17th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Mitigation - Tools, Techniques and Challenges (4)

Author: Dr. Alessandro Rossi
IFAC-CNR, Italy, a.rossi@ifac.cnr.it

Dr. Elisa Maria Alessi
IFAC-CNR, Italy, em.alessi@ifac.cnr.it
Dr. Giulia Schettino
IFAC-CNR, Italy, g.schettino@ifac.cnr.it
Dr. James Beck
Belstead Research Ltd, United Kingdom, james.beck@belstead.com
Dr. Ian Holbrough
Belstead Research Ltd, United Kingdom, ian.holbrough@belstead.com
Mr. Thorn Schleutker
DLR (German Aerospace Center), Germany, thorn.schleutker@dlr.de
Mr. Federico Letterio
Deimos Space SLU, Spain, federico.letterio@deimos-space.com
Mr. Gonzalo Vicario de Miguel
Deimos Space S.L., Spain, gonzalo.vicario@deimos-space.com
Dr. Jonathan Becedas Rodríguez
Elecnor Deimos, Spain, jonathan.becedas@elecnor-deimos.com
Mr. Florio Dalla Vedova
LuxSpace Sarl, Luxembourg , dallavedova@luxspace.lu
Dr. Hedley Stokes
PHS Space Ltd, United Kingdom, hedley_stokes@msn.com
Dr. Camilla Colombo
Politecnico di Milano, Italy, camilla.colombo@polimi.it
Dr. Ioannis Gkolias
Politecnico di Milano, Italy, ioannis.gkolias@polimi.it
Prof. Franco Bernelli-Zazzera
Politecnico di Milano, Italy, franco.bernelli@polimi.it
Dr. Narcís Miguel Banos
Politecnico di Milano, Italy, narcis.miguel@polimi.it
Dr. Scott Walker
University of Southampton, United Kingdom, sjiw@soton.ac.uk
Mr. Federico Romei
University of Southampton, United Kingdom, f.romei@soton.ac.uk
Prof.Dr. Kleomenis Tsiganis
Greece, tsiganis@auth.gr
Ms. Despoina Skoulidou
Aristotle Uiniversity of Thessaloniki, Greece, dskoulid@physics.auth.gr
Prof. Enrico Stoll
TU Braunschweig, Institute of Space Systems, Germany, e.stoll@tu-braunschweig.de
Mr. Volker Schaus

TU Braunschweig, Institute of Space Systems, Germany, v.schaus@tu-braunschweig.de
Ms. Rada Popova
Institute of Air and Space Law, University of Cologne, Germany, rada.popova@gmail.com
Mr. Youngkyu Kim
University of Cologne, Germany, engkyu@naver.com
Prof. Alessandro Francesconi
University of Padova - DII/CISAS, Italy, alessandro.francesconi@unipd.it
Dr. Lorenzo Olivieri
CISAS "G. Colombo" - University of Padova, Italy, lorenzo.olivieri@unipd.it
Prof. Simone Gerardin
University of Padova, Italy, simone.gerardin@dei.unipd.it

THE H2020 REDSHIFT PROJECT: A SUCCESSFUL EUROPEAN EFFORT TOWARDS SPACE DEBRIS MITIGATION

Abstract

The ReDSHIFT (Revolutionary Design of Spacecraft through Holistic Integration of Future Technologies) project was concluded on March 31, 2019.

It was a 3-year project that displayed an impressive level of collaboration between 13 European partners, aimed at studying, implementing and testing novel solutions for space debris mitigation.

The main results can be summarized as:

1. A complete mapping of the LEO to GEO space was performed and the cartography was exploited to devise "dynamical" disposal strategies for any orbital regime.

2. The possibility to exploit area augmentation devices (e.g., solar and drag sails) was studied both from the dynamical and the hardware point of view.

3. A prototype small spacecraft "debris compliant" was designed and assembled exploiting the advantages offered by the additive manufacturing procedures. After a first round of environmental tests the initial spacecraft design was revised and a new design, optimized for 3D printing, was obtained.

4. Several parts, including a solar/drag sail container, an in-orbit attach mechanism for sail module and new debris shields, were designed, 3D printed and tested. The sail mechanisms underwent deployment and mechanical tests, while the shields were tested with hypervelocity impacts.

5. The materials and components of the spacecraft were tested for Design for Demise (D4D).

6. A software tool (whose web version is now publicly available on the project website: http://redshift-h2020.eu/) encompassing all the above findings was produced. The software shall help the users to conceive a "debris compliant" space mission from the design to the disposal phase.

7. A number of possible improvements to the international space regulations and standards, stemming from the projects findings, were analyzed and identified.

A comprehensive summary of all the above results will be presented with a specific focus on the latest final achievements, mainly itemized in points 3, 4, 6 and 7 above. The research leading to these results has received funding from the Horizon 2020 Program of the European Union's Framework Programme for Research and Innovation (H2020-PROTEC-2015) under REA grant agreement n. [687500]- ReDSHIFT.