HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
Enablers for the Future Human Missions (7)

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SPACE STATIONS USING THE SKYLON LAUNCH SYSTEM

Abstract

The paper reports the results of a study into the architecture of space stations that are both built and supported using the SKYLON spaceplane in the timeframe immediately after its introduction to service and when the ISS capability will require replacing; that is 2020-2030.

The selected architecture consists of multiple specialist stations, typically in the MIR class (120 tonnes, crew four) but with some stations up to double this size. Like Mir and ISS, the stations are assembled in orbit from modules, but these modules are more strictly functionally based than in existing stations and as a consequence these stations are not in any respects operational until the assembly is complete. Since the in-orbit assembly process takes around a month this constraint is not foreseen as a drawback.

Depending on the number of different station types required, between eight and sixteen modules need to be developed. The biggest increment in the number of modules, over the minimum required, would be for spinning stations with centrifugally generated artificial gravity. Each module has a typical development cost in the order of $2.5 billion so the total development cost to acquire the capability to construct these stations lies between $20 billion and $40 billion. However, as the modules have simple interfaces between them, largely separate development is possible and this cost could easily be spread among cooperating nations.

Once developed a science station, with a crew of four and a quarter the ISS experimental accommodation, would cost in the order of $2 billion to acquire including launch. Annual support costs for this station would be under $200 million assuming 120 day tours of duty. So to replace the ISS would require four or five such stations although growth in demand together with other applications is bound to increase the number of stations beyond this. While the precise total market for this modular station is highly speculative, it is clear that the production run for each of the core modules could easily surpass ten leading to efficiencies and other learning curve factors.

It is concluded that the introduction of SKYLON would not immediately alter the technology used by space stations and hence the development costs of the hardware would remain high. However by maximising the number of stations built and exploiting the low launch costs and high flight rate offered by SKYLON, order of magnitude reductions in cost of ownership can be achieved.