

Plan for sensor development of super precise inter-satellite ranging and my research topic in JAXA ISAS

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- **Introduction of myself**
- **Inter-satellite speed ranging sensor**
 - What we have done so far
 - Current problem
 - Future plan
- **My research in JAXA ISAS**
 - Orbit determination by inter-satellite ranging
- **Discussion**
 - 宇宙戦略基金 (Funding)
 - Study abroad?



- **Affiliation**

- The University of Tokyo
- Electrical Engineering and Information Systems (EEIS) (JAXA ISAS)
- M1

- **Research Interests**

- Application of multi satellites or multi robotics in space engineering
- Robot Vision

- **Hobby, Lifework**

- Engineering related to soccer
- Community management

Engineering related to soccer



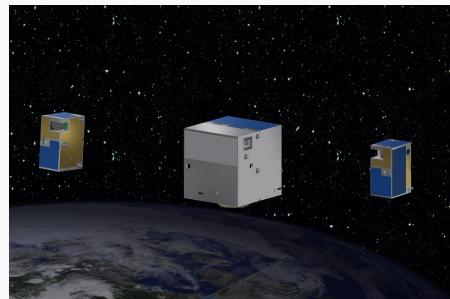
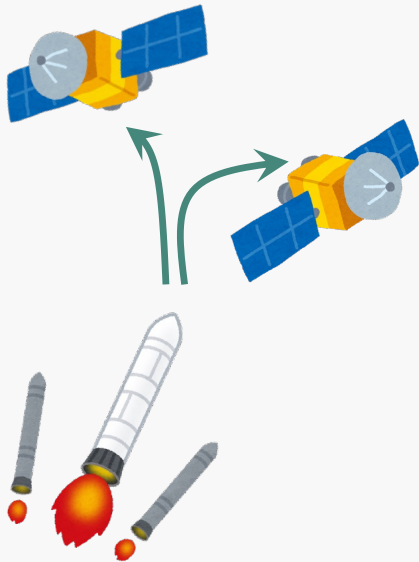
Relative motion control using GPS Slow down using inter-satellite speed ranging sensor Fringe lock



~1 cm/s

1 $\mu\text{m/s}$

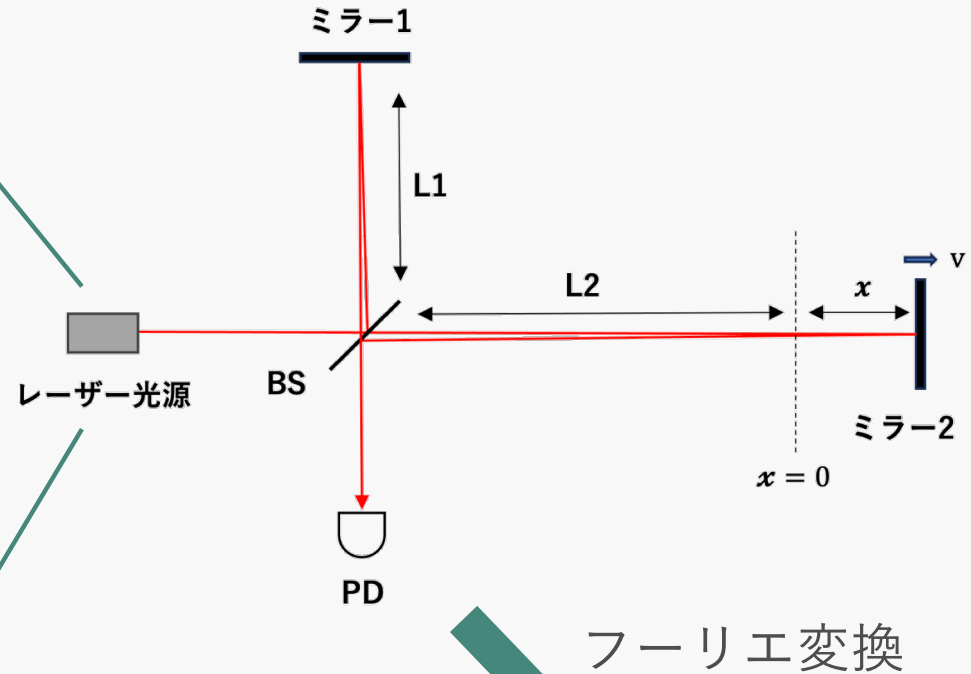
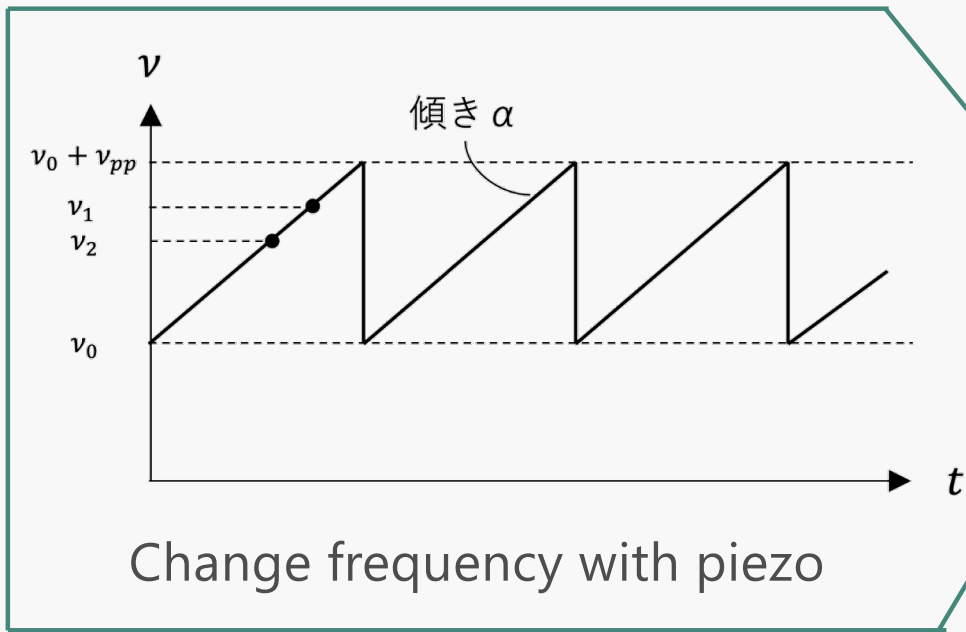
< 1 $\mu\text{m/s}$



SEIRIOS



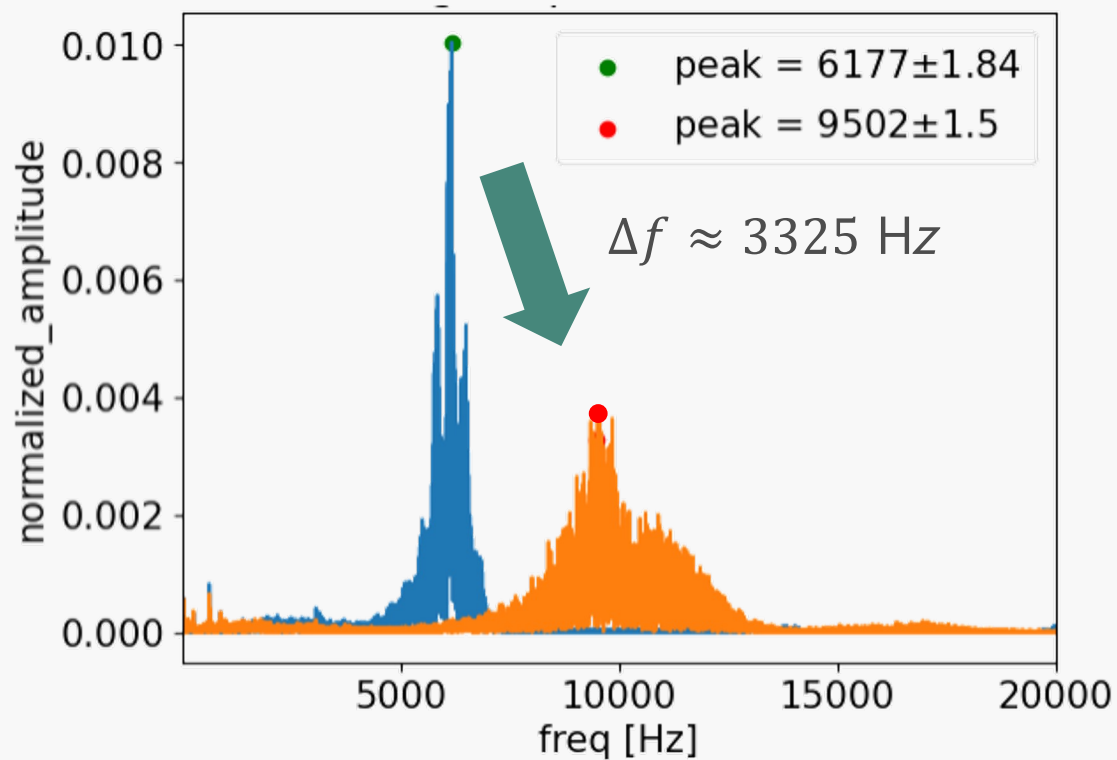
B-DECIGO

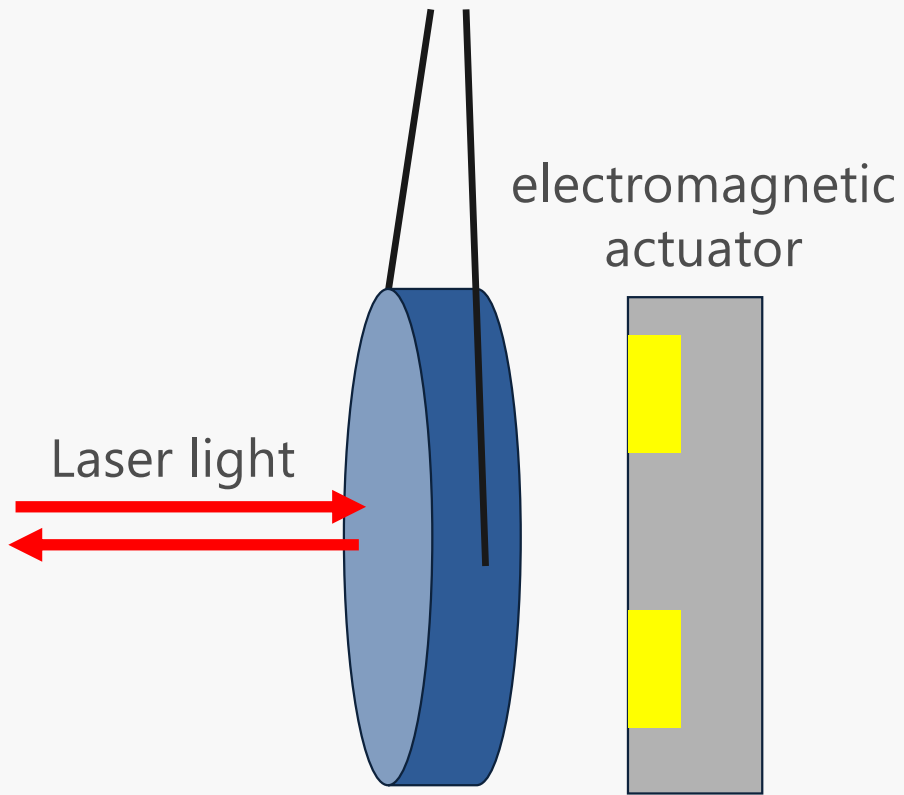


フーリエ変換

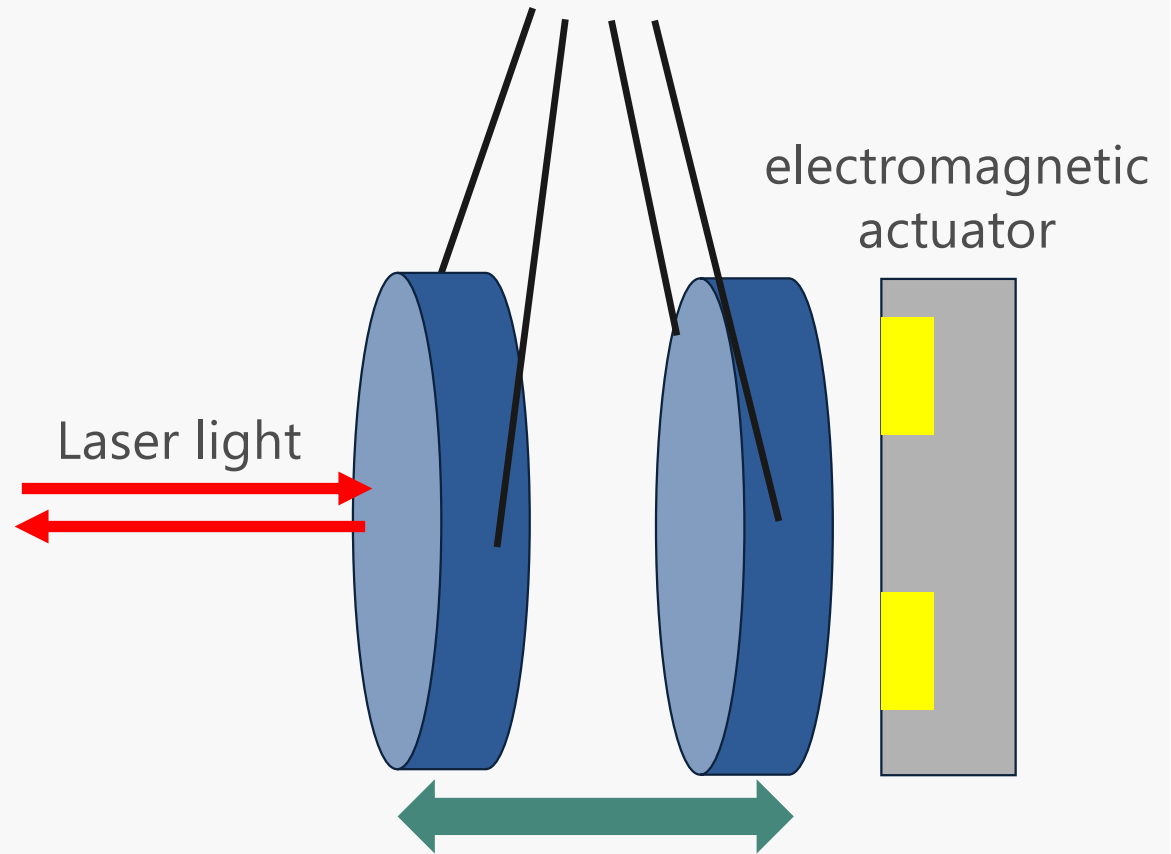
Mirror speed: v , Frequency measured in PD: f : $f = \frac{2\Delta L\alpha}{c} + \frac{2v}{\lambda}$

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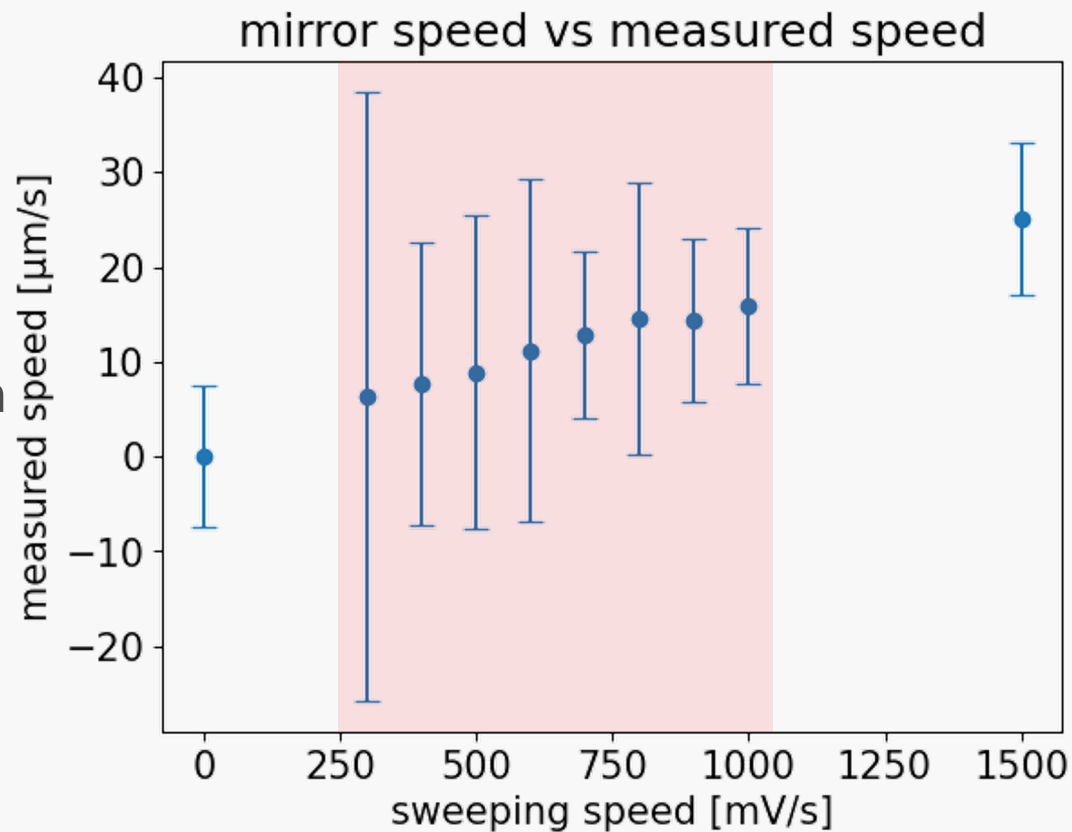
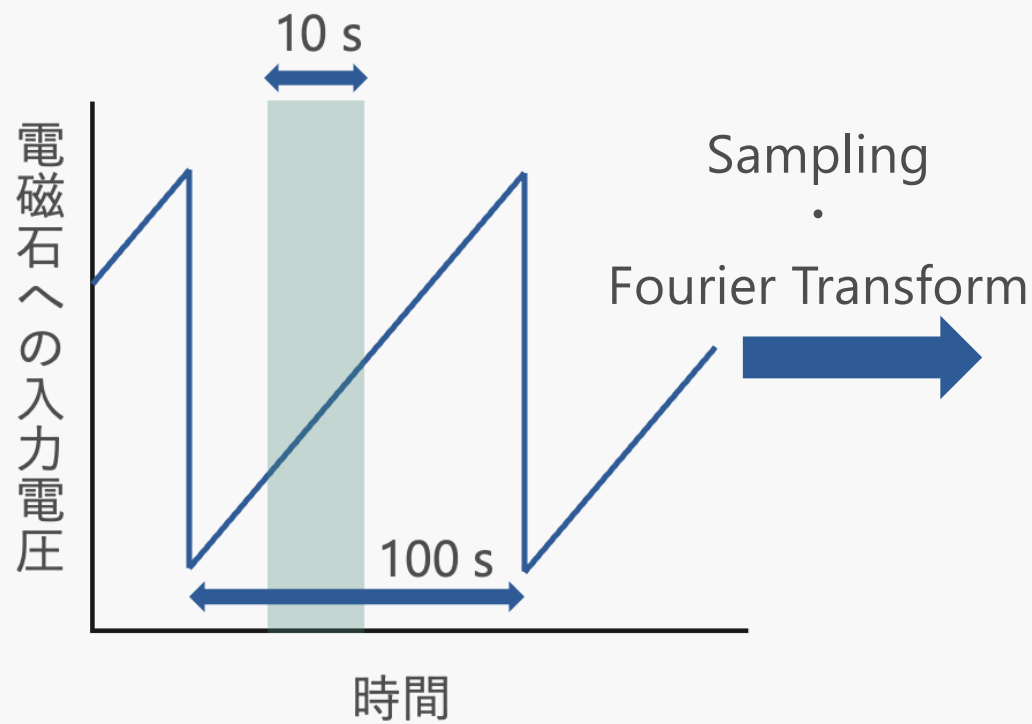




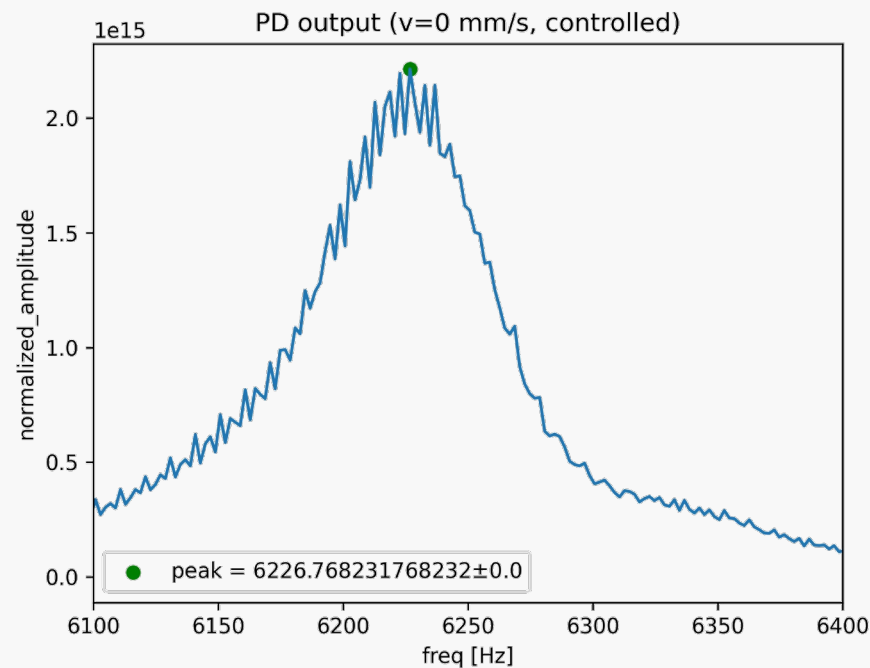
High speed : Control angle



Slow speed : Control angle + small motion



Increase 2 Hz ($1.6 \mu\text{m/s}$) for each 100 mV/s
 → $\mu\text{m/s}$ order resolution



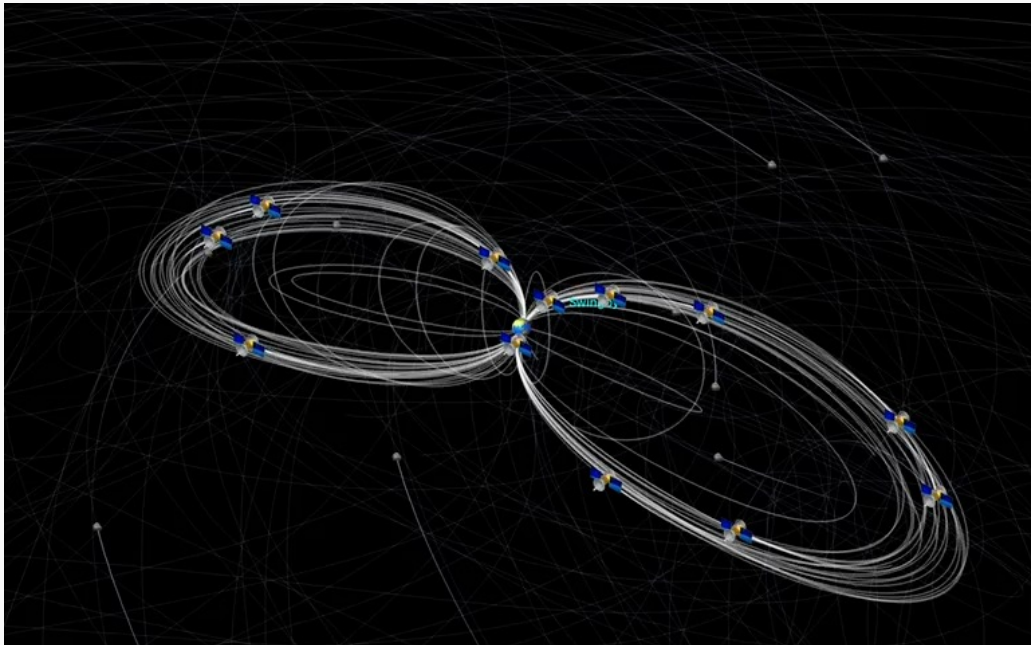
Tradeoff of resolution vs # of trials

$$\sigma \sim 10-100 \text{ Hz} / \sqrt{N}$$

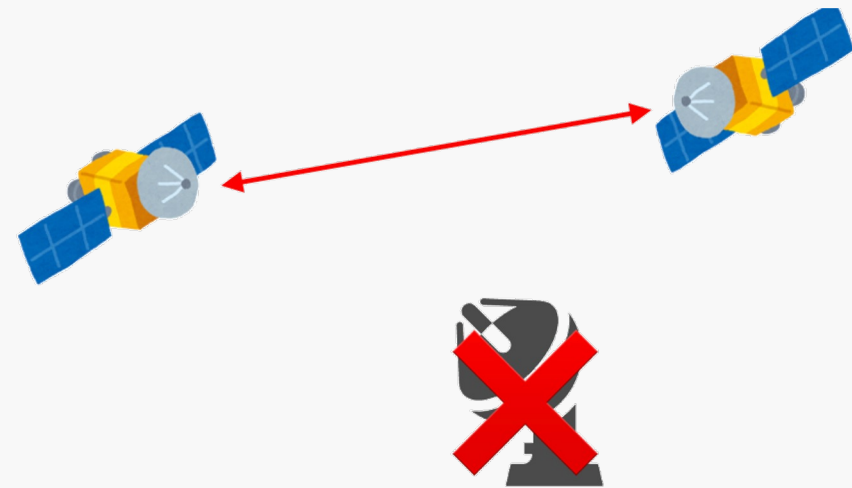
Depends on strength of control

- **Check the upper limit and lower limit of speed measurement**
 - Lower limit has problem of noise
- **F-V conversion with circuit**
 - Make it work in non square waves
 - Check accuracy
- **Connect with fringe lock**
- **Use dual QPD to separate effect of movements**

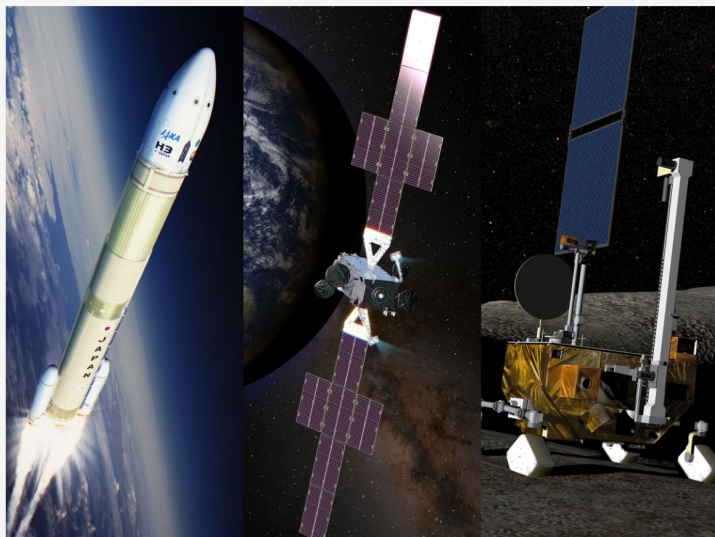
- 2025 Jan AIAA SciTech? 2025 Mar IEEE?
- PRD? Advances in Space Science?



Deep space constellation



Autonomous navigation



特集

10年で1兆円「宇宙戦略基金」を徹底解説-事業費が全額補助になる場合も（秋山文野）

2024.04.15 14:00
秋山文野

10年間で1兆円規模とされる「宇宙戦略基金」の第1期の募集が2024年度に始まる。宇宙分野での技術開発を後押しし、宇宙の利用や市場の拡大、探査の活発化を目指した基金だが、その実施方針と、総務省・文部科学省・経済産業省の審議会で公表された募集テーマから、その方向性を整理する。

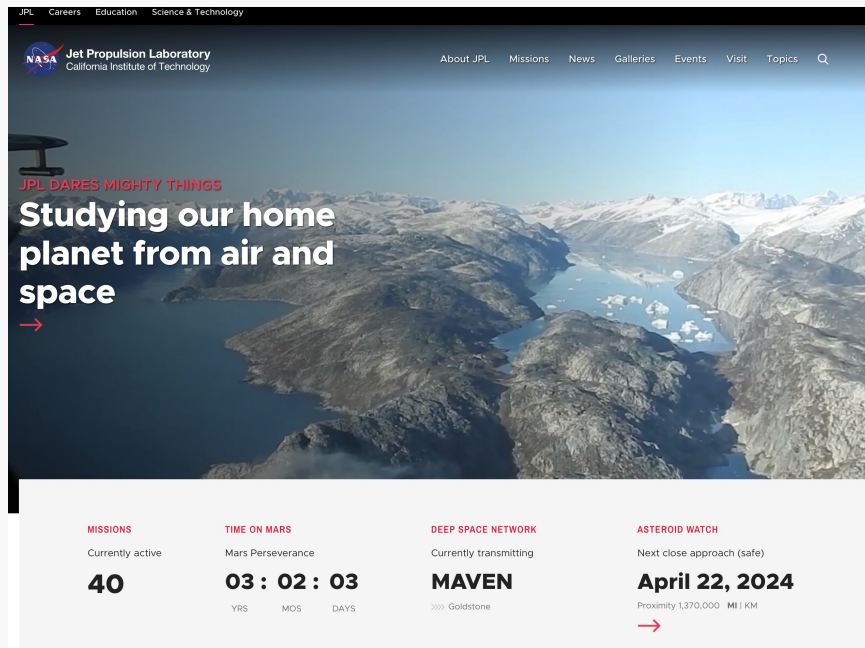
高精度衛星編隊飛行技術

単一衛星や従来のコンステレーションでは成し得なかった、衛星システムに対する高度な要求を実現し、多分野でブレイクスルーを生み出すことが期待される編隊飛行技術を用いた事業構想やミッションを推進する。

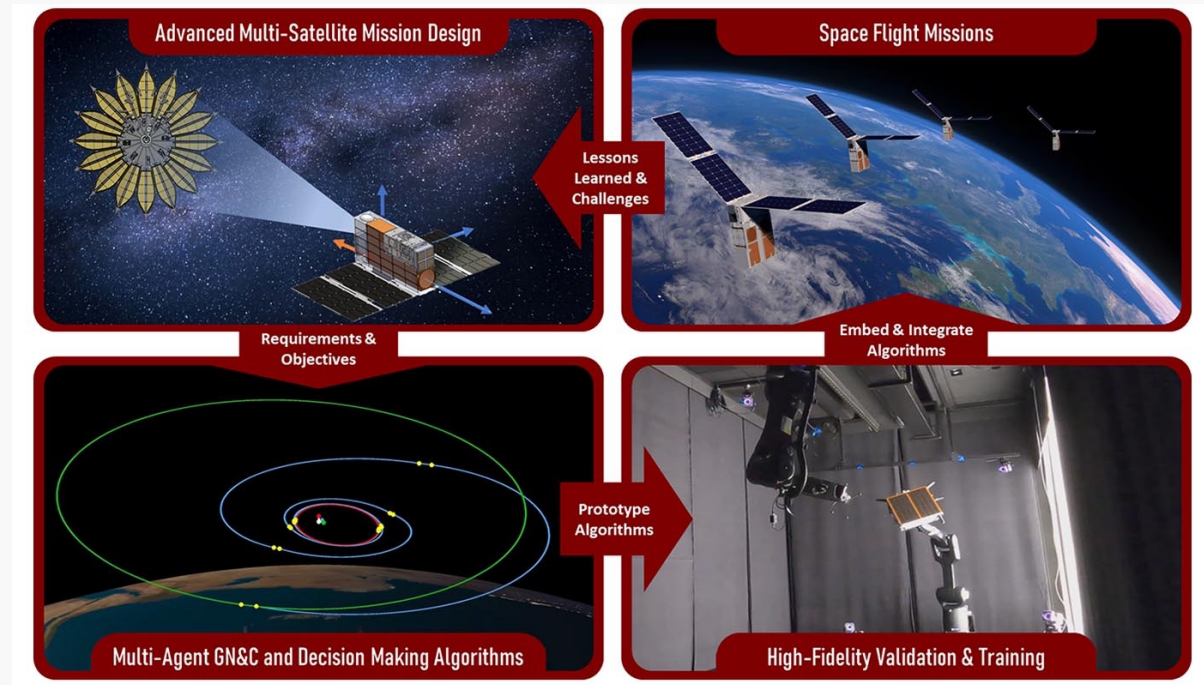
支援規模：3件で45億円程度（上限）

支援期間：7年程度（最長）





NASA JPL ?



D'amico lab in Stanford