

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 3st 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



ICG
International Committee on
Global Navigation Satellite Systems

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:
<https://www.unoosa.org/oosa/en/ourwork/icg/activities/2021/ai2021-gnss.html>

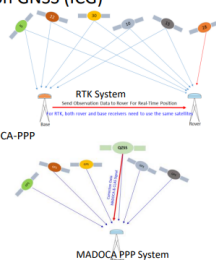
Application Deadline: 5th JANUARY 2021

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.

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



ICG
International Committee on
Global Navigation Satellite Systems

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>

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

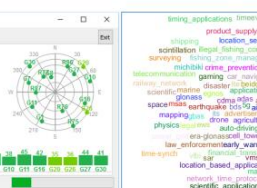
Training Application Link:
<https://www.unoosa.org/oosa/en/ourwork/icg/activities/2021/ai2021-gnss.html>

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

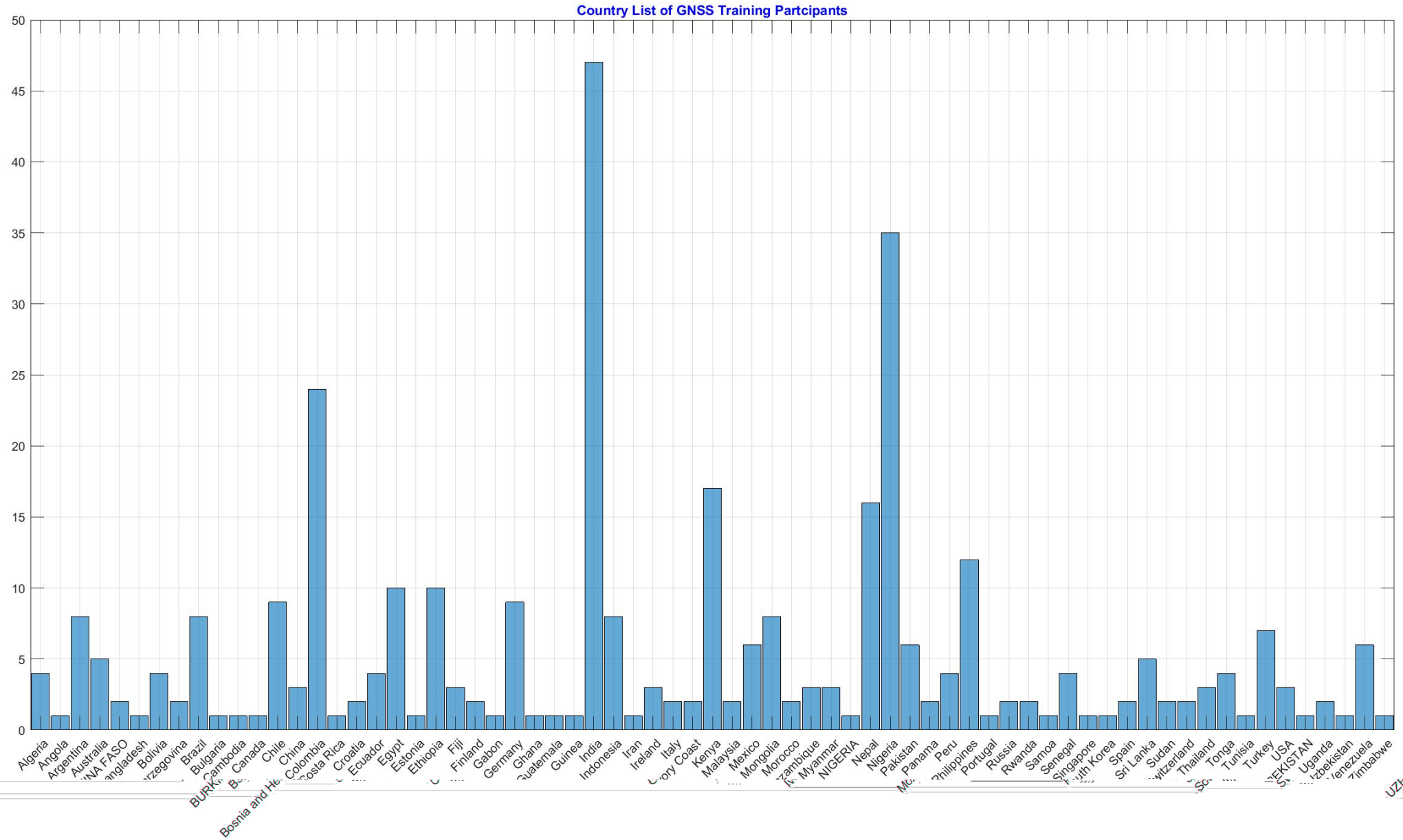
Capacity Building Activities

Summary of GNSS Trainings: Jointly Organized by CSIS and ICG/UNOOSA

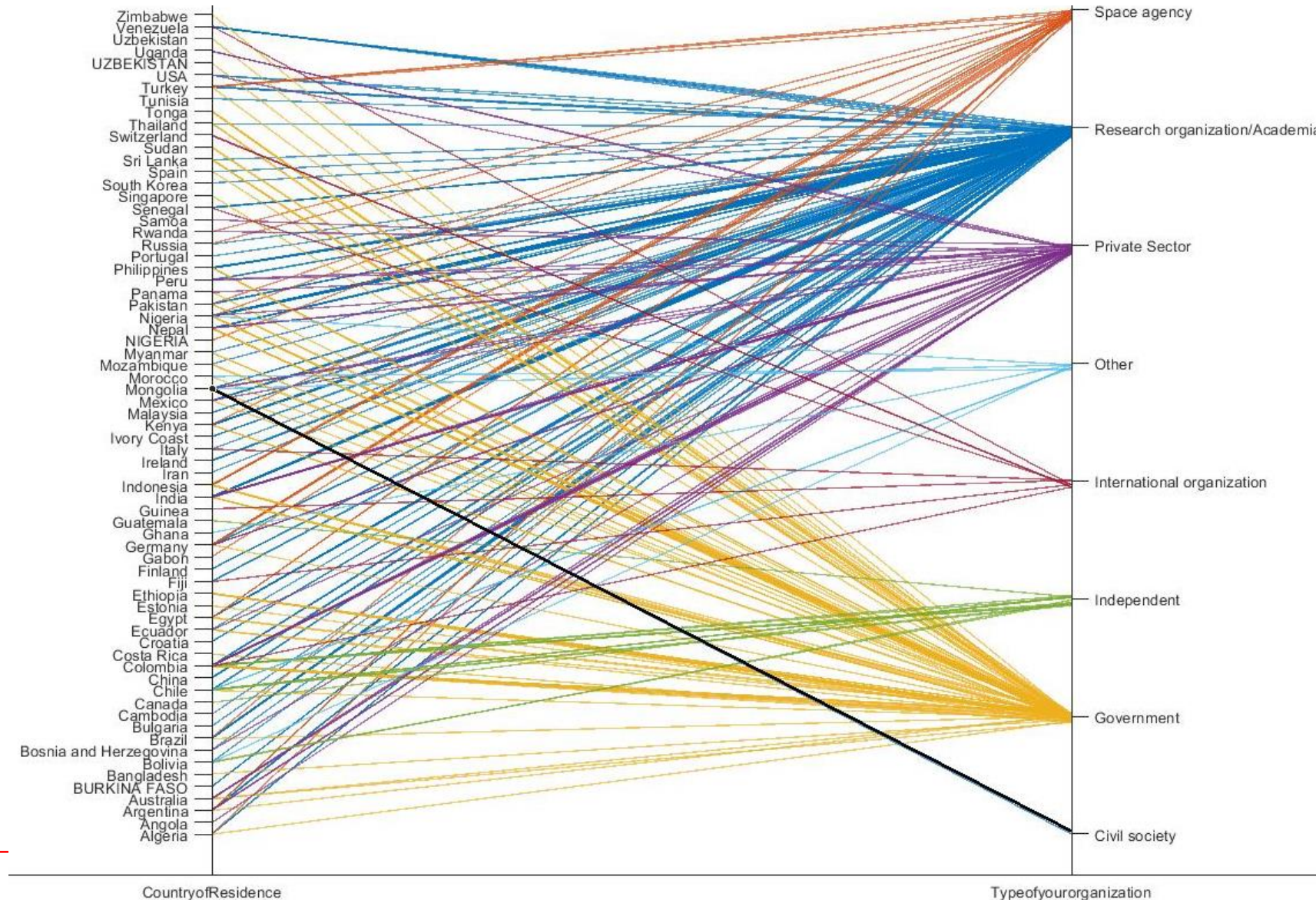
Course A: GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems, 19 – 21 JAN
Course B: GNSS for Policy and Decision Makers, 28 JAN 2021

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

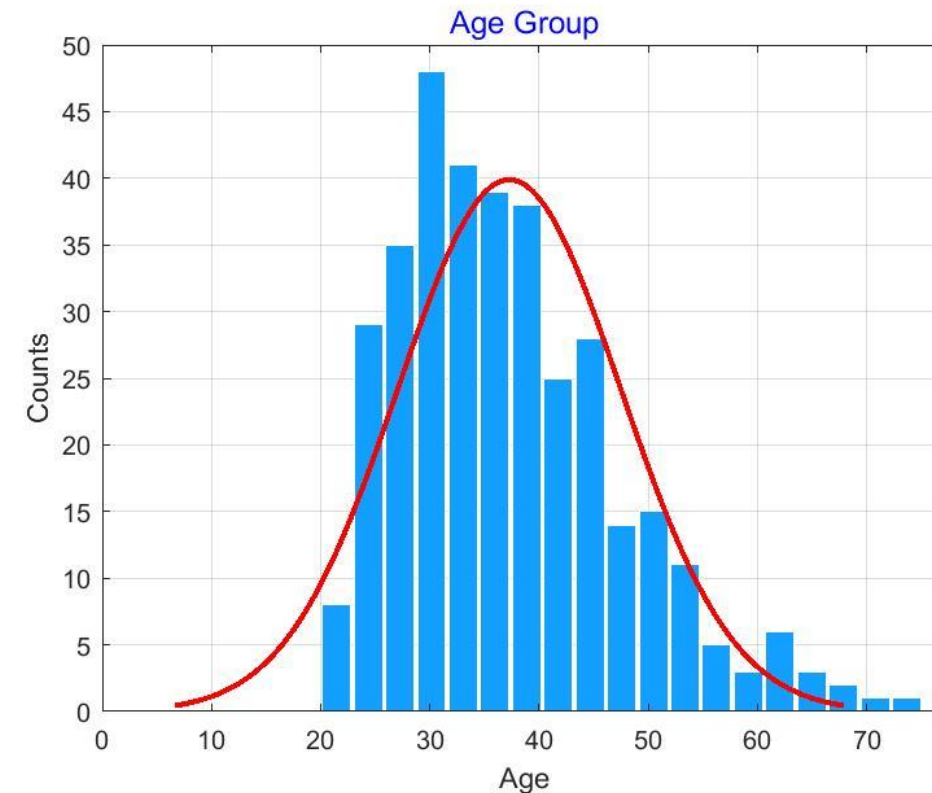
Course A: List of Countries: 70 / No of Selected Participants: 260



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

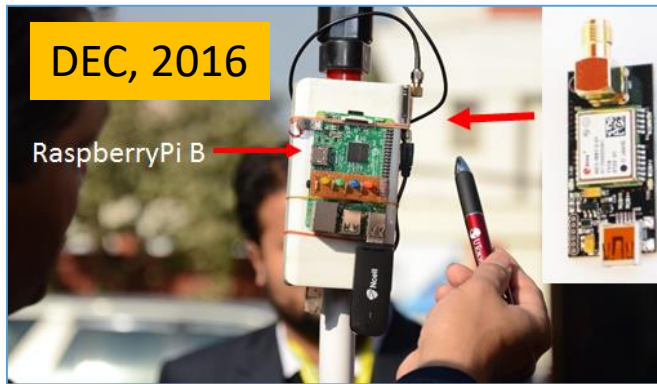
ICG / UTOKYO GNSS Training 2022 (Hybrid Format)

- 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



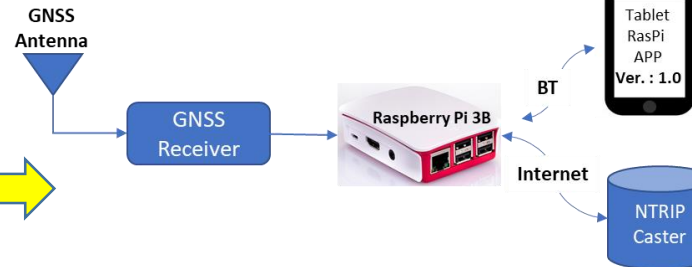
DEC, 2016

RaspberryPi B

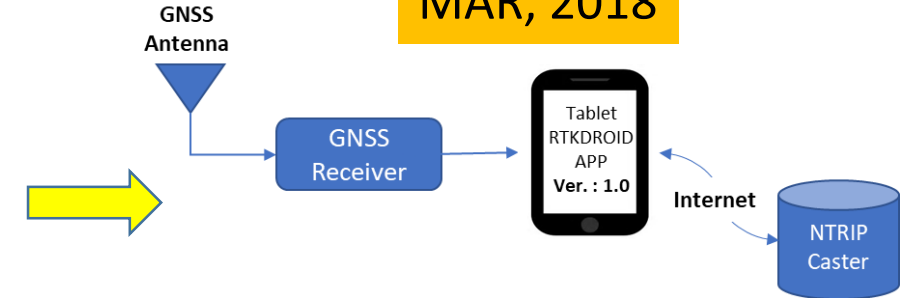
Demo during UN/Nepal GNSS workshop

MAY, 2017

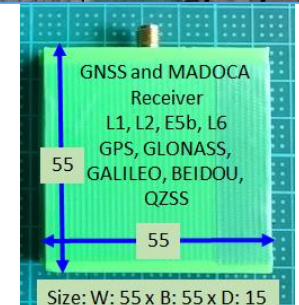
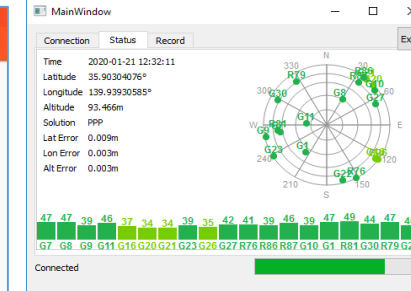
Low-Cost RTK



MAR, 2018



Low-Cost MADOCA



DEC, 2019

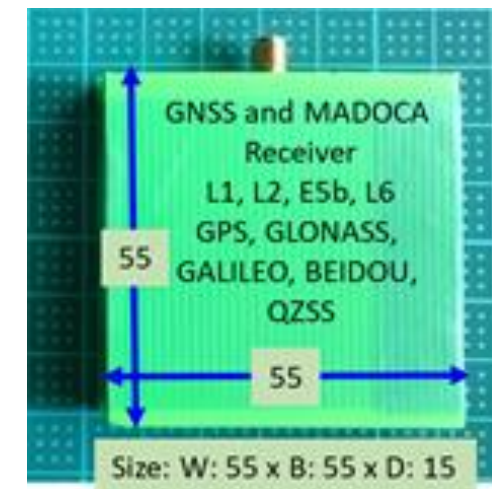
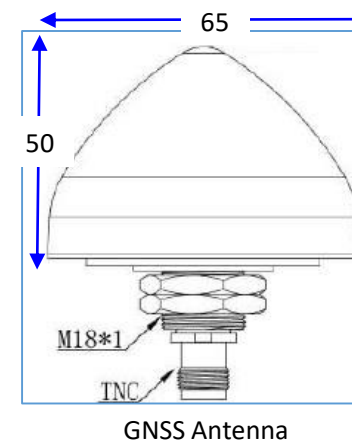
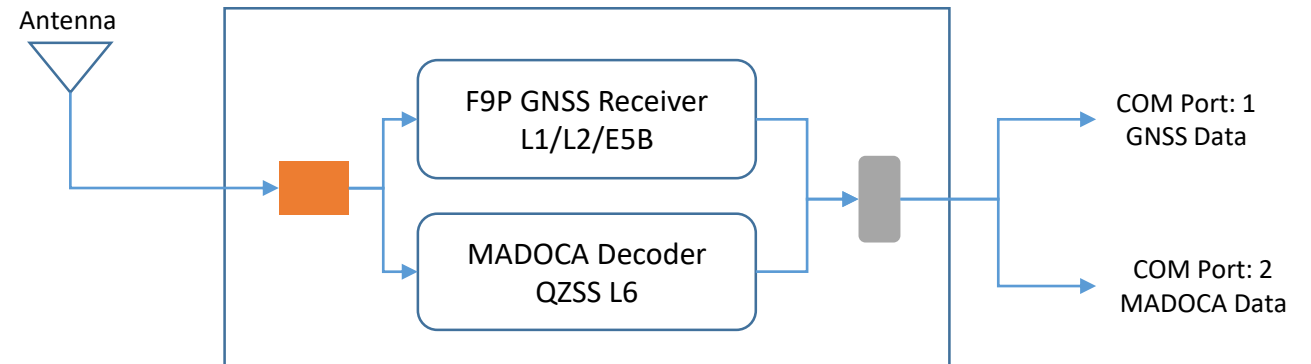
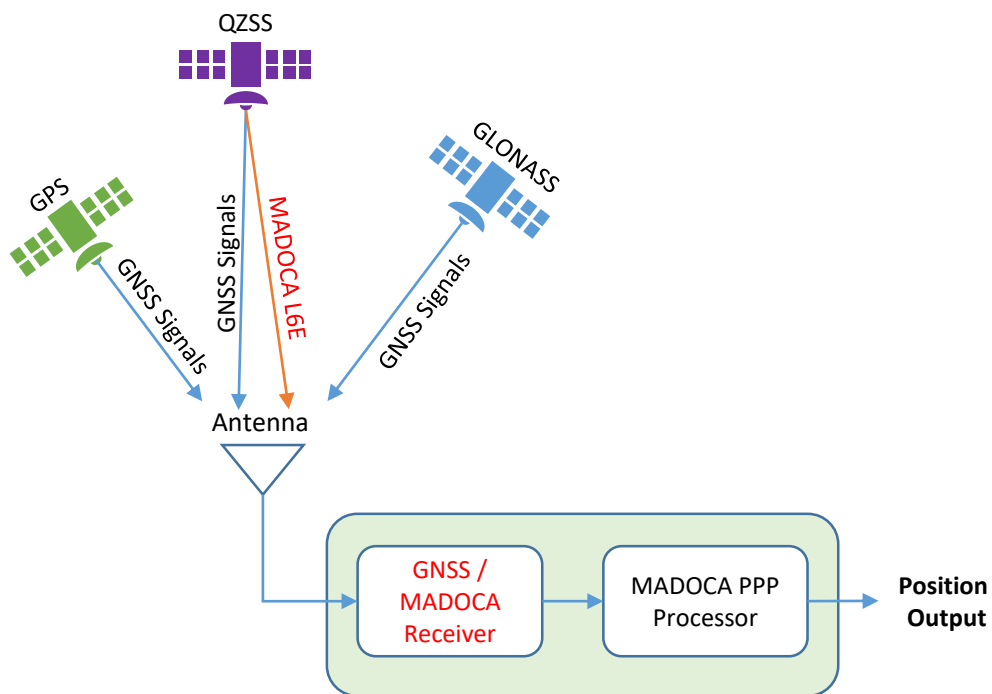
Enhancement of
MADOCA System
2021

Android Device
RTK / MADOCA / EWS / SAR
System
2022

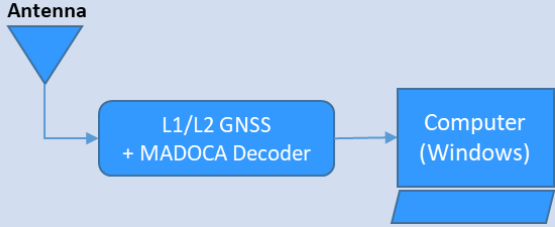
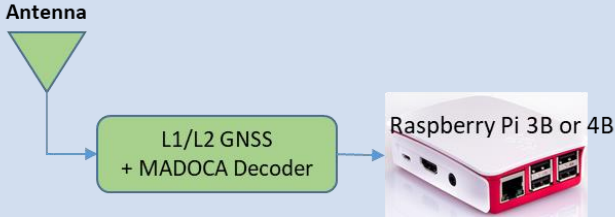
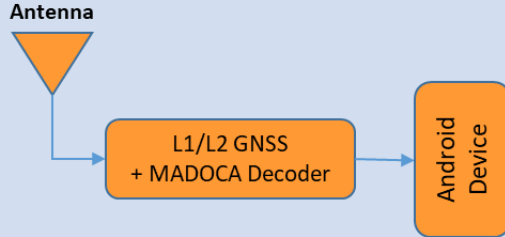
**What type of smart-phone
will emerge by 2025 ?**

Low-Cost MADOCA Receiver System

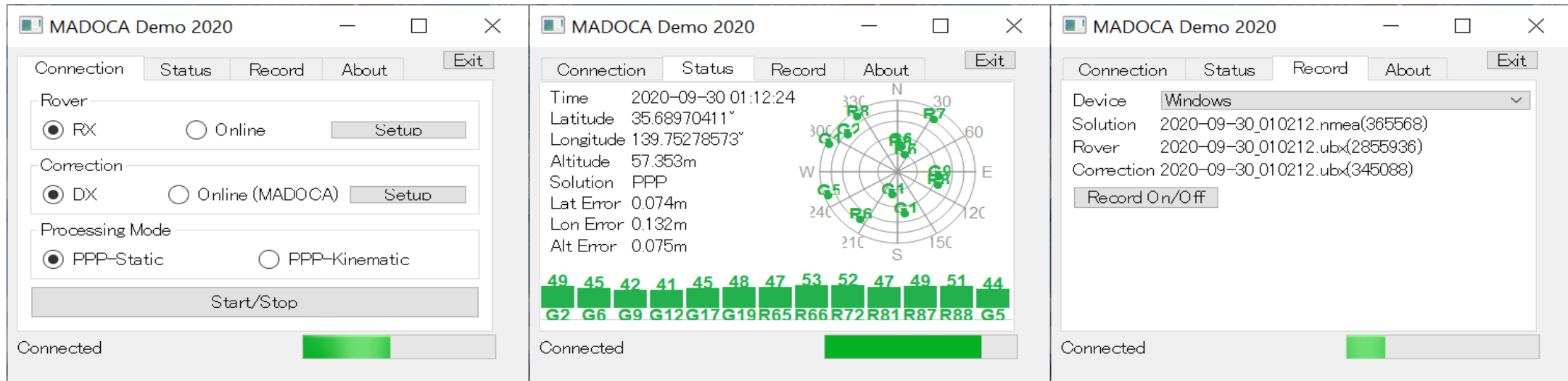
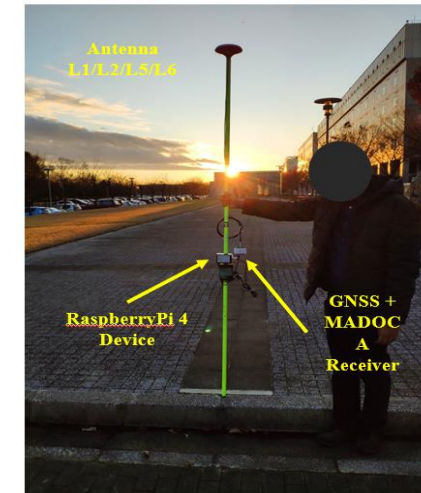
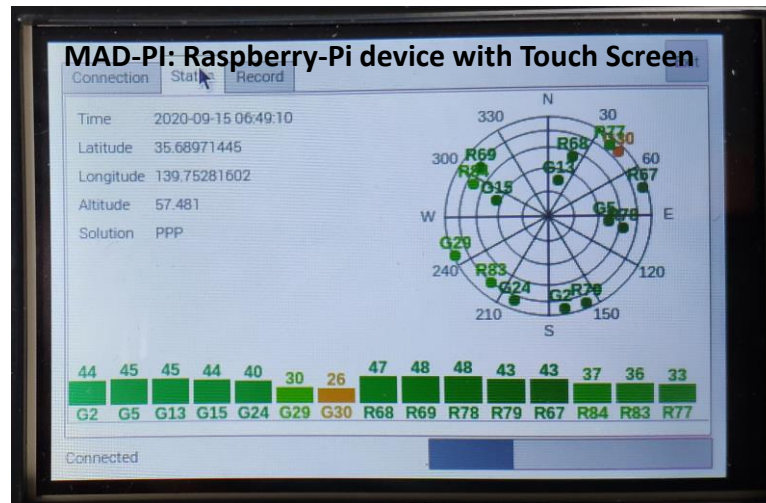
GNSS Receiver + MADOCA Decoder



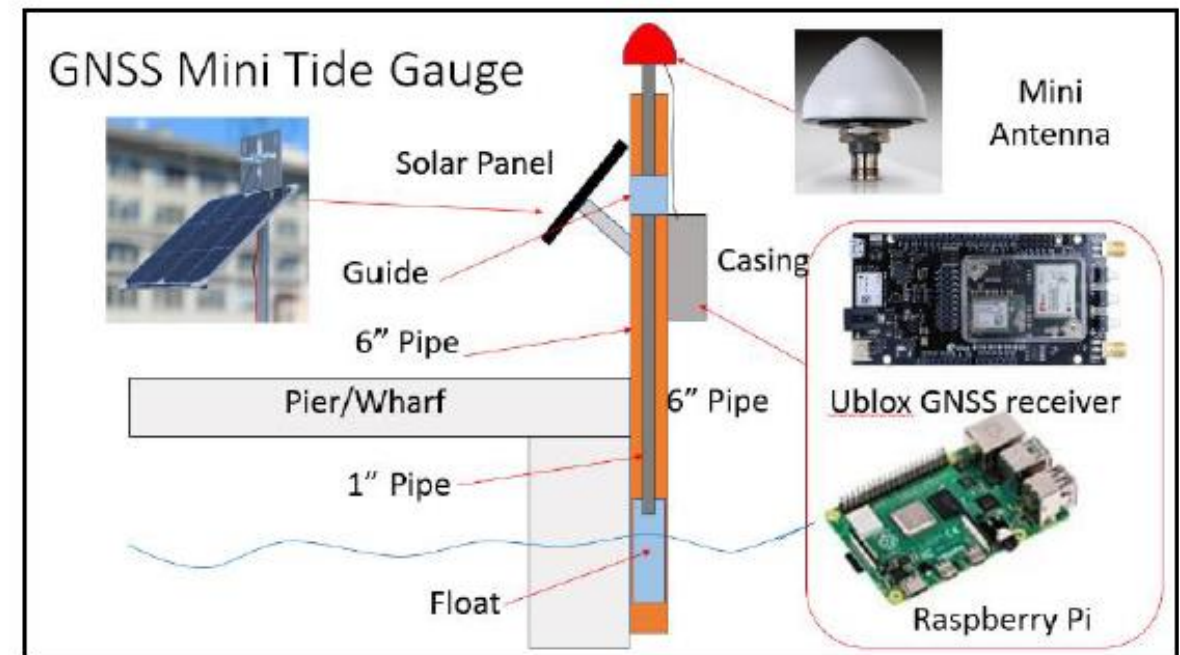
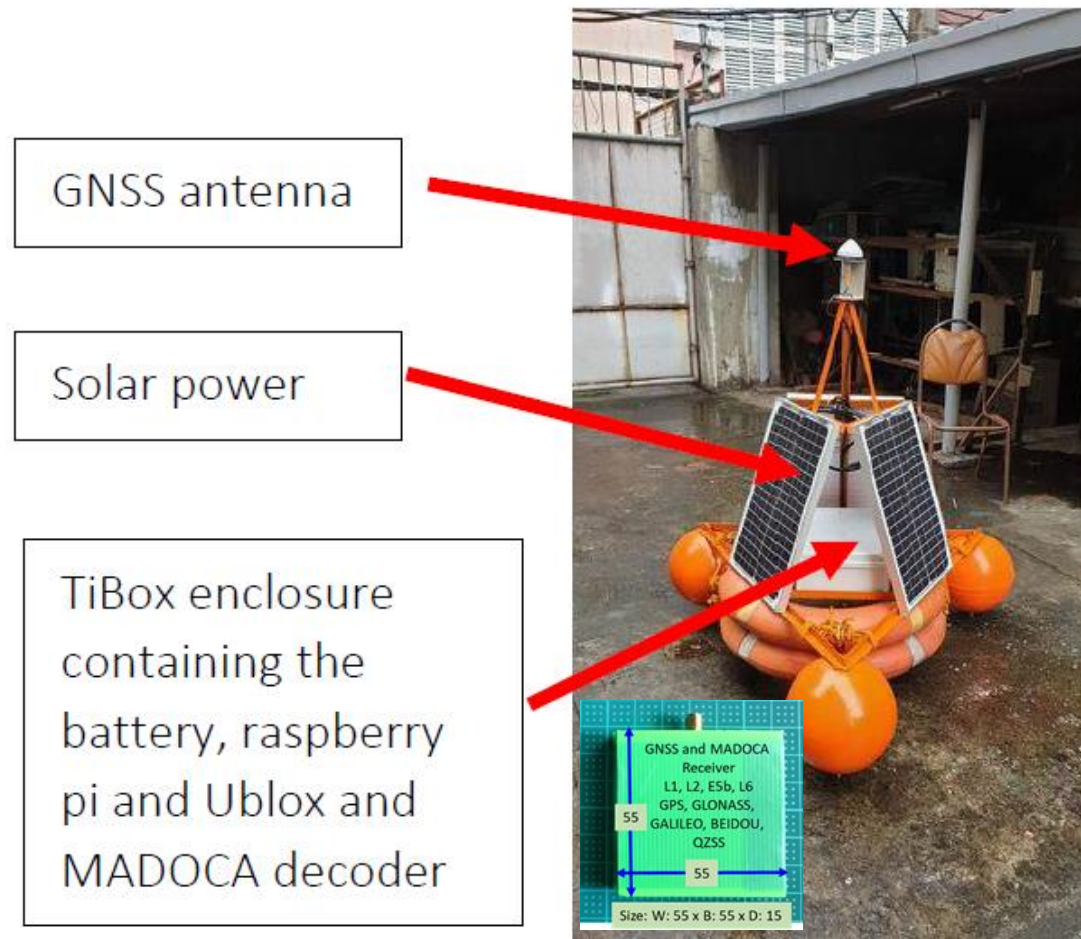
Low-Cost MADOCA Receiver Systems: Product Types

	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

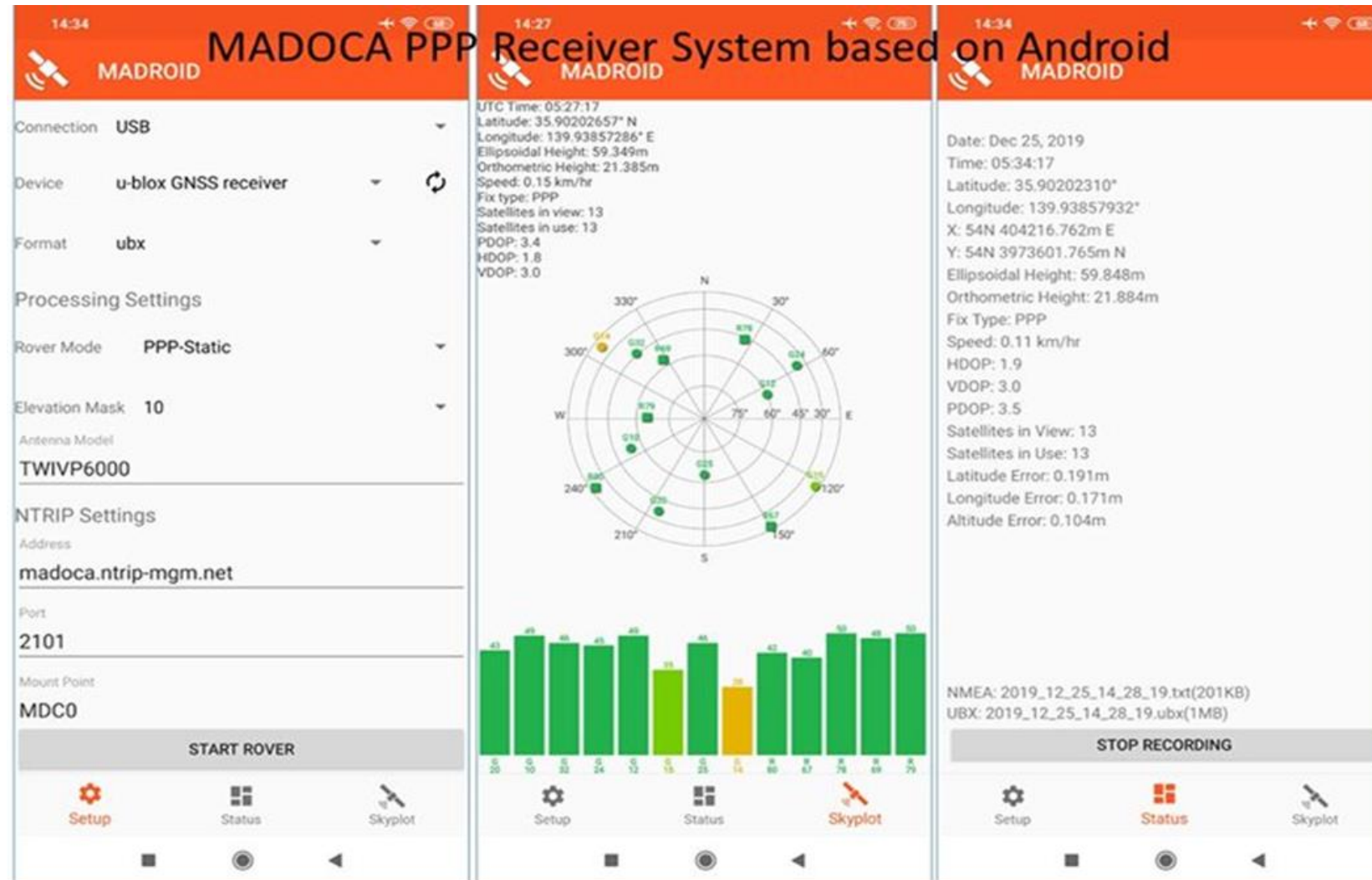


Low-Cost MADOCA Receiver for Sea-Level Rise Measurement



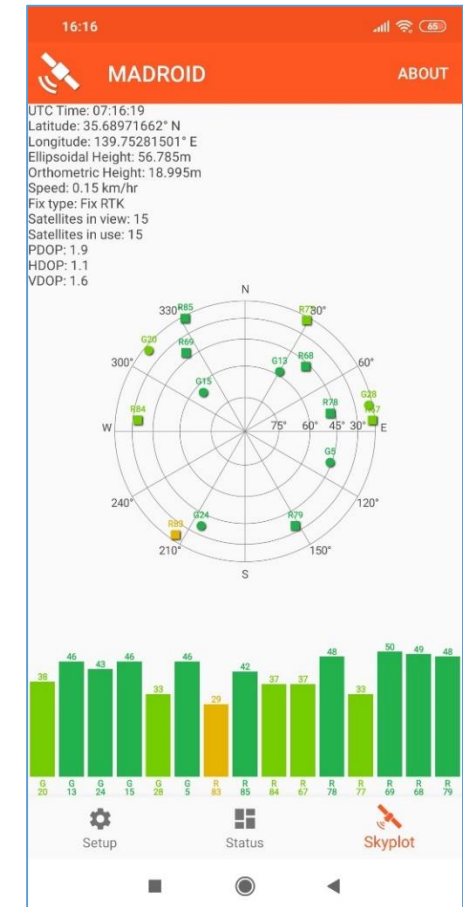
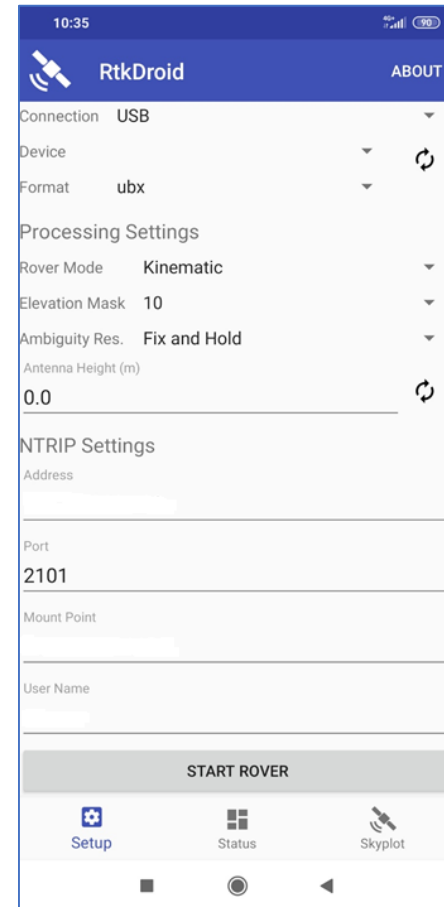
Source: Technical Report, GNSS/QZSS MADOCA PPP Data Acquisition for Sea Level Rise Measurement, DR. ROSALIE B. REYES, UP DGE and Project Leader, CLSR-Phil Project

MADROID: MADOCA with Android Device



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-

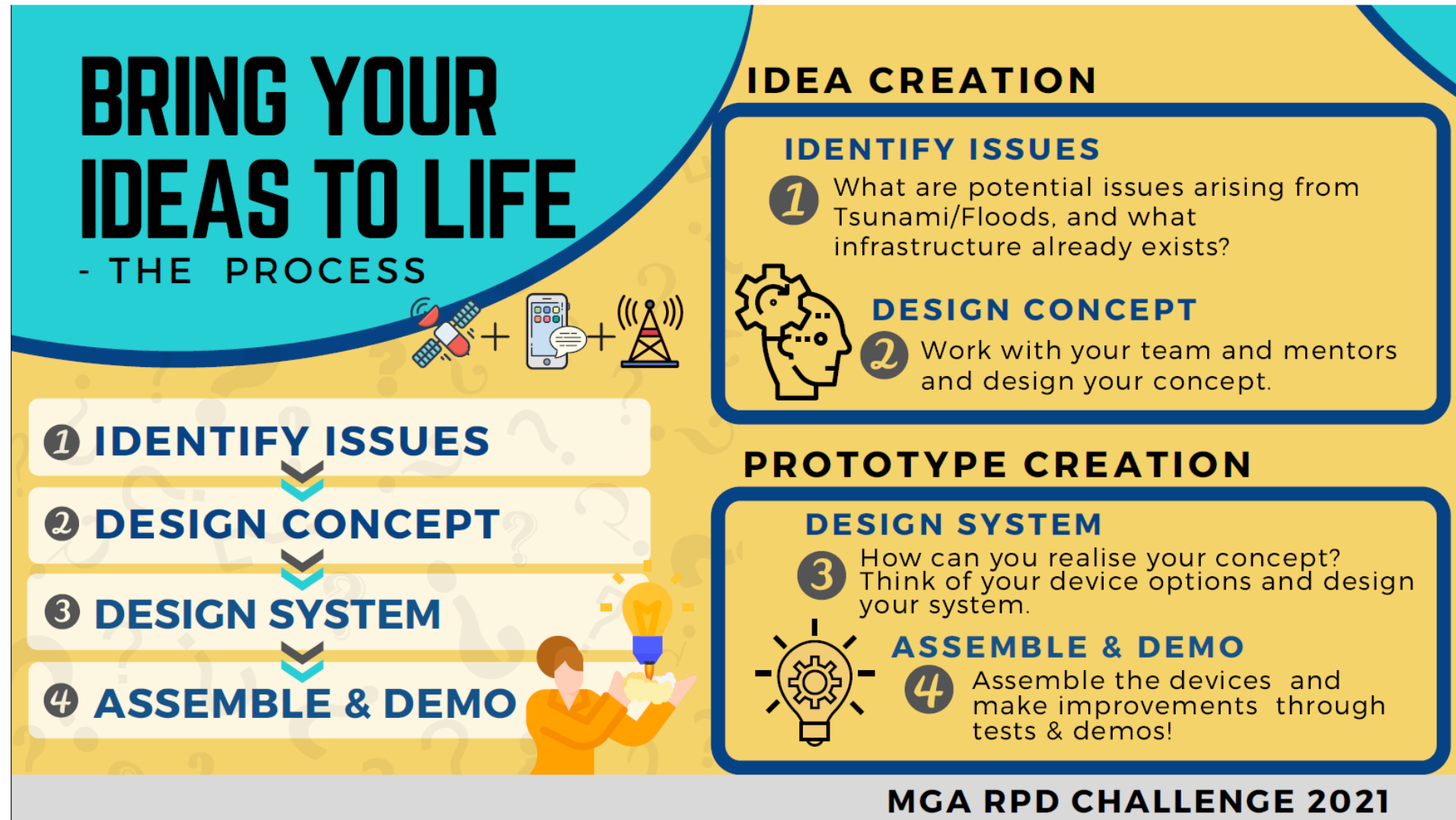
Co-organised by

Supported by

MGA GISTDA Cabinet Office AIS CSIS ESCAP 慶應義塾 Keio University SONY 東京大学 The University of Tokyo 日本大学 NITNT NTT DATA



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



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

PROGRAMME SCHEDULE				
 WEB BASED  PHYSICAL MEETING	STEP	DATE & TIME (THAI LOCAL TIME)		COURSE OVERVIEW
	LET'S GET STARTED Introduction	Aug-Sept		GNSS101 *GNSS101 lectures on Youtube
	STEP 1 Define scenario	10/2	10:00-18:00	Demo by RPD 2020 Teams Define Scenario / Idea Creation
	STEP 2 System design & project Planning	11/6	14:00-15:40	System Design
		11/20	14:00-15:35	Project Planning
	<ONLINE TECH DAYS>	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		
	STEP 3&4 Develop Prototype, Demonstration & Awards in Thailand	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

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 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/>

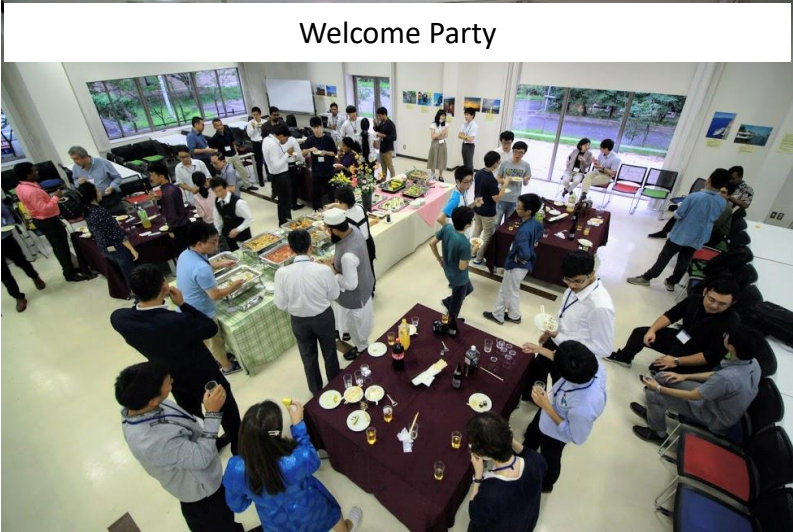
The result will be informed to the applicants by e-mail by the end of April.



QZSS Services

Photo @ Welcome Party 2019

Welcome Party



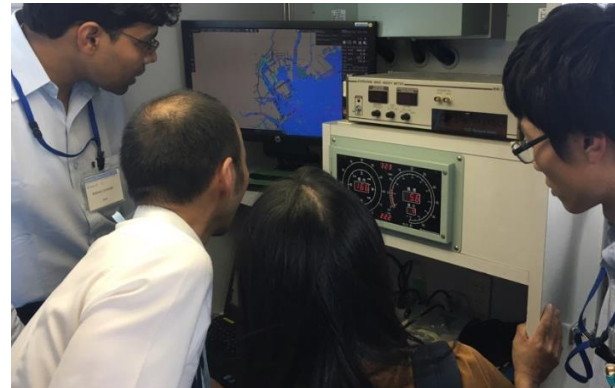
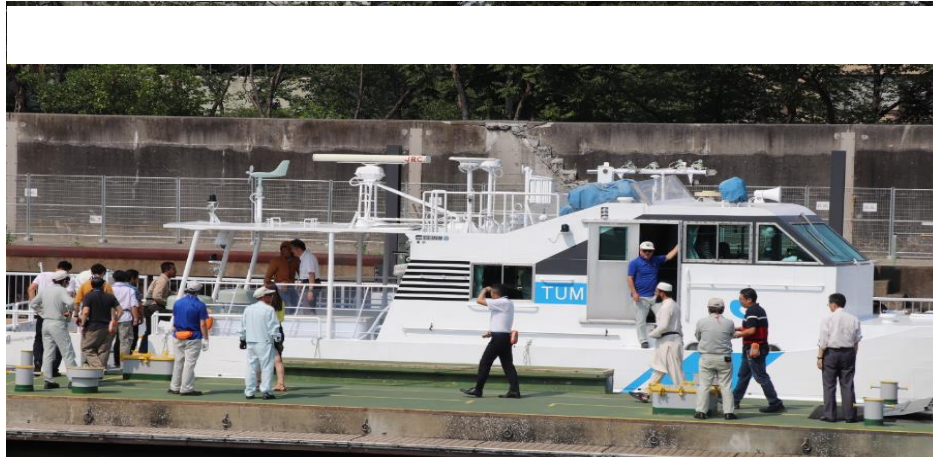
Lecture and Demo on GNSS Spoofing



Workshop on SDM / Ideathon



AIS & ECDIS Demo by JRC Team



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***
			Class C-2			
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	Pariticipants Workshop
1540-1550	Break	Break	Break	ECDIS Center G-I	Break	Break
1550-1720	Self-Intorduction	QZSS-Intro & Demo*	Class C-4	RTK-LIB Practice	SDR Practice II	Pariticipants Workshop Closing
1730-	Welcome Party	1 class=90 minutes			Farewell party	
		Introduction	Dr. Akio Yasuda		System Design by	***by Dr. Dinesh Manandha
		Class-A	Dr. Nobuaki Kubo		Dr. Naohiko Kohtake	
		Fundamentals	Dr. Ivan G. Petrovski A-1,2,3			
		Class-B	Dr. Takeyasu Sakai , B-1,2,3,4		* by QZSS Group	
		Software	Mr. Tomoji Takasu B-5,6,Practice			
		Class-C	Dr. Toshiaki Tsujii, C1,2,3		**Status of CORS in Japan	
Receiver	Dr. Taro Suzuki, C4, SDR-Practice					

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