2-2
PP activity for outward request (risk reduction activities)

2026/01/15

MMX PP Team

MMX Planetary Protection Meeting

Outline

1. MMX PP Request for Outward
2. Cleanliness Control Status and Bioburden investigation
3. PP Activity Plan at Tanegashima Space Center (TNSC)

1. MMX PP Request for Outward

Main PP request for MMX outward

1. Mars impact probability < 1×10^{-3} under ISO 8 Cleanroom

(Including Contamination Probability < 1×10^{-3})

Current Status: $9.0 \times 10^{-4} < 1 \times 10^{-3}$

2. Mars impact probability < 1×10^{-4} for rocket upper stage

Current Status: $5.7 \times 10^{-7} < 1 \times 10^{-4}$

3. Cleanliness Control (ISO class 8) Status

- **ISO class 8 or better based on MMX cleanliness control compliance matrix (EMX-244004A)**
- **Currently, cleanliness of MMX flight hardware meets the requirement of ISO class 8 or better.**
- **This is basically verified by facility quality and procedure.**
- **In addition, we obtain bioburden data by carrying out cleanliness tests and bioburden assay tests.**

2. Cleanliness and Bioburden Tests

■ Purpose

- Investigate whether flight hardware environments meet the requirements of ISO class 8 with regard to both cleanliness and bioburden levels.

■ Standard and investigation method for ISO class8

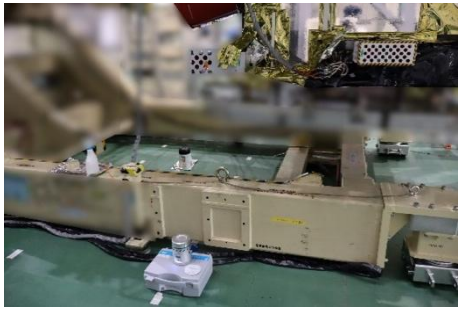
Item	Standard	Method	etc
Airborne microorganisms	88.4 CFU/m3	Air sampling	Active air sampling
Fallen microorganisms	44 CFU/D=8.5cm/4 hours	Setting plate sampling	323,000 CFU/m2/week
Airborne particles	3,520,000 (0.5 μm)	Particle counter	
Surface microorganism density	1.0 CFU/ cm^2	Swab assay Wipe assay	
Long-term fallen microorganisms	323,000 CFU/m2/week	Contamination Coupon	For biodiversity assessment

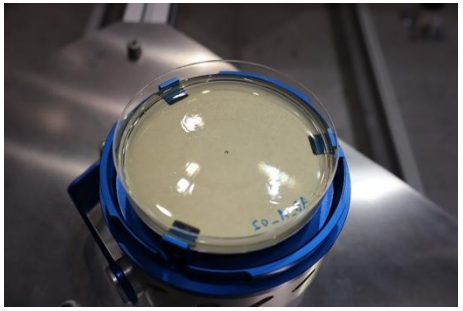
Example of Tests, 1/2

- We have carried out cleanliness and bioburden tests for several flight hardware at several phase
- Test examples are as follows.

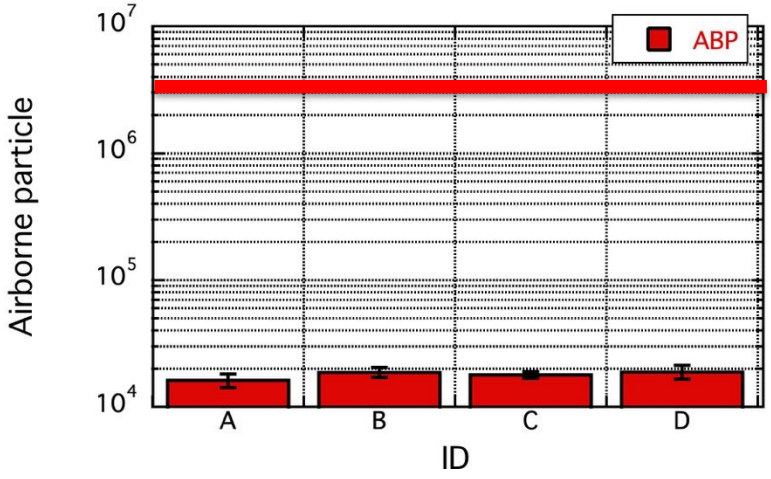
1. MMX system test environments:

Item	Measured	ISO8	Result
Airborne particles (0.5 μm、m^{-3})	18,000	3,520,000	Compliant (ISO 6 class)
Airborne microorganisms (CFU/m^3)	4.6±3.3	88.4	Compliant (ISO 6～7 class)

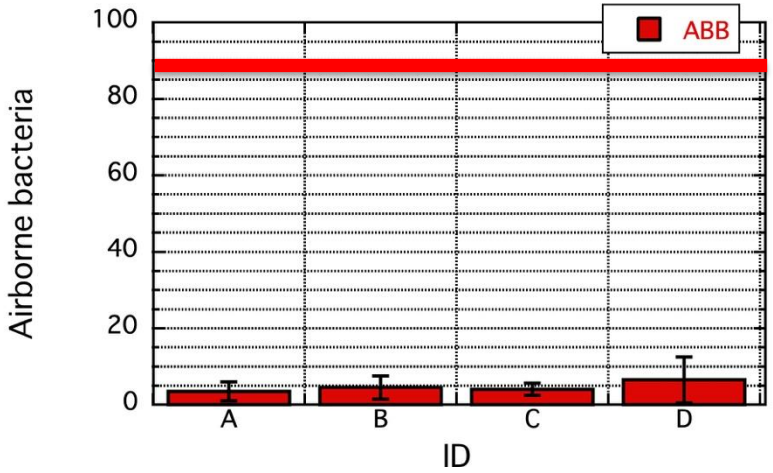




Airborne particles: system test environments



Airborne microorganisms: system test environments



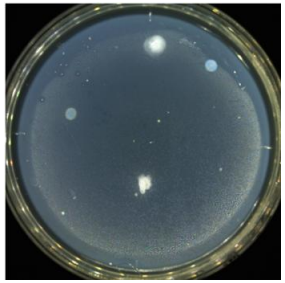
Example of Tests, 2/2

- We have carried out cleanliness and bioburden tests for several flight hardware at several phase
- Test examples are as follows.

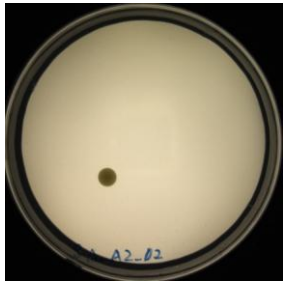
1. MMX system test environments: landing gear etc.

Swab=COPAN FLOQSwab 552C, Wipe= TEXWIPE STX1004

Item	Target	Measured	ISO8	Result
ρ_s (CFU/m^2) [Wipe1]	mesophilic aerobic spores and bacteria	800±400	10,000	compliant (ISO7 class, better)
ρ_s (CFU/m^2) [Wipe2]	aerobic mesophiles	3,300±500	10,000	compliant (ref)
ρ_s (CFU/m^2) [Swab1]	mesophilic aerobic spores and bacteria	600±1,100	10,000	compliant (ISO7 class, better)
ρ_s (CFU/m^2) [Swab2]	aerobic mesophiles	1,100 ± 2,200	10,000	compliant (ref)

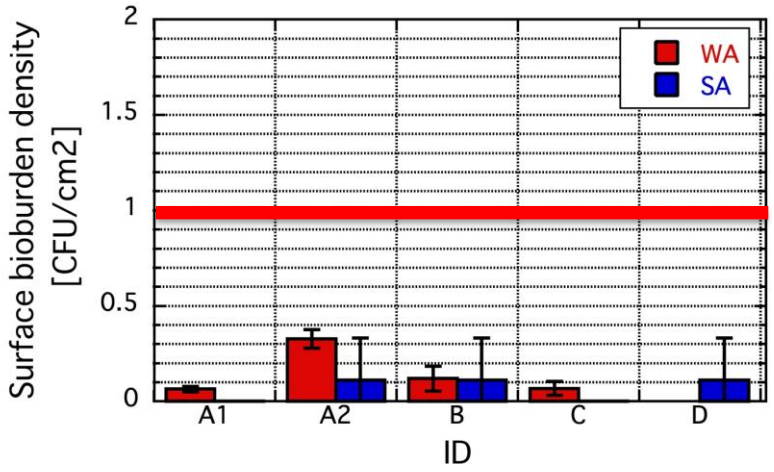


Wipe assay: landing gear



Swab assay: landing gear

Airborne microorganisms: system test environments



Surface bioburden density: system test environments

3. PP Activity Plan at TNSC

- **Here is a risk reduction activity plan at the launch site (Tanegashima Space Center)**
- **STA2: MMX spacecraft assembly and tests**
- **SFA3: Fairing assembly and propellant loading**
- **VAB: Rocket assembly and final access to spacecraft**

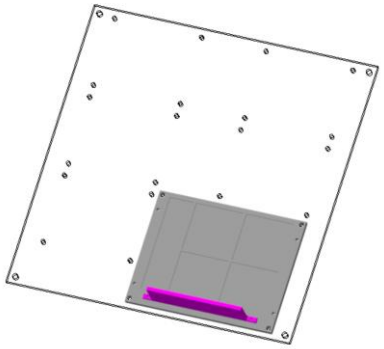


Image of CC plate

Table: Risk reduction activity plan for PP at TNSC

#	Building	Phase	Test Content	Method, etc
1	STA2	MMX test environment 2026, spring-summer	Surface bioburden density Airborne microorganisms	Swab・Wipe assays Airborne tests
2	SFA3	After payload fairing transport 2026, summer	Environment inside H3 fairing	Long-term contamination coupon (CC) setup Airborne tests
3	SFA3	Before propellant loading 2026, summer	Environment of SFA3 before propellant loading	Swab・Wipe assays Airborne tests
4	SFA3	After propellant loading 2026, summer	Environment of SFA3 after propellant loading	Swab・Wipe assays Airborne tests
5	VAB	After fairing transport to VAB(Vehicle Assembly Building) 2026, fall	Environment of VAB after fairing transport	Long-term CC collection