

R/V Mirai MR11-07 Cruise for CINDY2011

Operational Plan

August 18, 2011

JAMSTEC

Research Institute for Global Change (RIGC)

Tropical Climate Variability Research Program (TCVRP)

&

Marine Technology and Engineering Center (MARITEC)

Research Fleet Department (RFD)

1. Purpose

The aim of the cruise is to collect in-situ atmospheric and oceanic data to advance our knowledge on the initiation mechanism of the Madden-Julian Oscillation (MJO), which is the dominant intraseasonal mode in the tropics. The MJO is an eastward propagating disturbance, occurring primarily over the central equatorial Indian Ocean, and is known as a phenomenon, which has a great impact onto the climate of not only the tropics but also higher latitudes through the interaction with El Niño, monsoon, tropical cyclone, and so on. Although previous studies have revealed the various aspects of the MJO, so far there is no definitive explanation on the onset of the MJO convection over the Indian Ocean and associated upper-ocean variability. This cruise is designed to improve our knowledge on the initiation processes by providing in-situ data.

It should be noted that this cruise will be conducted as a part of an international field experiment CINDY2011 (Cooperative Indian Ocean experiment on intraseasonal variability in the Year 2011). CINDY2011 and its US component DYNAMO (Dynamics of the MJO) project are officially endorsed by the World Climate Research Programme (WCRP) / Climate Variability and Predictability Project (CLIVAR).

During this cruise, the following 13 themes, which were selected through the public selection process, will also be carried out in addition to the main JAMSTEC mission.

- (1) Observational and modeling analyses of the effects of multi-scale moisture variability on the organization of meso-scale convective systems.
(PI: Tetsuya Takemi / Kyoto University)
- (2) Validation of daily simulation results using a cloud-resolving model over the tropical Indian Ocean.
(PI: Taroh Shinoda / Nagoya University)
- (3) On-board continuous air-sea flux measurement.
(PI: Osamu Tsukamoto / Okayama University)
- (4) Videosonde observation of microphysical structure in precipitating clouds associated with MJO-convection.
(PI: Kenji Suzuki / Yamaguchi University)
- (5) Observation study on ozone and water vapor variability in the tropical tropopause layer.
(PI: Masatomo Fujiwara / Hokkaido University)
- (6) Distribution and configuration of clouds in various Oceans.
(PI: Toshiaki Takano / Chiba University)
- (7) Lidar observations of optical characteristics and vertical distribution of aerosols and clouds.
(PI: Nobuo Sugimoto / National Institute for Environmental Studies)
- (8) Maritime aerosol optical properties from measurements of ship-borne sky radiometer.
(PI: Kazuma Aoki / Toyama University)
- (9) Tropospheric aerosol and gas observations on a research vessel by MAX-DOAS.
(PI: Hisahiro Takashima / JAMSTEC)
- (10) Water sampling for building water isotopologue map over the Ocean.
(PI: Naoyuki Kurita / JAMSTEC)
- (11) Study of ocean circulation and heat and freshwater transport and their variability in the Pacific and Indian Oceans, and experimental comprehensive study of physical-chemical-biological processes in the western North Pacific by the deployment of Argo floats and using Argo data.
(PI: Toshio Suga / JAMSTEC and Tohoku University)

(12) Distribution and ecology of oceanic Halobates inhabiting tropical area of Indian Ocean and their responding system to several environmental factors.

(PI: Tetsuo Harada / Kochi University)

(13) Standardising the marine geophysics data and its application to the ocean floor geodynamics studies.

(PI: Takeshi Matsumoto / University of the Ryukyus)

2. Period (Appendix-1)

Leg-1 : September 23 (Friday), 2011 - October 27 (Thursday), 2011

Leg-2 : October 28 (Friday), 2011 - December 2 (Friday), 2011

3. Ship to be used

(1) Name : R/V MIRAI

(2) Communication system : Phone : +81-90-302-2-5636 (only available when Mirai cruises near Japan)

FAX : +81-90-302-3-5636 (ditto)

Inmarsat telephone : +870-343193916

Inmarsat FAX : +870-343193941

E-mail : mirai.mirai@jamstecfb.com

4. Main Observation Area (Appendix-2)

Tropical central Indian Ocean

5. Ports of call

Leg-1 Singapore, Colombo/Sri Lanka

Leg-2 Colombo/Sri Lanka

6. Organization (Appendix-3)

- (1) Head of the Cruise
- (2) Advisor for Safety
- (3) Chief Scientist
- (4) On-board scientists
- (5) Senior Technical Staff
- (6) Technical Staff
- (7) R/V MIRAI Captain and ship crew

7. Observations

(1) Precipitation

a. C-band (5.3 GHz) scanning Doppler radar observation

* Volume scan: 10 min interval, 21 elevations (0.5, 1.0, 1.8, 2.6, 3.4, 4.2, 5.0, 5.8, 6.7, 7.7, 8.9, 10.3, 12.3, 14.5, 17.1, 20.0, 23.3, 27.0, 31.0, 25.4, 40.0 degrees)

Surveillance scan: every 30 min

RHI: occasionally

b. Disdrometer measurement

- (2) Upper air sounding
 - a. GPS radiosonde (Vaisala RS92-SGPD, DigiCORA MW 31, Ver. 3.64.1) every 3 hours during both legs
 - b. CFH water vapor radiosonde (with ozone-sonde) during both legs (total 20 times)
 - c. Videosonde measurements during Leg-2 (15 times)
- (3) Clouds and aerosol measurements
 - a. Ceilometer (Vaisala CT-25K, sampling interval = 60 sec)
 - b. Vertical pointing 2-wavelengths (532, 1064 nm) Mie-scattering LIDAR (sampling interval = 10 sec)
 - c. Vertical pointing High Spectral Resolution LIDAR
 - d. Vertical pointing 95GHz FM-CW Cloud Radar
 - e. Infrared radiometer (measurement of cloud base temperature)
 - f. Sky radiometer (aerosol optical thickness at 400, 500, 675, 870, and 1020 nm; Ångström exponent, etc.)
 - g. Multi-axis differential optical absorption spectroscopy (MAX-DOAS)
- (4) Surface Meteorology
 - a. Surface meteorological station (P, T, Td, wind speed/direction, short/long wave radiation, Rain, SST)
 - b. SOAR (Shipboard Oceanic and Atmospheric Radiation) measurement
(PSR, PIR, Fast-Rotating Shadowband Radiometer)
 - c. GPS-derived water vapor amount
 - d. Sea surface temperature measurement by three different methods; in-take (5 m depth), Sea-snake floating thermistor (2-3 cm below the surface), and ISAR (Infrared Sea temperature Autonomous Radiometer) for skin temperature.
 - e. Surface turbulent flux measurement using eddy correlation method
- (5) Isotope
 - a. Rain and water vapor sampling for measurement of stable water isotope
- (6) Argo floats measurement
 - a. An argo float will be deployed with setting of 500 m parking depth and ascent once per day.
- (7) Ocean current
 - a. Shipboard Acoustic Doppler Current Profiler
- (8) CTD/LADCP/Water sampling
 - a. CTD with DO sensor and LADCP (Lowered ADCP)
 - * It will be casted to 500 m depth every 3 hours during the stationary observation.
Once per day it will be done to 1,000 m depth.
 - b. Water sampling (36 bottles are attached to CTD)
 - * It will be carried out every 6 hours for biogeochemical analyses of salinity, dissolved oxygen, chlorophyll-a, and nutrients.
- (9) Ocean surface measurements
 - a. Ocean surface monitoring (SST, salinity, dissolved oxygen, and fluorescence)
- (10) Ocean surface micro-structure profiles
 - a. Micro-structure profiler (JFE Advantec Co., TurboMAP-L).
 - * It will be casted at least every 3 hours just after CTD/LADCP measurement. Cast numbers will be increased to 48 times/day (at least for several days) depending on the meteorological and sea conditions.

- (11) Moorings
 - a. Sub-surface ADCP mooring with PAL (Passive Acoustic Listener)
 - * It will be deployed at 5S, 78.1E just before the start of stationary observation in Leg-1, and will be recovered after the end of stationary observation in Leg-2.
 - b. In emergency case, we may recover the DYNAMO buoy, which will be deployed at 8S, 78.5E, by US R/V Revelle.
- (12) Satellite
 - a. NOAA/AVHRR
- (13) Halobates (Sea-skater) sampling
 - a. Halobates will be sampled once (45 min) per day at night using Neuston net (6 m long, 1.3 m diameter).
- (14) Underway geophysics
 - a. Sea surface gravity (LaCoste & Romberg air-sea gravity meter S-116)
 - b. Sea surface 3-components magnetometer (Tierra Tecnica SFG1214)
 - c. Multi-narrow beam echo sounder for bathymetry (SEABEAM 2112)

8. Others

- (1) Safety guidance
 - a. Follow the “Safety Guidance” of JAMSTEC when on-board.
 - b. Follow the “Act on Preventing Collisions at Sea”
 - c. Be aware of ship around
 - d. In case of emergency, follow the instructions described in “JAMSTEC Guidelines for Emergency Response to Accidents and Troubles”. (Appendix-4)
 - e. Follow the operation manual for each observation.
 - f. It is prohibited to enter the designated areas (around the radar radome, top deck of rear operation room, and roof of radiosonde container) during the Doppler radar operation.
 - g. Adequate working time should be assigned to each person, especially in conducting 24 hours continuous observations.
 - h. JAMSTEC researchers should instruct non-JAMSTEC researchers to conduct enough preparation and maintenance for their hand carry instruments.
 - i. Measures should be paid against piracy problem.
- (2) Licenses / Approvals
 - a. Necessary permissions based on “Foreign Exchange and Foreign Trade Act” have been obtained.
 - b. It is no need to arrange for “Fishery Adjustment” for this cruise.
 - c. Marine Technology and Engineering Center should request a worldwide navigational warning to Japan Marine Safety Agency.
 - d. Necessary information for NOTAM (Notice to Airmen) in conducting radiosonde sounding should be sent to the authority of relevant FIR (Flight Information Region).

Schedule

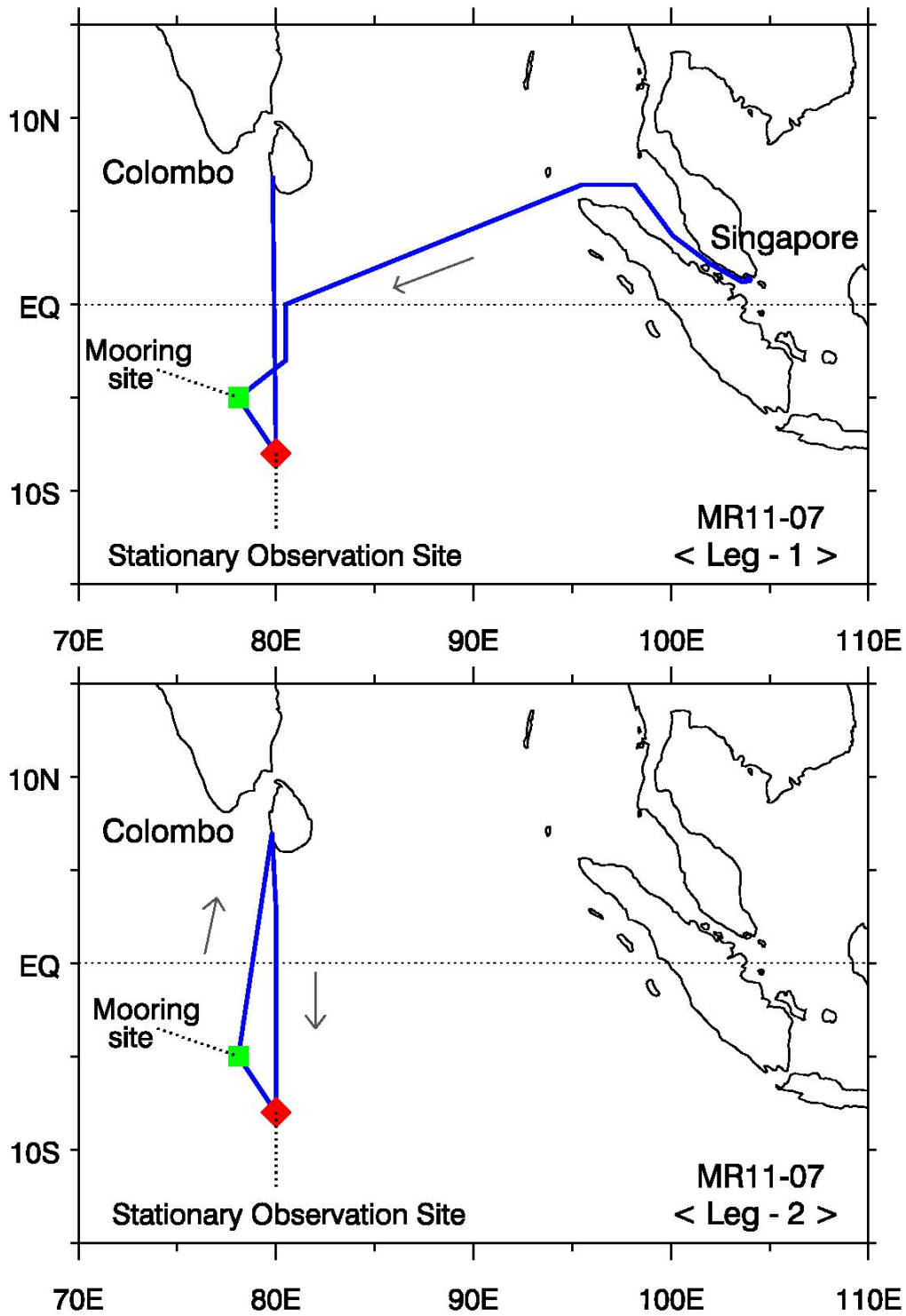
Year 2011

Sep. 22 (Thu)	Leg-1 participants embark
Sep. 23 (Fri)	Depart Singapore (start of Leg-1)
Sep. 24 (Sat)	Cruising without any observation in Malacca Strait
Sep. 25 (Sun)	Observations will start after Mirai enters Indian Ocean
Sep. 28 (Wed)	Start radiosonde observations (every 3 hours)
Sep. 29 (Thu)	Deploy sub-surface ADCP mooring at 5S, 78.1E
Sep. 30 (Fri)	Arrive at the stationary observation site 8S, 80E
Oct. 1 (Sat)	Start of CINDY2011 Intensive Observations
Oct. 25 (Wed)	Leave 8S, 80E
Oct. 27 (Thu)	Arrive at Colombo (end of Leg-1) Leg-1 participants disembark, and Leg-2 participants embark.
Oct. 28 (Fri)	Depart Colombo (start of Leg-2)
Nov. 1 (Tue)	Restart stationary observation at 8S, 80E
Nov. 28 (Mon)	End of stationary observation and leave 8S, 80E
Dec. 1 (Thu)	End of all observations
Dec. 2 (Fri)	Arrive at Colombo (end of Leg-2) Leg-2 participants disembark.

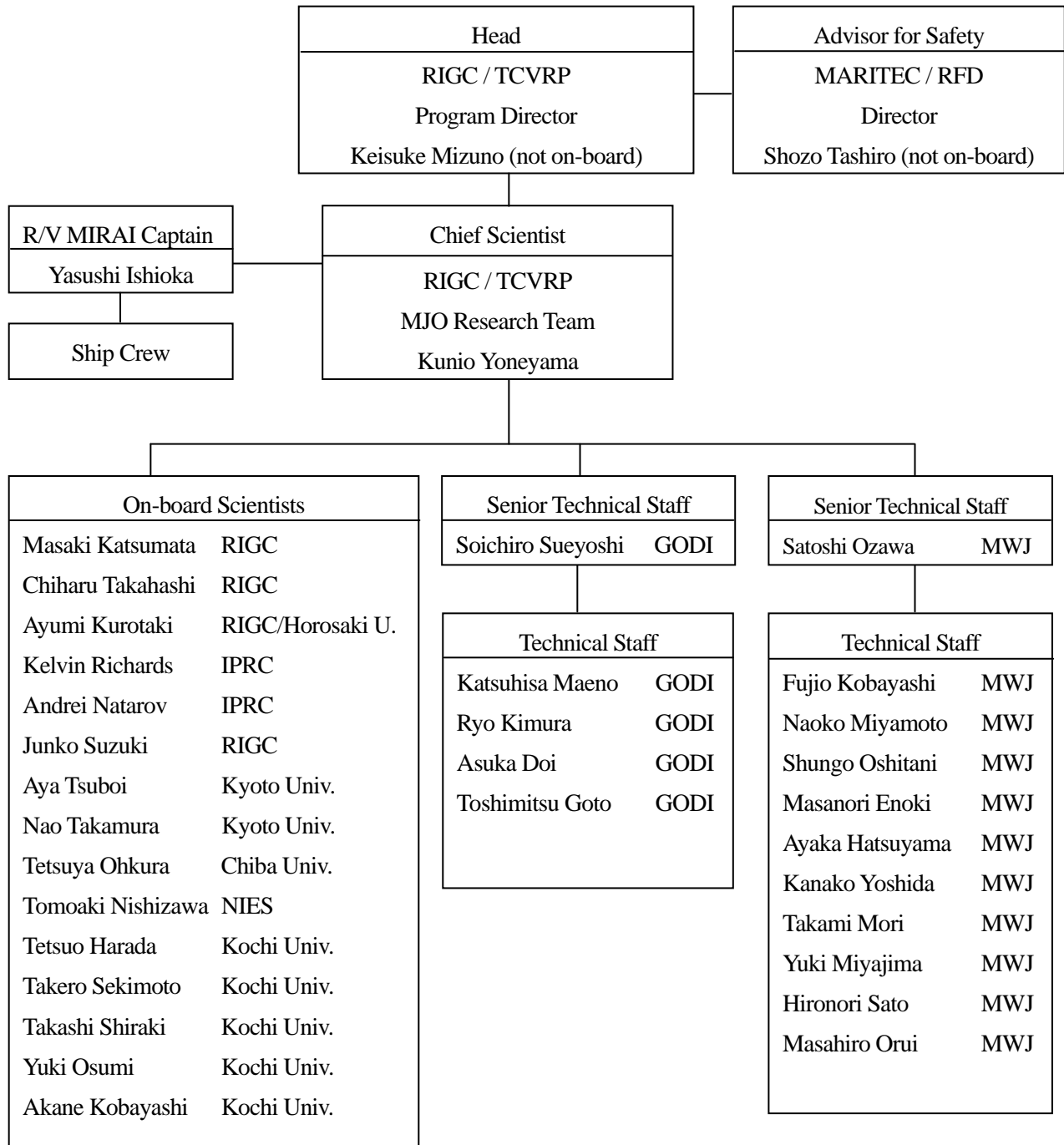
Remarks.

Those dates and locations are subject to change due to various reasons such as sea conditions.

Planned Cruise Track

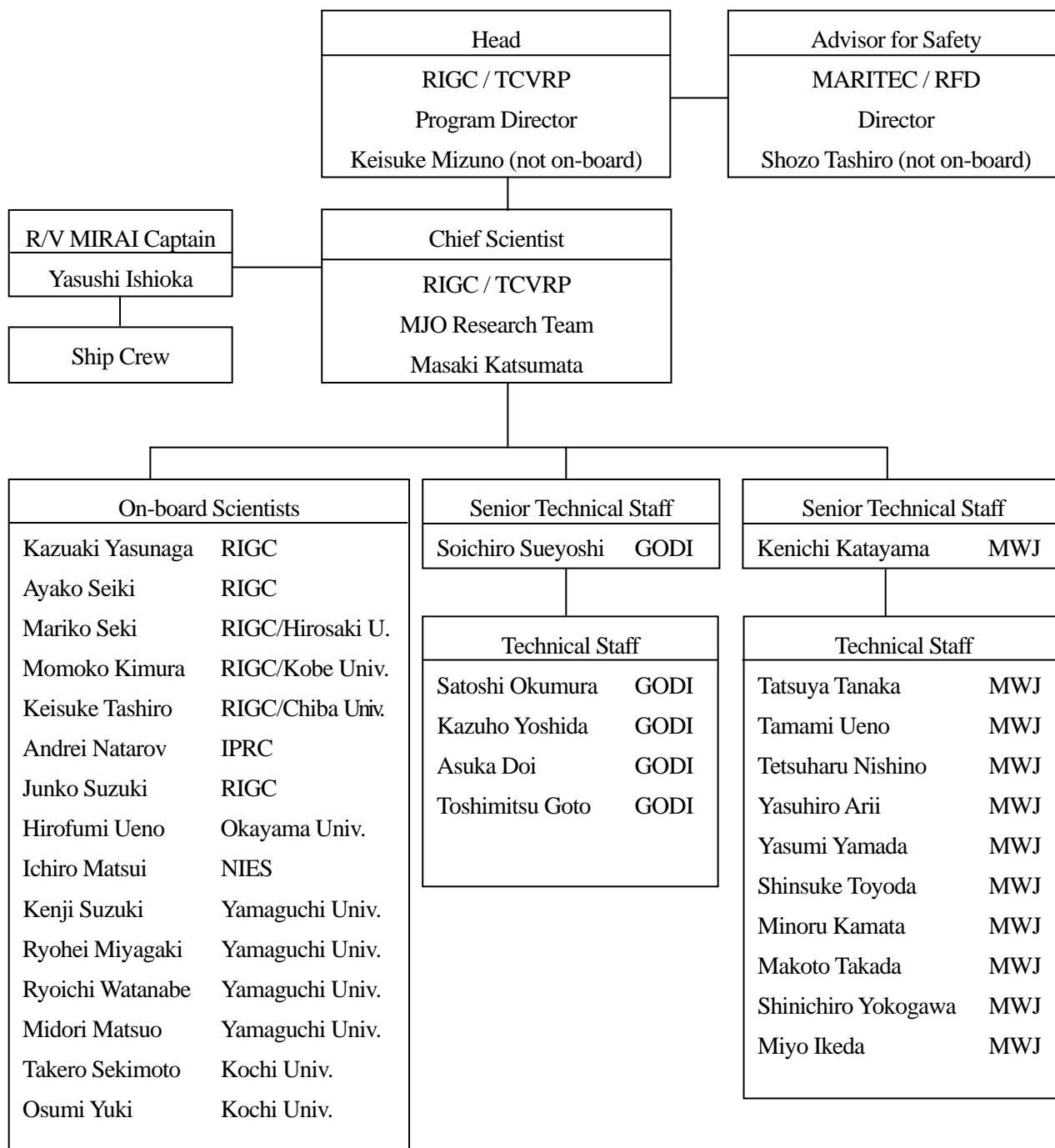


Organization Chart for Leg-1



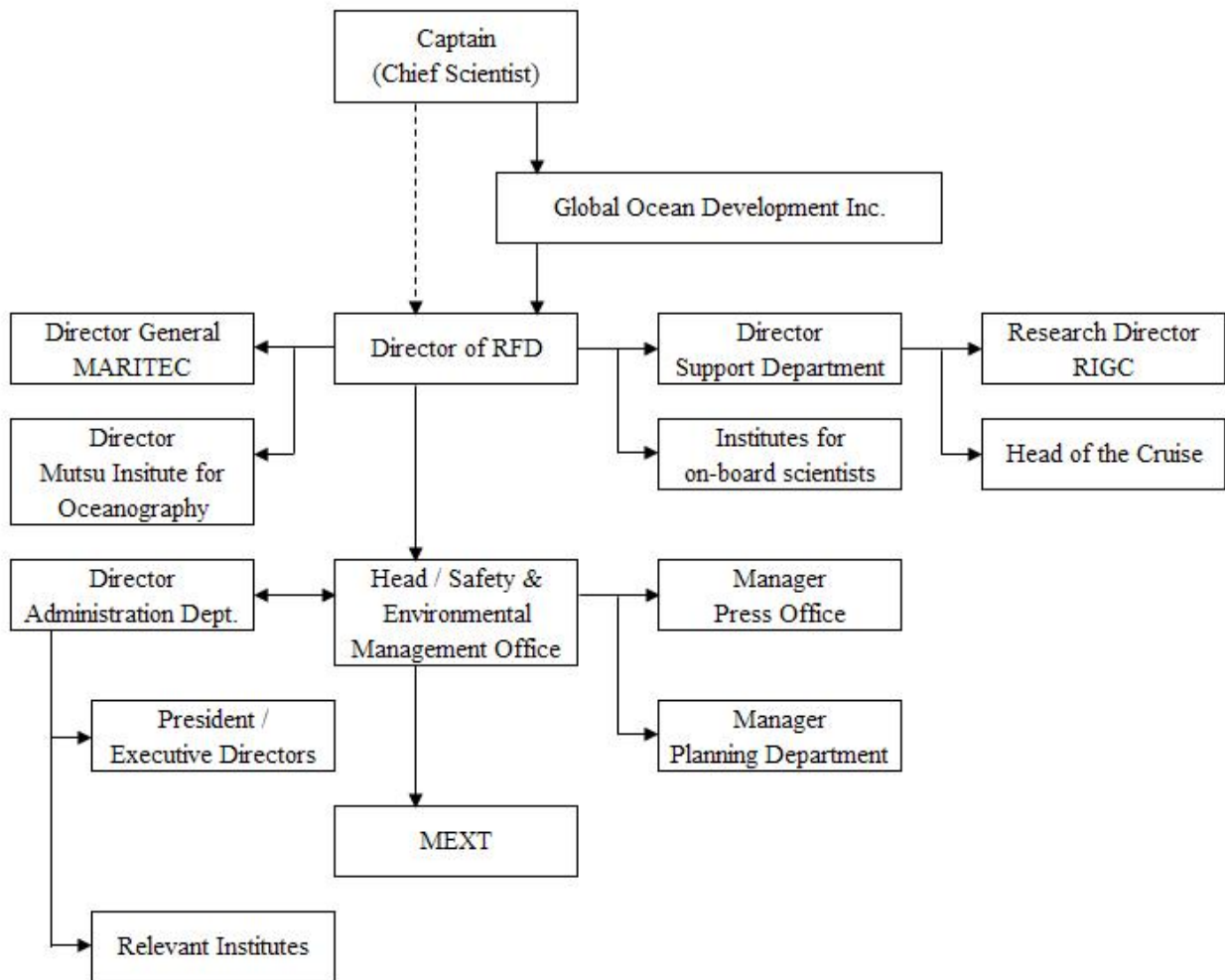
- RIGC: Research Institute for Global Change / JAMSTEC
- MWJ: Marine Works Japan, Co. Ltd.
- GODI: Global Ocean Development Inc.
- IPRC: International Pacific Research Center
- NIES: National Institute for Environmental Studies

Organization Chart for Leg-2



RIGC: Research Institute for Global Change
 MWJ: Marine Works Japan, Co. Ltd.
 GODI: Global Ocean Development Inc.
 IPRC: International Pacific Research Center

Phone Network in case of emergency



* Phone directory will be provided to relevant personnel.