POTENTIAL SCIENCE INVESTIGATIONS FOR OCEAN WORLDS ENABLED BY RADIOISOTOPE POWER IN PRESSURE VESSELS. A. Austin[1], Y. H. Lee[1], B. K. Bairstow[1], [1]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA, 91109 (alexander.austin@jpl.nasa.gov, young.h.lee@jpl.nasa.gov, brian.k.bairstow@jpl.nasa.gov)

Exploring the oceans of the outer planets is one of the top planetary science community priorities. However, in-situ investigations to these destinations could be faced with some of the most challenging environments in the solar system, particularly due to high pressures that could reach into the tens, hundreds, and even thousands of bars. One of the options to overcome these environmental challenges is to utilize a pressure vessel that could protect instruments, avionics, and other pressure-sensitive items.

The Radioisotope Power Systems (RPS) program conducted an architecture study to investigate the science justification for in-situ, long-life explorers on Ocean Worlds using a pressure vessel and power from a conceptual Next-Generation Radioisotope Thermoelectric Generator (Next-Generation RTG).

The study team first characterized the atmospheres and environments of the potential ocean world mission destinations in order to produce guidelines for mission architecture generation. From these environmental overviews, the team was able to determine which mission types and destinations were feasible with current and expected technology development for missions in the next twenty years.

The study team then developed notional science goals for each identified destination, along with the desired measurements and instruments that may be required to achieve those goals. Considered science goals for the study included, among others:

- Ocean and ice composition
- Ice shell thickness and thermal conductivity
- Assessment of potential active seismology
- Assessment of how the body has changed over time
- Past and present potential habitability assessment
- Presence and sources of hydrothermal vents

Based on these notional science goals, desired measurements and potential instruments were identified.

Finally, the study team developed preliminary RPS-powered mission architectures to explore the identified destinations and meet the considered science goals. The primary destinations considered were Europa, Enceladus, and Titan, as these destinations were deemed to be the most probable locations for a pressure vessel mission in the next twenty years. Many science goals and architectures identified for these targets would be applicable to other potential ocean worlds, such as Ceres, Ganymede, and Pluto.

The two concepts developed in furthest detail were an Ice Explorer to traverse through the ice shell, and an Ocean Explorer to take measurements within the liquid ocean. The team identified notional mission concept details including, among others:

- Requirements on the RPS and mission to accommodate a nuclear power system in a pressure vessel
- Subsystem design and accommodation including thermal, telecommunications, and structures
- Science instrument selection and accommodation
- Notional concept of operations

These architectures were chosen considering commonality among RPS-powered pressure vessel concepts in various destinations of interest to the science and mission communities.

In addition, the study findings would inform the future mission need for RPS that are compatible with pressure vessels and also illustrate exciting new science that could be enabled by potential new RPS technologies.