

MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Sciences onboard the International Space Station and Beyond (6)

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SPEED: SMALL PAYLOAD EXPRESS EARTH DELIVERY

Abstract

Now that the International Space Station is operational, it is time to enhance its productivity and value. Most commercially-useful research is highly iterative. One ISS enhancement that may radically boost the productivity and value of most iterative research is regular weekly return of priority small payloads from the ISS to researchers on the ground. SPEED is a small reentry capsule with a 7 liter cylindrical payload bay (25 cm dia x 15 cm long). SPEED can hold up to 4 kg of test-tubes and other small payloads. Each capsule can handle frozen, refrigerated, or unrefrigerated payloads, but provides only one temperature regime on each flight.

SPEED can be taken outside ISS on any EVA, or passed through a small airlock/ejector designed for it and similar small deployable payloads. The most novel feature of SPEED is its passively safe deorbit system: a spinning gossamer "dragsail" 12m in diameter. This should pose fewer safety issues to the ISS and its crew than either rockets or tethers, because SPEED slowly acquires the velocity change needed for deorbit as it decays below station altitude. Changing the spin rate changes the sail cone angle and orientation, and can allow accurate deorbit time and hence location despite uncertainties in atmospheric density below ISS. Adjusting dragsail release altitude between 150 and 200 km allows additional range adjustment. Banking during a low-lift entry allows even more range adjustment, and can also reduce peak reentry deceleration from 9 to 5 gees. The preferred recovery technique is mid-air capture near the coast of the US or other ISS partner countries, with water recovery as a backup if mid-air capture fails.

The dragsail should take 4 hours to deorbit the SPEED capsule, and overall time from capsule loading to unloading should normally be 6 hours. Expected cost for weekly service with fully-loaded capsules should be of order \$50/gram + \$25/cc.

The paper will include more detailed information for potential SPEED users, a description of the reentry range control strategy, a description of development status and plans, and a target date for initial service if funding is continuous.