

SPACE DEBRIS SYMPOSIUM (A6)  
Space Debris Removal Concepts (6)

Author: Mr. Robin Biesbroek  
ESA european space agency, The Netherlands, robin.biesbroek@esa.int

Ms. Carole Billot  
Thales Alenia Space Espana, France, carole.billot@thalesalieniaspace.com  
Mr. Stephane Estable  
Airbus Defence and Space (DS), Germany, stephane.estable@astrium.eads.net  
Mrs. Simona Ferraris  
Thales Alenia Space Italia, Italy, simona.ferraris@thalesalieniaspace.com  
Mr. Richard Haarmann  
University of Stuttgart, Germany, Richard.Haarmann@gmx.de  
Mr. Gerrit Hausmann  
OHB System AG - Munich, Germany, gerrit.hausmann@kayser-threde.com  
Dr. Michael Oswald  
EADS Astrium, Germany, michael.oswald@airbus.com  
Dr. Luisa Innocenti  
ESA, France, luisa.innocenti@esa.int

THE E.DEORBIT MISSION: RESULTS OF ESA'S PHASE A STUDIES FOR AN ACTIVE DEBRIS  
REMOVAL MISSION**Abstract**

In the period 2012 to 2014 ESA (European Space Agency) has performed several internal assessment studies, as well as a phase A study on an Active Debris Removal (ADR) mission called e.deorbit. The mission objective of e.deorbit is to remove a large uncooperative ESA owned space debris from the 800-1000 km (near) polar region. Internal studies in 2012 focussed on the analysis of several capture techniques for both cooperative and uncooperative large targets. This was followed in 2013 by three industrial contracts to assess a service oriented approach towards the implementation of an ADR mission. In 2014 three contracts for a phase A study were awarded to Airbus Defence and Space, Thales Alenia Space, and Kayser-Threde (now OHB System). Each contractor was asked to design three concepts: 1) an ADR controlled de-orbit mission based on a rigid capture link, 2) an ADR controlled de-orbit mission based on a flexible link, and 3) an ADR re-orbit mission. A trade-off between the three concepts was requested at the end of the study based on ESA-defined cost and risk criteria. The phase A was completed with a Preliminary Requirements Review.

In parallel to the phase A activities, several technology development studies were awarded within ESA's Clean Space initiative. These studies focussed mainly on the payload design, such as clamping mechanisms preliminary design, net capture concept bread-boarding and testing in parabolic flights, analysis of flexible dynamics between a chaser and the target connected by a tether, and GNC related activities related to close rendezvous and capture, as well as de-tumbling of a target.

This paper shows the results of the three concepts for each phase A contract, and gives an overview of the 2015 activities related to ESA's ADR mission, including a timeline of the phase B1 design, technology maturity studies and In-Orbit Demonstration mission studies.