Planetary Protection of Outer Solar System Bodies

K. Olsson-Francis[1], P. Cabezas[2], G. Kminek[3], E. Rabbow[4], N. Walters[2], A. Antunes[5], S. Leuko[4], D. Pearce[6], M. Saunders[7], A. Spry[8], P. Rettberg[4]

[1]Open University, UK; [2] European Science Foundation-Science Connect,France; [3]Committee on Space Research (COSPAR), France; [4]Deutsches Zentrum fur Luft- und Raumfahrt (DLR), Germany; [5]Edghill University, UK; [6] Northumbria University, UK; [7]Independent consultant for NAS, USA; [8]SETI, USA.

The presence of water is central to when, where, and under what conditions, past or present life may have existed. Increasing evidence suggests that liquid water is present on bodies in the outer Solar System, for example large aqueous brine oceans beneath the outer ice shells of the icy moons, Europa, Ganymede and Enceladus [1,2]. Measurements from fly-by missions and also from the ground based observations point to these oceans as promising targets for habitability, as they could contain liquid water, an energy source for metabolism and chemical elements that can be used as nutrients.

Therefore, the icy moons are targets for several future missions, including, JUPiter Icy moons Explorer (JUICE; funded by ESA), which will study the Galilean moons of Ganymede, Europa and Callisto, and the Europa Clipper (funded by NASA), which will perform detailed investigations of Europa. Due to their potential as habitable environments a major consideration is planetary protection, which has, to date, focused on the need for effective microbial reduction techniques to prevent contamination. These bioburden constraints? are not only limited to landers, as current concepts for orbital missions call for disposal onto the surface.

In this context, the Planetary Protection of Outer Solar System (PPOSS) project is an initiative supported by the European Commission under the H2020 programme (grant agreement No 687373) that provides an international platform and forum where science, industry, and policy makers meet to catalyse discussions and produce policy recommendations regarding Planetary Protection of? the outer Solar System. One of the outcomes of this work is a Research White Book which outlines recommendations for future missions and identifies scientific knowledge gaps and challenges, which need to be addressed in order to prevent biological and organic contamination. Here we present the outputs of this work with a focus on the microbial contamination aspects and good practices that need to be implicated for future missions to the outer Solar System.

References: [1] Iess *et al* (2014) Science 344, 78-80. [2] Walker & Smidt (2015) *Geophys Res Lett 23, 712-9.*