



Avatar Explore: The fad in autonomous operations

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What is Avatar Explore?

Avatar Explore involves performing autonomous robotic operations in a mobile test bed located in the Mars Emulation Terrain, located in Quebec, from the International Space Station



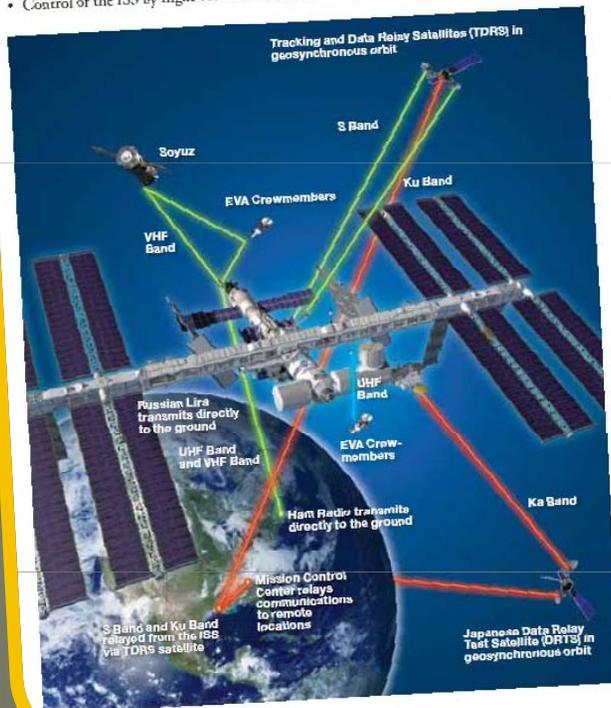
The principal investigator of this operation is Pierre Langlois of Space Technologies in St. Hubert Canada and the co investigator is Erik Dupuis of the same organization

Communications

The radio and satellite communications network allows ISS crews to talk to the ground control centers and visiting vehicles. It also enables ground control to monitor and maintain ISS systems and operate payloads, and it permits flight controllers to send commands to those systems. The network routes payload data to the different control centers around the world.

The communications system provides the following:

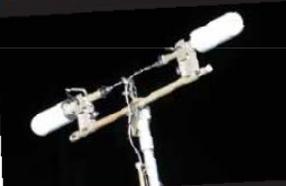
- Two-way audio and video communication among crewmembers aboard the ISS, including crewmembers who participate in an extravehicular activity (EVA).
- Two-way audio, video, and file transfer communication between the ISS and flight control teams located in the Mission Control Center-Houston (MCC-H), other ground control centers, and payload scientists on the ground.
- Transmission of system and payload telemetry from the ISS to the MCC-H and the Payload Operations Center (POC).
- Distribution of ISS experiment data through the POC to payload scientists.
- Control of the ISS by flight controllers through commands sent via the MCC-H.



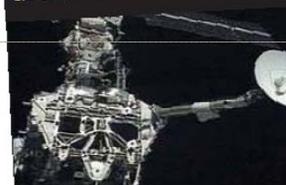
REFERENCE GUIDE TO THE ISS HOW IT WORKS COMMUNICATIONS



Ku band radio in U.S. Lab.



UHF antenna on the P1 Truss.



Ku band radio on exterior of ISS.



Yuri Oudrienko during communications pass.



Expedition 22 crewmembers performing a public affairs event in Kibo.

Paving the way to new autonomous technology

- This major advancement in remote communication will have profound applications in the future as space exploration takes us to distant planets
- The Avatar Explore's ability to be remotely controlled allows researchers and astronauts to traverse landscapes too difficult for any human
- On Earth, it opens up new opportunities in the field of communications and operational protocols
- This innovation will be "one small step for man and one big step for mankind"

Still Paving the way!

- We are becoming increasingly dependent on autonomous robots for space exploration because, well let's face it, humans can't traverse certain landscapes.
- With Rover "Red" (shown to the left) that problem is but a thing of the past
- The Avatar Explore program will allow us to explore the galaxy from inside the ISS, a major breakthrough for space exploration technologies



**TESTING
IN
PROGRESS**



Time to put it in action right?

- Avatar Explore was first introduced in Increments 20 and 21 where astronauts aboard the ISS guided “Red” the rover to a heat source hidden in the Mars Emulation Bed
- After Increments 20/21, constant testing, revising, and testing again has occurred in order to increase the Avatar Explore’s efficiency



How is this Possible?

- On Earth, this could provide insight on new communications technologies and can be an inspirational tool for budding scientists trying out the field of remote communication
- In space, we are becoming increasingly dependent on autonomous systems due to space's hostile conditions and for this reason, the ability to remotely communicate with a robot will give us the opportunity to explore new lands

Communications



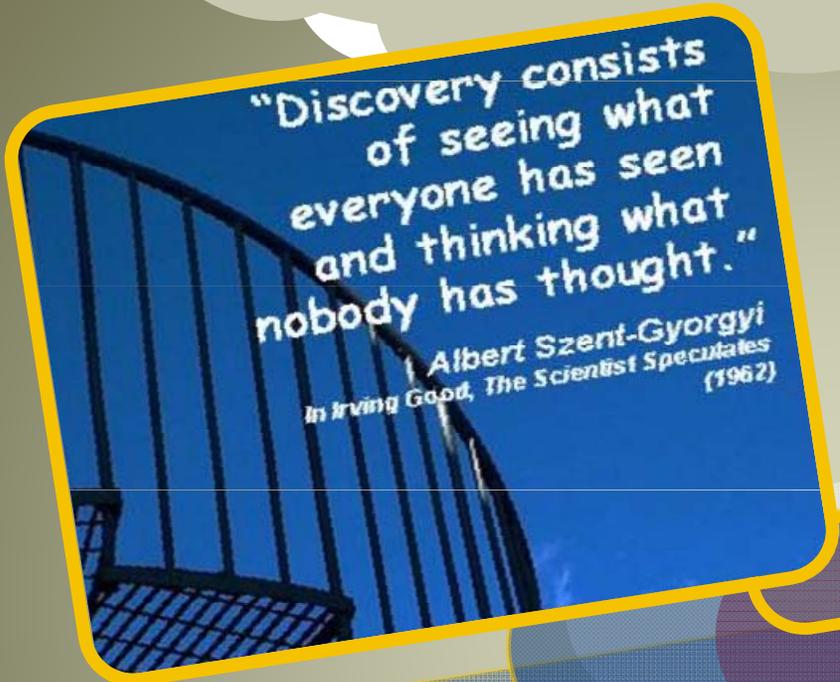
The Workings

- The ISS and a rover exchange files through a low-bandwidth channel
- The ISS crew members analyze the files and send a command file to the rover
- Once the file has reached earth, the rover will open the file and execute the command
- The rover has the ability to do laser scans and thermal imaging in order to create 3D topographical data

Fruits of Labor



- As the ISS's ability to communicate with rovers on Earth increases, so will our ability to explore uncharted territories
- Without advancements such as this, space exploration would not be possible
- The results from Avatar Explore indicate that remote communication, from very far away, is effective and that it is the future for earth and space based technologies



"Discovery consists
of seeing what
everyone has seen
and thinking what
nobody has thought."

Albert Szent-Gyorgyi
In Irving Good, *The Scientist Speculates*
(1962)

Thanks For Watching

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