Since the beginning of the ISS program has highlighted the difference between the amount of payload carried on board the station (upload) with a variety of means, with respect to the amount carried by the ground station (download).

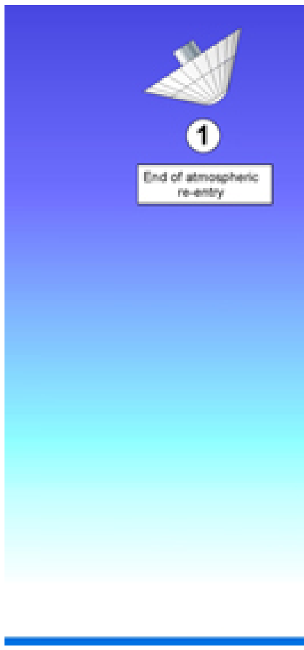
The means available for upload are:

• Space Shuttle (with or without MPLM)
• Soyuz TMA (current version of the Russian capsule with three seats)
• Progress M (portable version, to lose, Soyuz)
• ATV (European logistics vehicle to lose)
• HTV (Japanese vehicle logistics to lose)

To date, the maximum possible in terms of payload, is available for download from the Space Shuttle which will be retired from service in 2012. Whereas both the Progress M that the ATV is not designed to re-enter the only possible way to return to the land of the scientific payload for the ISS is committed to the re-entry module of the Soyuz TMA, which can allocate up to few tens of kilograms.

This scenario leaves a "hole" caused by leaving the scene of the Shuttle until the advent of the next generation of U.S. manned space vehicle (Orion) and European (Manned ATV) of at least five years for what concerns the possibility of being able to include significant loads on the ground, in terms of weight, from the International Space Station.

In this sense, a capsule IRENE could have a useful role, they can be used as a "postman" for the ISS because of its ability to allow recovery of small payloads in pressurized section and, with it's relatively cheap (compared to large, complex systems such as "manned").



A possible scenery of the mission would arrive at the ISS IRENE capsules in a "piggyback" (that is delivered with a "transition" from another medium), and that effect would be three candidates:

• Space Shuttle (with a GAS - Get Away Special - housed in the Cargo Bay)
• Progress M (latched abroad)
• ATV (latched abroad)
Hence the capsule could be moved within one of the Airlock (the U.S. "Quest" or the Russian "Pirs") to be loaded with the payload.

Once loaded in the payload capsule IRENE has two possible ways to get back to shore:

1.To return piggyback with the Progress M or ATV
2.Start return home independently.

In the first case would require an EVA, or the use of the robotic arm to replace the capsule IRENE return to his carrier. After the carrier has made its power for de-orbiting the capsule IRENE be separated from them and will make a return to self-destroy while the carrier is in the upper atmosphere.

In the second case the capsule IRENE should be equipped with its own engine deorbiting, attitude control system and guidance system active.

The first case is advantageous because it saves the weight of the service module of the ISS and a flyaround complex (complex and potentially risky), but puts limits on re-entry capsule IRENE in uninhabited areas (usually ATV and Progress M deorbitare are made on the 'Pacific Ocean), thus making it complex and expensive the recovery.

In the second case we can assume a return and then flown directly to an area "convenient" in terms of recovery, as might be the Mediterranean basin, but requires the use of a service module and the making of a move Separation and flyaround the ISS, which must be carefully designed to avoid, at most, the risk of collision.
In any case, once back in the atmosphere, the capsule was recovered by the team of Irene and ground transportation to the management of the vehicle for the recovery of the payload.
The advantage of having a capsule version IRENE "space mail" would be to be able to get the scientific payloads and not secure, not involving the use of carriers manned in times other than those imposed by operations with manned and more often (considering how many are launched ATV and Progress M year).

- **The History** The history of atmospheric re-entry vehicles coincides with the development of long-range weapon systems on the one hand, and with strong growth of the

aviation in the years 1940 to 1960. Remember, that for atmospheric re-entry means the end of the flight of a spacecraft during which, both as a pilot or erratic, the vehicle comes into contact with the upper atmosphere layers , decelerates and finally lands on Earth's surface (or splash down) or destroyed during re-entry if it is not designed to be able to survive, as in the case of most satellites.
During atmosphere re-entry, which can be ballistic, semi- load-bearing or load-bearing, the speed gained by spacecraft during the launch, is converted into heat for the most part due to friction with the layers of the atmosphere that gradually becoming more dense near sea level. The heat is directly function of the starting velocity (which is about 28,000 km / h) while the heat flux is a function of the return's time and then of the spacecraft's trajectory. The return trajectory depends of the characteristics of spacecraft, for example if the spacecraft is load-bearing the trajectory will be very long and re-entry will be diluted.

Guidelines to perform a controlled re-entry into the atmosphere were born from a series of studies conducted in various parts of the world in the 20s and 30s of last century: the researches led both Russians and Americans to adopt the idea of an intercontinental ballistic missile capable of releasing one or more nuclear warheads over the target at the end of its flight. This idea stemmed from rapid innovation in rockets field, introduced by the Germans during World War II and by Russians, with the GIRD first and the OKB-1 of Sergei Pavlovich Korolev later.
The objective was to allow at the terminal part of missile, that housed the weapon system, to survive at the delicate atmospheric re-entry phase with hypersonic speed (

At the same time there was a rapid development in aeronautic sector with vehicles, first with the jet and after with rocket propulsion, able to travel at high altitudes and velocities, until to achieve sub orbital flights, as in the case of the North American X-15 of the NASA, that arrived to reach over 100 Km of height with a speed of Mach 7 and beyond. All researches done in aerodynamic and aerothemal fields will lead to the conception of the Space Shuttle in the US and of the Buran in the URSS.
For what concerns the re-entry technologies was decisive the implementation of the ablative materials in the late 50s. For ablative material means a synthetic material able to exfoliate itself, layer by layer, during the atmospheric re-entry phase dissipating, so, the heat developed by friction. Note that a layer, with an appropriate thickness, of ablative material is able effectively to protect a spacecraft during all atmospheric re entry phase allowing to arrive into dense air whence it can to land with relative low speed deploying a parachute. This technology has made possible, first, the ability to survive to the atmospheric re-entry for a war head (made up a nuclear warhead or conventional one) and after the introduction of the spacecraft.

The technology of the spacecraft comes in the midst of the Cold War for driven applications and for automatic one. The first case was the debut of human activities into Space with the first

space flights of the spacecrafts Vostok (Russian) and Mercury (U.S.) creating the “Space Race” that culminating with the American landing on the Moon in 1969. In the second case has made possible the introduction of the spy satellites (or reconnaissance). The dawn of astronautic field, the Russian and American spy satellites had some issues. In particular for the American satellites the problem was to recover the video recording doing during the flights, because there was yet available the technology of digital transmission for the video signals. While, for the Russian satellites, the problem was the recovery of the optical subsystem, that was more expensive, to use it after.
Subsequently, the reconnaissance satellites have been able to use the digital transmission and therefore they have not needed of recoverable unmanned spacecrafts. The technology has been used for civilian applications, such as spin-off, and also has been used, with success, for both recoverable spacecrafts that for interplanetary probes.

Some of the technical challenges are associated with the development of the parashield concept: it is suggested that it is a viable ultralow ballistic coefficient geometry capable of providing aerothermodynamic re-entry shielding to general scientific or commercial payloads. Previous experiments shown that a parashield made of commercially available high-temperature ceramic fabrics, which is supported by a relatively inexpensive aluminum structure, could survive an orbital reentry. These results are applicable to re entry from LEO or less energetic aeromaneuvers, including data drops from the space station or a crew re entry vehicle for the station. Because of the relatively small heating margin with existing fabrics, additional aerothermodynamic analysis are required before the concept could be accepted for higher energy reentries such as lunar return.
A comprehensive review of the full stability derivatives, acoustics, vibrations, and aeroelastics of the parashield are included in the focus of IRENE Study. These factors should be a priority in future parashield research and development.

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