



Identifying critical elements of a future landing mission to the Jovian moon Europa to support the selection of the most appropriate earth-analogue field test environment

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The technical implementation of a future landing mission to the Jovian moon Europa creates high demands on the components of the space exploration hard- and software. With the overall goal of finding bio-signatures on Europa the concept of going deep, i.e. exploring the subsurface environment appears to be the most promising exploration concept. In the case of Europa it also implies that the mission will rely on having the right means to penetrate through the thick ice sheet and release an underwater robot into the expected ocean. Every step in that mission concept has to be evaluated in regard to their technical feasibility under the strict constraints arising in space exploration programs. This applies in particular to size and weight constraints, as some components of the final system in particular for the underwater vehicle cannot be scaled done as desired.

To lower the risk of failure of such a mission a systematic test program has to be developed that makes use of earth analogue environments in the Arctic or Antarctic necessary where conditions can come as close as possible to the future mission environment. Under that premise engineering models of the overall system in combination with the expected environmental conditions will provide more reliable predictions of potential issues during operations and possible mitigation measures. As a consequence a performance matrix has to be developed that synthesizes all aspects of the system behaviour.

A particular focus of the test concept is on using permanent stations on the Antarctic ice shelf as logistical base and on exploring the accessibility of sub-glacial lakes for those types of earth analogue missions. Ideally these lakes should be saline to focus on those life forms and their related bio-signatures as expected on Europa. Ice thicknesses on the order of 100s m and similar water depths are seen as adequate test environments as they imply operation times long enough to make sound predictions on the system reliability.

By selecting specific examples for critical mission elements a first idea on the efficiency of the overall design methodology will be developed. This evaluation will also include aspects on how the information coming from the exploration vehicle can build up on adequate situational awareness.