



Console Handbook

VVO

Visiting Vehicle Officer

Since crewmembers use the International Space Station (ISS) to live and work, resources and products are often “used up” and require frequent resupplies from Earth. Accumulated waste on the ISS must be removed periodically as well. Spacecrafts from Earth which visit the ISS and handle these tasks are referred to as Visiting Vehicles (VVs).

The Visiting Vehicle Officer (VVO) is a phase specialist who provides non-Space Shuttle visiting vehicle rendezvous/separation system and trajectory expertise to the crew and the Mission Control Center-Houston (MCC-H) Flight Control Team (FCT). The VVO provides a contact point to the Visiting Vehicle Control Team and manages the guidance and navigation between the ISS and VVs.



ISSLive!

VVO

Visiting Vehicle Officer

System Managed: Visiting Vehicle Rendezvous/Separation System

Visiting Vehicles (VVs)

What types of VVs are available? Who provides them?

Government agencies of ISS international partners have always managed supply transport to and from the ISS. While several countries have developed unpiloted cargo spacecraft to handle these tasks (and are still in use today), commercial companies are becoming involved in creating uncrewed cargo spacecrafts which will service the ISS in the future.

Government-Managed Visiting Vehicles

Which countries provide VVs for the ISS? What does each VV do?

Visiting Vehicles (VVs) are provided by several countries and each is controlled from a control center in its country of origin. Visiting Vehicle Control Centers (VV-CCs) in these countries work with MCC-H to rendezvous (or dock) and depart VVs from the ISS.

The Russian Space Agency (RSA) launches two types of spacecrafts to the ISS – the Progress and the Soyuz. The Progress, an uncrewed vehicle, supplies the ISS with dry cargo, propellant, water and gas. It serves as a disposable freighter, which means once it delivers the cargo, it is filled with waste from the ISS, then it is undocked, deorbited and destroyed in reentry to Earth's atmosphere at the end of its mission. Typically, four to six Progress vehicles carry supplies to the ISS each year.

The Soyuz is a crewed spacecraft which is used to transport cosmonauts and astronauts to and from the ISS. With the retirement of the space shuttle, this is currently the only method of transport to and from the ISS. There is always a Soyuz spacecraft docked to the ISS to be used as the emergency escape craft.

The Japan Aerospace Exploration Agency (JAXA) launches an uncrewed resupply spacecraft to the ISS, called the H-II Transfer Vehicle (HTV). The HTV carries dry cargo, gas and water and propellant. Once emptied of supplies, it is filled with waste and trash, and then is undocked, deorbited and destroyed in reentry to the Earth's atmosphere.

Additionally, the European Space Agency (ESA) has created the Automated Transfer Vehicle (ATV), an uncrewed spacecraft which transports supplies to the ISS and removes waste products. The ATV is also a disposable freighter, and it is destroyed in reentry to the Earth's atmosphere. The ATV is designed to complement the Russian Progress and has three times the carrying capacity.

Commercially-Developed Visiting Vehicles

What types of VVs are currently being developed for future use?

One United States (U.S.) company (Space Exploration Technologies Corporation) is creating a spacecraft called Dragon. This spacecraft will consist of a capsule for pressurized cargo and an area called the "trunk" for unpressurized cargo. The "trunk" will be jettisoned (intentionally thrown away) and destroyed during reentry of Earth's atmosphere, and the capsule containing the return cargo will survive reentry, returning to Earth.

Another U.S. company (Orbital Sciences Corporation) is currently working on a spacecraft called Cygnus. Cygnus is a resupply craft which will carry pressurized cargo to the ISS. Once the cargo is unloaded, it will be filled with waste, undocked, deorbited and destroyed in reentry to Earth's atmosphere.

Responsibilities of the Visiting Vehicle Officer (VVO)

What are the VVOs duties before and during the mission?

Pre-Mission Responsibilities

What are the responsibilities of the VVO prior to the mission?

The VVO develops a plan prior to the mission, which includes developing requirements for both the crew-monitoring displays and developing simulation capabilities for analysis, training and real-time monitoring.

The VVO also coordinates the development of several products and/or tools which are needed to carry out the mission. These products include Flight Rules (guidelines the flight control team follows to conduct flight operations, ensuring the safety of the crew and station and satisfying mission objectives) and VV rendezvous and proximity operations procedures for the ground and crew.

Real-Time Responsibilities

What type of support does the VVO provide to other team members during the mission?

Mission Control Center-Houston (MCC-H)

As a VV is prepared to launch to the ISS, support from the VVO starts one week prior. This includes providing operations information to MCC-H and to the onboard crew (based on spacecraft data and video), creating a summary timeline to show sequence of rendezvous events and generating relative motion plots for situational awareness. The VVO ensures viewing options via cameras and windows for ISS crew, etc. are provided and that Flight Rules for spacecraft trajectory and crew monitoring operations are enforced. The VVO also monitors the carry-out of flight procedures, spacecraft software solutions and spacecraft sensor performance to ensure that ISS safety is maintained and mission objectives are met.

Visiting Vehicle Control Team

The VVO provides trajectory expertise, insight on vehicle performance and acts as an interface to work integration issues with the proper ISS teams. He or she makes sure the Flight Rules are explained and enforced and also coordinates the Visiting Vehicle Control Center (VV-CC), MCC-H and crew events (i.e. grappling vehicles).

ISS Onboard Crew

The VVO provides information on docking, relocation and undocking to the crew during a mission. This includes crew viewing and tracking messages, undock-deorbit relative motion plots, procedure assistance and summary and detailed timelines.

Acronyms and Abbreviations

ATV	Automated Transfer Vehicle
FCT	Flight Control Team
HTV	H-II Transfer Vehicle
ISS	International Space Station
JAXA	Japan Aerospace Exploration Agency
MCC-H	Mission Control Center-Houston
RSA	Russian Space Agency
TRRJ	Thermal Radiator Rotary Joint
U.S.	United States
VV	Visiting Vehicle
VVO	Visiting Vehicle Officer