a different view.

