IN-ORBIT OPERATION AND INITIAL SAMPLE ANALYSIS AND CURATION RESULTS FOR THE FIRST YEAR COLLECTION SAMPLES OF THE TANPOPO PROJECT.

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Introduction and Current Operation Status: Although the Japanese space program has never emphasized on astrobiology until very recently, a number of past and present space science and exploration projects have contributed to the advancement of the field in unique ways. Since late 2000's, Japanese astrobiologists have started to be involved more into space experiments and missions and sample return and micro-analyses are what Japanese space science community particularly try to keep advancing within many disciplines within this field.

In this respect, their efforts have resulted in the successful start of the in-orbit operation of the "TANPOPO" mission, named after dandelion, a grass whose seeds with floss are spread by the wind. It is Japan's first astrobiology space experiment onboard the International Space Station-Kibo Exposed facility since May 2015, in order to test various aspects of the "quasi-panspermia" hypothesis for exogenesis origin of life precursors and their interplanetary transport (Fig. 1) [1]. In May and November 2015, the first year samples were installed on two sets of small pallets called "ExHAM" on the handrail of the ISS-Japan Experiment Module (JEM), or Kibo, Exposed Facility (EF) in the duration of 1-3 years, in order to test key questions consisted of the "quasi-panspermia" hypothesis, a theory for exogenesis origin of life and their transports among celestial bodies.

By analyzing captured micrometeoroids in the aerogels, one can learn what kinds of extra-terrestrial organic compounds inside micrometeoroids can be transported from parent bodies and how they may be altered in outer space. Also by evaluating retrieved samples of exposed terrestrial microbes and astronomical organic analogs on the exposure panels, one can investigate their survivals and alterations in the duration of interplanetary transport. These samples will be returned to ground laboratories after retrieval to the Earth in every year in 2016-2019 (Fig. 2).

Experimental Set-Ups and Post-Retrieval Analysis Themes: The TANPOPO employs blocks of ultra-low dense aerogels [2] on the Capture Panels (CP) that will be exposed and retrieved to capture impacting solid microparticles such as organic-bearing micrometeoroids and possible terrestrial particles in the low Earth orbit, for assessing the possibility of interplanetary transport of life and its precursors. By analyzing captured micrometeoroids in the aerogels, one can learn what kinds of extraterrestrial organic compounds in the pristine states inside micrometeoroids can be transported to the earth from primitive bodies and how they will be altered in outer space.

Once microparticles of terrestrial origin impacted into the CPs, one can test if terrestrial microbes (e.g., aerosols embedding microbial colonies) may be present, even temporarily and in "freeze dry" form in the low earth orbit altitudes. Also by evaluating retrieved samples of exposed terrestrial microbes and astronomical organic analogs on the Exposure Panels (EP), one can investigate their survivals and alterations in the duration of interplanetary transport (Fig. 3). The dedicated bimetal thermometer attached to the EP monitors the maximum and minimum temperatures of the EP has experienced proving the terrestrial microorganism and atifitial organic samples can survive unaltered in this space environment.

The TANPOPO experiment consists of following six sub-themes: 1) capture of microbes in space, 2) exposure of microbes in space, 3) exposure of organic compounds in space, 4) capture of organic compounds in micrometeoroids in space, 5) evaluation of ultra low-density aerogel developed for the Tanpopo mission, and 6) capture of space debris at the ISS orbit. Each will utilize one or more CP and EP samples from various pointing faces onboard the ExHAM as the ISS is an earth gravity gradient three-axis stabilized satellite.

Initial Sample Analysis and Curation Preparation: The TANPOPO-Initial Sample Analysis and Cu-

ration (ISAC) are planned and will be conducted by its Preliminary Examination Team (PET) as below:

PET-1 PHASE-1 (2016/07/01-09/30)

ExHAM-1-1 sample retrieval at JEM
ExHAM-1-2 sample exposure at JEM
ExHAM-1-1 sample Earth return
ExHAM-1-1 sample arrival to ISAS Clean Room (CR)
PET-1A(ExHAM-1-1) starts at ISAS

PET-1 PHASE-2 (2016/10/01-12/31)

PET-1A(ExHAM-1-1) delivers the first samples to all sub teams
ExHAM-1-1 samples preserved in ISAS CR
ExHAM-1-1 samples data archived
ExHAM-2-1 sample retrieval at JEM
ExHAM-2-1 sample Earth return
ExHAM-2-1 Sample arrival to ISAS CR
PET-1B(ExHAM-2-1) starts at ISAS
PET-1A the initial publication submission

The ISAC plan for CPs covers the receipt of retrieved samples, their initial inspection and documentation, processing and distribution of the samples for detailed analyses of each sub-theme, cataloging for data archiving and sample storage. For initial inspection and documentation, they will map and measure aerogel penetration tracks and captured particles (e.g., incoming angle, track depth and track volume) by the original keystone machine at ISAS clean room. Then they will process keystones containing microparticles to be inspected further and their penetration tracks for allocation to respective sub-theme researchers, in accordance with their requests for the subsequent detailed analyses (Fig. 4) within the first 100 days after the Earth sample return [5].

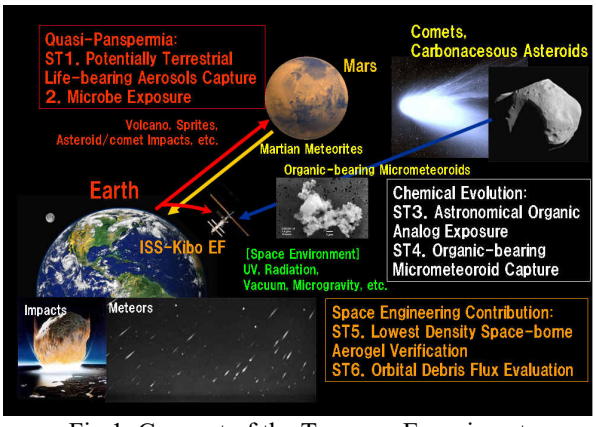

Fig.1 Concept of the Tanpopo Experiment

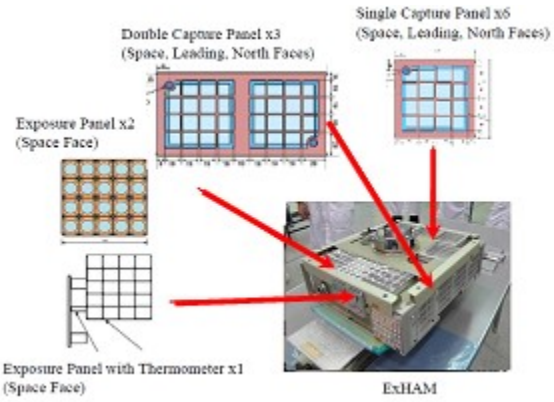

Fig.2 Exposed and capture panels of Tanpopo on the ExHAM pallet

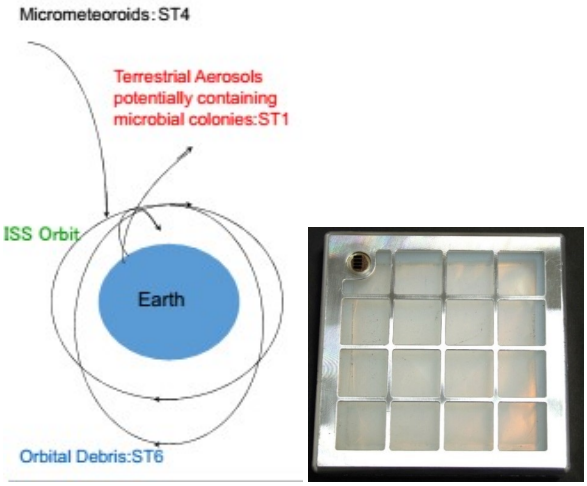

Fig. 3 Possible impaccting microparticles onto Tanpopo and its double-layered areogel module and a carbon nanotube witness plate of the capture panel

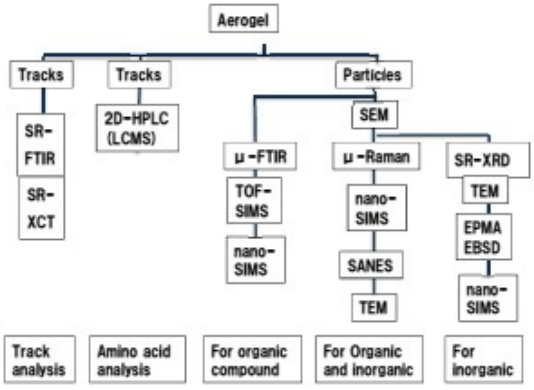

Fig. 4. An example of sample analysis flow of the cosmic dust sub-team.

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