Leakage of the ATV Pressurised Module

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Introduction

- Requirements
- Design Implementations
- Ground Verifications
- On-orbit Verification
- Conclusions

Requirements

- ATV is first autonomously launched ESA Pressurised Module
- Leakage verification to detect damage or improper integration
- Risk of waste of resources
- Risk of crack growth/failure
- 100 gram/day agreed with NASA and RSC-Energia

Design Implementation

- Redundant seals for all apertures with Diameter ≥ 6 inches (10 apertures)
- Redundant seal verified during integration or pre-launch processing
- Valves in series, except on Russian Docking System.

On-Ground Verifications -I

- On-ground verification constrained by practical limitations:

  - Hydrostatic test unrealistic
  - Immersion unrealistic
  - 45 m3 volume pressurised at 2 bar absolute poses hazard during test
  - Maintaining constant temperature over time (days)

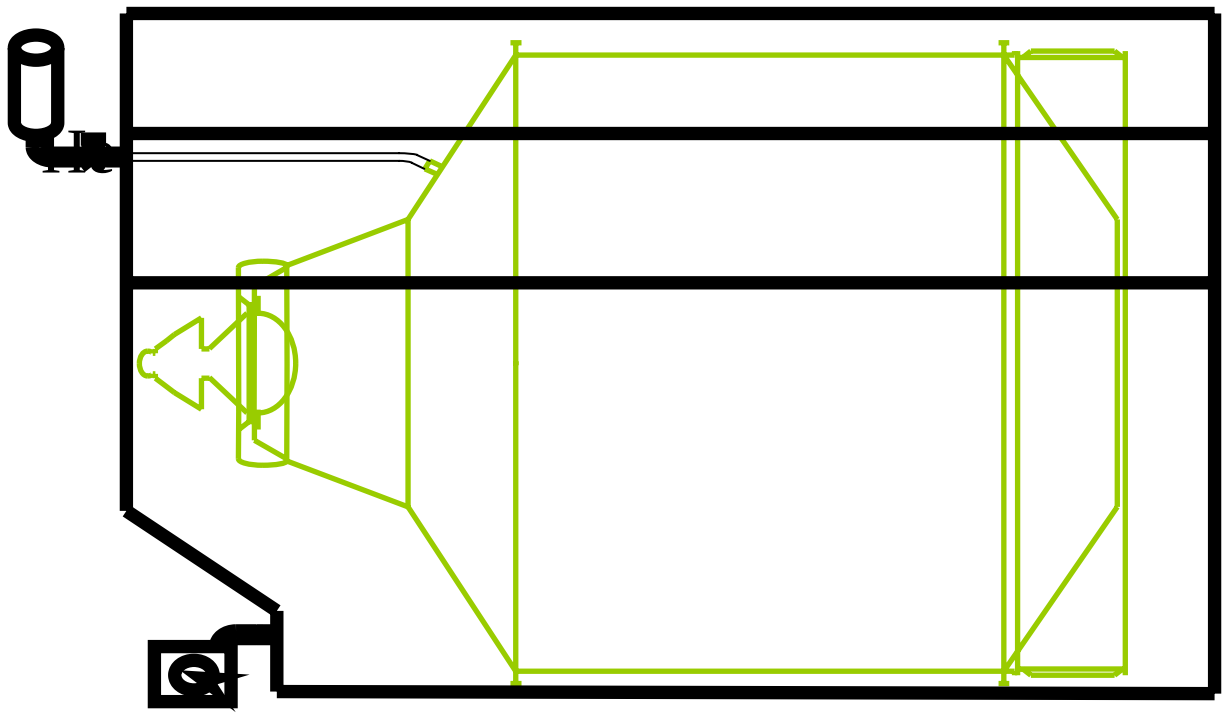
- Pressure Decay Test (≤ 24 g/day)

On-Ground Verifications -II

- Precision of pressure decay test is low, ISS partners pushed for more precise measurement
- NASA had large vacuum chamber at launch site which allowed test of modules, not Shuttle
- RSC-Energia has vacuum chamber in Moscow and in Baikonour to test Soyuz and Progress
- ESA has no such facility in Kourou

On-Ground Verifications -III

- Test in ICC Transport Container devised as alternative:



On-Ground Verifications -IV

- With appropriate calibration precision similar to test in vacuum chamber
- Test performed in Torino 1.7 gram/day
- Test performed in Kourou 1.3 gram/day

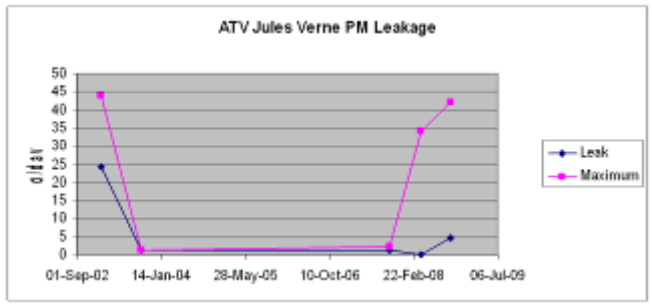
On-orbit

- ATV Jules Verne mission not typical: long time between launch and docking, de-docking and re-entry
- Before docking no measurable leak
- Precision 34 gram/day
- After de-docking 4.6 gram/day
- Precision 42 gram/day

Conclusions-I

- Title of this paper is incorrect

Conclusions-II



- Behaviour over time is consistent
- ATV Design and integration validated: leak rate similar to Partners' leak rates.

Conclusions-III

- ATV Jules Verne performance excellent
- No room for complacency for future missions

Questions?

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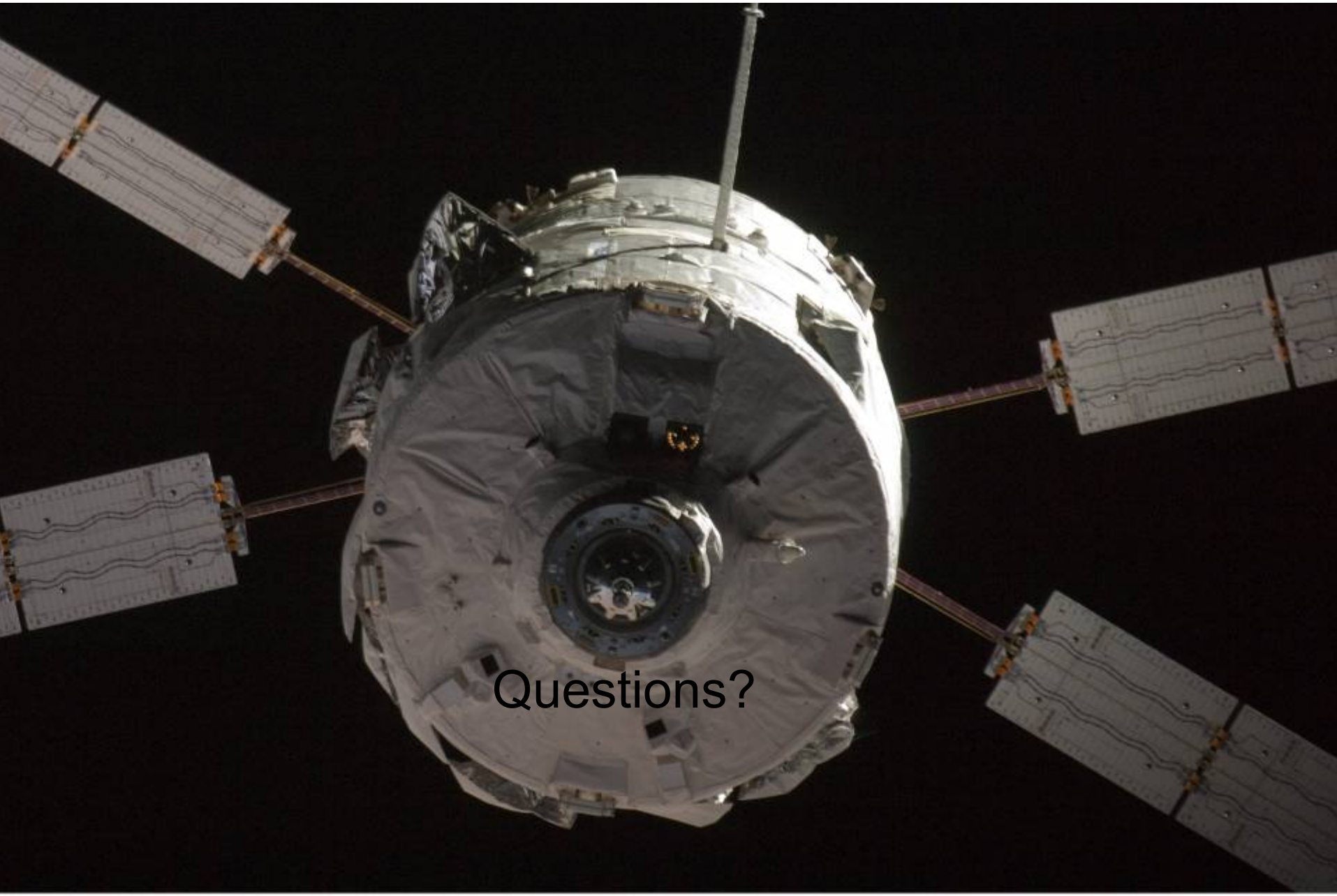
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