

Note on the potential re-use of existing units, subsystems or platforms

Re-use of existing Service Modules (SVM) allows absorbing design and development costs over a number of missions, thus reducing the overall cost. Re-use of SVM without significant modifications is more effective based however on the following factors:

- Clear separation between SVM and Payload Module (PLM), allowing the re-use of the same spacecraft platform in the presence of different payload complements (this is particularly the case for astrophysics missions);
- Similarity of mission profiles with specific reference to mission analysis (total delta-V, space environment) and launcher vehicle;
- Comparable total mass at launch;
- Similarity of the main mission requirements impacting on key subsystem specification (e.g. pointing requirements, lifetime, power, etc.);
- Launch date proximity (< 3 years), as to avoid obsolescence problems and to leverage the benefits of common procurement.

Such factors can generally only be considered in the presence of a pre-defined programme, with an established number of missions, selected to be compatible with the re-use of the existing platform and planned for a clear implementation sequence, within a short time interval. Although such conditions are difficult to be respected in the present scenario of Cosmic Vision 2015-2025, one can still identify advantages provided by the re-use of common units or subsystems.

Given the specific nature of planetary missions (e.g. characterized by specific trajectories, different delta-V, very specific thermal environments), re-use of common elements is a more realistic possibility than re-use of platforms, unless missions with rather similar characteristics are selected through the Call (as was the case of Mars and Venus Express). Astrophysics and Fundamental Physics missions could in principle benefit more from a common platform scenario (e.g. HEO missions such as XMM and Integral, or L2 missions as Herschel and Planck).

The main benefits related to the re-use of existing elements and subsystems (including potentially complete SVM) are:

- Reduction of the development risks by re-using elements with flight heritage.
- Considerable simplification of the qualification programme (limited to new specific elements not shared with previous missions).
- More accurate mass budget estimates based on existing or known equipment.
- Reduced complexity / cost of modeling and analysis (e.g. re-use of structure / thermal analysis and related Finite Element Analysis models).
- Simplified AIV/T activities and related preparation, due to previous experience.
- Possible re-use of existing GSE (MGSE, EGSE, OGSE).
- Partially reduced test programme on the basis of well characterized equipment.

It is obvious that all advantages listed above translate into both direct (e.g. procurement, reduced development time) and indirect (e.g. lower risk) cost reductions.

Based on the arguments discussed above, a number of general recommendations can be formulated for the preparation of mission proposals in response to the Cosmic Vision Call. It is acknowledged that the potential re-use of existing flight elements is somewhat hindered by the timescale of the implementation of the future missions (not entering their definition phase before 2010), but an effort needs to be made to identify areas for possible cost reductions. Such an approach must result not only in reduced design and qualification activities (by assuming the re-use of existing hardware), but especially in the need to minimize specific technology developments which inevitably lead to increased risk, cost and longer implementation time.

The main issues that may need to be considered in the formulation of mission proposals which would include a timely reuse of an existing platform or spacecraft units are as follows:

- Consider the potential re-use of existing platforms, such as GAIA (astrophysics missions) and BepiColombo (planetary missions) or recurrent platforms in the case of smaller size LEO or HEO mission profiles, including magnetosphere physics and fundamental physics (e.g. Astro-Bus, PROTEUS, Minisat-400, etc.).
- Consider re-use of existing functional elements and units, eventually upgraded with specific parts of newer production and improved performance, such as elements baselined for missions such as BepiColombo and GAIA.
- Isolate specific subsystems and or functional elements that would require customization on the basis of specific mission requirements.
- Consider that data handling systems and telecommunication units evolve more rapidly as compared to other subsystems, such as propulsion and thermal control
- Considerable cost benefits are to be expected in the area of avionics suites common to a number of missions (e.g. BepiColombo or GAIA) as they enable considerable commonalities in the ground segment as well as in the flight units.
- Highlight cost benefits to be expected by re-use of existing parts, in terms of compressed schedule, reduced testing and overall risk.

Further technical details on past missions or current projects under development and the possible potential for re-use can be found at:

<http://sci.esa.int/science-e/www/area/index.cfm?fareaid=65>.