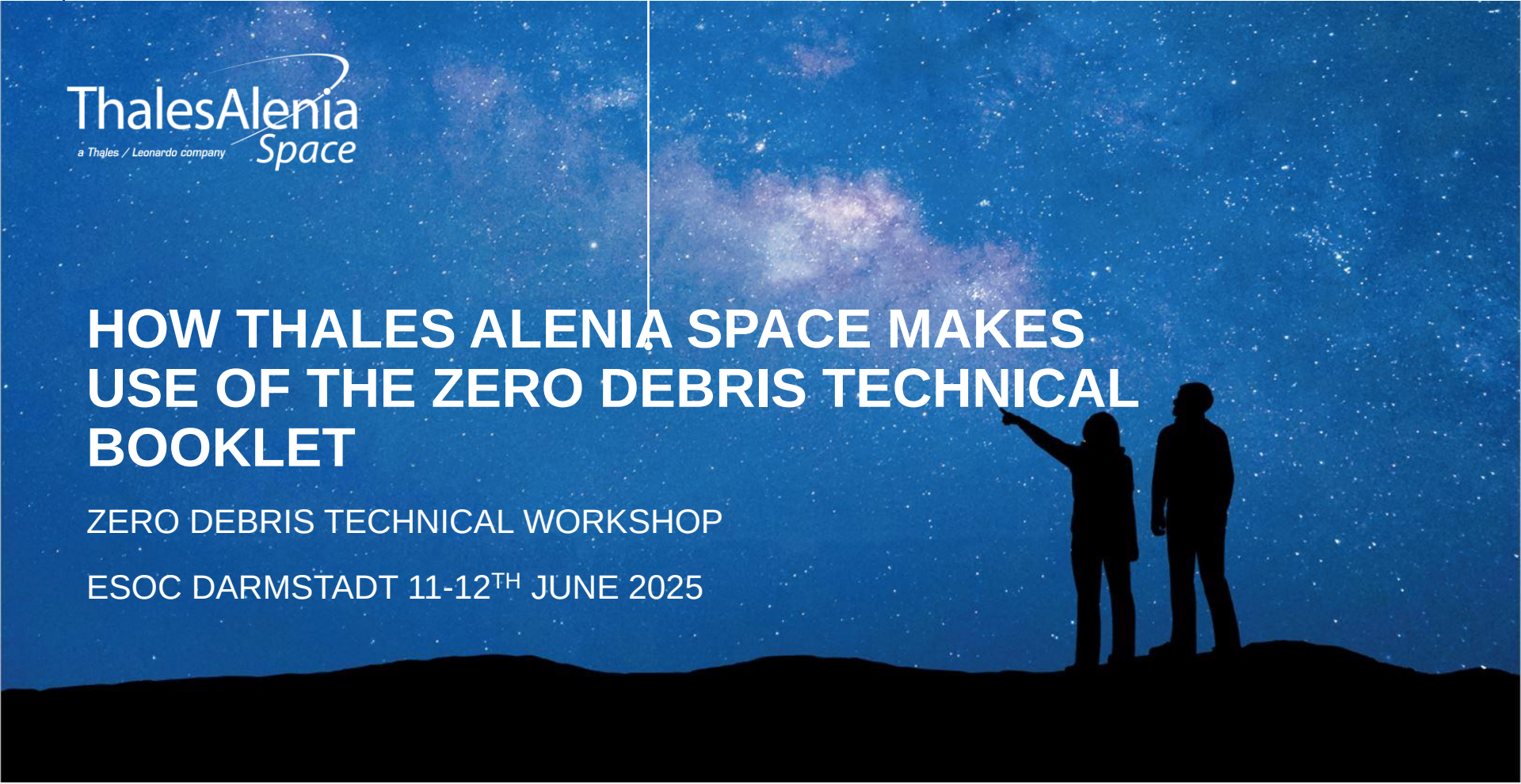

HOW THALES ALENIA SPACE MAKES USE OF THE ZERO DEBRIS TECHNICAL BOOKLET

ZERO DEBRIS TECHNICAL WORKSHOP

ESOC DARMSTADT 11-12TH JUNE 2025

Date: 17/06/2025
Ref: Not referenced
Template: 83230347-COM-TAS-EN-012

CONTENTS

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ZERO DEBRIS OBJECTIVES IN THE CONTEXT OF OVERALL SPACE SUSTAINABILITY FOR THALES ALENIA SPACE

The Space industry's footprint:

SATELLITE DEVELOPMENT AND MANUFACTURING

LAUNCH

GROUND SEGMENT MANUFACTURING & OPERATION

MANUFACTURING & USE OF USER DEVICES

STORAGE & PROCESSING OF DATA/IMAGES

SPACE DEBRIS

EFFECTS OF RE-ENTRY: ATMOSPHERE AND ON-GROUND

RADIO & NIGHT SKY POLLUTION

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ORIENTATE ROADMAPS

/// The ZD booklet, along with on-going CleanSpace Studies help TAS orientate our roadmaps:

Platform product lines	In-orbit servicing	Structure & materials	Avionics	Payload
• Earth Observation • Telecoms	• Extend mission lifetime • Active Debris Removal	• Demisability • shielding	• higher reliability • more automated EOL functions	• demisability

UNDERSTAND THE NEEDS OF CUSTOMERS/PARTNERS

/// The ZD booklet also helps us understand the complexities and constraints faced by our partners and customers, for example:

OPERATORS:

impact of much more frequent and short-notice collision avoidance manoeuvres

ADR and IN-ORBIT SERVICERS:

Tracking and rendez-vous interfaces and requirements

SUPPLIERS:

Use-cases for their technical solutions e.g. drag sails

PROPOSE SOLUTIONS TO ADDRESS THE NEEDS OF THE SPACE INDUSTRY

/// Having a better insight into the current and future needs allows TAS to propose a variety of solutions to potential future customers, for example:

- Solutions to simplify/automate collision avoidance
- Active Debris Removal Interfaces on satellites
- In-orbit servicers to increase mission lifetime

CONSTANT EVOLUTION OF THE ZD BOOKLET

/// Participating in the evolution of the ZD booklet will give us better visibility of the evolving needs and trends, allowing us to anticipate the needs, for example:

The impacts on the atmosphere of re-entry :

Emissions from expired satellites, which burn up upon re-entry, could significantly impact ozone recovery and climate, with potential temperature anomalies and wind speed reductions due to aluminium oxide release

The impacts of other metals including titanium, lithium, iron and copper are still to be modelled

Anticipate evolution of requirements for materials used on spacecraft that re-enter → adapt technology

Or even that the “fully demisable” strategy may no longer be the preferred solution for the majority of LEO satellites, requiring us to move more quickly to the circular economy model, or alternative EoL strategies

/// It is essential that the ZD guidelines evolve with new data and feedback from the wider community, ensuring that the space industry does not cause further problems elsewhere while solving it’s own

PRIORITISE AND ALLOCATE BUDGET

/// The guidelines in the technical booklet also allow us to justify the allocation of budget for the development of technologies and strategies and systems addressing the space debris problem and helps prioritise our activities

/// It also highlights the urgent need for investment from both governmental and private entities to close the gap: