

C08

ADRAS-J プロジェクト概要-世界初大型デブリ除去実証技術とは-

ADRAS-J Project Overview -World first ADR Technology Demonstration-

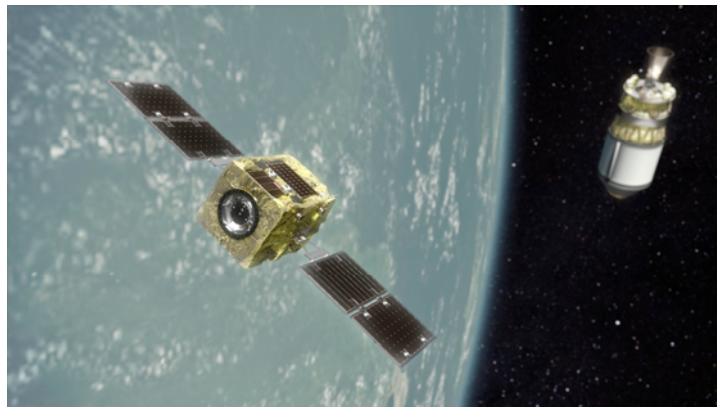
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ADRAS-J(Active Debris Removal by Astroscale-Japan)は、軌道上にある使用済み宇宙機の除去技術を実証するミッションです。

また、同プロジェクトは、JAXA が世界に先駆け行う商業デブリ除去の技術実証 (CRD2:商業デブリ除去実証) のフェーズ I の民間実施パートナーとして選定されており、2022 年度中の打上げを予定しています。フェーズ I では、非協力ターゲットデブリへの接近・近傍制御を行い、軌道上に長期間放置されたデブリの運動や損傷・劣化の様子を把握するため、画像・映像の取得を目指しています。得られる知見やデータは、2025 年以降に打ち上げを予定する除去・リエントリを含むフェーズ II へ活用されます。ADRAS-J ではこれらの JAXA ミッションに加えアストロスケールが独自に実施する技術実証を行います。

アストロスケールは、ELSA-d プロジェクトの設計・開発・運用までに培った知見を ADRAS-J プロジェクトへ活用することで、より品質と信頼性の高いサービスを提供できるよう取り組んでいます。

JAXA selected Astroscale and its Active Debris Removal by Astroscale-Japan (ADRAS-J) satellite as commercial partner for Phase I of its Commercial Removal of Debris Demonstration project (CRD2), which will focus on the observation, characterization, and eventual removal of a Japanese rocket body. Phase I will be demonstrated by the end of the Japan Fiscal Year 2022 and includes data acquisition on an upper stage Japanese rocket body. Astroscale will be responsible for the manufacturing, launch and operations of the satellite that will characterize the rocket body, acquiring and delivering movement observational data to better understand the debris environment.





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 - 世界初大型デブリ
 除去実証技術とは -
 ADRAS-J Project Overview
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2020, December, 9th

株式会社アストロスケール

CRD2 Phase1 (ADRAS-J)
 Project Manager

Sho Fujita 藤田 勝

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Astroscale Overview



- Establishment : 2013年
- Head quarter : Tokyo, Japan
- Funding : \$191M
- Mission : Develop innovative technologies, advance business cases, and inform international policies that reduce orbital debris and support long-term, sustainable use of space
- Vision : Secure safe and sustainable development of space for the benefit of future generations
- Services : EOL, ADR, ISSA, LEX



Astroscale Overview



The only company solely dedicated to on-orbit servicing across all orbits.



CRD2 Phase 1 Project



Astroscale is selected as a partner for JAXA's CRD2 Phase 1 Project from 2020 March for key technology demonstration for commercial ADR service.

目指す姿：「デブリ除去を新規宇宙事業として拓き、民間事業者が新たな市場を獲得する」

今回のRFP発出の範囲

デブリ除去技術実証の実施 (その1) フェーズ I 2022年度打ち上げ

- フェーズIサービス (デブリへの接近、近傍制御、撮像) の実施
- マイルストーン審査の実施、成果報告書の納入

世界初の大型デブリ除去へ

デブリ除去技術実証の実施 (その2) フェーズII 2025年度以降打ち上げ

- フェーズIIサービス (デブリへの接近、近傍制御、撮像、除去、リエントリ) の実施
- マイルストーン審査の実施、成果報告書の納入

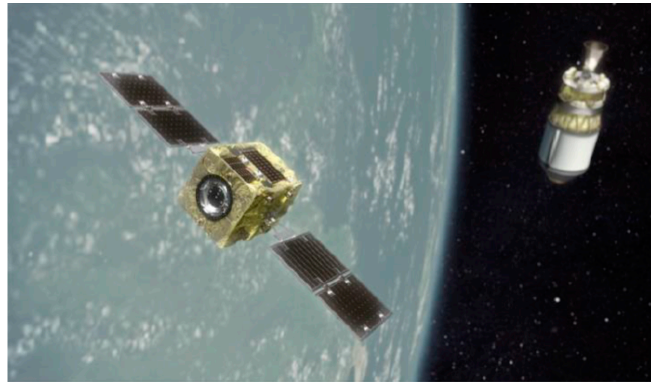
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<http://www.kenkai.jaxa.jp/research/debris/crd2/crd2.html>

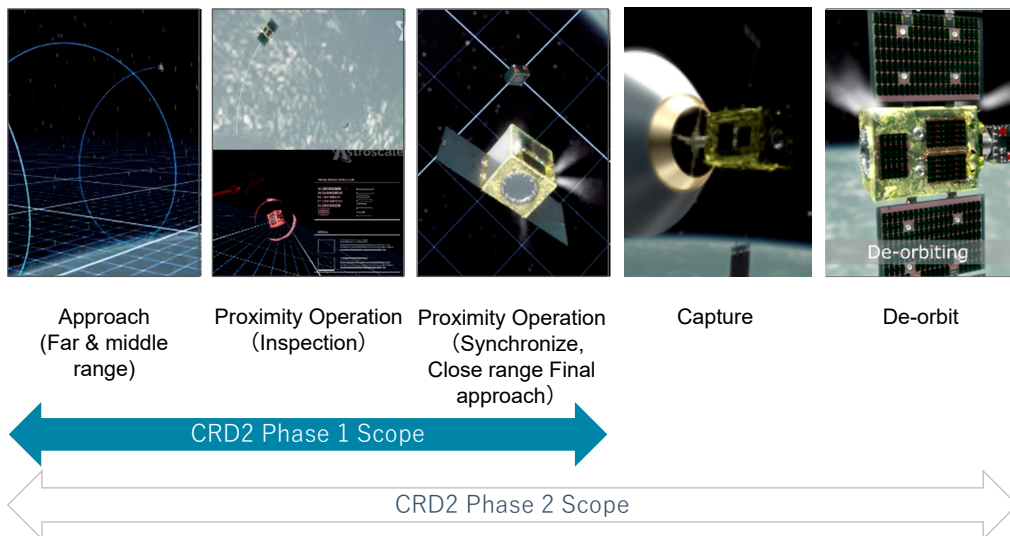
CRD2 Phase 1 Project



- First Challenges to demonstrate ADR Technology in the orbit
- First Challenges for mission procurement type contract. Thus, private company will proactively develop, own and operate spacecraft and demonstrate technologies based on its business strategy, and deliver mission products to JAXA. JAXA will provide technical supports.



Key Technologies for ADR



ADRAS-J Overview

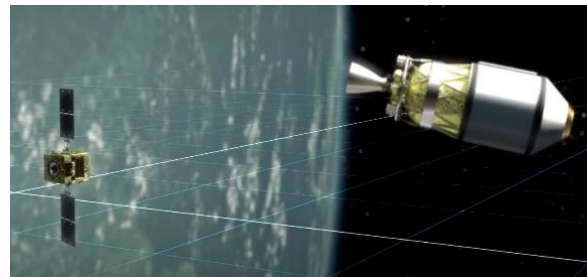
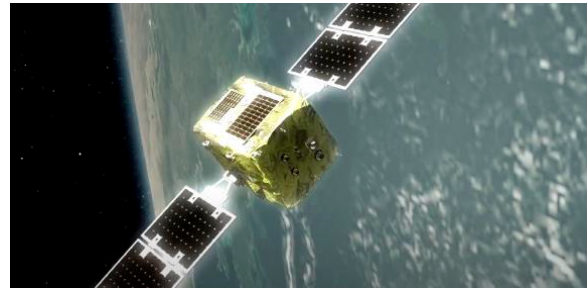


ADRAS-J: Active Debris Removal Service by Astroscale

- Developed in CRD2 Phase1

Key Mission Details

- Chaser: ~180 kg
- Target: Japanese Rocket Upper Stage
- Launch targeting: within Japan fiscal year 2022
- Full range technology of RPO (Rendezvous and Proximate Operation) with Non-cooperative target will be demonstrated
- Astroscale will be responsible for the manufacturing, launch and operations of the satellite that will characterize the rocket body, acquiring and delivering movement observational data to better understand the debris environment.

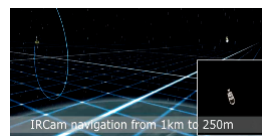


CRD2 Phase 1 - ADRAS-J - Features



Rendezvous Technology for Non-Cooperative Target

- Challenges for rendezvous to Non-Cooperative Target are
 - No Optical Markers on Target
 - No Communication link with Target
 - No Attitude control on Target
 - Uncertainty Target characteristics (attitude motion, surface damage and appearance condition)
- Approach and navigation technology with multiple types of sensor will be demonstrated



COTS Rendezvous Sensors


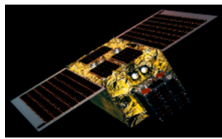
- COTS sensors will be used for Rendezvous
- State of the art sensing technology in ground-use consumer products will be applied for space-use

World First Real large Debris data Observed In Space

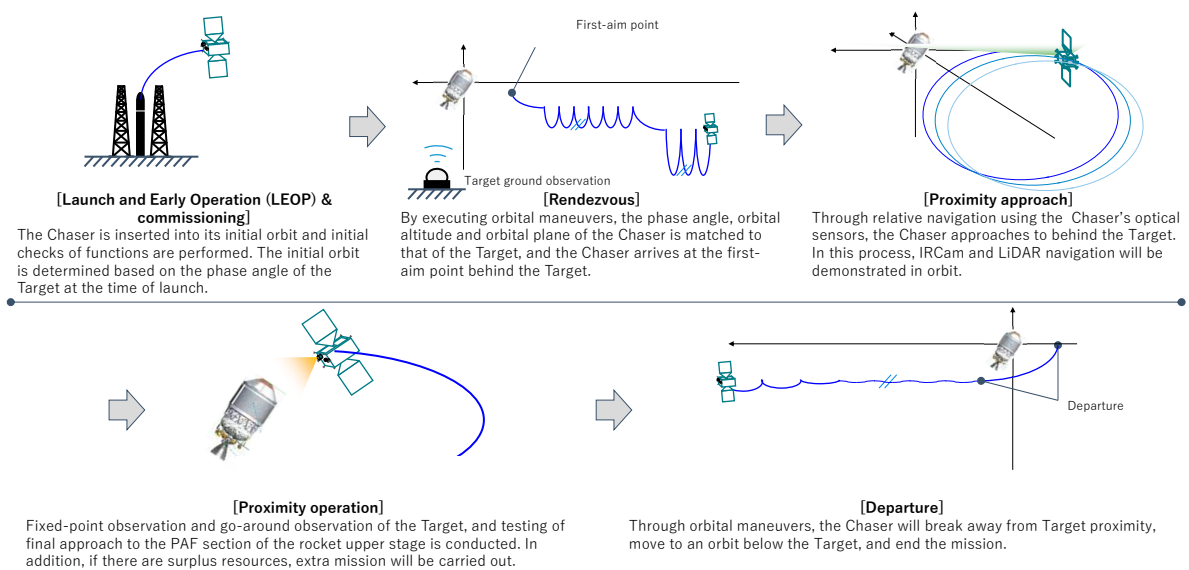
- Nobody knows attitude motion, surface damage and appearance condition of large debris in space yet
- World first in-situ observation data will contribute further understanding on debris behavior and environment.

CRD2 Phase 1 - ADRAS-J - Features

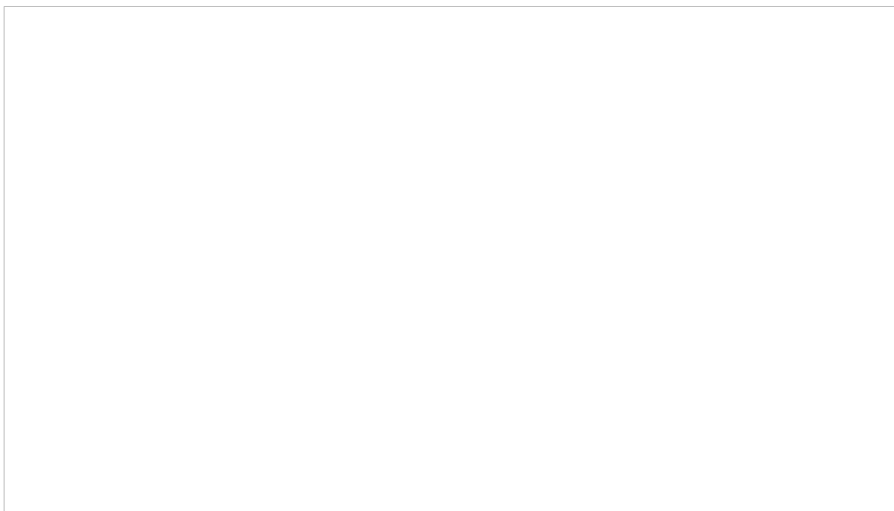


<p>Safe Mission and System Design</p> <ul style="list-style-type: none"> • 1 fail safe design • Collision avoidance (passive and active abort) • Safety ellipse trajectory • FDIR • Architectural Redundancy 	<p>Full Range Rendezvous System</p> <ul style="list-style-type: none"> • Not only close-range relative navigation technology but also full range rendezvous technology will be demonstrated • Launch condition definition, Far range rendezvous trajectory design, absolute navigation • Middle and close range trajectory design, relative navigation, close range trajectory design
<p>Consolidated System Technology Including Ground Segment and Operation</p> <ul style="list-style-type: none"> • Astroscale is responsible for not only spacecraft but also ground segment development, launch vehicle procurement and in-orbit operation. 	<p>Leverage ELSA-d's outcome</p> <ul style="list-style-type: none"> • ELSA-d is Astroscale's world first system to demonstrate End of life service technology which is ready for March 2021 launch. • ADRAS-J leverage ELSA-d's outcome. 

ADRAS-J Mission Scenario



ADRAS-J Mission Scenario



ADRAS-J video https://youtu.be/5u_X33krhHY

Path Forward



- We will acquire capability and experiences to make our commercial ADR business viable through this CRD2-1 project.
- We will further leverage this by pursuing opportunity to demonstrate full ADR service technology, such as CRD2-2 opportunity, which is yet open for bid though.
- To make ADR constant and sustainable action, discussion over anchor tenancy to bring down Japan-derived debris after CRD2 program is necessary.
- We have actively advocated sustainable debris mitigation rules to many governments and organizations world wide