P03

低軌道 NEO 観測小型衛星

Small Satellite for NEO Observation from LEO

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地球接近天体（NEO）やデブリの地上からの観測は、太陽や月による照射環境や天候や大気の揺らぎの影響を受ける。特に太陽と地球の間にある物体の発見は困難である。この制約を除去するために、低コスト、短期間な宇宙からの観測を検討した。衛星の検討にあたり、光学観測望遠鏡、軌道条件、打上ロケット、観測シーケンスなどのミッションプロファイルを仮定した。これらの仮定のもとで衛星の概念検討を実施してマイクロ衛星の一つの解を得た。 衛星の規模は 60×60×80cm、質量は 65kg となった。概念検討により 3 つの技術課題を抽出し、各々の課題に対する対策の実現性の見通しを得た。検討にあてって仮定したミッションプロファイルの曖昧さを考慮しても、NEO 観測衛星は 100kg 級で実現できると考える。この衛星は運用中や運用終了した衛星に危険を及ぼすデブリの観測にも有効である。ポスターは NEO 観測の概念検討結果の概要を紹介する。

Near Earth Object “NEO” and debris observation from ground site is restricted by the light condition from the sun and the moon, atmospheric condition and fluctuation. Especially it is difficult to detect objects between the sun and the earth. In order to release from these restrictions, observation from space is considered with low cost and short development period. Mission profile of NEO observation satellite such as dimension and mass of an optical telescope, orbital condition, rocket interface and observation sequences had been assumed. Under those assumption, feasibility study of satellite had been carried out and one of result of small satellite was obtained. Dimensions of the satellite is 60×60×80cm and its mass is about 65kg. In this feasibility study three technical issues are recognized and possibility of solutions are introduced. Considering an ambiguity of the assumption, NEO observation satellite will be realized by small satellite with 100kg class. This technology is useful for observing debris which is hazardous for operating or post mission satellites. This poster shows outline of a small satellite for NEO observation.

Small satellite for NEO observation from Low Earth Orbit

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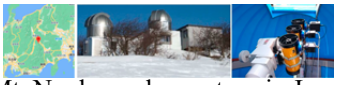
Near Earth Object (NEO) had caused significant damages to local areas.

Tunguska explosion

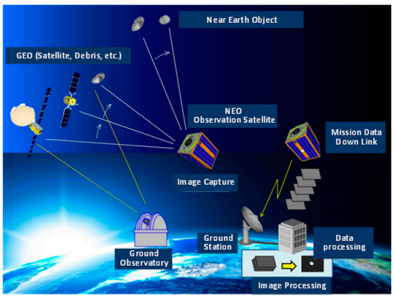
Chelyabinsk meteorite

For ground-based observation with 20cm-class small telescopes located in Japan and Australia, **we have discovered 11 NEOs since March of 2017**



Mt. Nyukasa observatory in Japan

Siding Spring Observatory in Australia



Observation from ground and space **contributes to SSA.**

Our research team is considering the observation network for these NEOs.
We call our activity "**JANESS**", **JA**xa **NE**o **S**urvey **S**ystem.

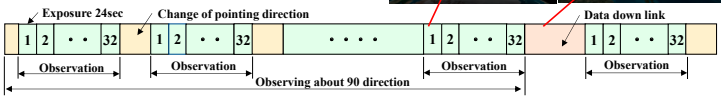
We have carried on feasibility study of 100kg class of micro-satellite to observe NEO from low earth orbit.

Mission Concept

- Telescope(Refferred from ground telescope)
  Size;200 × 220 × 620mm, Mass;16kg,
  Power Consumption:16W, FOV;3.5 × 3.5deg,
  Size of 2D Image sensor; 2048 × 2048pixcel
  Resolution: 16bit/pixcel
- Stability during exposure; Better than 0.002deg/24sec
  (In order to obtain high S/N)
- 2 observation modes.
  NEO Mode; Orient one direction in inertial axis.
  24seconds exposure, 32 images.
  GEO Mode; Orient one point on GEO.
  4seconds exposure, 32 images.

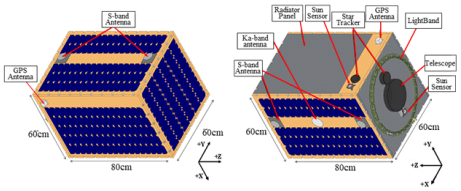
(Ex.)Sequence of NEO Mode

(a) Orient to required directed direction.
(b) Obtain 32 images with 24 exposure time.
(c) Orient to next direction.
(d) Obtain 32 images with 24 exposure time..
(e) Repeat sequence (c) and (d).
(f) Attitude maneuver to orient antenna to ground station.
(g) Down link stored data.
(h) Return to sequence (a).

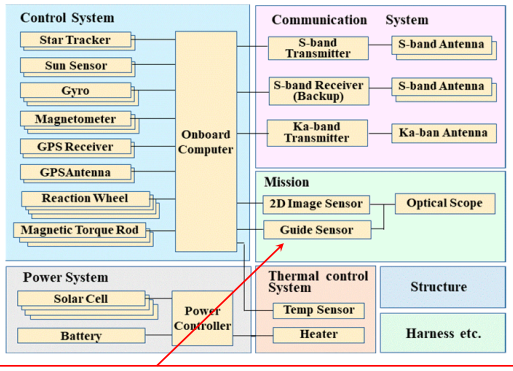


Ride share or piggy back launch.
Altitude;650km, Sun Synchronous Orbit, Local Sun Time;12:00, Rocket I/F;LightBand.

Result of conceptual design of the satellite system

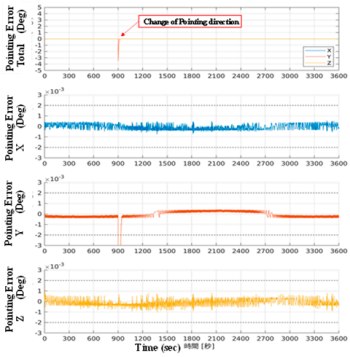


Power;60W(EOL)
Battery; 6Ah
Bus Voltage;24～33V
HK;S-Band
Data;Ka-Band



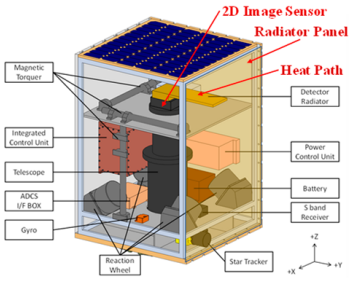
- Mass;65kg, Size;60 × 60 × 80cm
- Telescope is fixed on satellite body.
- Pointing control is achieved by attitude control of the body.
- Solar cells are mounted on satellite body. In order to eliminate source of micro vibration, deployable solar panel is not applied.
- Components with flight heritage of small satellite are selected.

A Guide Sensor detects micro change of direction of line of sight



Using the signals from a guide sensor, stability better than 0.002deg/24sec will be achieved. (By simplified 3 axis simulation)

- To reduce thermal noise, 2D image sensor shall be cooled below -70℃.
- +Y panel is used as a radiator panel.
  ➡ Incident light from the sun to +Y panel shall be avoided. (Restriction on the operation)
- Under high temperature condition, temperature of 2D image sensor exceeds -70℃.



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Researched with IHI Corporation and Meisei Electric. Co., Ltd.