

Benefits of a Single-Person Spacecraft for Weightless Operations

Brand Norman Griffin

Gray Research, Jacobs Engineering ESTS Group, Huntsville, Alabama, 35806; Ph (256) 544-2427; email: brand.n.griffin@nasa.gov

ABSTRACT

Historically, less than 20 percent of crew time related to extravehicular activity (EVA) is spent on productive external work. For planetary operations space suits are still the logical choice; however for safe and rapid access to the weightless environment, spacecraft offer compelling advantages. FlexCraft, a concept for a single-person spacecraft, enables any-time access to space for short or long excursions by different astronauts. For the International Space Station (ISS), going outside is time-consuming, requiring pre-breathing, donning a fitted space suit, and pumping down an airlock. For each ISS EVA this is between 12.5 and 16 hours. FlexCraft provides immediate access to space because it operates with the same cabin atmosphere as its host. Furthermore, compared to the space suit pure oxygen environment, a mixed gas atmosphere lowers the fire risk and allows use of conventional materials and systems. For getting to the worksite, integral propulsion replaces hand-over-hand translation or having another crew member operate the robotic arm. This means less physical exertion and more time at the work site. Possibly more important, in case of an emergency, FlexCraft can return from the most distant point on ISS in less than a minute. The one-size-fits-all FlexCraft means no on-orbit inventory of parts or crew time required to fit all astronauts. With a shirtsleeve cockpit, conventional displays and controls are used, there is no suit trauma and because the work is not strenuous, no rest days are required. Furthermore, there is no need to collect hand tools because manipulators are equipped with force multiplying end-effectors that can deliver the precise torque for the job. FlexCraft is an efficient solution for asteroid exploration allowing all crew to use one vehicle with no risk of contamination. And, because FlexCraft is a vehicle, its design offers better radiation and micro-meteoroid protection than space suits.