CSIS Working Group (part 2) "Filling the Gap"

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Preamble: Relevant results of ESA Ministerial Conference 2008

- Strong political support for European space activities as a whole: 10b€ new funds despite economic crisis

- Clear commitment to the ISS (continuation of ISS exploitation; increased budget for ISS utilisation)

- Initiation of the future (studies on ARV and Moon cargo lander, continuation of exploration architecture studies)

Definition and consequences of the Gap(s)

- **Gap 1:** Time between Shuttle retirement and operational availability of successor (Ares 1/Orion)
  - No redundancy in human transportation
  - Very limited (insufficient) ISS cargo download capability
  - Reduced (insufficient?) ISS cargo upload capability
  - No US independent human access to space

- **Gap 2:** Time between end of ISS and next destination for human spaceflight
  - Continuity of human spaceflight at stake (loss of skill base?)
  - Risk that ISS is seen as "dead end"

Goals/options for mitigating Gap 1

- ## Goals:
  - Compensate for missing Shuttle services
  - Secure robust operations scenario (redundancy in human transportation (eventually even rescue))
  - Minimise US dependency on Russian resources (mainly US goal)

- ## Options:
  - Procure additional Russian resources (no redundancy)
  - Extend Shuttle operations (shift of gap, but no closure)
  - Advance Ares 1 / Orion
  - COTS
  - Best use/combine transportation means of all ISS Partners
  - Adapt utilisation&maintenance concept (in order to reduce cargo transport requirements)

Constraints for mitigating Gap 1

- ## Constraints:
  - Price and capability of Russian resources
  - Shuttle extension would shift but not reduce the gap (unless substantial additional funding provided, or COTS (D) makes significant progress)
  - Safety considerations (in case of Shuttle extension)
  - Workforce-transition from Shuttle to Constellation Programme
  - Feasibility for significantly advancing Ares1/Orion or COTS
  - (current) lack of interoperability of existing/planned transportation means (Ares, EELV, Ariane 5, H-II, Orion, ATV, HTV, ARV)
  - (current) lack of initiative to develop and exploit interoperability
  - Responsibility (share of tasks) for ISS logistics is defined in IGA/MOU – no (financial) plan for additional European contribution
  - Timeliness of a human-rating of Ariane 5
  - Political (and possibly other) constrains to involve other than ISS Partners

Goals/options for mitigating Gap 2

- Goals:
  - Provide continuity for human spaceflight
  - Seamless vision integrating ISS and exploration
  - Avoid perception that ISS is a "dead end" (would result in loss of credibility for Human Spaceflight and Exploration as a whole)

- Options:
  - Exploit/use ISS as long as technically feasible and justified by utilisation or other return
  - Provide in time a post-ISS infrastructure (be it in LEO, or elsewhere) that (a) builds on ISS heritage, (b) allows frequent astronaut flights, (c) serves exploration objectives. Providers: ISS partnership (+ beyond?)

Constraints for mitigating Gap 2

- Constraints:
  - Timeline for human Moon exploration too late to connect to ISS?
  - US Constellation Programme does not require LEO infrastructure
  - Slow maturation of international exploration architecture and related international work-sharing
  - Concepts for post-ISS LEO infrastructures only in infant stage (rationale + architecture)

Avoiding gaps in future (in space exploration)

Understanding that Space Exploration has to be implemented in international cooperation: Learn Lessons from ISS:

- Provide for redundancy of key capabilities
- Create wide interoperability of key capabilities
- Allow for dependency (in order to make most efficient use of budget resources and capabilities of the partners)
- Set flexible programme objectives (to reduce the risk inherit to dependency, and to meet setbacks and discontinuities over the long lifetime of the exploration endeavour)
- Organise sufficient and lasting political and public support (to ensure sufficient and sustained funding)
  - Establish stable cooperation framework
  - Stimulate and entertain public engagement