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KITE-システムと実験概要-

Overview of Kounotori Integrated Tether Experiment on HTV-6 -System and Experiment-

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- Teppei Okumura, Kentaro Iki, Yuta Horikawa, Yasushi Ohkawa, Satomi Kawamoto, Koichi Inoue and KITE team

JAXA は HTV-6 号機にて導電性テザー実証実験 (Kounotori Integrated Tether Experiment, 以下、KITE) を実施予定である。本発表では、KITE の実験システムと実験の概要について報告する。KITE では HTV から 700m のテザーを伸ばし、電流を流す。テザーに電流を流すためには、周辺プラズマと電氣的に結合させる必要がある。KITE では電子源モジュールから電子を放出させることにより、テザーに電流を流す。伸展後のテザーの挙動計測には、HTV が装備しているランデブーセンサを使用する。その他、HTV の機体電位状態を把握するための帯電電位モニタや、実験中の磁場環境を測定するための磁気センサ、及びテザーの挙動を撮影するためのカメラが装備されている。実験では、テザーの動的特性の取得、電流駆動原理の確認を行うほか、HTV 機体への影響を調べる。

JAXA plans to perform “Kounotori Integrated Tether Experiment” (KITE) on HTV-6. In this experiment, we deploy 700m tether from HTV. In order to make an electrical circuit between ambient plasma and tether, we use the field emission cathode. The rendezvous sensors on the HTV allow us to monitor the relative motion of tether after releasing from HTV. By the experiment, we plan to investigate the dynamics of tether, characteristics of the tether current and voltage and its electrical influence on HTV due to EDT operation.

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KITE

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JAXA調布

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Introduction



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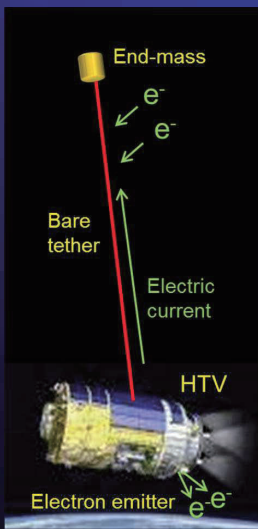
KITE

Kounotori Integrated Tether Experiment

HTV-6

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Overview of KITE



KITE Image on Orbit

KITE Specifications

Platform	H-II Transfer Vehicle (HTV)
Mission duration	7 days (planned)
Orbit	20 km (or more) below ISS orbit Altitude: 300 – 400 km Inclination: 52 deg.
Tether length	700 m (approx.)
Tether current	10 mA (approx.)
Electron collector	Bare tether
Electron emitter	Field emission cathode

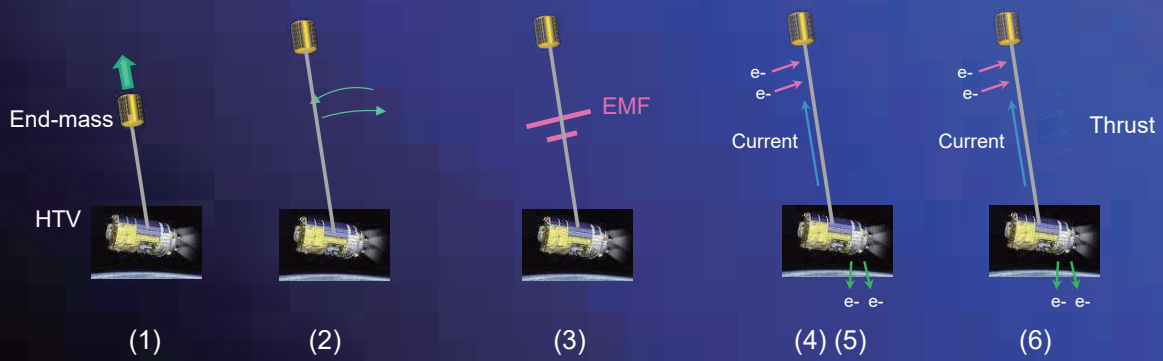
Completely Propellant-less Combination

※EDT Thrust: ~0.1 mN (max.)

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Overview of KITE

- Primary objective of KITE is “To demonstrate key technologies of EDT preparing for future debris-removal application”
 - (1) Deployment of bare tether
 - (2) Motion monitoring of tether and end-mass
 - (3) Electric potential generation by electromotive force
 - (4) Electron collection by bare tether
 - (5) Electron emission by field emission cathode
 - (6) Thrust measurement



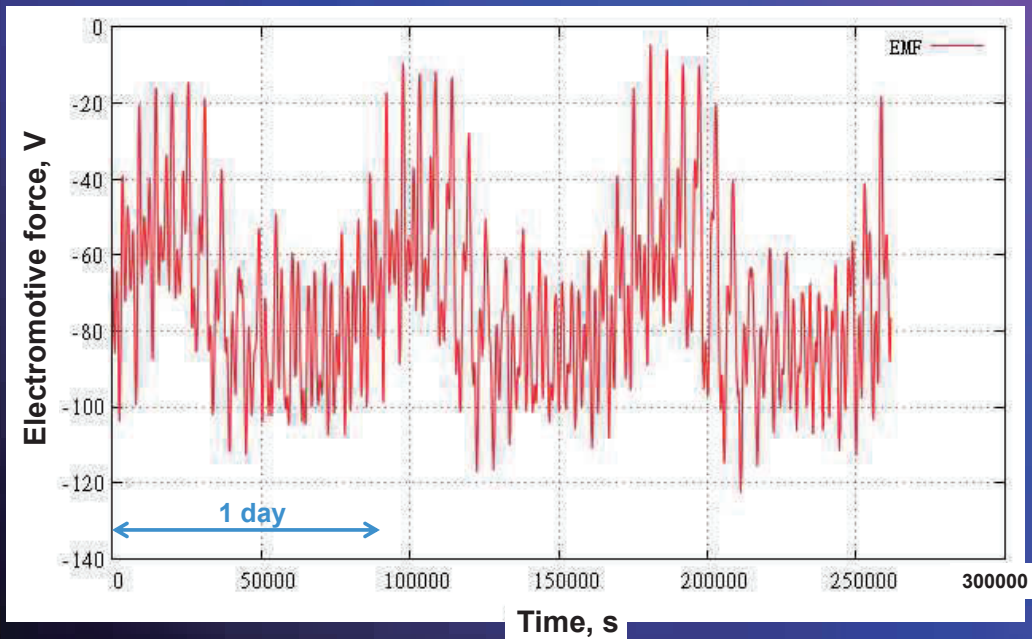
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Overview of KITE

Day	Event	Image
Day 1	①Checkout of KITE Components	
	②End-mass Ejection (Tether Deployment)	
	③Tether Motion Stabilization by HTV Maneuver	
Day 2	④Observation of Tether Dynamics & ⑤Measurement of Electromotive Force	
	⑥Checkout & Characteristics Measurement of Field Emission Cathode	
⑦Measurement of HTV Electric Potential with and w/o Electron Emission		

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Overview of KITE



The above graph shows a typical example of estimated electromotive force induced by the KITE tether. The electromotive force of about 100 volts is expected at maximum.

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Overview of KITE

Day	Event	Image
Day 4	⑧ Repetitive Measurement of Tether Electric Potential & Current for EDT Fundamentals	⑧ Current Electron collection Electron emission
Day 5	⑨ Tether Motion Stabilization by HTV Maneuver (If required)	⑩ Current Electron collection Electron emission
	⑩ Autonomous EDT Operation at Several Settings	
Day 6	⑪ Autonomous EDT Operation at Maximum Electron Emission for EDT Thrust Measurement by Tether Vibration Monitoring	⑪ Observation of end-mass motion Electron collection Electron emission
Day 7	⑫ Extra Time for Additional Tests	⑬ Cutting
	⑬ Cutting of Tether from HTV	

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See the promotion movie

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Current status of KITE

Major milestones of KITE

Event	Date
Mission Definition & System Requirement Review	October, 2012
System Definition Review	February, 2013
Critical Design Review	September, 2014
Flight Unit Manufacturing	Start on October, 2014
Post Development Review	June, 2016
HTV-6 Flight	9 December 2016

Final review has been finished.

Now, ready to start the experiment!



Thank you for your attention