



Current Exercise Operational Support for Japanese astronauts

Hiroshi Ohshima
JAXA

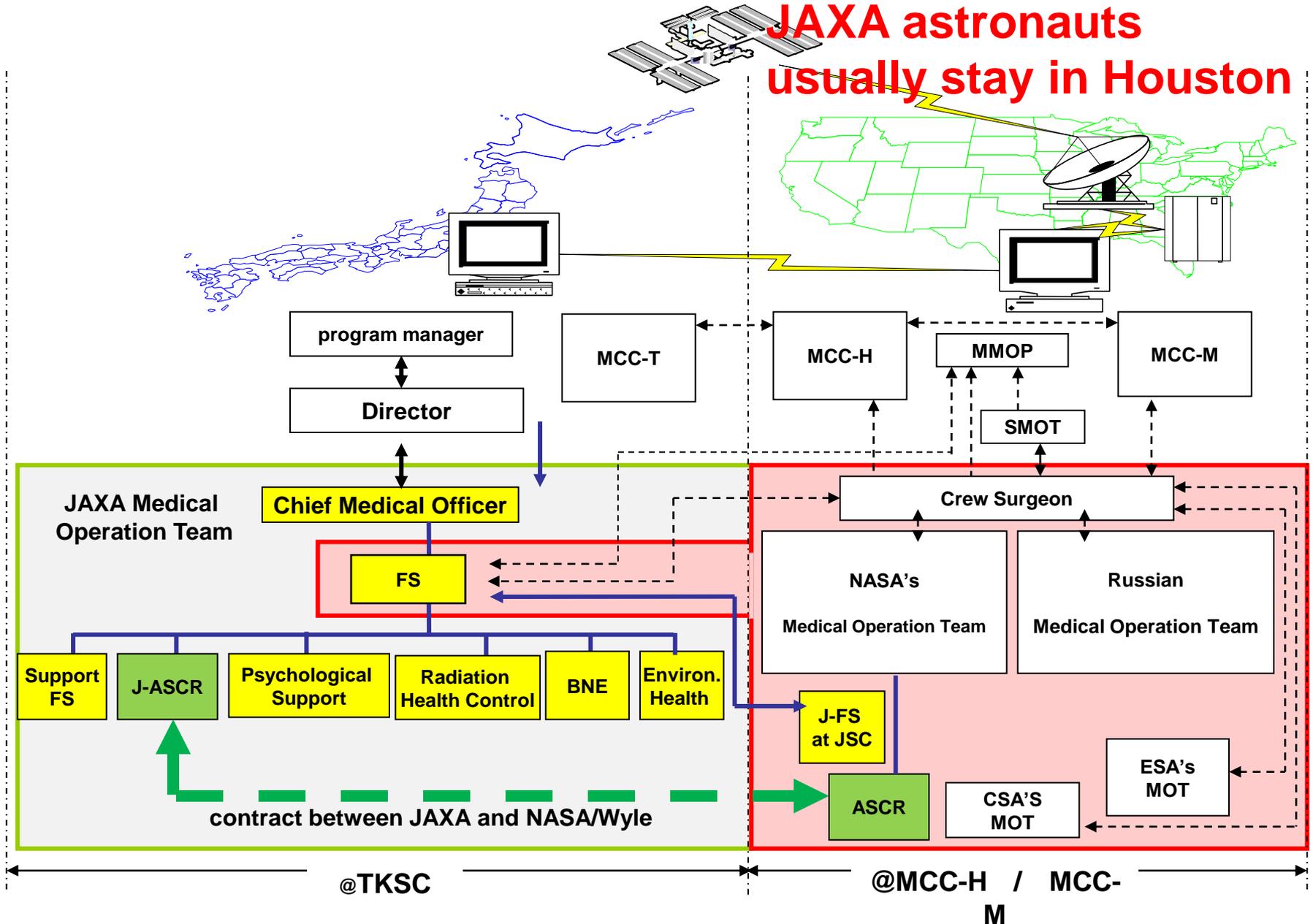


Medical risks for human space flight



	During space flight	After landing
Cardio vascular	Fluid shift	Orthostatic hypotension
Neuro vestibular	Motion sickness	Motion sickness
Muscle	Muscle atrophy Muscle weakness	Sprain Muscle injury
Bone & Calcium	Bone loss Renal stone	Fracture Renal stone

Organization of JAXA Medical Operation



- 1st Japanese station astronaut
- Launch and land by Space shuttle
- Attend R+0 press conference at KSC

- 2nd Japanese station astronaut
- Launch and land by Soyuz
- First R+0 return to Houston



Dream
Pursuit of truth
Thoughtful





きぼう

JEM, H-IIB Rocket, and HTV

JEM

Experiment Logistics Module

Pressurized Section (ELM-PS)

Remote Manipulator System (JEMRMS)

10m Experiment Logistics Module Exposed Section (ELM-ES)

Air Lock

Pressurized Module (PM)

11.2m

Exposed Facility (EF)

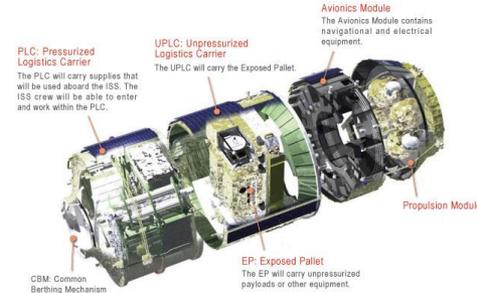
Mission Control Center @ TKSC



H-II Rocket



HTV



Onboard schedule of JAXA astronauts

2009年

2010年

2011年

2012年

2013年



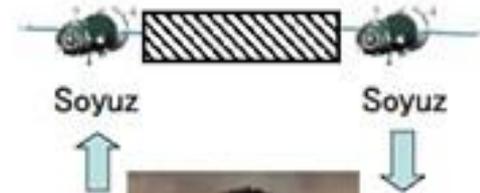
Astronaut Yamazaki



19A

No earlier than March 18, 2010

Six-month stay from early summer 2012



Astronaut Hoshide
32/33 Expedition crew

Six-month stay from Dec. 21, 2009

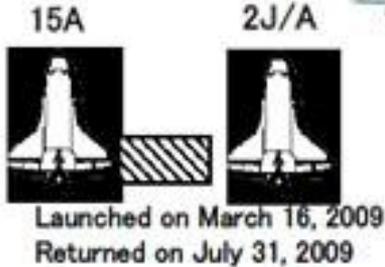


Astronaut Noguchi
22/23 Expedition Crew

Six-month stay from spring 2011



Astronaut Furukawa
28/29 Expedition Crew



Astronaut Wakata
18/19/20 Expedition Crew

Completed

Just Completed

Pre-flight training program

(Targets)

- Built up physical strength for mission success
- Prepare for in-flight training

(Program)

- 2 hours x 3 days/ week
 - (Aerobic and Resistance training)
- shuttle mission : voluntary training
- ISS mission : scheduled training as medical requirement
- For EVA: Add upper limb training
 - (Rock climbing, Hand ergometer)



In-flight training program

(Targets)

- To maintain physical strength, and to prepare walking after landing
- Early Phase : Acclimation to onboard exercise in μ gravity
- Middle P : Maintain physical strength
- Final P : Preparation for Re-ambulation

(Program)

- 6 days a week
- 2.5 hours/ day
- (1) Aerobic (CEVIS or T2)
- (2) Resistance T(ARED)

CEVIS



T2 (or TVIS)



ARED



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CEVIS



**NASA
JAXA**

- **1hour X3 days a week**
- **Program**
 - 1) **Greenleaf's interval training**
 - 2) **PFE protocol**
(25, 50, 75, 25 %Vo2 Max)
 - 3) **Tour De ISS Protocol**
- **Target Strength**
 - 1) **Borg's scale:13**
(somewhat hard)
 - 2) **NTE HR**

T V I S/T2



- 1 hour x 3 days a week
- Target Strength
 - 1) 60-80% HRMax
 - 2) Borg's scale 13
- Axial load by use of harness
(60 ~ 100% BW)

- Vibration Isolation System
- Stabilized by Gyroscope

Resistance Training

- 1.5 hours x 6 days a week
- 3 body M + 3 limb M training a day
- 10RM x 1 ~ 3 sets for
- Avoid Muscle injury
(Not repeat the same RT next day)

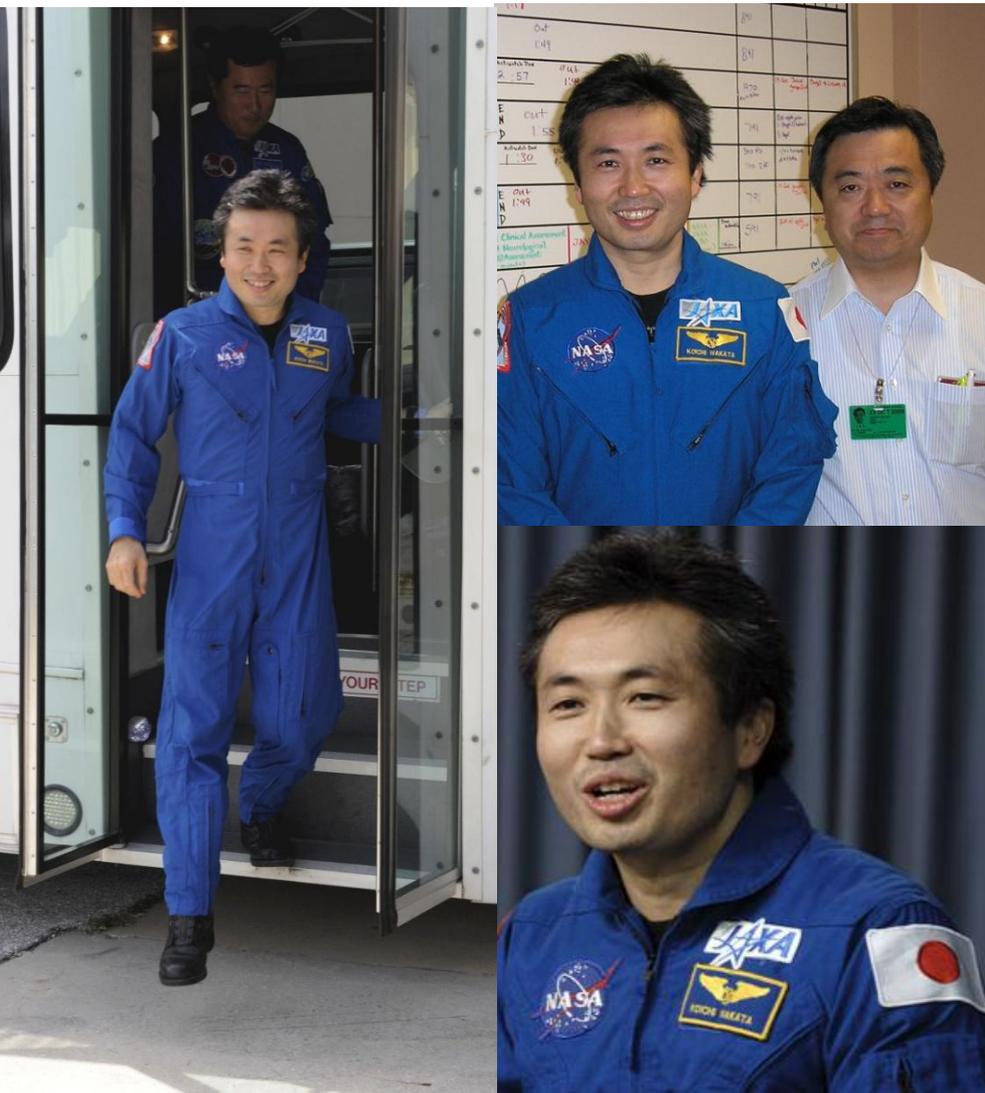
ARED



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Monday Thursday	Tuesday Friday	Wednesday Saturday
Squat	DL	Wide Stance Squat
RDL	SL Squat	Sumo DL
SDL Hi pull	Bench	RDL
Heel Raise	SL Heel Raise	Upright Row
Bent-over row	Shoulder Shrug	Single Arm Row
Shoulder Press	Triceps	Biceps Curl

Landing day after 138 days space flight
1st Japanese station astronaut



Landing day after 161 days space flight
2nd Japanese station astronauts



Post-flight Rehabilitation Program

- 2 hours/ day of protected rehabilitation for 45 days

Phase 0 (Landing day) Symptomatic treatment

- Orthostatic Intolerance
- Vestibular dysfunction

Prevent fall

- Assist walk

RSA
NASA
JAXA

Phase 1 (~ R+7)

Readaptation to gravity

- Aerobic exercise
- Dynamic/ static Stretching
- Walking Exercise, Med Ball Training
- Balance Training, Core Exercise

Phase2 (~ R+14)

Incremental physical conditioning

- Frequent rest
- Aerobic and Resistance training
- Hydrotherapy, massage

Phase (~ R+45)

Obtain pre-flight level of fitness

- Aerobic and Resistance training
- Agility training, Balance training
- Hill running, Hot Spring



Dynamic stretching at the beginning of training

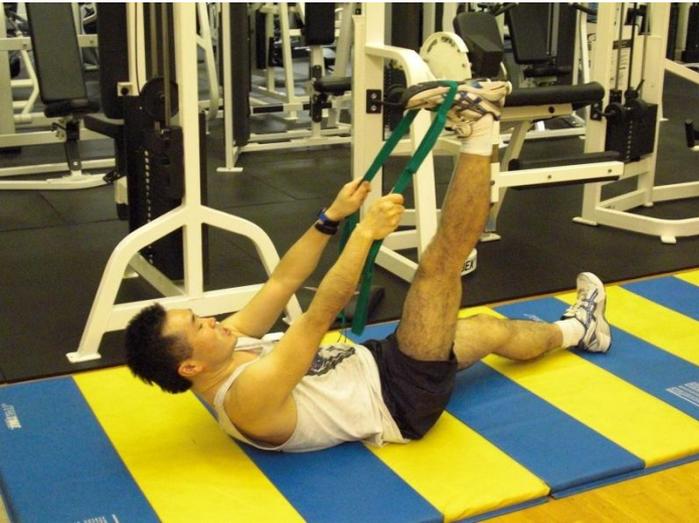


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- warm up
- Reduction of stiffness

Static stretching at the end of training



- Cool down
- Improve ROM

Aerobic training after landing

1. Cycle ergometer (R+1 ~)
2. Ellipse training (R+3/5 ~)
3. Treadmill walking (R+7 ~)
4. Truck running (R+14 ~)
5. Field running (R+21 ~)

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Training with balls

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Core Exercise

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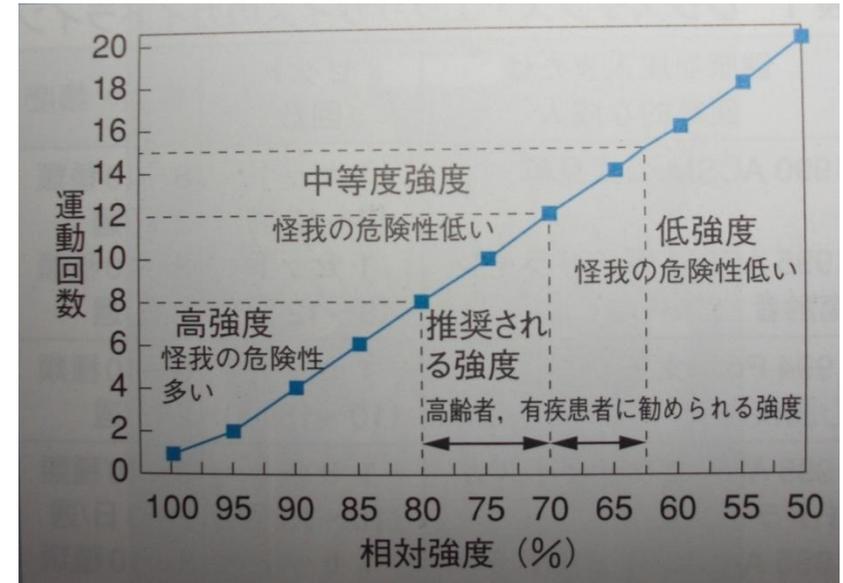


Resistance Training

- 8-12RM x 1-3 sets
- Not to repeat next day



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Walking Exercise



Balance Training



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Acknowledgements

JAXA FS

Tachibana S

Shimada K

Koike Y

Matamoto A

Miki T

J-ASCR

Kawashima S

Training Advisor

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NASA

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