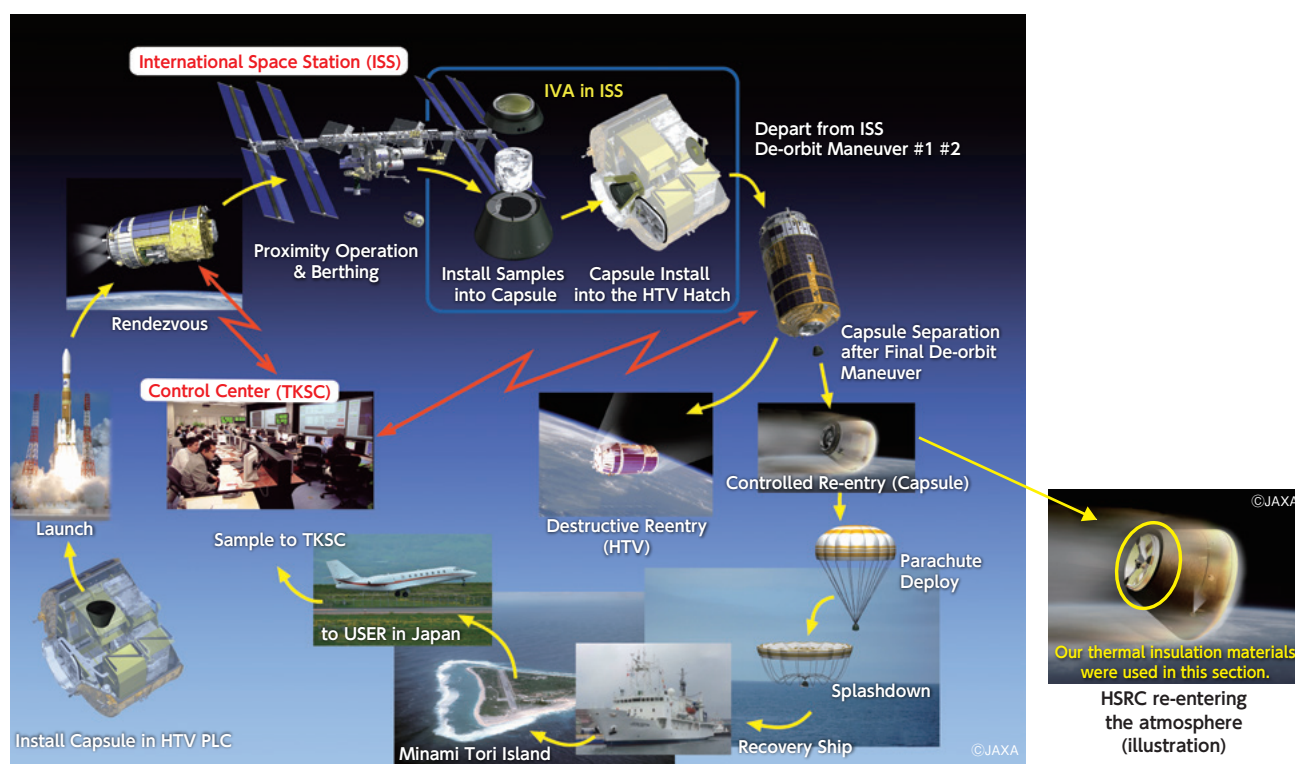


NICHIAS' thermal insulation materials were used in the HTV Small Re-entry Capsule test conducted by JAXA.

The Japan Aerospace Exploration Agency (JAXA) conducted a cargo recovery test using the HTV Small Re-entry Capsule (HSRC) when the H-II Transfer Vehicle KOUNOTORI 7 (HTV 7) for delivering supplies to the International Space Station (ISS) made re-entry. In this test, NICHIAS' thermal insulation materials were used in the rear section of the capsule.

This article describes our thermal insulation materials used in the test.

The JAXA took the opportunity of KOUNOTORI 7's re-entering into the atmosphere to test and demonstrate the cargo recovering technology from the ISS by using the HSRC.

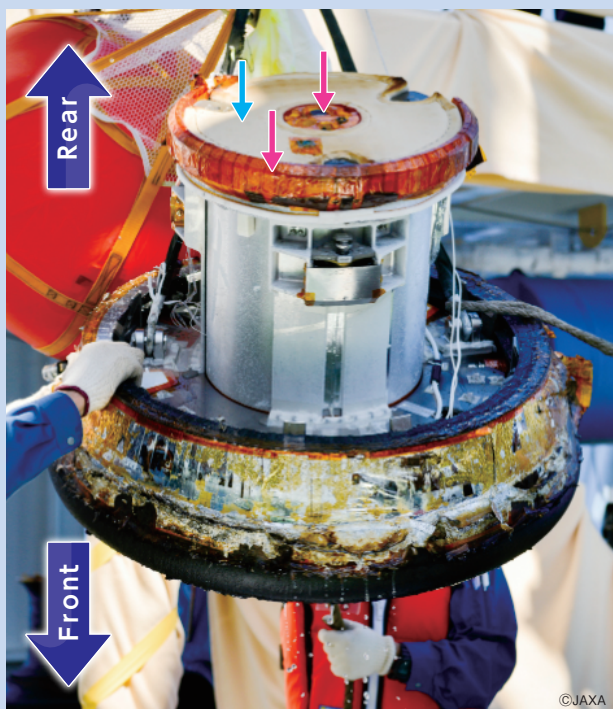


Date and time	Event
(1) September 23, 2018 02:52*	H-IIB rocket lifted off carrying HTV-7 that contained HSRC.
(2) September 28, 2018 03:08*	Docking of HTV-7 with ISS completed.
(3) November 8, 2018 01:50*	HTV-7 was separated from ISS.
(4) November 11, 2018 06:24*	HSRC was separated from HTV-7.
(5) November 11, 2018 07:06*	HSRC splashed down off the coast of Minami-Tori-Shima Island.
(6) November 11, 2018 10:25*	HSRC was recovered by a ship.

*In Japan time

The HSRC withstood the shock and intense heat during the re-entry into the atmosphere and successfully carried protein samples back to the Earth.

Overview of cargo recovery test using HSRC
(Source: JAXA website <http://jda.jaxa.jp>)



HSRC recovered from the sea

Our thermal insulation materials were used in the rear part (upper part in the photo) with respect to the position during re-entry into the atmosphere.

- White part: Flexible thermal insulation material
- Orange parts: Outer ring and center connector insulation materials

A challenge the JAXA faced was a design and a choice of insulation material for the rear section of the HSRC.



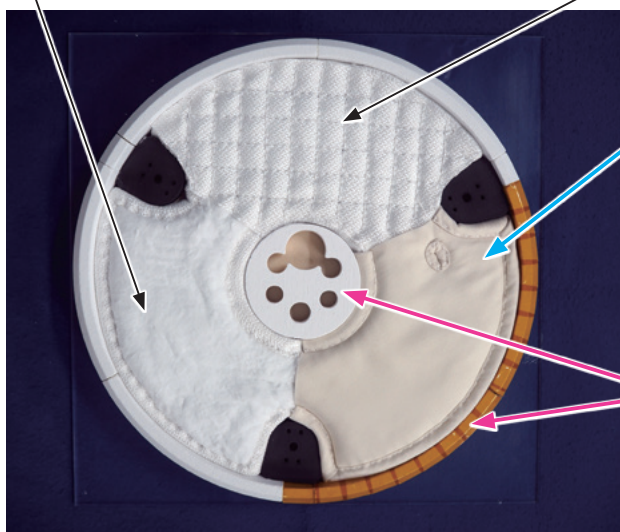
Preliminary simulations were unable to accurately estimate the thermal load distribution pattern. Furthermore, the insulation material has to be easily attached and possess high strength.

JAXA turned to NICHIAS because of our long track record of supplying custom designed thermal insulation for the H-IIA and H-IIB rockets. Our laboratory also has capabilities to test thermal load in ultra-high temperature ranges and measure thermal conductivity under vacuum. We are also working with the JAXA in estimating the actual thermal load by examining the recovered capsule.

NICHIAS takes pride in offering a reliable solution in aerospace field to the JAXA who showed unwavering trust in NICHIAS.

Structure of the thermal insulation used in the rear section of the HSRC

Core: Fiber thermal insulation material



Replica of the thermal insulation material used in the HSRC (To show the material composition, the replica is divided into 3 sectors, exposing the material in each layer. The lower right sector represents the final appearance.)

Covering material: Alumina cloth

This material covers the core fiber thermal insulation material. It forms a flexible thermal insulation material by solid sewing and quilting.

Flexible thermal insulation material

A fibrous material with exceptional heat resistance covered by an inorganic fibre cloth providing superior strength and flexibility at high temperature. The outermost layer is additionally covered with an aramid cloth.

Outer ring and center connector thermal insulation materials

Remarkable heat and high strength inorganic fibre board machined into a complex shape with high precision.

*The orange parts are polyimide films that prevent fibers from splashing.

NICHIAS thermal insulation materials used in the HSRC

The features, applications and role of our thermal insulation used in this HSRC are described below.

TOMBO™ No.5615

FINEFLEX BIO™ Blanket

Made by continuous laminating of silica-magnesia-calcia based alkaline earth silicate (AES) wool and needle-punch processing. Used as thermal insulation and back-up material in industrial furnaces.

In the HSRC: Core of flexible thermal insulation material



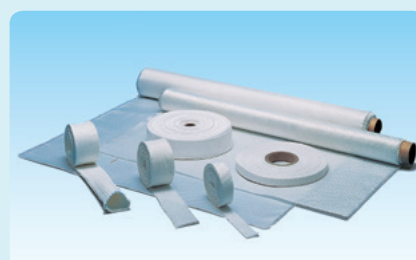
TOMBO™ No.8350

RUBILON™ Cloth

A continuous alumina fiber textile product, which has long-term heat resistance of 1400°C.

Features high strength and excellent flexibility in ultra-high temperature ranges. Used for thermal insulation blanket covering materials and industrial furnace curtains.

In the HSRC: Covering for flexible thermal insulation material



TOMBO™ No.5461

RF Board™ 18HD

Created by adding inorganic and organic binders to alumina fiber and forming it into boards. Can be used at a temperature up to 1800°C. Used for lining materials for various types of high-temperature furnaces.

In the HSRC: Complex-shaped (circumference and center connector) sections



Certificate of appreciation given by JAXA following the success of the mission

Following the success of the HSRC test, we received a certificate of appreciation from JAXA. It is displayed together with a full-scale replica of the thermal insulation material in the Innovation Gallery at NICHIAS Hamamatsu Research Laboratory. Please visit the laboratory to have a look.

For more information, please contact Industrial Products Division, NICHIAS Corporation.

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*TOMBO is a trademark or registered trademark of Nichias Corporation.

*Product names marked with TM are trademarks of NICHIAS Corporation.