Supernatural science

Research into biological and life sciences aboard the International Space Station has never been more exciting, as investigations expand into the consequences for living things in microgravity.

Whether focusing on the health effects of weightlessness for astronauts on long duration space flights, applying biomedical experiments aboard the ISS to benefit the sick and the elderly on Earth, or conducting basic research to open new paths to physical and psychological findings, new equipment is about to give investigators better and more powerful tools.

Assembled at the Marshall Space Flight Center in Huntsville, Alabama, a new Life Sciences Glovebox (LSG) is scheduled to join the ISS in August this year where it will be installed in the Destiny module to supplant the Microgravity Science Glovebox (MSG) delivered to the ISS aboard Shuttle Endeavour (STS-111) launched on 5 June 2002. The MSG was a crucial experiment facility which has seen intensive use and exemplary performance over the last 15 years, a European contribution built by Bradford Engineering in the Netherlands.

Founded in 1984, Bradford Engineering BV is located in Heerle (Roosendaal) between Rotterdam, Breda and Antwerp. The company has about 50 employees and a 350 m^3 clean room facility with dedicated research and development facilities for glovebox technology. This company has made a name for themselves in glovebox design and engineering and has played a leading role in development of such facilities for use aboard the ISS.

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ABOVE
ESA astronaut Frank DeWinne works with the Microgravity Science Glovebox aboard the International Space Station.

Each Glovebox is equipped with an air circulation and filter system that prevents any contamination exiting the enclosed work volume. During operation, the work volume is kept at a constant pressure of typically 3 to 10 mbar relative to the main cabin environment. This ensures that in the event of a leak material will remain contained inside the work volume.

In addition, a number of Bradford's Gloveboxes provide data acquisition and video monitoring as well as thermal control by means of a cold plate embedded in the work volume floor onto which the experiment can be directly installed. For the larger gloveboxes, an airlock provides access to the work volume without the need to interrupt the under-pressurised closed-loop mode which would require opening one of the main access ports.

Gloveboxes from Bradford have flown on the Space Shuttle and the Russian Mir space station, ranging in size from 20 litres for the Portable Glovebox to 500 litres for the Life Science Glovebox.

NEW LIFE RESEARCH

Development of the Life Sciences Glovebox resulted from a partnership between the Japanese space agency (JAXA) and Bradford Engineering several years ago but the project was placed on hold for a variety of reasons. Recently, it has been reactivated and the project taken over by NASA at Marshall. The original partners refurbished the equipment and updated the heritage hardware, preparing it for flight while Marshall fabricated the secondary structure and provided power and thermal control systems.

"It's been an amazing team effort across Marshall, NASA and the international partnership to ready this hardware for launch, from the refinement of heritage JAXA hardware to the avionics design, plus integration and testing support from across Marshall's Engineering Directorate", said Susan Spencer, Marshall's deputy project manager for the LSG, adding that "The glovebox core facility, set to fly to space in a refrigerator-freezer rack modified by Boeing to accommodate the core facility packed in the foam clamshell, will be the largest soft-stowed payload ever flown".

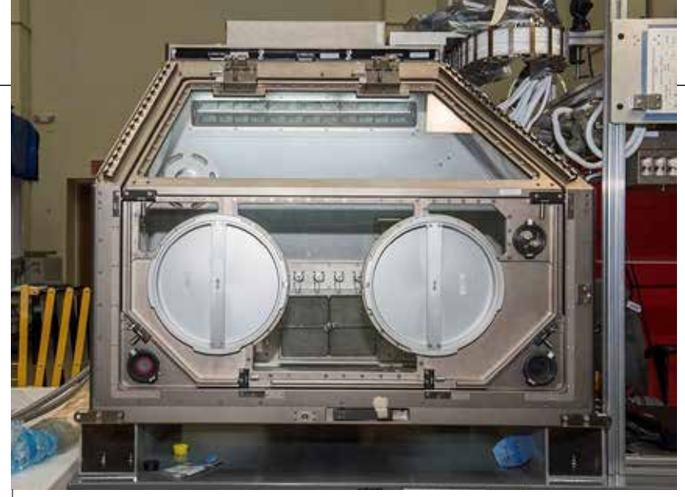
BUILT IN HOLLAND, ASSEMBLED IN ALABAMA

The facility is fully enclosed with a work volume of 0.424 m^3 and incorporates an acrylic window with two glove ports on the front window and two each on the left and right sides of the structure. Two astronauts can work the LSG at the same time, with the option for guidance from experimenters on the ground conducting at least two experiments simultaneously. These limited access points allow the crew to work on materials which would be potentially hazardous if exposed to the environment of the station.

When sent up to the ISS in August, the LSG will be installed in Japan's Kibo module and housed in a zero-gravity stowage rack, plugged in to the station's electrical system through the power supply connectors developed by Marshall, and to the air filtration system, together with connections to the station's video, data recording and real-time downlink capability.

At present the facility is in the Marshall Space Flight Center but it will be flown to Japan in March for final outfitting and preparation for launch. The LSG avionics package will be sent up to the ISS in June, with several integral elements and spare parts lifted up on separate commercial space flights. The 408 kg facility will be the last to launch. The new glovebox will be unwrapped from its foam-based enclosure by the astronauts and installed in Kibo ready for experimenters to start work in November this year.

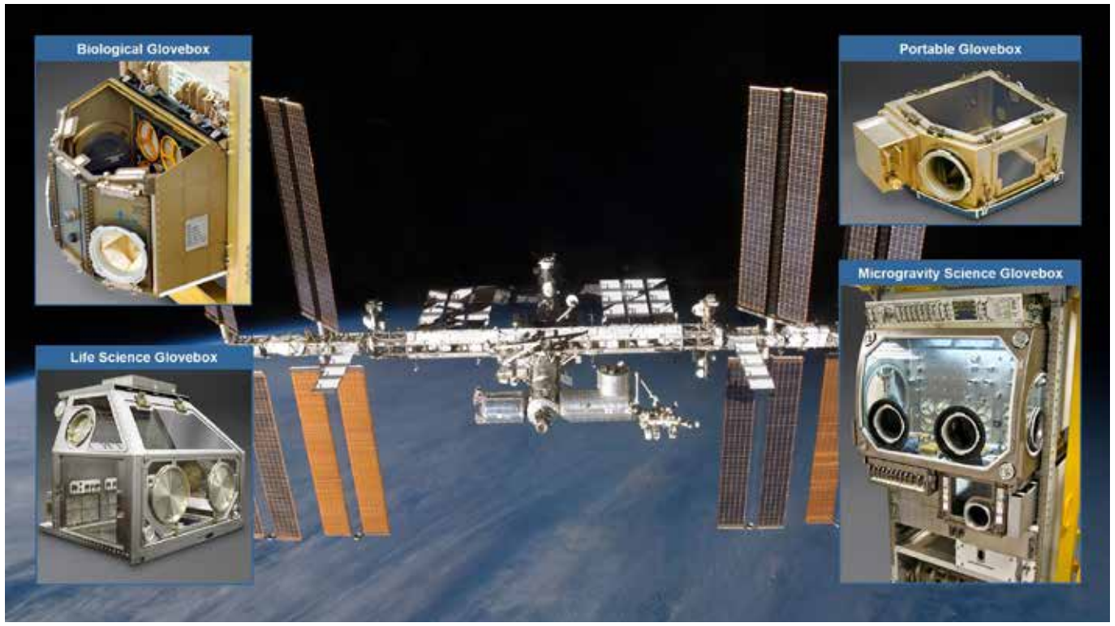
"My goal in life was always to build and fly hardware to space", said Susan Spencer. "Seeing something you've had your hands on lift off and fly? Watching the launch of a flight mission you've contributed your best work to? There's nothing like that experience." SF



ABOVE
The Life Sciences Glovebox will provide new research possibilities in the Kibo module supporting biological work.

RIGHT
Final assembly of the Life Science Glovebox at NASA's Marshall Space Flight Center.

BELOW
Based in the Netherlands, Bradford Engineering has produced a range of different work boxes for the ISS and has cooperated with JAXA and NASA in development of the Life Science Glovebox.



IMAGES: ESA (OPPOSITE), NASA (ABOVE RIGHT) AND BRADFORD ENGINEERING BV