

SPACE OPERATIONS SYMPOSIUM (B6)  
Training Relevant for Operations, including Human Spaceflight (3)

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MEETING THE CHALLENGES OF OPERATIONS TRAINING IN AN INTERNATIONAL  
ENVIRONMENT

**Abstract**

This paper examines the challenges present when teams distributed across several countries, but who are involved in the operations of a single spacecraft, are to be trained.

Several missions, mostly but not entirely concerned with the International Space Station (ISS) programme, have training requirements with an international context. These include Columbus, HTV and ATV.

Such international training situations present particular challenges compared with normal operations training. This paper explores some of these challenges, and presents potential strategies to address them, based on experience gained within the ATV programme.

The ATV mission has many operational phases, some of which need training at an international level. These phases include:

- rendezvous, when ATV makes its initial approach to the ISS
- docking, the final approach and mating with the ISS
- refuelling, when ATV transfers fuel supplies to the ISS
- reboost, when ATV adjusts the ISS orbit
- debris avoid manoeuvres, when ATV moves ISS to avoid space debris or other objects which could compromise crew safety
- undocking, when ATV leaves the ISS at the end of its mission

The international training programme for ATV includes on-console simulations, paper simulations and other training exercises. The on-console simulations make use of three high-fidelity simulators, based in three locations. The simulators in Moscow & Toulouse, France are interconnected, and coordinated in real time with the simulator in Houston. The simulators include realistic modelling of ATV including flight

software (in Toulouse) and ISS Russian Segment including flight software (in Moscow), and are coupled together by a wide area network, controlled from the Columbus Control Centre in Germany.

The challenges of organising such international training include:

- meeting the training objectives for multi-control centre interfaces
- communication and culture
- information exchange
- planning, in particular dealing with the impact of external constraints
- scheduling, taking into account multiple sites and time zones

This paper examines how these issues were addressed during the ATV-1 and ATV-2 training campaigns, and presents improvements proposed for ATV-3 and following missions.

In particular, this paper examines means of communication, particularly during training preparation, and methods ensuring the necessary information exchanges between all parties. It includes an analysis of the effectiveness of the simulation planning, and lessons learned for the future.