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# THE SIMBOX EXPERIMENT SYSTEM: A TURN-KEY DEVELOPMENT APPROACH TO LIFE SCIENCE EXPERIMENTS

**Abstract**

The Shenzhou 8 Mission of 2012 represented an important milestone in the ambitious road map of the Chinese Space Program. It marked the Chinese Manned Space Program's first cooperation with a foreign country on a Shenzhou mission. An important part of this mission was the successful completion of the SIMBOX experiment. SIMBOX was composed of a set of life science experiments performed by Chinese and German scientists under micro-gravity conditions throughout the 17-day mission, including seventeen individual experiments in the field of biology and medicine executed by sixteen scientific teams from Germany and China. The scientists successfully performed experiments on plants, nematodes, bacteria, and human cancer cells. The experiments addressed biological and medical issues of fundamental importance, such as developing substances to attack antibiotic-resistant bacteria and the vector-borne parasites that cause malaria. Two of the experiments performed were a direct cooperation between Chinese and German scientists. The Universities of Erlangen and Wuhan, examined material and energy flows in a closed miniature ecosystem populated by algae and snails. Scientists from Hamburg University and the Institute of Biophysics at the Chinese Academy of Sciences in Beijing crystallized medically relevant proteins in microgravity.

Astrium Space Transportation, under a contract to DLR, supported the scientists and developed the SIMBOX facility (with incubator and centrifuge) and experiment unique equipment. The incubator and experiments, based on Astrium's standard Type 1 Experiment Container and Incubators, have a long heritage, beginning with the first Biorack mission on the Space Shuttle in 1985 and continuing today in various ESA and DLR facilities such as BIOBOX and KUBIK. The SIMBOX Incubator provided the experiment commanding, data management, temperature control and a centrifuge for 1g environment reference which allows the researchers to distinguish between micro gravity and side effects (i.e. radiation). The SIMBOX hardware also represents a facility upgrade, with extended performance, and was developed specifically for the Shenzhou mission and the related scientific experiments. The latest configuration provides added functionality including fixation, liquid exchange (e.g. washing, nutrient medium), illumination, density monitoring and stirring, and is able to support the growth of various organisms in standard growth chambers through the exchange of specimen slides.