

## **Project Summary**

### **The purpose of the research**

The PMWC is a logistical waste management system designed by ORBITEC to process select dry and wet waste resultant from supporting human life in space. Processing includes the functions of compressing the waste into a more manageable, easily storable tile, recovering water from that waste, and offering the option of the tiles to be used in radiation shielding efforts.

The PMWC is a standalone system, capable of operating on its own with external interfaces limited to AC power and a computer.

The PMWC was designed and built under a NASA Phase II contract. The primary goals were to demonstrate design feasibility related to increasing the size of the design from the Phase I effort and to characterize related design and operational issues to incorporate into future designs and plans. The prototype system was sized to operate from two to four times per day as if aboard the International Space Station (ISS) supporting a crew of four. Although designed with the goal of integrating with an ISS EXPRESS rack, the current prototype payload is not designed for flight and is not intended for use in space.

### **Description of the research carried out**

The PMWC was designed and built to test the general design and performance of the processing chamber and of the system as a whole. The top priorities included researching the effectiveness of the surface treatments, scaling up the chamber size to accommodate a 16-inch square tile, and using a vacuum pump/condenser/hollow-fiber membrane as the primary means to extract water from the chamber.

The system was designed, fabricated, and tested. Testing consisted of many trials using various trash waste ersatz models. This allowed us to measure performance of the system based on load input.

### **Research findings or results**

Testing has shown that the system is fully functional as far as providing compaction, water extraction and storage, and air removal with minimal processing. The primary metric is water extraction performance of which the PMWC performs well but has been shown to be dependent on trash ersatz packaging method. When many small, sealed bags of trash are used, water extraction is difficult. However, when few bags are used, sealed or unsealed, water extraction is always nearly complete. Full encapsulation of the trash has not been accomplished, primarily because the trash in the PWMC was originally heated on only one face and, due to thermal losses in the system, the opposite face of the processed tile was not able to reach the temperature required for encapsulation. A late addition to the system, however, have been four heaters on the door that will allow for heating the opposite tile face. Integration testing has shown that this addition greatly increases the chance for encapsulation of the trash.

