Mars Sample Return Mission
Terminal Rendezvous Requirement

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Why a MSR Mission?

- ESA Aurora programme
- Mission of scientific and technological importance.
- Precursor for the human exploration of Mars.

Figure 1 : Images for a Mars Sample Return Mission [www.esa.int/images/]

- Hopefully answer the fundamental question of whether or not life exists or ever existed on Mars.

Project Aims

Generation and evaluation of a capture mechanism as part of the return phase of the Mars Sample Return mission, where the capture mechanism will be able to perform the following mission system requirements:

- Deploy and prepare for initial capture.
- Detect the incoming sample canister.
- Capture the sample canister through its inlet.
- Transfer the sample canister through its outlet.
- Push and insert the sample canister into the sealing/confinement system.
- Upon successful retention of the sample canister, the structure will be jettisoning.
- Issues of contamination and planetary protection regulations are to be resolved and integrated into the capture mechanism's design.

Proposed Capture Mechanism

* Dual deployment of six inflatable cylinders and a CFRP helix tube.
* Rigid Ring structure.
* Fully articulated lid mechanism with strategically located light gates.
* Pushing balloon to control the dynamics of the sample canister.
* Thermoplastic sealing interface and bag at the outlet of the capture mechanism.
* Bio-container with fully integrated lockdown and soft-spot mechanisms to retain the sample canister.
* Jettisoning through pyro-bolts and Y-shape connectors.

Baseline Architecture and Mission Requirements

- Sample canister is released into a 500 km 'free flying' orbit around Mars.
- Awaits retrieval and transfer by the Orbiter.
- The sample canister is a passive vehicle, diameter of 0.2 m and a mass of 6 kg.

Consider:

- The mechanical interfaces and rebound times.
- Maximum mechanical mass of 12 kg.
- No single point failure will cause a loss of function.
- No less than three bio-barriers with a maximum sealing system mass of 10 kg.

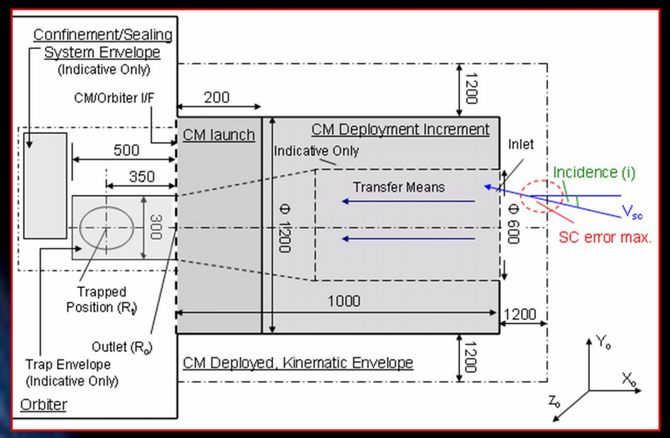

Figure 2 : Definition, Main Dimensions and Interfaces of the Capture Mechanism. All measurements are in millimetres

It is critical that the samples are transferred effectively and correctly, ensuring that the composition of the samples are preserved.

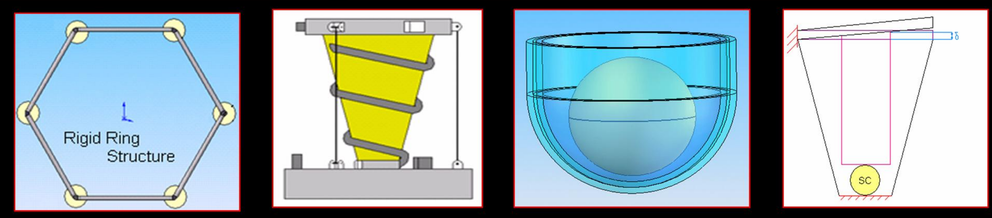

Figure 3 : Components of the Propsed design

Conclusion

Baseline design is considered a success!!

- Includes key redundant systems and components.
- Adheres to the associated challenges and the mission requirements.
- Technology readiness level of 4.3.

Future Work

Extended to incorporate:

* Collection of multiple sample canisters.
* Sealing and locking system development.
* Amalgamation of a sample handing system.