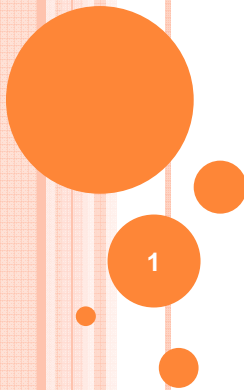


ASIA OCEANIA MULTI-GNSS DEMONSTRATION CAMPAIGN

Kazutoshi Sato, Hiroaki Tatashita, Wakabayashi Yaka, Hideshi Kakimoto, and Satoshi Kogure

Multi-GNSS Asia Secretariat

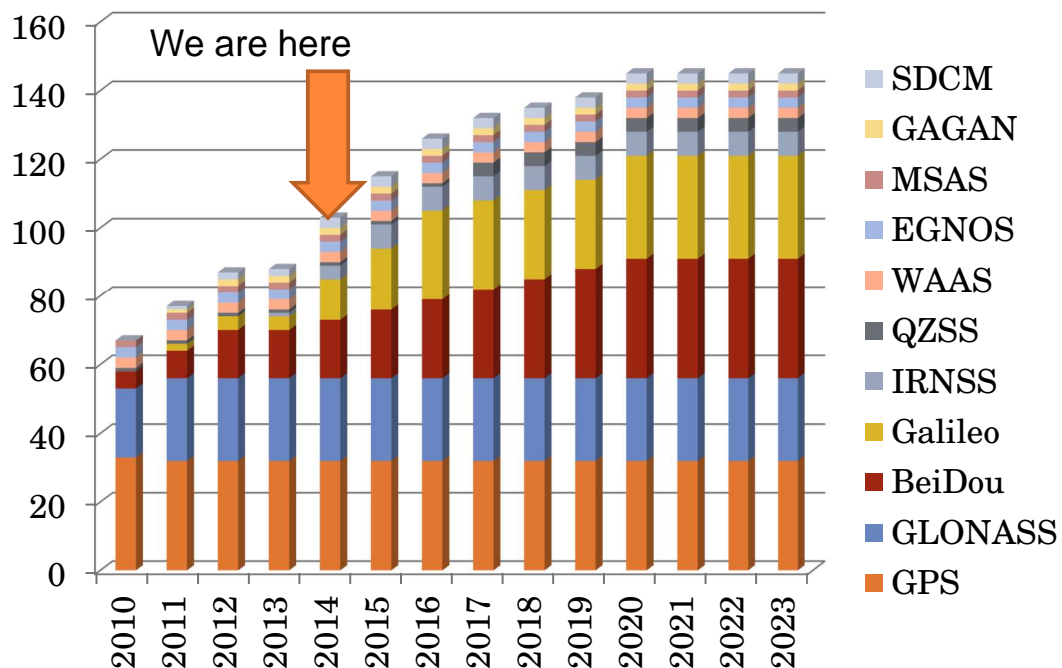
18 June 2014 @ KLCC, Kuala Lumpur, Malaysia



1

BACKGROUND - MULTI GNSS ERA-

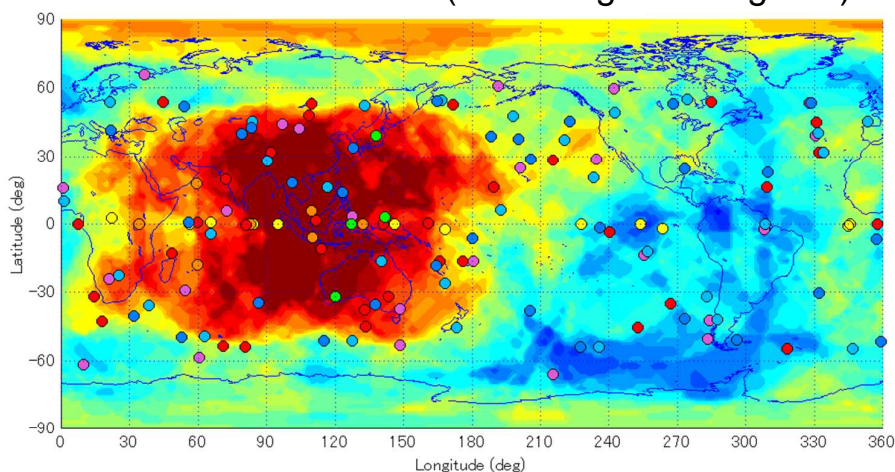
The number of SVs in multi GNSS systems



2

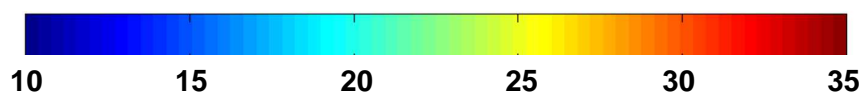
ASIA OCEANIA REGION IS SHOWCASE OF MULTI-GNSS APPLICATION

Visible satellite number (mask angle 30 degrees)



2020:

○ GPS(32)+ ● Glonass(24)+ ● Galileo(30)+ ● BeiDou(35)+ ● QZSS(4)+ ● IRNSS(7)+ ● SBAS(13)



THE MAIN OBJECTIVE OF MGA (MULTI-GNSS ASIA)

- Encourage GNSS signal and service providers and user communities in the Asia Oceania region to develop new applications, and to carry out experiments or demonstrations by using all available “Multi-GNSS” systems whose interface control documents are public, on a best efforts basis in the spirit of international cooperation.

ASIA OCEANIA MULTI-GNSS DEMONSTRATION CAMPAIGN

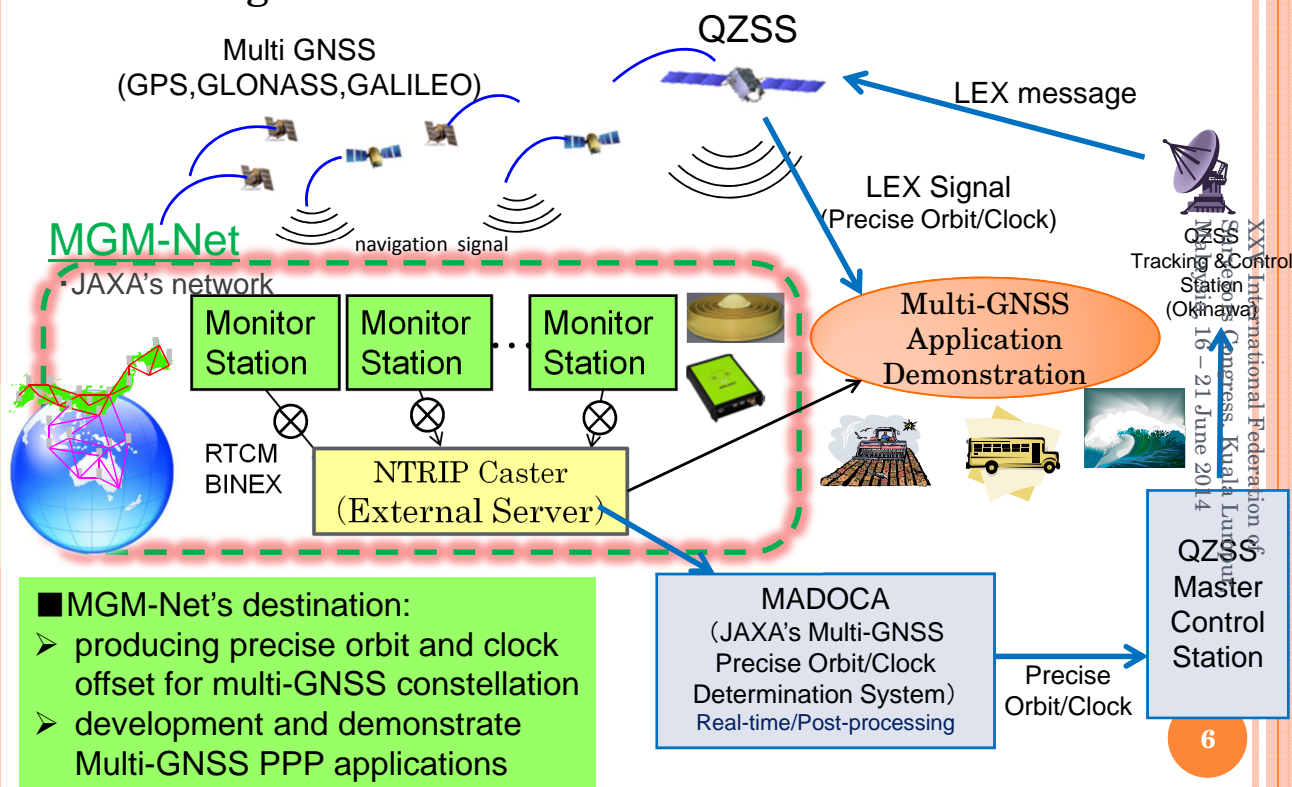


- Campaign consists of three main activities:

<h3>Establishment of Multi-GNSS Monitoring Network</h3>	<h3>Application Demonstration</h3> <p>Disaster Mitigation </p> <p>Precise Positioning </p> <p>ITS </p> <p>LBS </p> <p>Other, ionospheric observation etc</p>	<h3>Regional Workshop</h3> <p>4th Workshop, Dec. 2012 @ Kuala Lumpur, Malaysia </p> <p>3rd Workshop, Nov. 2011 @ Jeju, Korea </p> <p>2nd Workshop, Nov. 2010 @ Melbourne, Australia </p> <p>1st Workshop on GNSS, JAN. 2010, @ Bangkok, Thailand </p>
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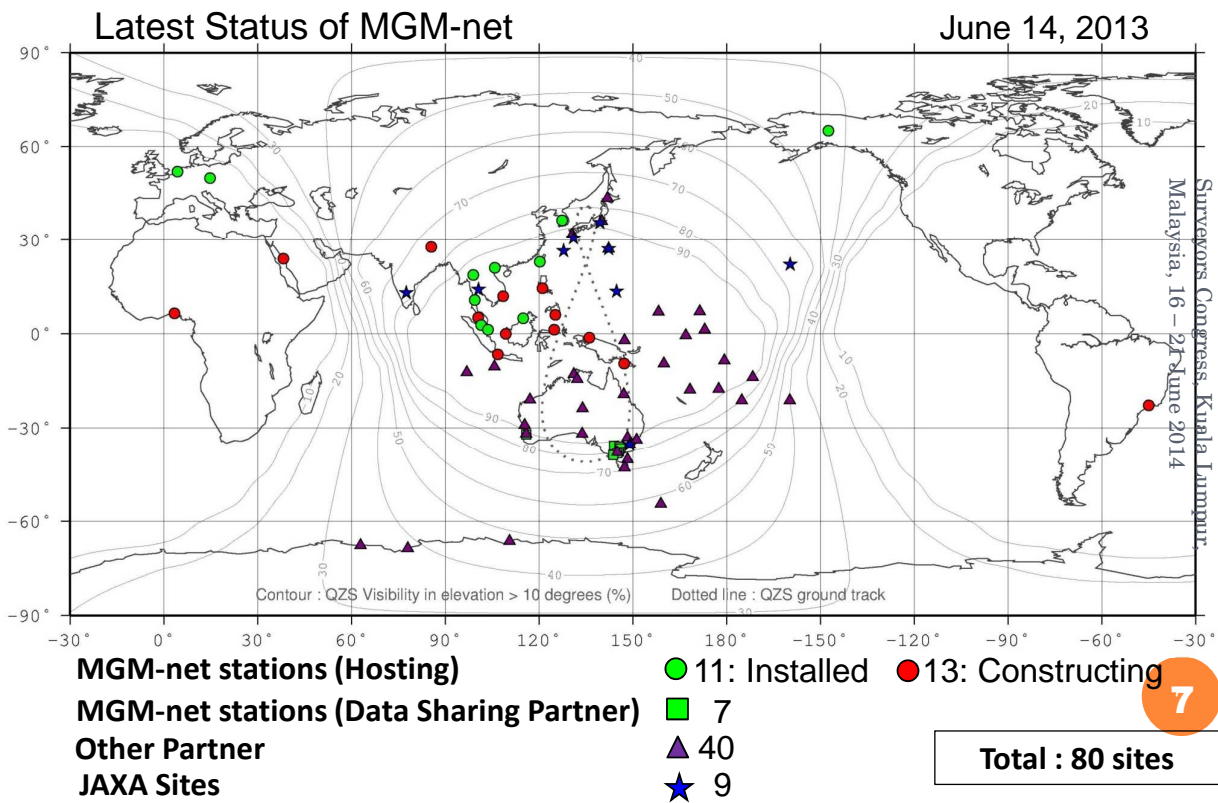
Activities 1 : Establishment of Multi-GNSS Monitoring Network



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LEX: QZSS's experimental signal including some information such as precise orbit /clock for PPP

Activity - 1 Multi GNSS monitoring network (MGM-net)



Multi-GNSS Demonstration Campaign WORKING GROUPS

Multi-GNSS Joint Experiments will be promoted in the following Working Groups

Working Groups	Examples of GNSS applications
Precise Positioning	<ul style="list-style-type: none"> • Precise Agriculture, • Construction machine guidance/control
Disaster Mitigation and Management	<ul style="list-style-type: none"> • Tsunami monitoring, • GNSS Meteorology, • Landslide Monitoring
Intelligent Transportation Systems (ITS)	<ul style="list-style-type: none"> • Probe-car, • Mobile Mapping System, • Road Pricing, • Car-navigation,
Location-Based Services (LBS)	<ul style="list-style-type: none"> • Mobile phone, • Pedestrian Navigation, • Short message, • Sightseeing application



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◆JAXA's Multi-GNSS Joint Experiments 2011-2012

Eight Multi-GNSS Joint Experiments have been started

	Title, Organization [Application Field]	Country/Region
1	Evaluation of Multi-GNSS for Precision Agriculture in Korea, <i>Chungnam National University</i> [Precise Positioning]	Korea
2	Sustainable Resource Utilization by Precision Farming of Oil Palm Plantation; RTK-Auto Guided Oil Palm Planter; On-the-Go Soil ECa Mapping, <i>University Putra Malaysia</i> [Precise Positioning]	Malaysia
3	Automated rice transplanter guided by using Multi-GNSS including QZSS, Agricultural Research Center, <i>National Agriculture Research Organization</i> [Precise Positioning]	Japan
4	"Joint QZSS/GPS positioning using L1/L5 band signals", <i>National Cheng Kung University</i> [Disaster Mitigation and Management]	Taiwan
5	"Multi-GNSS Experiment at RMIT University in Melbourne", <i>RMIT University</i> [Disaster Mitigation and Management]	Australia
6	Evaluation of QZSS-LEX based positioning compared to IGS PPP, positioning for Thailand, <i>Asia Institute of Technology</i> [ITS]	Thailand
7	Exploiting the use of QZSS and GNSS for navigational and high precision applications and their performance assessment (EQUATOR), <i>University of Nottingham Ningbo</i> [Precise Positioning]	China
8	Development of Driver Behavior Measurement Method for Level of Safety Estimation from High Precision and High Resolution Global Positioning System with Quasi-Zenith Satellite System (QZSS), <i>National Electronics & Computer Technology Center</i> [ITS]	Thailand

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◆JAXA's Multi-GNSS Joint Experiments 2012-2013

Six proposed Multi-GNSS Joint Experiments were endorsed to be implemented in 2013.

	Title, Organization [Application Field]	Country/Region
1	"WARTK test in Vietnam for enabling precise positioning for land-sliding applications", <i>NAVIS Center - HUST</i> [Disaster Mitigation and Management]	Vietnam
2	Field Evaluation of the Japanese QZSS LEX receiver for the Malaysian padi Field in Precision Rice Farming, <i>MARDI</i> [Precise Positioning]	Malaysia
3	Enhancement of multi-GNSS positioning solutions for Precision Agriculture using multiple QZSS signals and ground infrastructure, <i>QUT and UNSW</i> [Precise Positioning]	Australia
4	Proposal for landslide monitoring test under vegetated slope in Malaysia using multi-GNSS, <i>JKR (Public works Department)</i> [Disaster Mitigation and Management]	Malaysia
5	Improvement of GPS tracking accuracy for traffic information platform for Asia mega city, <i>TTET</i> [ITS]	Thailand
6	Identifying of needs within Asia Oceania Region for emergency messages from QZSS with Demonstration, <i>NTT data</i> [LBS]	Japan

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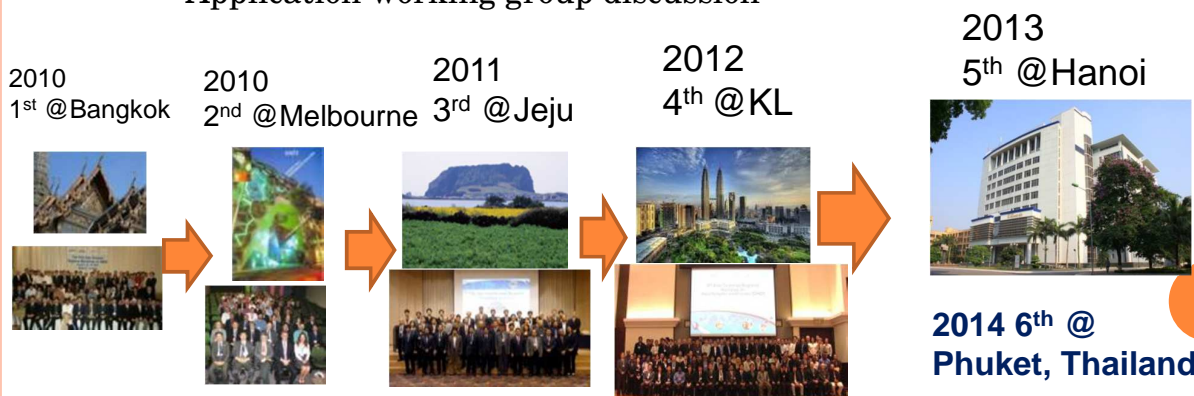
Activities 3 : Regional Workshop



ASIA OCEANIA REGIONAL WORKSHOP ON GNSS

- ◆ Aim is to discuss the future joint project and share the status and the results of the existing projects annually
- ◆ Contents
 - Current status of GNSS
 - Applications, introductions for the planned joint activities
 - Application working group discussion

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Multi-GNSS Demonstration Campaign



ORGANIZATION: WHAT IS MGA?

- “Multi GNSS Asia (MGA)” is an international organization to promote and support activities of the “Asia Oceania Multi-GNSS Demonstration Campaign”
- MGA was established in September 4th, 2011 in Tokyo

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1st meeting of MGA Steering Committee



public website: www.multignss.asia



site for members only

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MGA PARTICIPATING ORGANIZATIONS



No	Organizations	Countries/Regions
1	Beach Building & Civil Group (BBCG)	Australia
2	RMIT University (RMIT)	Australia
3	Japan Aerospace Exploration Agency (JAXA)	Japan
4	University Putra Malaysia (UPM)	Malaysia
5	National Cheng Kung University (NCKU)	Taiwan
6	Asian Institute of Technology (AIT)	Thailand
7	Chungnam National University (CNU)	Korea
8	SINGAPORE LAND AUTHORITY (SLA)	Singapore
9	The University of Nottingham Ningbo China (UNNC)	China
10	Tokyo University of Marine Science and Technology (TUMST)	Japan
11	National Electronics and Computer Technology Center (NECTEC)	Thailand
12	Ministry of Science and Technology (MOST)	Vietnam
13	National Agriculture and Food Research Organization (NARO)	Japan
14	Earthquake Research Institute, the University of Tokyo (ERI)	Japan
15	Research Faculty of Agriculture, Hokkaido University (AGHU)	Japan
16	Toyama National College of Technology (TNCT)	Japan
17	National Space Agency of Malaysia (ANGKASA)	Malaysia
18	Hanoi University of Science and Technology (HUST)	Vietnam
19	Growing NAVIS (GNAVIS)	Europe
20	Malaysian agricultural research and development institute (MARDI)	Malaysia
21	University of New South Wales (UNSW)	Australia
22	Keio University	Japan
23	Burdwan University	India
24	Electronic Navigation Research Institute (ENRI)	Japan
25	SOARTECH SYSTEMS Sdn Bhd (SSSB)	Brunei
26	Industrial Geodetic Systems	Russia
27	GNSS.asia	Europe
28	KUgeomatic	Australia
29	Chulalongkorn University	Thailand
30	Satellite Positioning Research and Application Center (SPAC)	Japan
31	Research Institute of Geodesy, Topography and Cartography	Czech
32	St. Petersburg National Research University of Informational Technology, Mechanics, and Optics	Russia

32 organizations from
14 countries/regions

If you have interest
to join MGA,
please visit
www.multignss.asia

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HOW TO JOIN MULTI-GNSS ASIA (MGA)



- Please send LOI (Letter of Intent) to the secretariat

The LOI should include the following

1. Working group which you would like to participate in (including network sub-committee)***required**
2. Your interests: GNSS applications
3. your contributions to Multi-GNSS Demonstration Campaign such as proposing joint experiments and new GNSS applications and providing multi-GNSS receivers for the demonstrations. ***required**

Please visit to

http://www.multignss.asia/howto_join_mga.html

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HOW TO JOIN MULTI-GNSS ASIA (MGA)

<MGA Joining Flow Chat>

Organization Logo

Sample Letter of Intent

<Date>

MGA Secretariat
Satellite Applications and Promotion Center
Space Applications Mission Directorate
Japan Aerospace Exploration Agency
2-1-1 Sengen, Tsukuba-shi, Ibaraki-ken, 305-8505 Japan
Tel. +81-50-3362-3361 Fax. +81-29-868-5987

Dear Co-chairs of MGA,

Application for Multi-GNSS Asia Membership

We are pleased to express the intention to join "Multi-GNSS Asia (MGA)"

Your interests and contributions description

We appreciate your consideration and look forward to receiving consent from MGA Steering Committee.

Sincerely,

Sign
<Name>
<Position>
<Organization name>
<Contact information>



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5th Asia Oceania Regional Workshop on GNSS was held very successfully on December 1-3, 2013 at Hanoi University of Science and Technology, Hanoi, Vietnam



The 5th Asia Oceania Regional Workshop on GNSS



- 160 participants from many organizations including universities, institutes, government agencies, International organizations and companies gathered from 14 countries.



Workshop Agenda included

- Dec. 1st
 - GNSS Tutorial Session by G-NAVIS and JAXA
- Dec. 2nd
 - Welcome and Keynote Speech
 - What's New about GNSS
 - Status Report of the Multi-GNSS Joint Experiments
 - GNSS Applications /Network Session (1)
- Dec. 3rd
 - GNSS Applications /Network Session (2)
 - Discussion Session
 - QZSS Demonstration
 - Closing Session



Multi-GNSS Joint Experiment

8 Final results of Joint Experiment 2011 including improvement of positioning by Multi-GNSS were shared

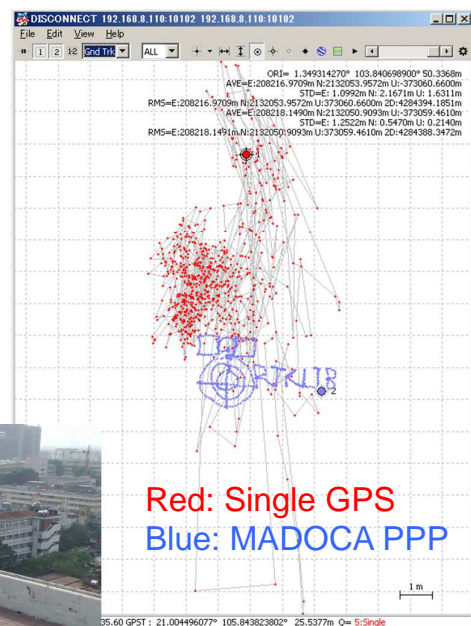
Preliminary results and next steps of joint experiments 2012 were shared. Final results of these experiments are expected to be reported in next workshop.

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Demonstration

Precise Point Positioning (PPP)
 Demonstration by using
 augmentation data created by using
 MADOCA (Multi-GNSS Advanced
 Demonstration tool for Orbit and
 Clock Analysis) via QZSS LEX signal



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Proposed Multi-GNSS Joint Experiments

- MGA Steering Committee endorsed the implementation of the following 5 proposed experiments
 1. "Autonomous rice transplanter guided by GNSS with QZS-LEX", National Agriculture and Food Research Organization, Japan [PP]
 2. "Smart strategy for a large number of offshore oil and gas platforms deformation monitoring", University of Technology PETRONAS, Malaysia [PP]
 3. "Experiment proposal of the evaluation of position accuracy achievable Industrial Geodetic Systems, Russia by single-frequency Multi-GNSS receiver using various of correction information", Industrial Geodetic Systems, Russia [DMM]
 4. "The evaluation of the QZSS's positioning augmentation functionality for the vehicular traffic management within the low-altitude region in South East Asia", Mitsubishi Heavy Industries, Ltd., Japan [ITS]
 5. "Multi-GNSS-PPP Navigation System in Vehicle Safety Monitoring", National Electronics & Computer Technology Center and Chulalongkorn Univ., Thailand [ITS]

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The 6th Asia Oceania Regional Workshop on GNSS

6th Asia Oceania Regional Workshop on GNSS will be held on 9-11 October, 2014 at Phuket, Thailand. The Detail information will be available on MGA website:

<http://www.multignss.asia>



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SUMMARY

- Multi-GNSS Asia (MGA) was introduced. The Active Participation in MGA be highly welcomed!!
- “Asia Oceania Multi-GNSS Demonstration Campaign” consists three main activities: (1)Multi-GNSS Monitoring Network Establishment, (2)Multi-GNSS Application Demonstration, and (3)Regional workshop
- Multi-GNSS Asia (MGA) was established as an international organization to promote the Campaign activities. 32 organizations from 14 countries participate in MGA.
- As results of the 5th Asia Oceania Regional Workshop on GNSS, Five proposed Multi-GNSS Joint Experiments were endorsed to be implemented.
- 6th Asia Oceania Regional Workshop on GNSS will be held on 9-11 October, 2014 at Phuket, Thailand.

Thank you for your kind attention!