

GNSS Education Activities at The University of Tokyo

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Center for Spatial Information Science, The University of Tokyo

Fifteenth Meeting of the International Committee on Global Navigation Satellite Systems (ICG)

Meeting of the Working Group C on Information Dissemination and Capacity Building

27 September - 2 October 2021, Vienna, Austria

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Overview

- Conduct GNSS Trainings, Workshops and Seminars
 - Basically in Asian countries
 - Indonesia, India, Laos, Malaysia, Myanmar, Nepal, Thailand, The Philippines, Singapore, Vietnam
 - Also, Some African Countries
 - Mozambique, Rwanda, Egypt
- Conduct Webinars
 - Conduct webinars under MGA (Multi-GNSS Asia)
- Conduct Joint Research and Pilot Projects
 - Low-Cost High-Accuracy GNSS Systems
 - Traffic Monitoring
 - Urban City Environment Monitoring
 - Illegal Fishing Monitoring
 - Any GNSS-based Application of your interest
- Installation of GNSS CORS
 - Install GNSS CORS in the Universities around the world for joint research, GNSS technology promotion and capacity building
- RPD (Rapid Prototype Development) Challenge during MGA (Multi-GNSS Asia)
 - Encourage students and researchers to bring solutions and business values by solving real-life problems
 - The 3rd RPD Challenge was held from AUG 2020 and extended to June 2021 due to COVID.
 - The 4th RPD Challenge will be held from OCT 2021 to MAR 2022.
- Develop Low-Cost High-Accuracy Receiver Systems for RTK and MADOCA-PPP
 - RTKDROID: RTK in Android
 - MADROID: MADOCA-PPP in Android
 - MAD-WIN: MADOCA-PPP in Windows
 - MAD-PI: MADOCA-PPP in RaspberryPi Device

Training on GNSS, Jointly Organized by UTokyo and ICG

Past Training in JAN 2021

Csis
The University of Tokyo

GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems
Online training program jointly organized by
Center for Spatial Information Science (CSIS) and International Committee on GNSS (ICG)
Date: 19 – 21 JANUARY 2021

This training program focuses on hands-on practices. After the training, the participants will be able to process GNSS Data for high-accuracy

- Use RTK and MADOCA PPP software to process GNSS data
- Use Low-Cost Receiver system data

Other Highlights:

- Learning and using RTKLIB, RTKDRDROID, MADROID and MAD-WIN software
- Understanding GNSS data types, GNSS errors, coordinate systems and applications
- Use of Android devices to log GNSS data for high-accuracy

Training Application Link:
[GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems \(office.com\)](https://www.unoosa.org/oosa/en/ourwork/icg/activities/2020/ai2020-gnss.html)

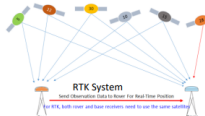

Application Deadline: 5th JANUARY 2021

Prerequisites: Knowledge of basic GNSS. If GNSS is new for you, please visit our past webinars and training materials and videos at:
2018: <https://home.csis.u-tokyo.ac.jp/~dinesh/WEBINAR.htm>
2019: <https://www.unoosa.org/oosa/en/ourwork/icg/activities/2019/ai2019-gnss.html>
2020: <https://www.unoosa.org/oosa/en/ourwork/icg/activities/2020/ai2020-gnss.html>
Number of participants will be limited to 250 persons.
The training will be conducted **online** from 06:00 – 11:00 UTC
CSIS and ICG reserve all rights for the selection of participants.


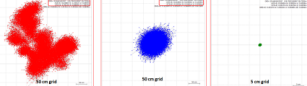
ICG International Committee on Global Navigation Satellite Systems

Training Schedule

- Day 1: 19 JANUARY
 - Lectures: GNSS Introduction and Applications
 - GNSS Accuracy, Errors, Coordinate Systems
 - Sample Data, Data Processing Software
- Day 2: 20 JANUARY
 - GNSS Data Logging and Processing for RTK and MADOCA-PPP
 - Software: RTKLIB, RTKDRDROID, MADROID, MAD-WIN
- Day 3: 21 JANUARY
 - GNSS Data Processing by the Participants
 - Presentation of Data Analysis Results and Reports

How to get centimeter level accuracy?

Csis
The University of Tokyo

GNSS for Policy and Decision Makers
Online workshop jointly organized by
Center for Spatial Information Science (CSIS) and International Committee on GNSS (ICG)
Date: 28 JANUARY 2021

This workshop is designed to provide the following information:

- General introduction of GNSS
- GNSS Applications and Its importance
- GNSS Accuracy, Errors, Coordinate Systems
- Required hardware and software for GNSS
 - Focusing standard and high-accuracy data processing
- Interpretation of GNSS specifications
- Low-Cost GNSS receiver systems
- Receiver selection guidelines

Reference to our past activities:
2018: <https://www.unoosa.org/oosa/en/ourwork/icg/activities/2018/ai2018-gnss.html>
2019: <https://www.unoosa.org/oosa/en/ourwork/icg/activities/2019/ai2019-gnss.html>
2020: <https://www.unoosa.org/oosa/en/ourwork/icg/activities/2020/ai2020-gnss.html>
<https://home.csis.u-tokyo.ac.jp/~dinesh/WEBINAR.htm>

ICG International Committee on Global Navigation Satellite Systems



Target Participants: People at policy and decision making level or who would like to pursue GNSS as a part of their career with working experiences

Training Application Link:
[Global Navigation Satellite Systems \(GNSS\) for Policy and Decision Makers \(office.com\)](https://www.unoosa.org/oosa/en/ourwork/icg/activities/2021/ai2021-gnss.html)

Application Deadline: 15 JANUARY 2021

Prerequisites: None
Please refer our past webinars and training materials for reference.
Number of participants will be limited to 250 persons
The training will be conducted **online** from 06:00 – 11:00 UTC

Sample GNSS data logged by base-stations, field receivers (both static and dynamic), GNSS data from Android devices etc. will be provided to explore data quality, accuracy and problems.
Hands-on exercise with GNSS data using Google Earth and u-center software.

ICG Programme on GNSS Applications

Upcoming activities carried out in the framework of the ICG Workplan

(Online) The International Space Weather Initiative Workshop on Space Weather: Science and Applications, 2 - 3 November 2021, jointly organized by the United Nations Office for Outer Space Affairs and the Vikram Sarabhai Space Centre of the Indian Space Research Organization, India

Announcement

Registration (Deadline: Sunday, 17 October 2021)

Event website

Past activities

▼ 2021: Activities carried out in the framework of the ICG workplan

(Online) Eastern Africa Global Navigation Satellite Systems and Space Weather Capacity Building Workshop, 21 - 25 June 2021, Kilifi, Kenya

Website (External Link): <http://indico.ictp.it/event/9621/>

Announcement (External Link): <http://indico.ictp.it/event/9621/material/poster/0.pdf>

(Online) Workshop on Global Navigation Satellite Systems, jointly organized by the Centre for Spatial Information Science (CSIS), the University of Tokyo, Japan and the International Committee on Global Navigation Satellite Systems (ICG)

GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems, 19 - 21 January 2021

Presentations

Programme

Information Note

GNSS for Policy and Decision Makers, 28 January 2021

Presentations

Programme

Information Note

Recordings of the sessions (External Website)

Resources (External Website)

Our Work

Secretariat of COPUOS

Programme on Space Applications

UN-SPIDER

International Committee on GNSS

Overview

Members

ICG Terms of Reference

Providers' Forum

Working Groups

ICG Annual Meetings

ICG Programme on GNSS

Applications

Workshops

Resources

ICG Documents

Other Events

ICG Timeline

UN-Space

UNISPACE+50

Space Law

Benefits of Space

Space4Health

Access to Space for All

Space for Persons with Disabilities

Space4Youth

Space4Water

Space4Women

World Space Forum

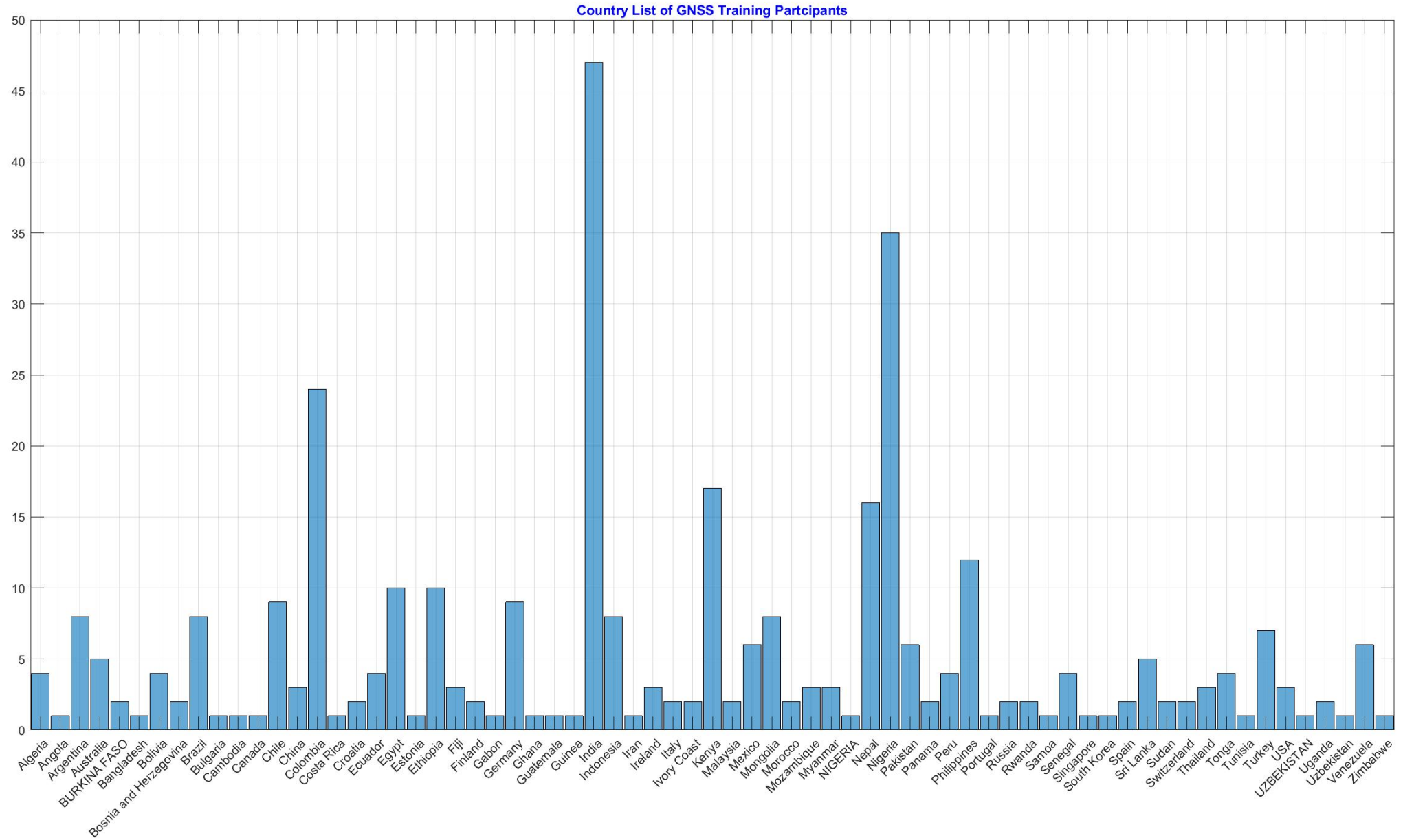
Worldwide Space Agencies

Capacity Building Activities

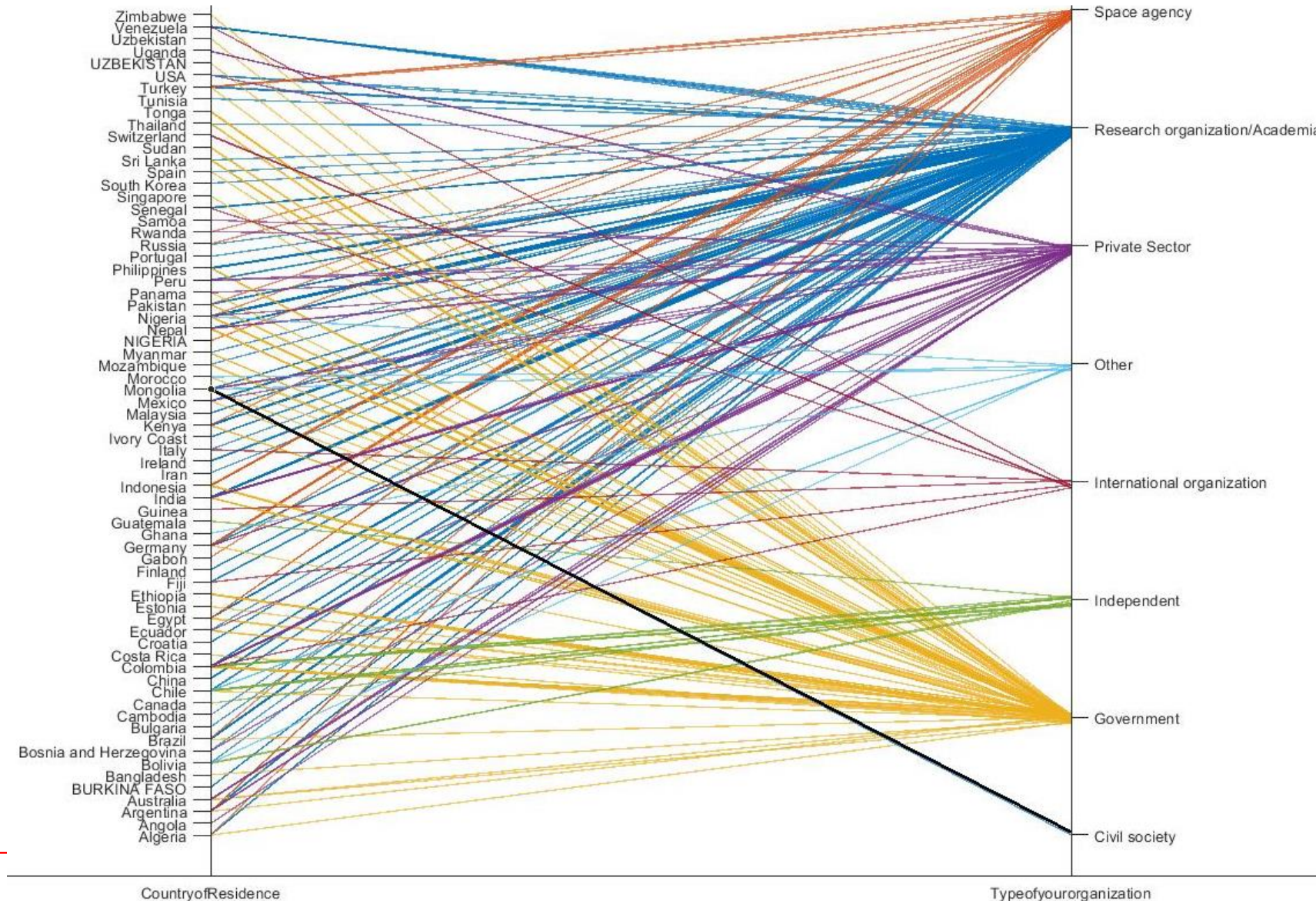
Summary of GNSS Trainings: Jointly Organized by CSIS and ICG/UNOOSA
 Course A: GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems, 19 – 21 JAN
 Course B: GNSS for Policy and Decision Makers, 28 JAN 2021

Number of Participants	Online GNSS Training Course A: 19 – 21 Jan 2021 Course B: 28 Jan 2021		Past GNSS Trainings held at AIT, Thailand		
			JAN 2020	JAN 2019	JAN 2018
	Course A	Course B	T-151	T-151/T-131	T-141
(A) ICG Funded International (travel only)	NA	NA	19	23	14
(B) Other Funding (travel only)	NA	NA	X	4 ^E	X
(C) Self Funded International	NA	NA	34	40	11
(D) Self-Funded Thailand	NA	NA	18	27	42 (24 + 18)
Total (A + B + C + D)	270	160	71	94	67
Number of Applicants	360	190	160+	180+	80+
Number of Resource Persons	15	6	16 7 (Int) + 9 (GIC)	20 11 (Int) + 9 (GIC)	13 7 (Int) + 6 (GIC)
Number of Countries	70+	60+	15	15	15
Resource Persons' Countries	4	3	4	7	4

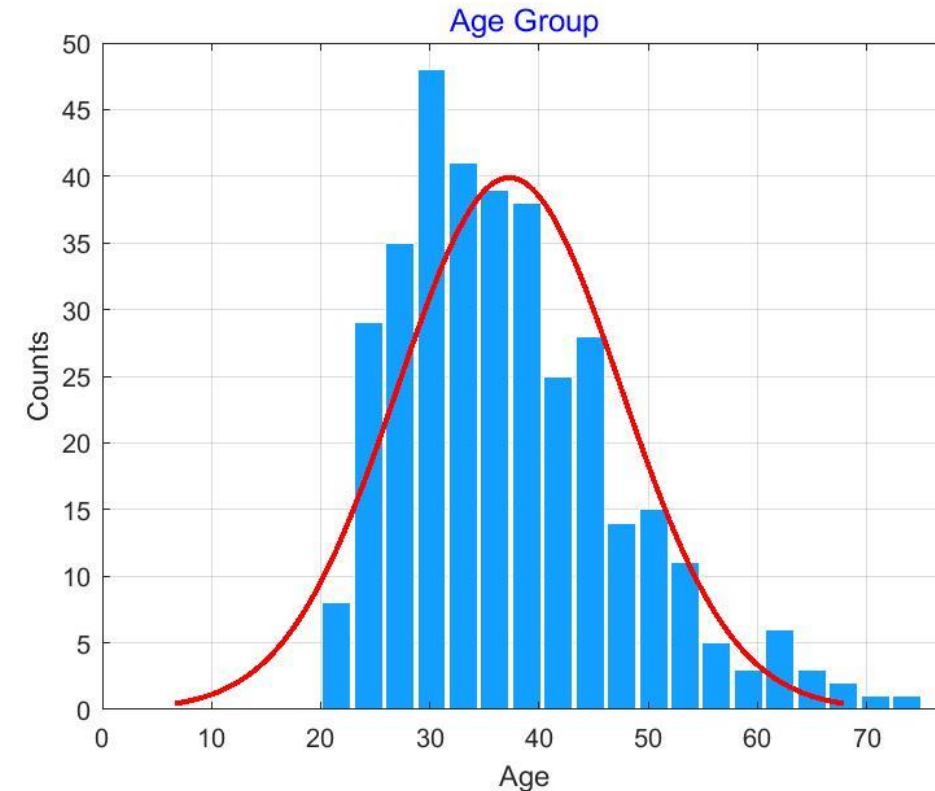
Course A: List of Countries: 70 / No of Selected Participants: 260



Training Participants (2021): List of Countries and Organization Types



Training Participants (2021): Country Text Map and Participants' Age Group



Bigger font → Higher number of participants

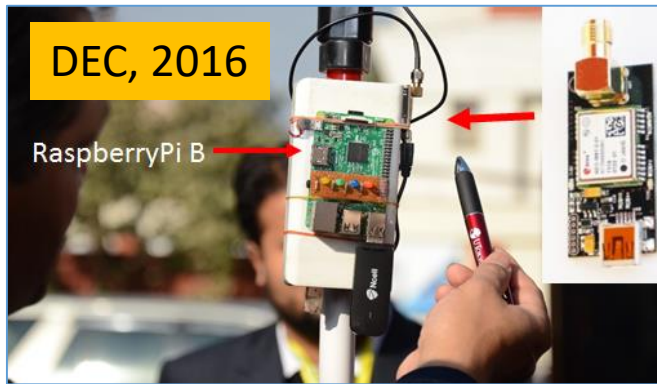
ICG / UTOKYO GNSS Training 2022 (Hybrid Format)

- Program – 1 : GNSS Training
- Program – 2 : Workshop on GNSS for Policy and Decision Makers
- Dates
 - Program 1: 11 – 14 January 2022
 - Program 2: 21 January 2022
- Venue
 - Onsite : Tribhuvan University, Pokhara, Nepal (depends on COVID situation)
 - Online
- Funding
 - Limited travel funding is available for eligible participants to attend on-site training program
 - Depends on COVID situation
- Notice will be announced soon. Please check ICG's homepage.

Installation of Base-Stations in Universities for Capacity Building

Country	Place	University	Receiver Type
Indonesia	Jakarta	University of Indonesia	GNSS + MADOCA
Japan	Tokyo-A	The University of Tokyo	GNSS + MADOCA
Japan	Tokyo-B	Tokyo University of Marine Science & Tech.	GNSS + MADOCA
Japan	Tokyo-C	KEIO University	GNSS
Laos	Vientiane	National University of Laos	GNSS
Malaysia	Kuala Lumpur	Malaysia Japan International Institute of Tech.	GNSS + MADOCA
Myanmar	Yangon	Yangon Technological University	GNSS
Thailand	Bangkok	Chulalongkorn University	GNSS + MADOCA
Thailand	Pathumthani	Asian Institute of Technology	GNSS
Thailand	Bangkok	Kasetsart University	GNSS
Thailand	Khon Kaen	Khon Kaen University	GNSS
Philippines	Manila	University of the Philippines	GNSS + MADOCA
Vietnam	Ho Chi Minh City	International University Vietnam National University	GNSS
Mozambique*	Maputo	Universidade Eduardo Mondlane	GNSS
Singapore	Singapore	Nanyang Technological Univeristy	MADOCA
Australia	Perth	Curtin University	MADOCA

Low-Cost High-Accuracy Receiver system Development Cycle



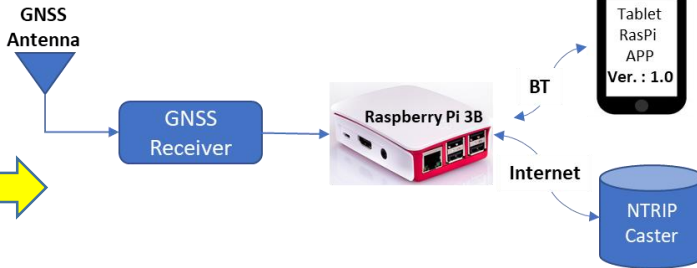
DEC, 2016

RaspberryPi B

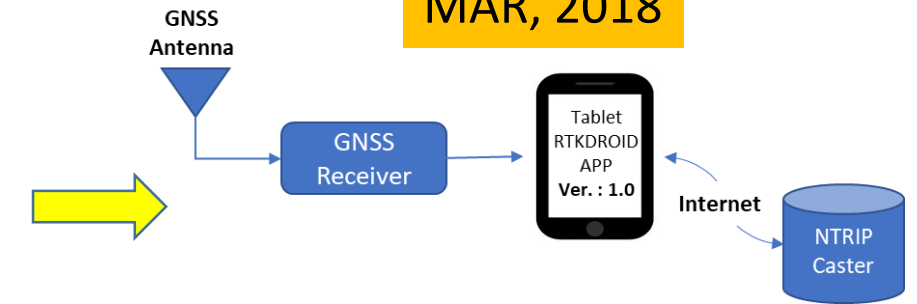
Demo during UN/Nepal GNSS workshop

MAY, 2017

Low-Cost RTK

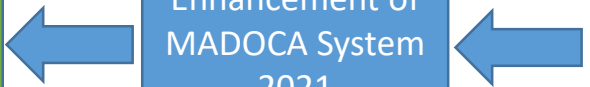


MAR, 2018

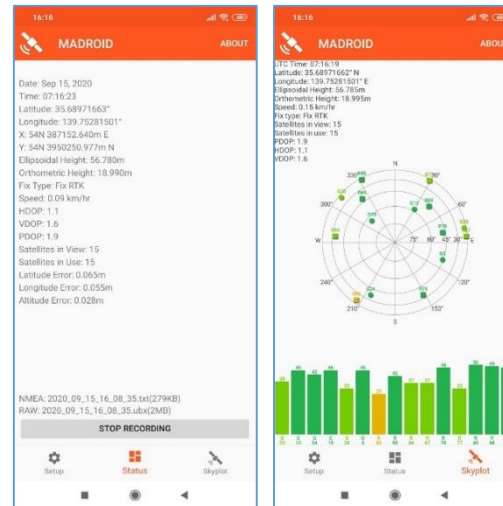


Android Device
RTK / MADOCA / EWS / SAR
System
2022

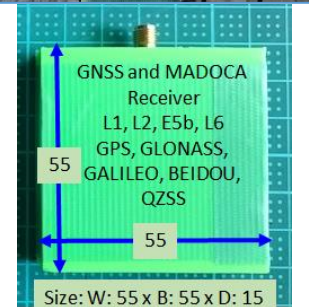
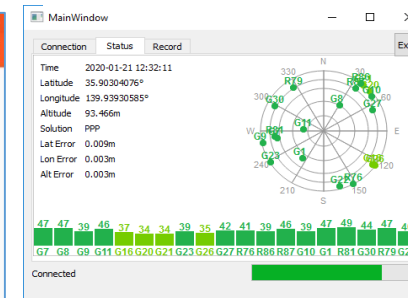
Enhancement of
MADOCA System
2021



What type of smart-phone
will emerge by 2025 ?



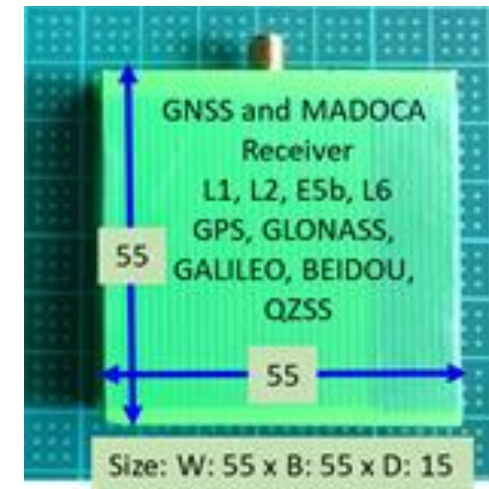
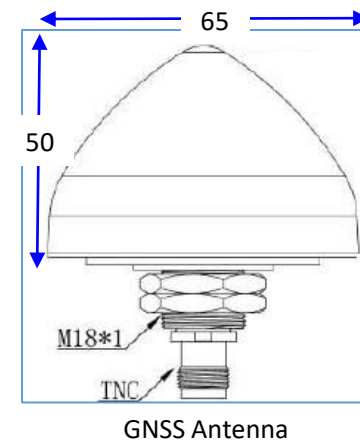
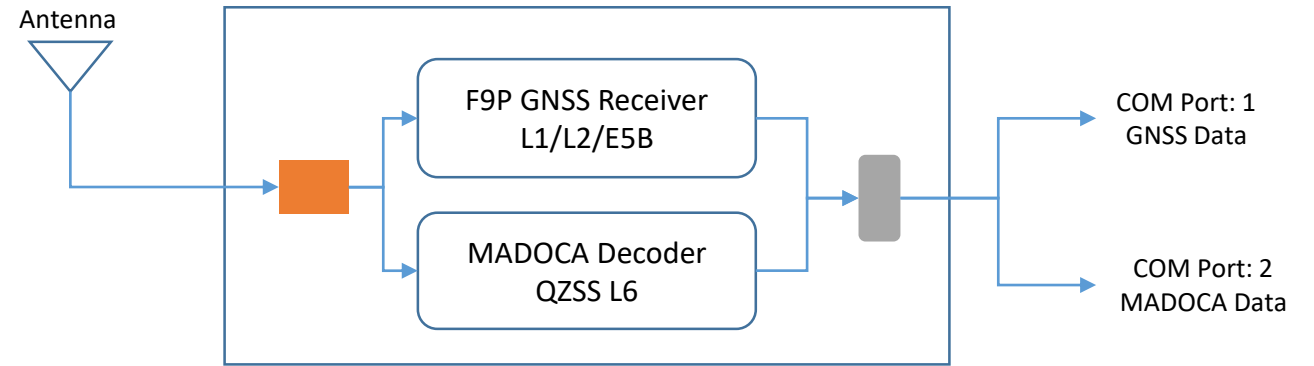
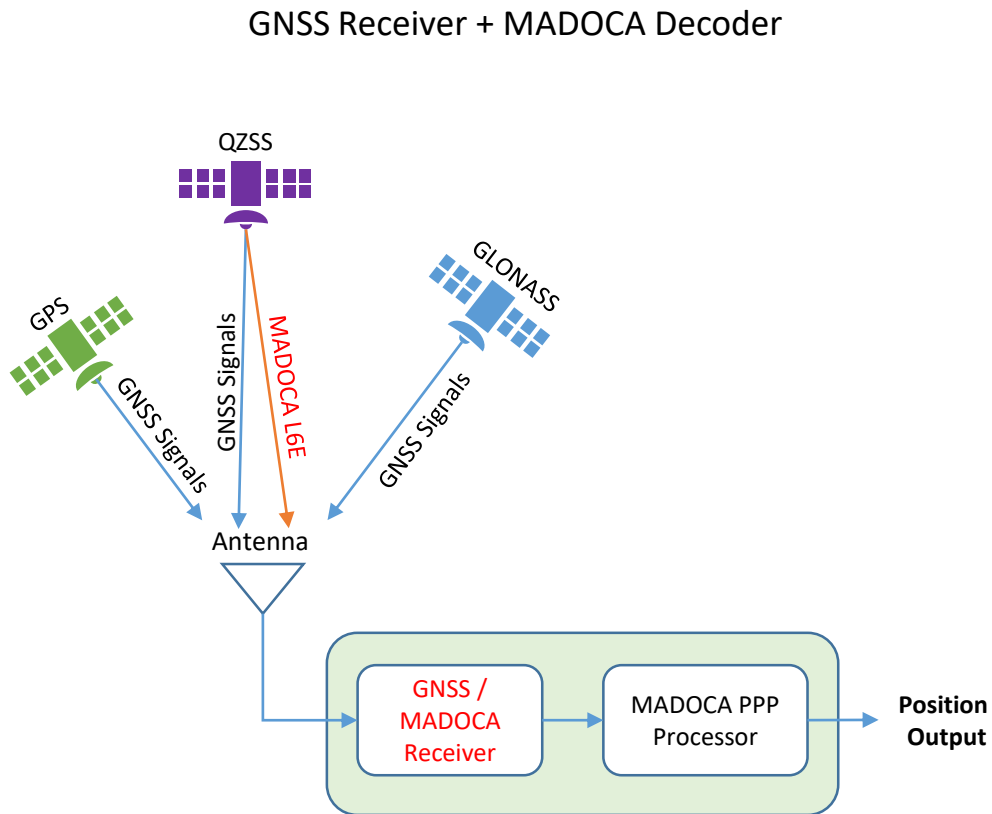
Low-Cost MADOCA



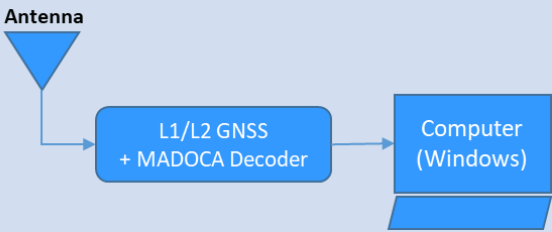
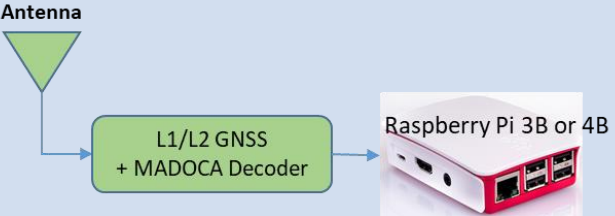
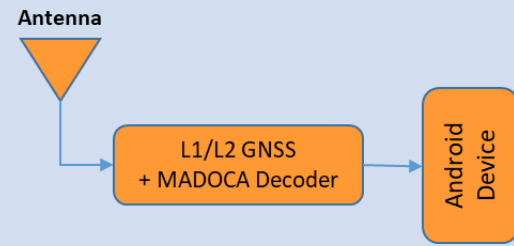
DEC, 2019

GNSS and MADOCA
Receiver
L1, L2, E5b, L6
GPS, GLONASS,
GALILEO, BEIDOU,
QZSS
Size: W: 55 x B: 55 x D: 15

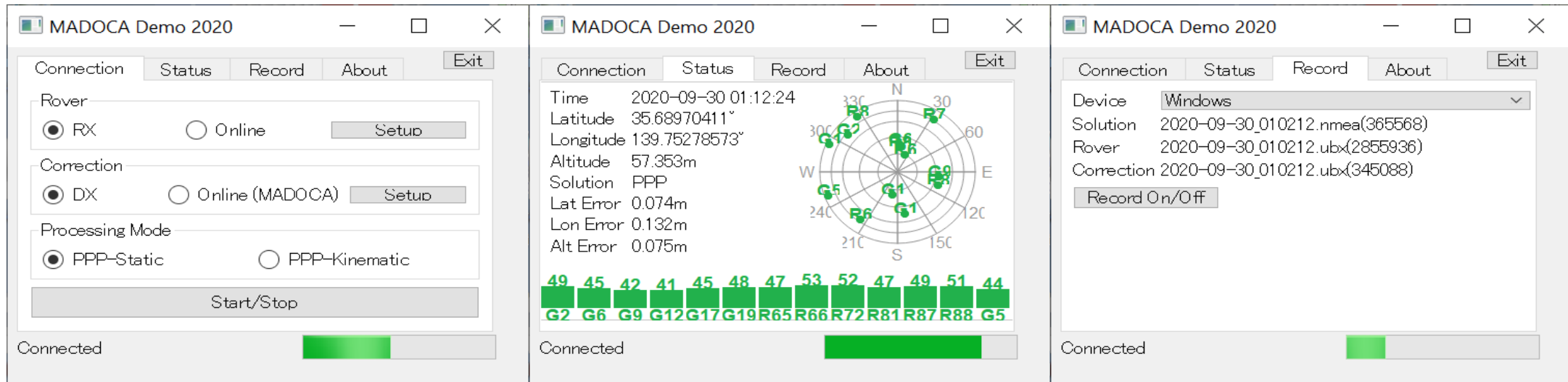
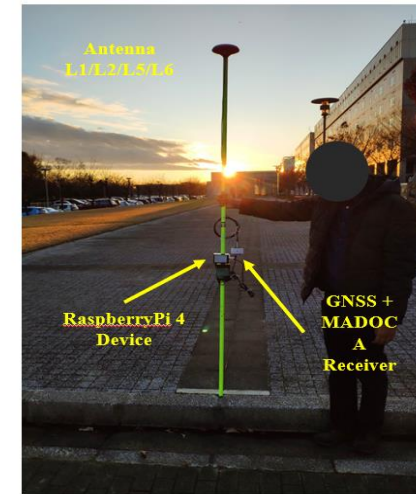
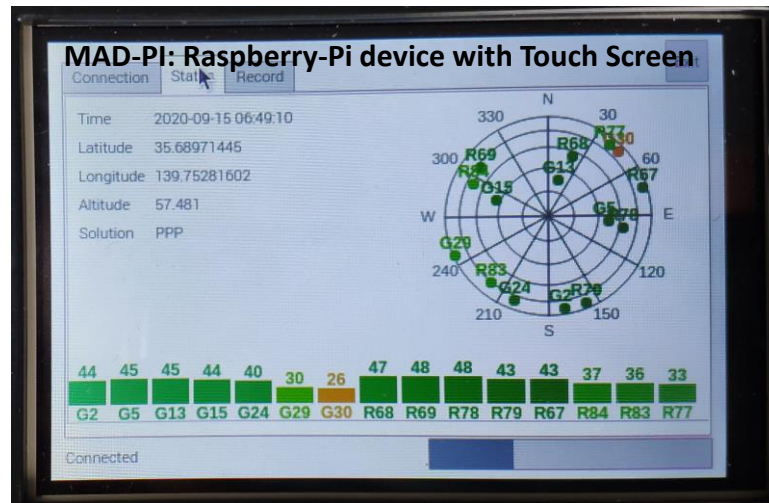
Low-Cost MADOCA Receiver System



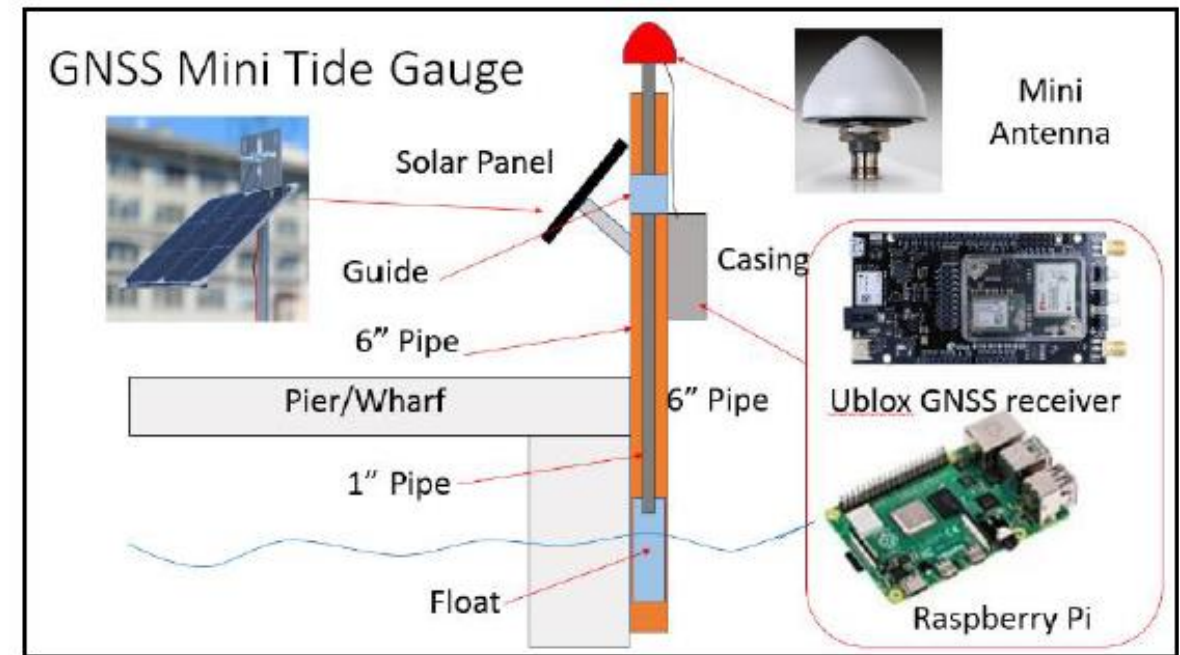
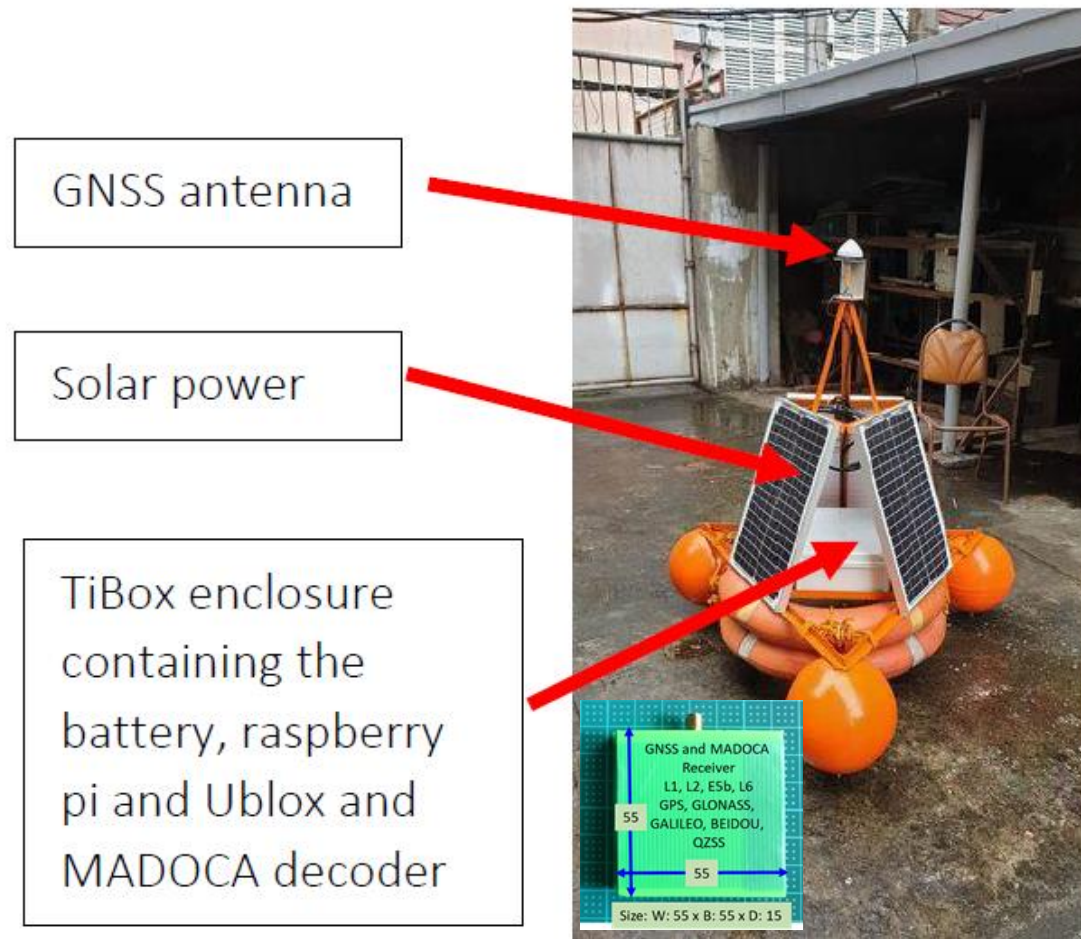
Low-Cost MADOCA Receiver Systems: Product Types

	MAD-WIN	MAD-π	MADROID
Platform / OS	Windows	RaspberryPi 3B or 4B	Android Device
GNSS Receiver	Default : u-blox F9P Other: Any dual-frequency Receiver	Default : u-blox F9P only	Default : u-blox F9P Other: Any dual-frequency Receiver
MADOCA Receiver	U-blox D9 only	U-blox D9 only	NA (MADOCA Online Correction Data only)
GNSS Receiver Data Format	UBX, SBF, RTCM3	UBX SBF, RTCM3 (For online GNSS data)	UBX
MADOCA Correction Data Format (Satellite)	UBX only	UBX only	NA
MADOCA Correction Data Format (Online)	Online Services from GPAS, UTokyo (Test Level) UBX or RTCM3	Online Services from GPAS, UTokyo (Test Level) Online Services UBX or RTCM3	GPAS Services, RTCM3 UTokyo Online Service in the next release
System Architecture			

MAD-WIN and MAD-PI System and User Interface



Low-Cost MADOCA Receiver for Sea-Level Rise Measurement



Source: Technical Report, GNSS/QZSS MADOCA PPP Data Acquisition for Sea Level Rise Measurement, DR. ROSALIE B. REYES, UP DGE and Project Leader, CLSR-Phil Project

MADROID: MADOCA with Android Device

The image displays three screenshots of the MADROID application interface on an Android device. The top bar of all screens is orange and contains the text "MADROID" and a satellite icon.

Left Screenshot (14:34): Shows the configuration screen. It includes sections for "Connection" (USB), "Device" (u-blox GNSS receiver), "Format" (ubx), "Processing Settings" (Rover Mode: PPP-Static, Elevation Mask: 10, Antenna Model: TWIVP6000), and "NTRIP Settings" (Address: madoca.ntrip-mgm.net, Port: 2101, Mount Point: MDC0). A "START ROVER" button is at the bottom.

Middle Screenshot (14:27): Shows the real-time data and skyplot screen. It displays UTC Time (05:27:17), Latitude (35.90202657° N), Longitude (139.93857286° E), Ellipsoidal Height (59.349m), Orthometric Height (21.385m), Speed (0.15 km/hr), Fix type (PPP), Satellites in view (13), Satellites in use (13), PDOP (3.4), HDOP (1.8), and VDOP (3.0). A skyplot shows satellite positions around the horizon. Below the skyplot is a bar chart showing signal strength for various satellites.

Right Screenshot (14:34): Shows the status screen. It displays Date (Dec 25, 2019), Time (05:34:17), Latitude (35.90202310°), Longitude (139.93857932°), X (54N 404216.762m E), Y (54N 3973601.765m N), Ellipsoidal Height (59.848m), Orthometric Height (21.884m), Fix Type (PPP), Speed (0.11 km/hr), HDOP (1.9), VDOP (3.0), PDOP (3.5), Satellites in View (13), Satellites in Use (13), Latitude Error (0.191m), Longitude Error (0.171m), and Altitude Error (0.104m). A "STOP RECORDING" button is at the bottom.

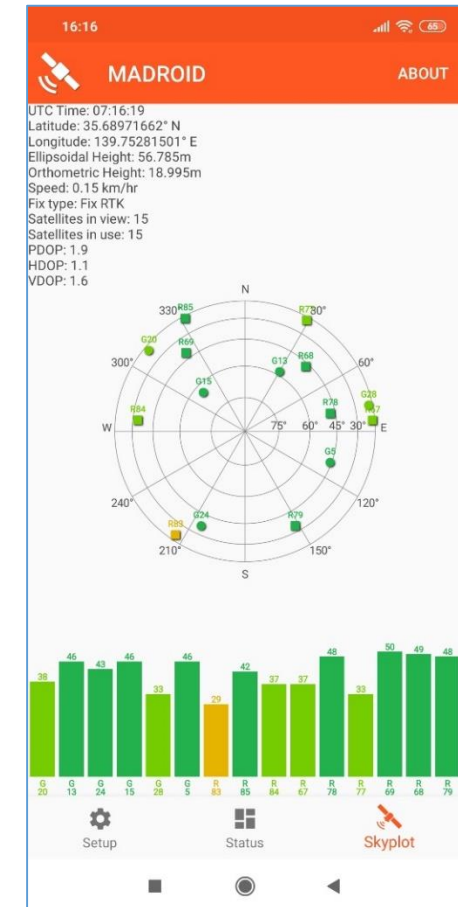
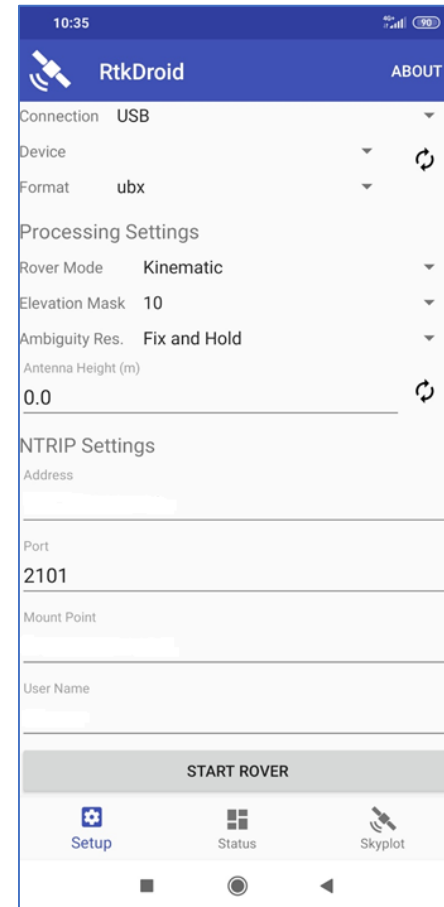
Android APPs for GNSS Data Logging & Processing

- RTKDROID

- Real-Time RTK for Android devices
- Based on RTKLIB
- Already Released – Distribution by Request
 - Send e-mail to dinesh@csis.u-tokyo.ac.jp

- MADROID

- Real-Time MADOCA-PPP based on MADOCA correction data
- Based on u-blox F9P dual frequency receiver
- Already Released – Distribution by Request
 - Send e-mail to dinesh@csis.u-tokyo.ac.jp



MGA (Multi-GNSS Asia) Activities

- We organize the following programs in MGA
 - Webinars
 - Regular webinars by inviting experts in the field
 - Please accept our requests to become a resource persons to give webinars
 - RPD Challenges
 - Rapid Prototype Development Challenge is held under Young Professionals' Forum session of MGA
 - Students, Researchers or Enthusiasts who would like to challenge with their ideas related with GNSS applications are welcome to attend
 - Forthcoming MGA Programs
 - Please check : <https://www.multignssasia.com/> 

MGA (Multi-GNSS Asia) Activities: RPD Challenge 2021

<https://www.rpdchallenge.com/>

**SOLUTIONS FOR
DISASTER MANAGEMENT :
TSUNAMI / FLOODING**

2021

RPD CHALLENGE

-A Multi-GNSS Asia Programme-

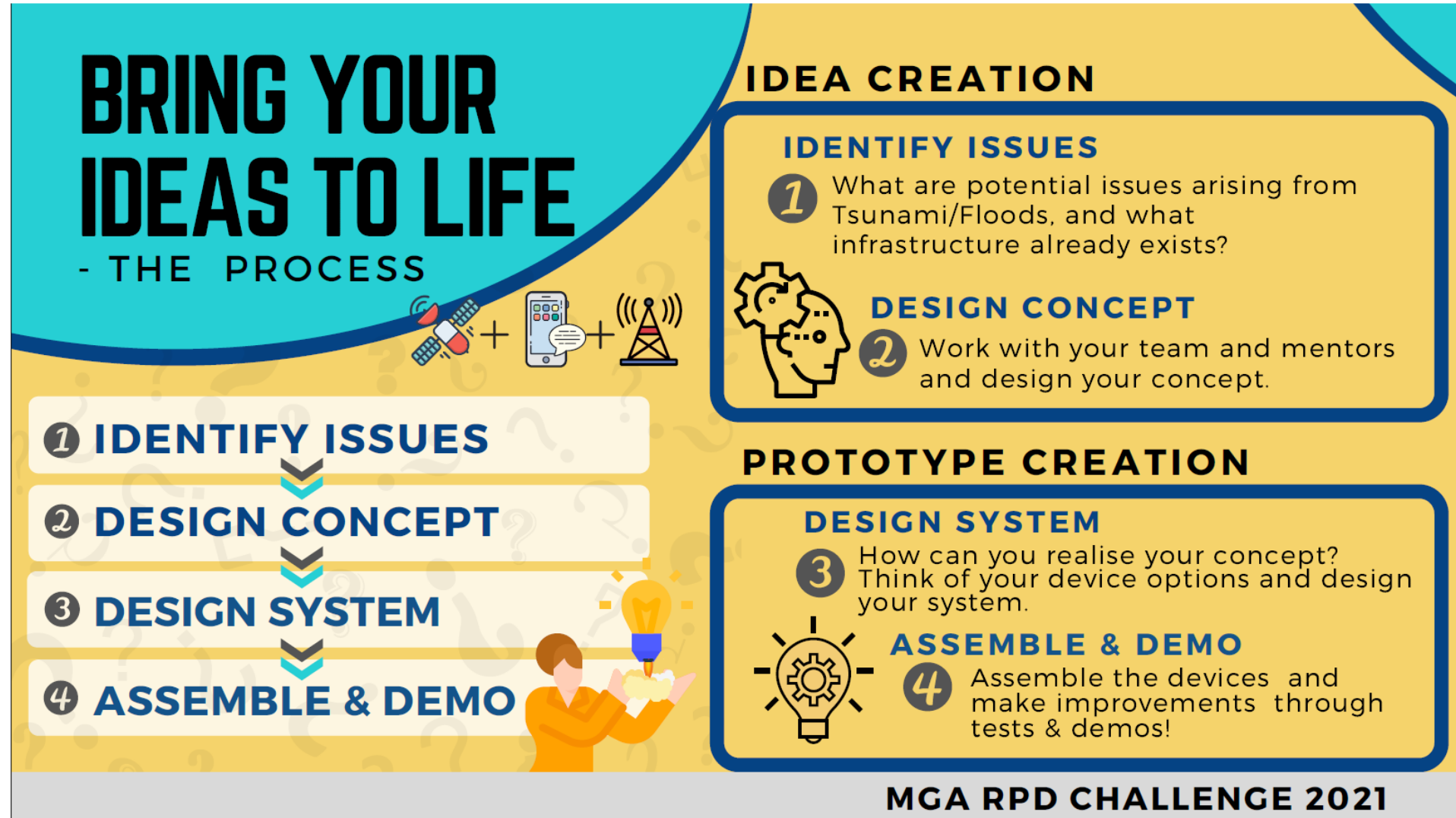
Co-organised by

Supported by



The banner features a central blue box with the text 'SOLUTIONS FOR DISASTER MANAGEMENT : TSUNAMI / FLOODING'. Below this, the year '2021' is displayed, followed by the large text 'RPD CHALLENGE' and the subtitle '-A Multi-GNSS Asia Programme-'. The background is yellow with blue and teal accents, including icons of waves, a lightbulb, and a house on water. At the bottom, there are logos for co-organizers (MGA, GISTDA, Cabinet Office) and supporters (AIS, CSIS, ESCAP, Keio University, SONY, and NTT DATA).

MGA (Multi-GNSS Asia) Activities: RPD Challenge 2021



MGA (Multi-GNSS Asia) Activities: RPD Challenge 2021

PROGRAMME SCHEDULE

STEP	DATE & TIME (THAI LOCAL TIME)		COURSE OVERVIEW
LET'S GET STARTED Introduction STEP 1 Define scenario STEP 2 System design & project Planning <ONLINE TECH DAYS> STEP 3&4 Develop Prototype, Demonstration & Awards in Thailand	Aug-Sept		GNSS101 *GNSS101 lectures on Youtube
	10/2	10:00-18:00	Demo by RPD 2020 Teams Define Scenario / Idea Creation
	11/6	14:00-15:40	System Design
	11/20	14:00-15:35	Project Planning
	12/4		
	12/5	14:00-15:40	Special Lectures by Sony Group, AIS, The University of Tokyo, Advanced Institute of Industrial Technology
	12/18		
	12/XX		
	1/13	14:00-15:40	QZSS Testing
	1/14	14:00-15:30	Trouble shooting
	FEB/MAR 1	10:00-17:00	Final Consultation by Experts
	FEB/MAR 2	08:00-16:00	Final Presentation & Demo


WEB BASED

Online Streaming
 Online Workshop
 Online Tech Days


PHYSICAL MEETING

MGA RPD CHALLENGE 2021



International GNSS School 2022

- Period : 2022/02/28- 03/05
- Venue : Tokyo University of Marine Science and Technology (TUMSAT)
 - Organized by Faculty of Marine Technology, TUMSAT
- Co-organized by Institute of Positioning, Navigation and Timing of Japan (IPNTJ)
- Sponsored by Japan Science and Technology Agency (JST)

Outline of International GNSS School in Tokyo

- Period : 2022/02/28-03/05
- Organized by : Tokyo University of Main Science and Technology (TUMSAT), Japan
- Co-Organized by : The Institute of Positioning, Navigation and Timing of Japan
- Attendees : Japanese and foreign students of post-graduate & young engineers and instructors who are teaching GNSS in their countries.
- Requested to bring their own notebook computer.
- Number of participants : 30 (10 of them have will be invited from abroad)
- Language : English
- Supported by : MGA(Multi-GNSS Asia)
- Sponsored by JST

Final Decision will be made by November 15th, 2021.

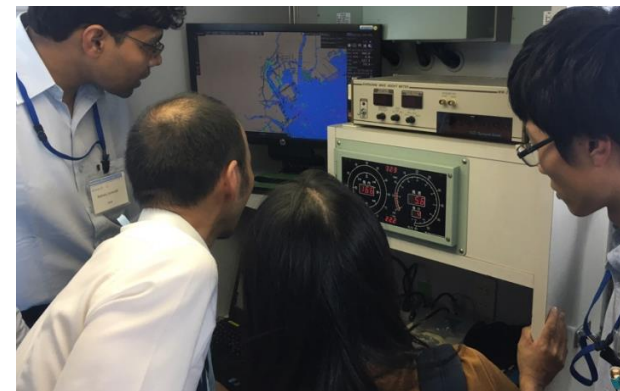
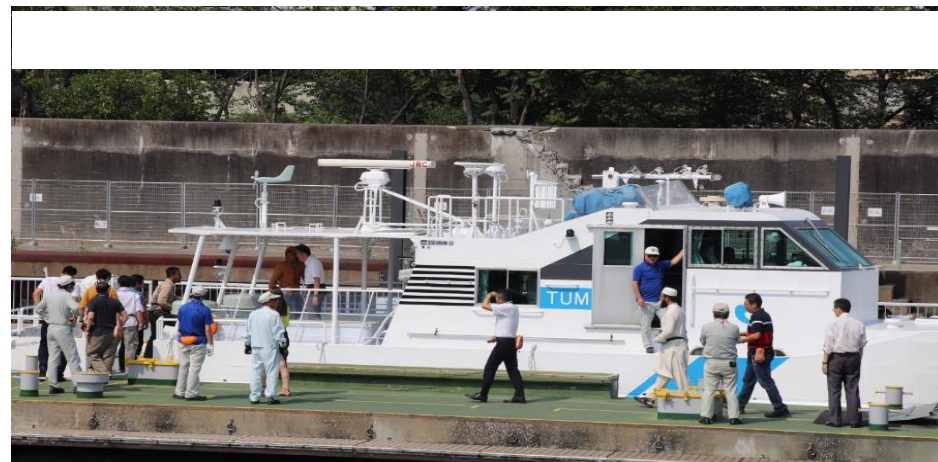
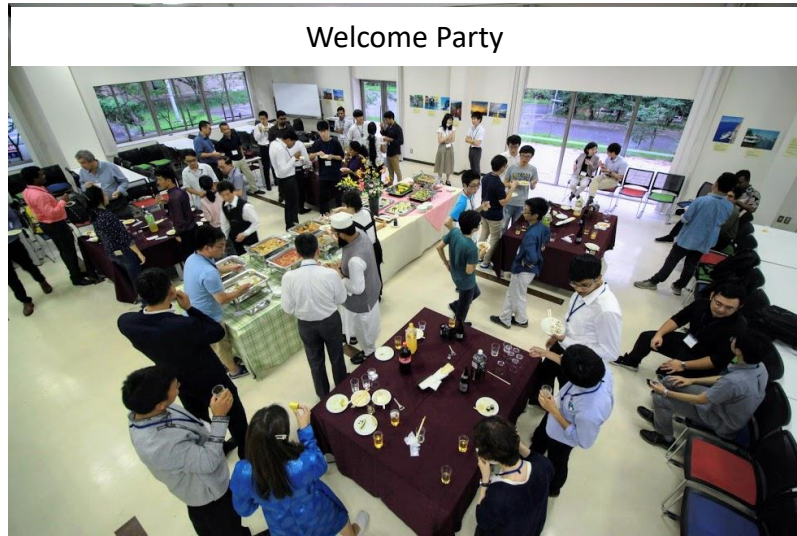
Application for 2022+

- Please prepare the following items, even though you don't apply the scholarship. The scholarship includes round trip ticket, 7-night accommodation, 6-day lunch and the fee. Please submit the following items **by February**, when you apply the scholarship.
 - 1. CV
 - 2. Certification of the graduation. (for your all career)*
 - 3. Transcript with student's records. (for your all career)*
 - 4. Certification for English ability (Score of TOEFL, IELTS or TOEIC)*
 - 5. Recommendations by two responsible persons*
 - #5 is waived, if you don't apply the scholarship.
- *Please submit the scanned original documents by e-mail to yasuda@kaiyodai.ac.jp for the selection and bring the originals if accepted.
- Please do not pay the fee** until the application is accepted even if you will attend by your own budget.
- Fill the registration form at** <https://fs221.xbit.jp/a424/form2/>
The result will be informed to the applicants by e-mail by the end of April.



QZSS Services

Photo @ Welcome Party 2019



Tentative Time Table in 2022

	28-Feb	1-Mar	2-Mar	3-Mar	4-Mar	5-Mar
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
0830-1000	Introduction	Class B-1	Special Lec. **	Class B-5	Practice for System Design, followed by SD-workshop I	GNSS Signal Security***
1000-1010	Break	Break	Break	Break		Break
1010-1140	Class A-1	Class B-2	Class C-1	Class B-6		GNSS Authentication***
1140-1230	Lunch	Lunch	Lunch	Lunch	Lunch 1200-1240	Lunch
1230-1400	Class A-2	Class B-3		RTK-Demo G-I at Port Cruise	SD-workshop II	GNSS Raw Measurements from Android Device***
1400-1410	Break	Break	Break	ECDIS Center G-II	Break	Break
1410-1540	Class A-3	Class B-4	Class C-3	RTK-Demo G-II at Port Cruise	SDR Practice I	Participants Workshop
1540-1550	Break	Break	Break	ECDIS Center G-I	Break	Break
1550-1720	Self-Introduction	QZSS-Intro & Demo*	Class C-4	RTK-LIB Practice	SDR Practice II	Participants Workshop Closing
1730-	Welcome Party	1 class=90 minutes			Farewell party	
		Introduction	Dr. Akio Yasuda		System Design by Dr. Naohiko Kohtake	***by Dr. Dinesh Manandha
		Class-A Fundamentals	Dr. Nobuaki Kubo Dr. Ivan G. Petrovski A-1,2,3			
		Class-B Software	Dr. Takeyasu Sakai, B-1,2,3,4 Mr. Tomoji Takasu B-5,6,Practice		* by QZSS Group	
		Class-C Receiver	Dr. Toshiaki Tsujii, C1,2,3 Dr. Taro Suzuki, C4, SDR-Practice		**Status of CORS in Japan	

Link for Reference Materials

- Lab Home Page
 - <https://www.csis.u-tokyo.ac.jp/en/>
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/>
- GNSS Training Materials, Data etc.
 - https://home.csis.u-tokyo.ac.jp/~dinesh/GNSS_Train.htm
- Low-Cost High-Accuracy Receiver Systems
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/LCHAR.htm>
- GNSS Webinar
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/WEBINAR.htm>
 - <https://gnss.peatix.com>
- Link to Documents, Software, Android APP etc.
 - <https://home.csis.u-tokyo.ac.jp/~dinesh/Download.htm>
- Facebook : <https://www.facebook.com/gnss.lab> (GNSS Related)
- Contact : dinesh@csis.u-tokyo.ac.jp