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Author: Dr. Nicholas H. Crisp
The University of Manchester, United Kingdom, nicholas.crisp@manchester.ac.uk

Ms. Sabrina Livadiotti
The University of Manchester, United Kingdom, sabrina.livadiotti@postgrad.manchester.ac.uk
Dr. Peter C.E Roberts
The University of Manchester, United Kingdom, peter.c.e.roberts@manchester.ac.uk
Dr. Steve Edmondson
The University of Manchester, United Kingdom, stephen.edmondson@manchester.ac.uk
Dr. Sarah Haigh
The University of Manchester, United Kingdom, sarah.haigh@manchester.ac.uk
Mrs. Claire Huyton
The University of Manchester, United Kingdom, Claire.Huyton@manchester.ac.uk
Mrs. Rachel Lyons
United Kingdom, rachel.lyons-2@manchester.ac.uk
Dr. Vitor Oiko
The University of Manchester, United Kingdom, vitor.oiko@manchester.ac.uk
Dr. Katharine Smith
University of Manchester, United Kingdom, kate.smith@manchester.ac.uk
Ms. Luciana Sinpetru
The University of Manchester, United Kingdom, luciana.sinpetru@manchester.ac.uk
Mr. Alastair Straker
The University of Manchester, United Kingdom, alastair.straker@postgrad.manchester.ac.uk
Dr. Stephen Worrall
The University of Manchester, United Kingdom, stephen.worrall@manchester.ac.uk
Dr. Jonathan Becedas Rodríguez
Elecnor Deimos, Spain, jonathan.becedas@elecnor-deimos.com
Ms. Rosa María Domínguez
Elecnor Deimos Satellite Systems, Spain, rosa-maria.dominguez@elecnor-deimos.es
Mr. David González
Elecnor Deimos Satellite Systems, Spain, david.gonzalez@deimos-space.com
Mr. Valentin Cañas
Elecnor Deimos Satellite Systems, Spain, valentin-jose.canas@deimos-space.com
Ms. Hanessian Virginia
GomSpace Aps, Denmark, vha@gomspace.com
Mr. Anders Mølgaard
GomSpace Aps, Denmark, anm@gomspace.com
Mr. Jens Nielsen
GomSpace Aps, Denmark, jni@gomspace.com
Dr. Morten Bisgaard
GomSpace ApS, Denmark, bisgaard@gomspace.com
Mr. Adam Boxberger

IRS, University of Stuttgart, Germany, boxberger@irs.uni-stuttgart.de
Mr. Yung-An Chan
Institute of Space Systems, University of Stuttgart, Germany, chan@irs.uni-stuttgart.de
Dr. Georg H. Herdrich
University of Stuttgart, Germany, herdrich@irs.uni-stuttgart.de
Mr. Francesco Romano
Institute of Space Systems, University of Stuttgart, Germany, romano@irs.uni-stuttgart.de
Prof. Stefanos Fasoulas
University of Stuttgart, Germany, fasoulas@irs.uni-stuttgart.de
Mr. Constantin Traub
Institute of Space Systems, University of Stuttgart, Germany, ctraub@irs.uni-stuttgart.de
Dr. Daniel Garcia-Almiñana
UPC-BarcelonaTECH, Spain, daniel.garcia@upc.edu
Dr. Silvia Rodriguez-Donaire
UPC-BarcelonaTECH, Spain, silvia.rodriguez-donaire@upc.edu
Dr. Miquel Sureda
UPC-BarcelonaTECH, Spain, miquel.sureda@upc.edu
Mrs. Dhiren Kataria
Mullard Space Science Laboratory, United Kingdom, dokataria@gmail.com
Dr. Ron Outlaw
United States, raoutlaw2016@gmail.com
Ms. Badia Belkouchi
Euroconsult, France, belkouchi@euroconsult-ec.com
Mr. Alexis Conte
Euroconsult, France, a.conte@euroconsult-ec.com
Mr. Jose Santiago Perez Cano
Euroconsult, France, sperez@euroconsult-ec.com
Mrs. Rachel Villain
Euroconsult, France, villain@euroconsult-ec.com
Ms. Barbara Heißerer
concentris research management gmbh, Germany, barbara.heisserer@concentris.de
Ms. Ameli Schwalber
concentris research management gmbh, Germany, ameli.schwalber@concentris.de

DEMONSTRATION OF AERODYNAMIC CONTROL MANOEUVRES IN VERY LOW EARTH ORBIT USING SOAR (SATELLITE FOR ORBITAL AERODYNAMICS RESEARCH)

Abstract

Aerodynamic forces have often been proposed as a possible means to perform a variety of different attitude and orbit control manoeuvres in very low Earth orbits including pointing control, constellation and formation management, and re-entry interface targeting. However, despite interest and numerous studies conducted in this area there is has been lack of on-orbit demonstration of these manoeuvres beyond simple proof of aerostability and some operational use of differential drag for constellation maintenance. SOAR (Satellite for Aerodynamics Research) is a CubeSat mission and part of DISCOVERER, a Horizon 2020 funded project to develop technologies to enable sustained operation of Earth observation satellites in very Low Earth Orbits. SOAR is due to be launched in 2020 with the primary aim to investigate the interaction between different materials and the atmospheric flow regime in very low Earth orbits. This satellite, with its set of rotating aerodynamic fins, also offers the unique opportunity to demonstrate and test novel aerodynamic control methods in the Very Low Earth Orbit (VLEO) environment. This paper presents the approach to demonstrate novel aerodynamic control methods in-orbit which will be

used on the experimental SOAR Cubesat. The aerodynamic manoeuvres and associated control methods selected for demonstration are first described. Simulations of the aerodynamic control manoeuvres and expected satellite dynamic behaviour are also presented, demonstrating potential advantages for spacecraft operations which can be achieved by utilising the natural aerodynamic forces present at these lower orbital altitudes.