



Recent JAXA's activities related with OOS

OOS 2004, Vancouver

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Japan Aerospace Exploration Agency (JAXA)

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WORKSHOP on
On-Orbit Servicing of Space Infrastructure Elements
Via Automation & Robotics Technologies
1-2 October 2004
Vancouver - Canada

JAXA's OOS related activities



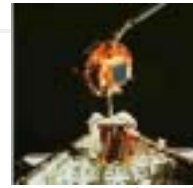
Experiences



MFD('97.8)



ETS-VII('97-'99)



SFU recovery('96.1)

Space Automation and Robotics

Automated Rendezvous Docking

JEMRMS



HTV



H-II Transfer Vehicle

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JAXA's Heritage

ETS-VII

- Automated Rendezvous Docking demonstration
 - Autonomous, low impact docking
- Space Tele-robot experiment
 - ORU exchange, Fuel supply
 - Autonomous satellite capture & handling
 - Onboard vision based robot control
 - Coordinated robot & sat. attitude control

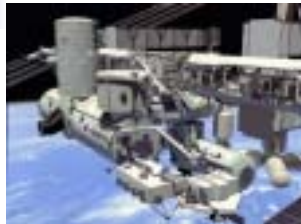


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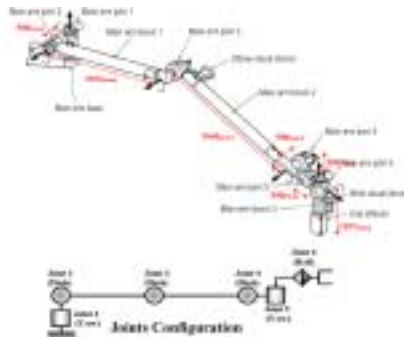
JAXA's Heritage

JEMRMS



Development finished.

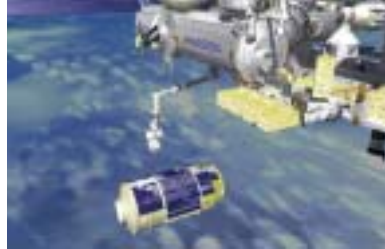
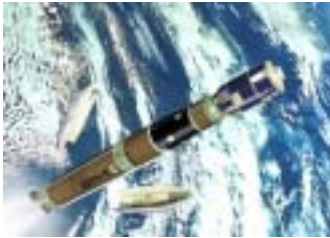
JEMRMS: 6dof, 10m long



JAXA's Heritage

HTV (H-II Transfer Vehicle)

- Total mass: 16.5ton
- Carry logistics to ISS / JEM
- Will be launched by H-IIA,
- Automated rendezvous to ISS
- Captured by SSRMS, transfer cargo to JEM
- Controlled Re-entry with garbage



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JAXA's next interests

- Best use of on-going projects/system and their technologies
 - JEM/ISS
 - HTV
- Research of future mission / system
 - Moon
 - OOS
 - SPS

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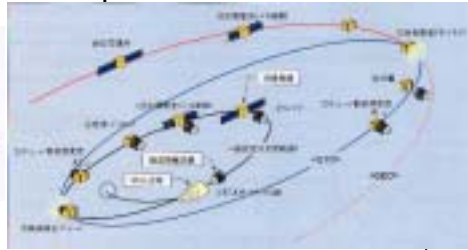
Rescue of stranded satellite

- Many satellites left on useless orbit by troubles of launcher or satellite propulsion system
- Rescue system : Capture & Orbital transfer
- Feasibility ?
 - Technology - - - OK !
 - Economy ? - - - Quick & low cost are must !
- HTV based rescue vehicle will be possible in both senses.



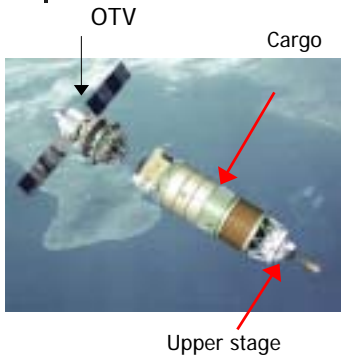
HTV

HTV based Rescue Vehicle

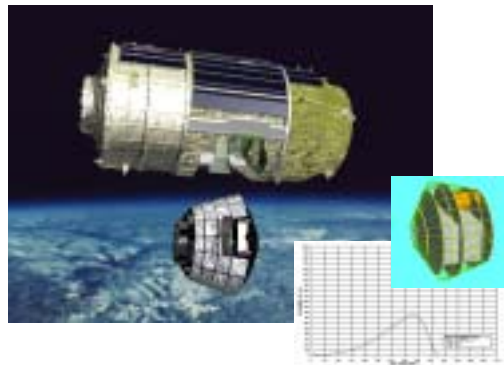


Rescue ofr stranded GEO satellite

Study of HTV derived system



On-orbit based HTV



HTV based re-entry capsule

HTV based HST service vehicle

■ Mission

- Capture HST, Life Extension (replace battery, gyro, equipment) and Controlled Re-entry after mission of HST (5 years later?)
or
- Capture HST and controlled Re-entry

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HST servicing



Autonomous Rendezvous with HST

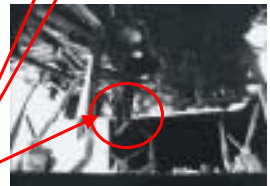
Capture HST by JEMRMS equivalent RMS

Docking with HST using ETS-VII docking mechanism

HST has similar docking handles with ETS-7 target satellite.



Berthing of HST

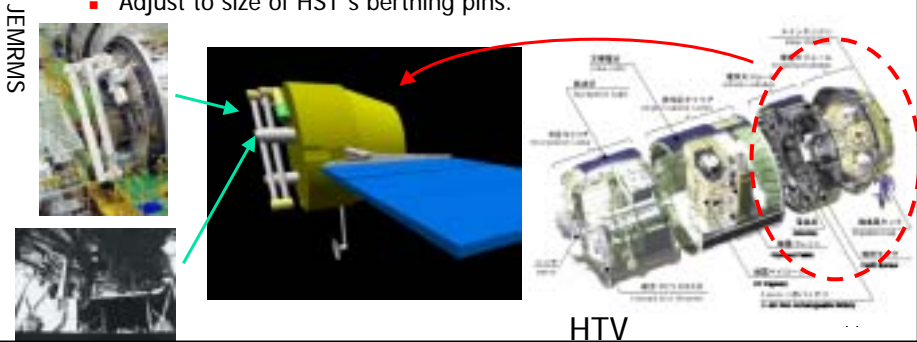


(ETS-VII target / chaser)



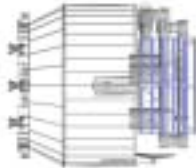
HTV based HDV (HST De-Orbit Vehicle)

- Utilize HTV's Propulsion & Avionics modules.
 - Functions of Autonomous rendezvous & controlled re-entry are utilized.
 - Deployable solar array panels and TDRS HG antenna will be added.
- Utilize JEMRMS
 - diameter of HTV and JEM are same same mount can be used.
- Docking mechanism of ETS-VII with slight modification
 - Adjust to size of HST's berthing pins.



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HTV based HST de-orbit Vehicle



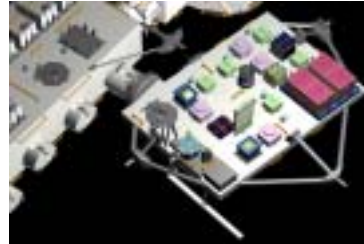
- HTV Propulsion & avionics module 3.1 ton
 - robot, docking mech. 1.7 ton
 - Fuel 2.4 ton
- (Total) 7.1 ton



JEM: Japanese Experiment Module



- Assume use of the Standard Payload Unit, based on frequent logistic flights. However....
- Study of multi-users platform and robot that assists installation / operations



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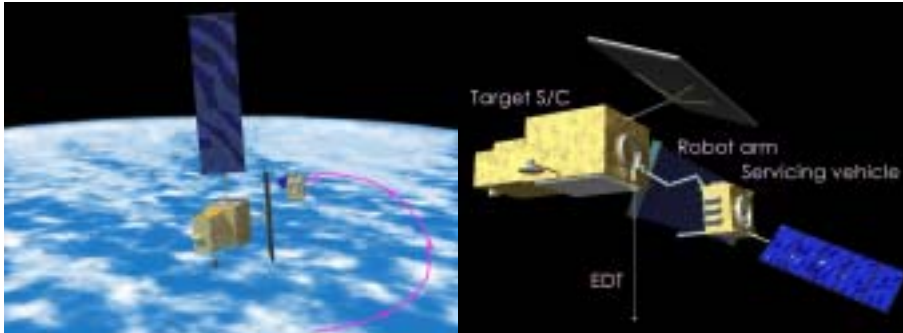
Study of future mission / system

- Lunar exploration / utilization
- Debris mitigation
- Solar Power Satellite
etc.



Active Removal of Space Debris

- Robotic debris removal system carries several to ten small electro dynamic tethers (EDT).
- The vehicle attaches each one to each target.



Motion measurement and flying around

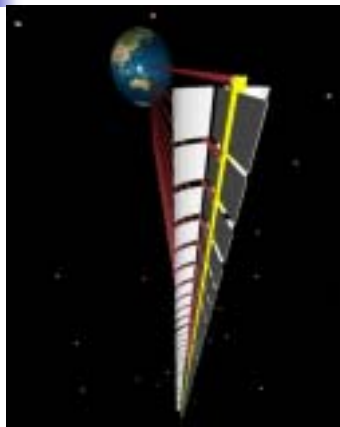
Deployment of electro dynamic tether

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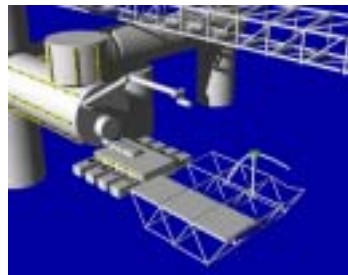


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SPS: Solar Power Satellite



L-SPS
(200mX200mX10km)



Technology demonstration on JEM/ISS

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Roadmap of JAXA's OOS



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