National Aeronautics and Space Administration

NASAfacts

Robotic Refueling Mission

NASA's Robotic Refueling Mission (RRM) is an International Space Station (ISS) investigation that demonstrates and tests the tools, technologies and techniques needed to robotically refuel and repair satellites in space, especially satellites that were not designed to be serviced.

As worldwide demand grows for satellite-provided communication and data products, NASA is using RRM to demonstrate technologies needed to keep satellites working longer in orbit. RRM is a joint effort with the Canadian Space Agency (CSA).

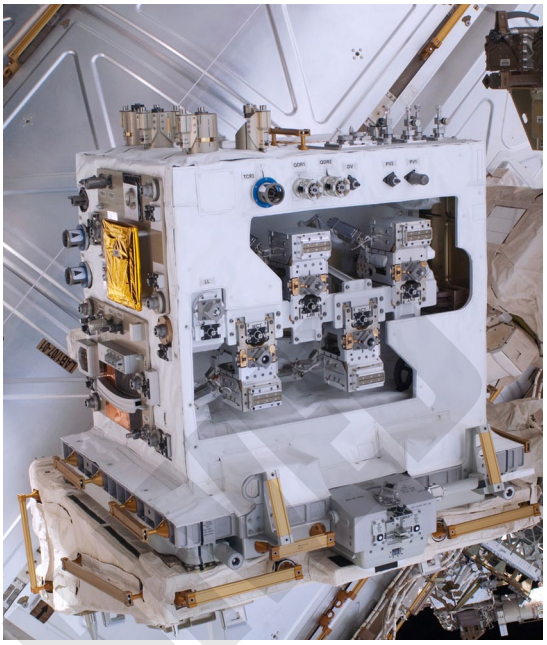
Meeting the Challenge of a Robotic Servicing Frontier

Hundreds of satellites reside in geosynchronous Earth orbit, providing such essential services as weather reports, communications and television broadcasts. Not a single one of these assets was designed to be serviced.

The RRM module contains the components, activity boards, and tools to practice satellite refueling and repair. NASA is using RRM results to prove the reliability of its robotic servicing technologies and to bolster the foundation for future robotic servicing missions.

How RRM Works

Mounted to an external platform of the ISS, the washing-machine-sized RRM module weighs approximately 550 pounds (250 kilograms) and includes 0.45 gallons (1.7 liters) of liquid ethanol to demonstrate fluid transfer. Four unique RRM tools are stowed inside the module: the Wire Cutter and Blanket Manipulation Tool, the Safety Cap Removal Tool, the Multifunction Tool, and the Nozzle Tool.



NASA designed the RRM module and tools to practice satellite-servicing tasks.

Dextre (center) practices a servicing task on RRM (above).

During RRM operations, the space station's twin-armed Canadian "Dextre" robot acts as a skilled spacecraft technician. Remotely controlled by mission operators at NASA's Johnson Space Center in Houston, Dextre picks up RRM tools and practices tasks on RRM's components and busy boards. Activities include cutting and peeling back protective thermal blankets, unscrewing caps, accessing valves, and transferring fluid.

NASA is launching a new round of RRM tools and task boards to the ISS in the summer of 2013 to continue RRM investigations through 2015.

Top RRM Accomplishments

March 2012: RRM proved that remotely controlled robots and specialized tools can successfully perform extremely precise servicing tasks in space. An RRM tool at the end of more than 70 feet worth of teleoperated robotics cut wires the thickness of four sheets of paper with only millimeters of clearance.

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January 2013: In a first-of-its-kind fluid transfer in space, RRM confirmed that current-day robotic technology can refuel the triple-sealed satellite fuel valves common to orbiting satellites.

Developing RRM

RRM was developed by the Satellite Servicing Capabilities Office (SSCO) at NASA's Goddard Space Flight Center in Greenbelt, Md. Veterans of five servicing missions to the Hubble Space Telescope, SSCO carried the RRM investigation through its rapid 18-month development to its July 2011 launch on STS-135, the last space shuttle mission.

RRM operations are monitored and remotely controlled by flight controllers at Goddard, Johnson, Marshall Space Flight Center in Huntsville, Ala., and CSA's control center in St. Hubert, Quebec.

For more information, visit:
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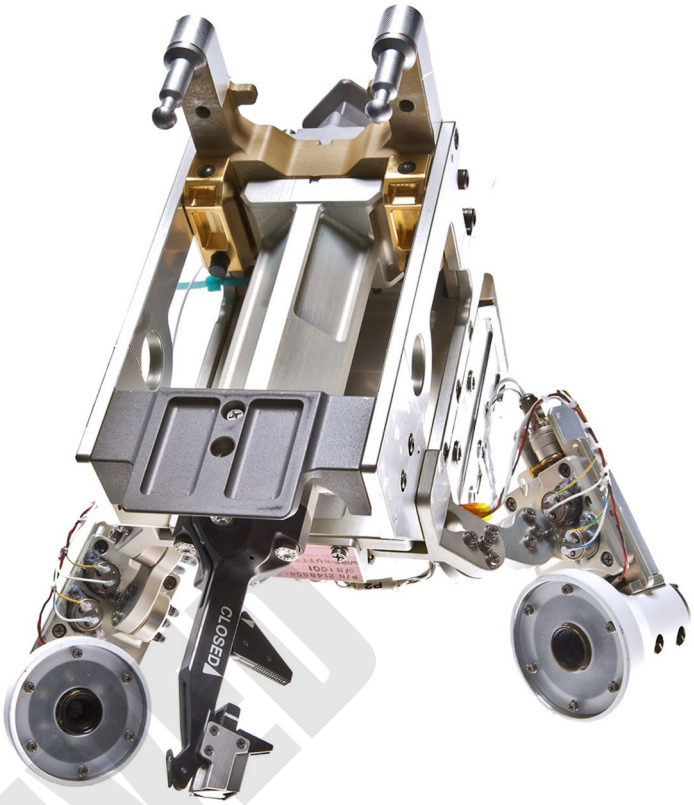
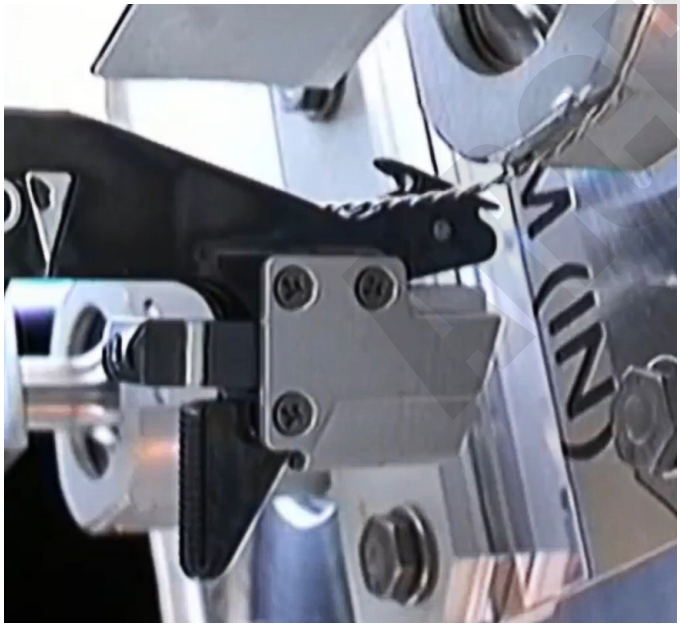
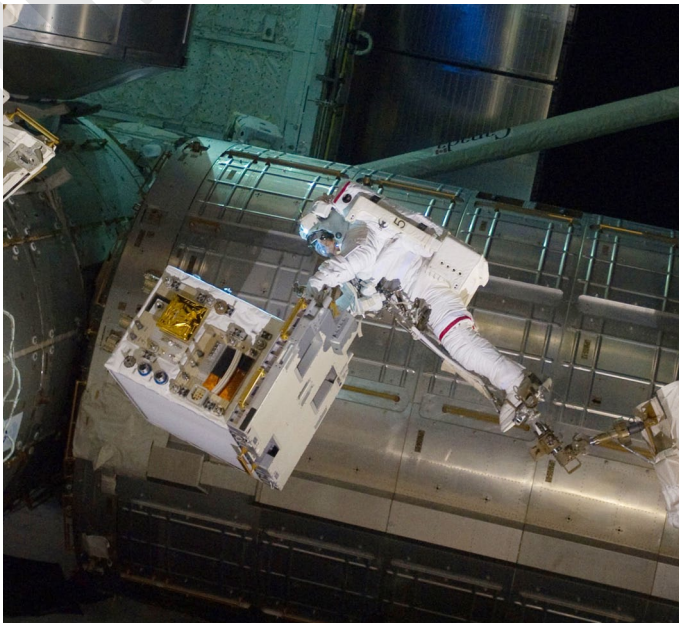


The RRM Wire Cutter Tool (WCT).



The WCT snips wire on orbit during March 2012 operations on space station.



RRM was the last payload to be removed by an astronaut from a space shuttle payload bay.

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