Status of Multi-GNSS Monitoring Network Establishment

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Introduction

- **Total 65 3G(GPS/GLONASS/GALILEO)+QZSS receivers were delivered to JAXA.**
  - **Three divided procurements were done through JAXA's open biding procurement process.**
  - **Three manufacturers applied to the bid proposing to add QZSS tracking function to their existing 3G products.**
  - **JAVAD was selected for all procurement opportunities.**
    - **DELTA or SIGMA G3T were modified so as to track and decode QZSS signals and NAV messages.**
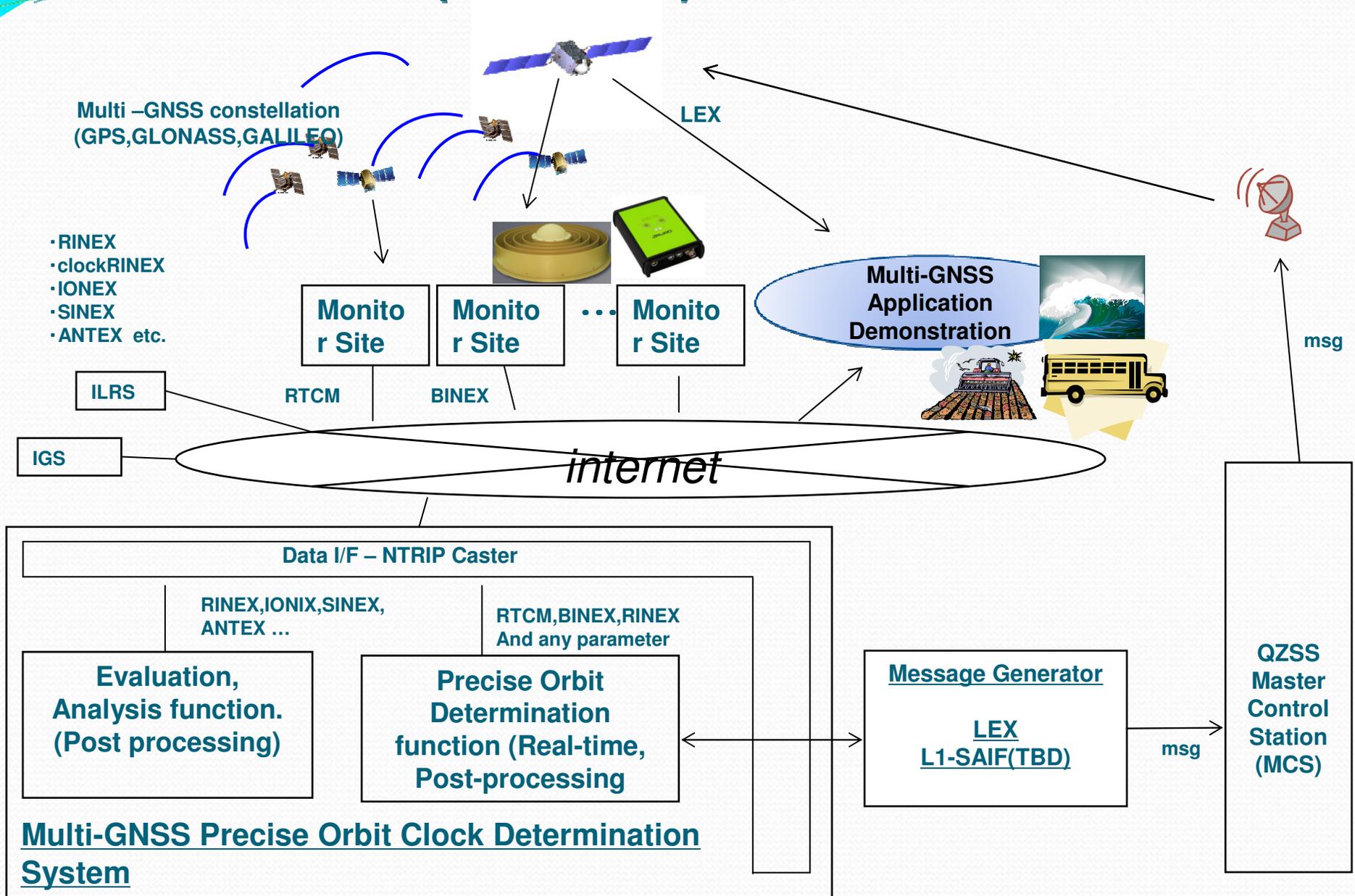
JAXA decided to distribute them to establish observation network;
- **To enhance QZSS POD ability, i.e. improve accuracy of orbit and clock estimation.**
- **To contribute multi-GNSS demonstration campaign aiming to promote multi-GNSS application in Asia and Oceania region**

Overview of Multi-GNSS Monitoring Network(MGM-net)

Multi –GNSS constellation (GPS,GLONASS,GALILEO)

LEX

·RINEX
·clockRINEX
·IONEX
·SINEX
·ANTEX etc.

Multi-GNSS Application Demonstration

Monitor Site

Monitor Site

· · ·

Monitor Site

msg

ILRS

RTCM

BINEX

IGS

internet

Data I/F – NTRIP Caster

RINEX,IONIX,SINEX, ANTEX …

RTCM,BINEX,RINEX And any parameter

Evaluation, Analysis function. (Post processing)

Precise Orbit Determination function (Real-time, Post-processing

Message Generator

LEX L1-SAIF(TBD)

msg

QZSS Master Control Station (MCS)

Multi-GNSS Precise Orbit Clock Determination System

Overviews

- *Deployment of the MGM net will be done in a stepwise manner.*

  Step I
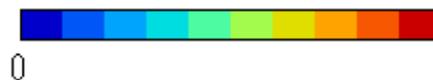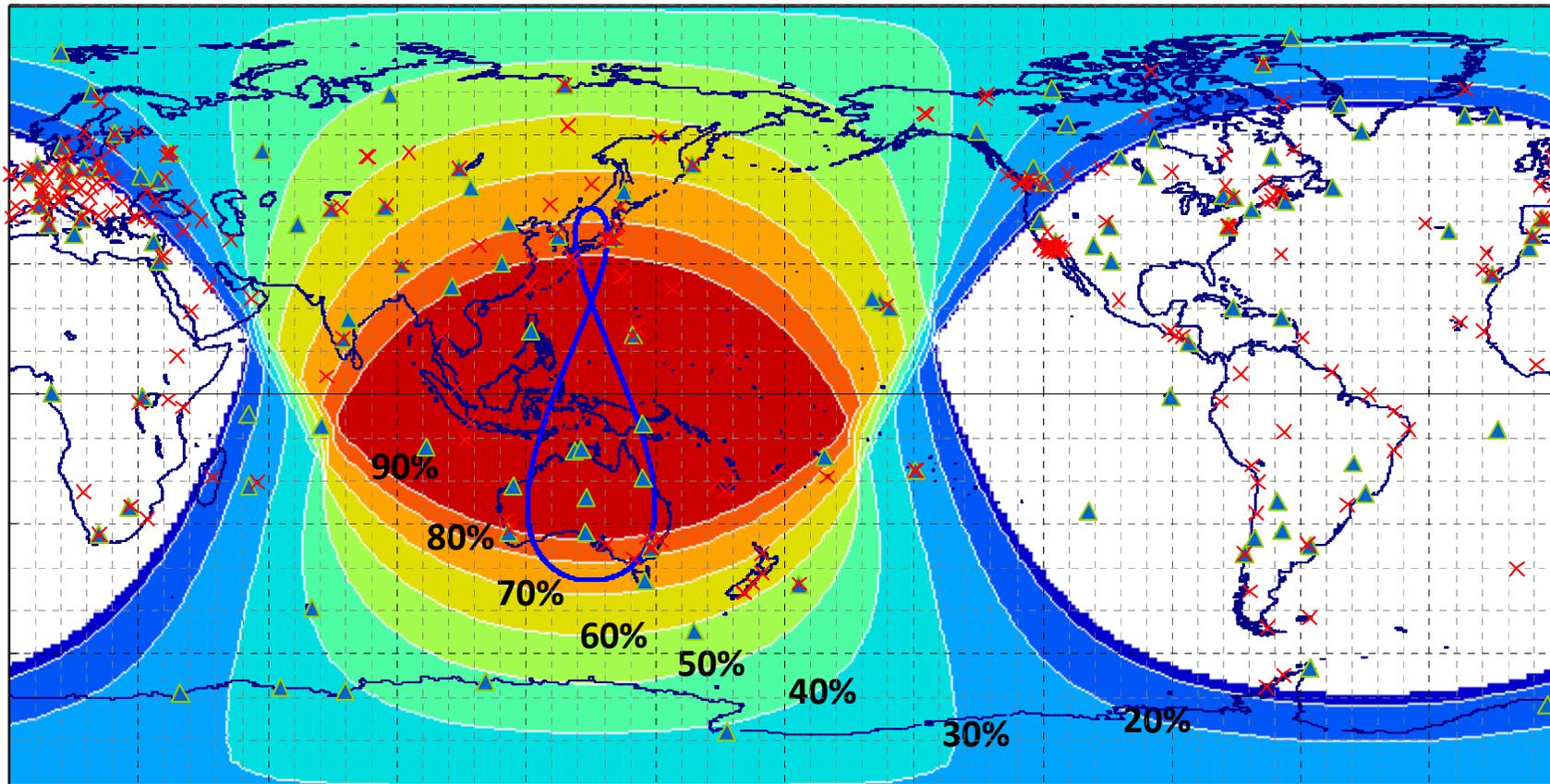
  - *Focusing to enhance QZSS orbit & clock estimation.*
  - *20 sets which have choke ring DM antennas are to be distributed as core network.*
  - *They are to be deployed in the area where QZSS can be observed, i.e. Asia and Oceania region by the end of March 2012.*

  Step II

  - *Additional 40 sets will be distributed after domestic or international demonstrations by the end of March 2013.*
  - *Distributed area will be extended to global area in order to track all GNSS constellations and generate precise orbit and clock estimation product.*

Time rate of QZS signal reception
(Visibility more than 10 deg elevation angle)

90%
80%
70%
60%
50%
40%
30%
20%

0   1

IGS Reference Site
IGS Site

Overviews

Network data and product sharing policy

- **Adopt same philosophy as IGS project**
  - Observed data is converted to RINEX format for sharing among GNSS community via IGS data center.
  - Real-time data stream is shared among organizations who provide their resources such as receiver, antenna, site, and data server, participating in MGM-Net applying to this call for application, or joining MGA with their own equipment, as well as IGS Multi-GNSS Pilot Project in IGS,
  - Products generated using shared observation data from the network will be provided to participants of MGA for multi-GNSS applications demonstration.

Call for Application(1/3)

- *The announcement of "Call for Hosting Site" was issued on JAXA's web site on June 2 2011.*
  - *Intended number of sites*
    - *Group A; 20 sites*
    - *Group B; 40 sites*
  - *Eligible applicants*
    - **An organisation or site operating existing continuous GNSS observation receiver or network of receivers**
    - *"Terms and conditions" should be agreed in advance.*
  - *Application form, terms and conditions, guidance are available on the following web site*
    - *http://www.satnavi.jaxa.jp/e/news/qz-1106012_e.html*

Call for Application(2/3)

- **Planned schedule for application and selection process**
  - **June 2, 2011:** Call for hosting site was issued
  - **End of August:**
    Dead line for Application and selection process start
  - **End of November:** Site Selection to be completed
  - **December 2011:** Site Installation will start
  - **Target of completion of the installation and operation launch**
    - Step I (20 sites): End of March 2012
    - Step II (40 sites): End of March 2013

Call for Application(3/3)

- **Requirement for hosting site**
  - **Visibility of QZSS constellation**
    - **30% or more for QZS-1 observation for the first group**
    - **No constrain on QZSS visibility for the second group**
  - **Continuous and real-time internet access**
  - **Better Geometry**
  - **Satisfy with IGS site requirement**
    - **IGS Site Guideline 2.1 -2.3**
  - **Air conditioned room or cabinet for receiver, power supply**
  - **Atomic clock (not mandatory, but better)**
  - **Monument/pillar (not mandatory, but better)**
- **Detail requirement can be referred to application guidance**

Participation with own Multi-GNSS Receivers

- *No need application and selection process.*
- *Contribution to establishing the network by an organisation which has its own multi-GNSS receiver is welcomed*
  - *improve the quality of generated products*
  - *increase the robustness of the network.*
- *Please contact the MGA secretariat if you wish to contribute to the network with data from your own multi-GNSS receiver.*
  - *secretariat@multignss.asia*

Result of Call for Application as of the end of August

- **11 applications for hosting site were received by 31 August 2011.**
  - **Korea, Philippines, Brunei, Indonesia, Malaysia (2 organizations), Vietnam, Papua New Guinea, New Zealand, Europe (2 organizations)**

- **6 networks/organizations are investigating to join sharing data framework with MGM-net**
  - **GA in Australia, GSI and ENRI in Japan, DLR (CONGO), EC/EUROCONTOL(ESDN), ESOC in Europe**

Next Steps

- *Conversation with IGS*
  - *Asking to the IGS sites, where are located in the area no applications, to host JAXA's receiver.*
  - *Participating in IGS M-GEX*
  - *Promoting collaboration with other networks*
    - *Existing of planed future update to multi-GNSS tracking*
- *Evaluation & selection site*
  - *by the end of November*

MGM net can contribute to multi-GNSS performance monitoring by sharing collected real-time observation data.

Data exchange format

- *JAXA prepared Draft QZSS extension version of RINEX and RTCM. UNAVCO updated BINEX format including QZSS*
  - *RINEX Extension for RINEX 2.1.2 and 3.0*
  - *RTCM 3.0*
- *JAVAD receivers provided by JAXA has already supported those formats of draft QZSS extension version*
- *JAXA will start and keep talking with IGS, RTCM, and UNAVCO about involvement of QZSS to the next formal updates of those international standards for data exchange format.*

Need WG-D recommendation?

Establish sub-group to discuss update version of those format? or urge each provider to join into IGS RINEX WG?

How about RTCM?

Analysis tool

- **The development POD software for multi-GNSS constellation has just started since May 2011.**
  - **Two steps development**
    - **JFY2011: off line software**
    - **JFY2012: real time software**
- **JAXA and Tokyo University of Marine Science and Technology has been extending RTKLIB, an analysis tool for several kind of PVT computations, to include multi-GNSS constellations.**

Summary

- **Multi-GNSS Monitoring network is planned to be established with 60 multi-constellation receivers provided by JAXA in 2011-2013.**

- **Call for application issued in June and By the deadline for the application, 11 applications was received by 31 August, 2011 and 6 organizations showed interests in data sharing with MGM-net.**

- *MGM-net and the framework of real-time data sharing can contribute to the performance monitoring for multi-GNSS civil signals as well as demonstration of multi-GNSS usage.*

- *Recommendation to promote earlier updating data exchange format to include multi-GNSS should be considered*

Multi-GNSS Demonstration Campaign!

Multi-GNSS Demonstration Campaign

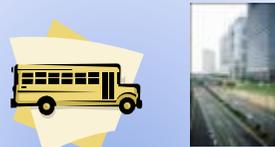### Multi-GNSS Monitoring Network

Application Demonstration

Disaster Mitigation

Precise Positioning

ITS

LBS

Other, ionospheric observation etc

Regional Workshop

1st Workshop, 25-26 JAN, 2010, @Bangkok

195 Participants, 18 Countries, 95 Organizations
2nd Workshop, 21,22 Nov. 2010 @ Melbourne, Australia

3rd Workshop, 1-3 Nov. 2011 @Jeju Island, Korea with KARI and GTC