



New concept for MGA joint experiment and test results 2016

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GESTISS

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Overview of new MGA joint experiment(1/2)

- Objective:
 - Aiming **to build practical, operational system/infrastructure utilizing multi-GNSS technology** in order to resolve social problems which Asian mega cities are facing commonly, such as heavy traffic jam, serious air pollution, environmental damages, inefficient transportation system and rising traffic accidents.
 - To establish more effective, inexpensive way to demonstrate multi-GNSS benefits on the above applications.
- Proposed package for MGA joint experiment
 - A package or set of documented knowhow, procedure, guidance and so on;
 - A package of equipment and analysis tool to be used in the joint experiment
 - Initial set of experiment items



Overview of new MGA joint experiment(2/2)

- Initial pilot experiment will be conducted in Manila and Hanoi in 2016
 - To create a set of initial documentation
 - Using the documentation, pilot experiment will be conducted as the first iteration process for improving procedure, process, manual and after evaluating them, they will be updated for next joint experiment.
 - To demonstrate how the whole process on the joint experiment is carried out more efficiently by using the document package.
- After 2017, the new joint experiment will be proposed to countries in Asia and Oceania
 - Other Asian mega cities such as Jakarta, Bangkok, Singapore, Kuala Lumpur and other cities.....
 - Proposal on improving their public transportation system, traffic control system, and etc.



More simply...

- Let's do GNSS test utilizing QZSS together
- Package for the test is provided
- Improve the package and can be used for other countries
- Resolve social problems using GNSS technology

Efficient Transport System

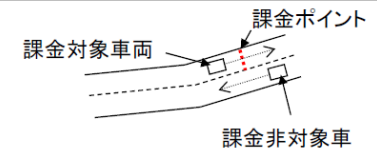


- Singapore case -

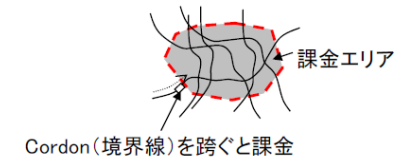


Next generation system will adopt **gateless system** using GNSS technology.

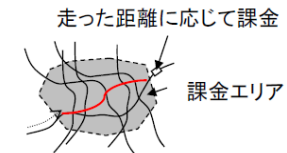
Point-based



Cordon-based



Distance-based



Electronic Road Pricing

Flexible : type of car, place, time and the price can be reflected based on the amount of traffic

- ✓ Gateless
- ✓ Various charging scheme
- ✓ New service other than charging
- ✓ Future Telematics and ITS

Initial Pilot experiment in Manila and Hanoi



- The Pilot Experiment includes following tasks
 - I. Create Documentations
 - II. Local Seminar and Workshop
 - III. Implementation of the Joint Experiment
- Long-term fixed point observation and repeated driving observation
- Some positioning solutions and combination with multiple constellations are to be compared
- JAXA and Ministry of Economy, Trade and Industry will support the initial pilot project respectively. GESTISS, Honda and other will conduct with local organizations

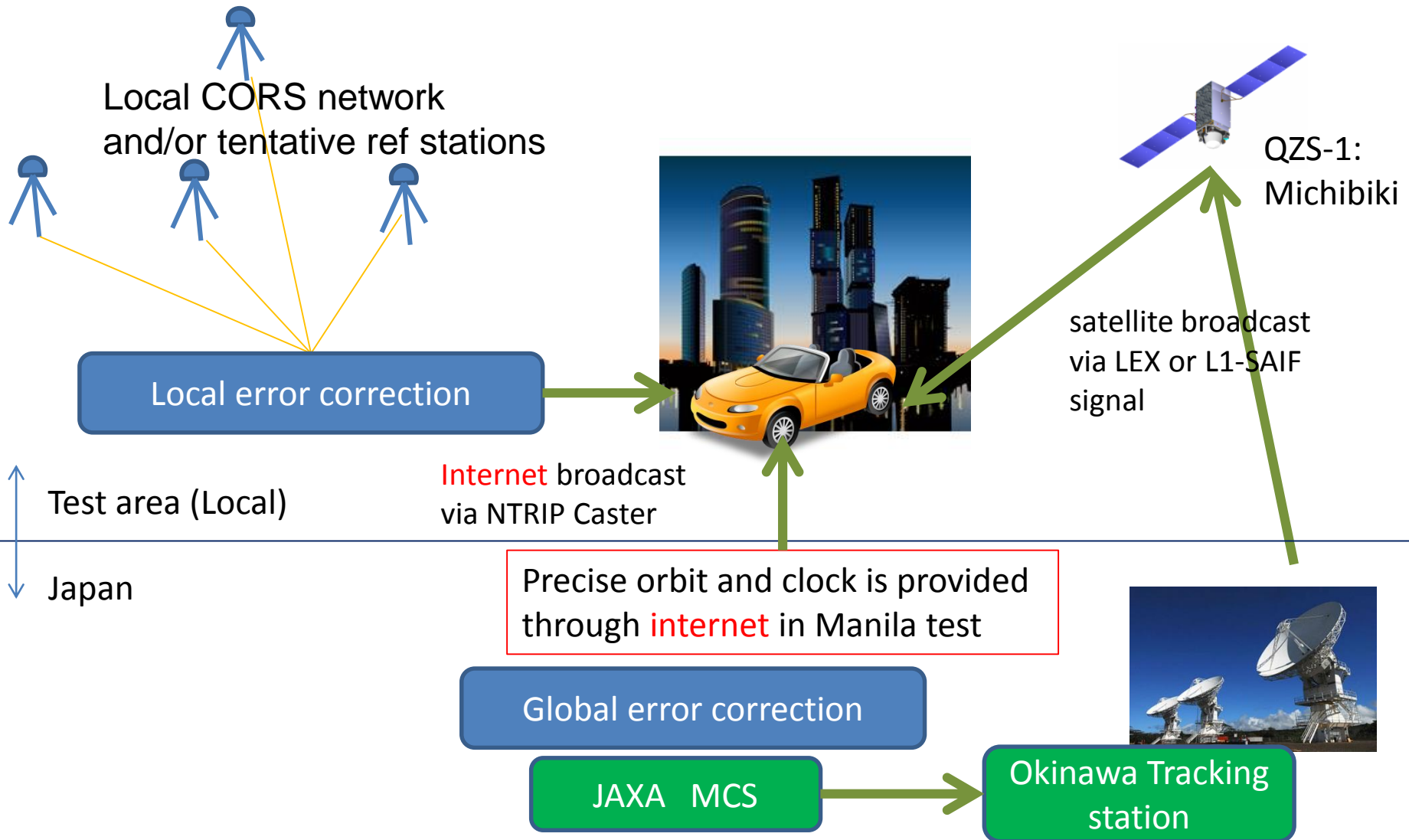
Probe car and motor bike experiment

Positioning methods to be evaluated



Method	Rx	GNSS	Accuracy level	NOTE
RTK	Geodetic	GREBQ	2-3 cm(rms)	For reference value
Single Freq Positioning	Geodetic Low-cost	GREBQ	Several meters	
MADOCA-PPP (PPP-AR)	Geodetic	GRQ	Deci-meter	Local error correction can be applied
DGNSS	Geodetic Low-cost	GREBQ	Sub-meter	Option : L1-SAIF/SBAS

Augmentation through QZS-1 for Local PPP



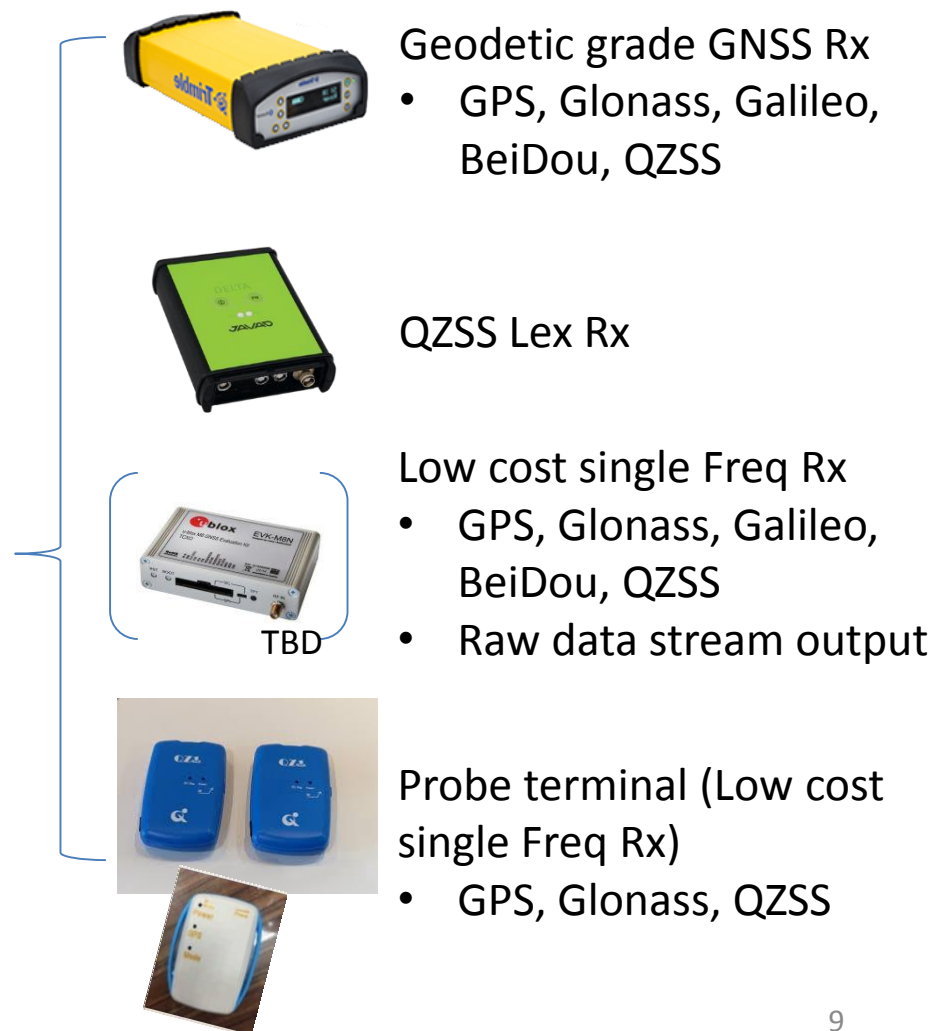
A example set of equipment for the experiment



Fixed Point Observation: Reference station (tentative site)



Driving Observation: Test vehicle





Initial Pilot Experiment in Manila

Driving Test Schedule



UP : University of Philippine

NAMRIA : National Mapping and Resource Information Authority

- Oct. 11 AM Seminar at UP
PM Setting and Highway
- Oct. 12 AM+PM Suburban (near NAMRIA)
Total 11 runs
- Oct. 13 AM+PM Urban (near NAMRIA)
Total 14 runs

Static test for local PPP has been conducted since the end of October.

Test Manual



PPT

PPP-AR+local correction positioning tool manual

2016/ 09/12 JAXA, SNU, Endoh Masaaki

1. system configuration

- base stations consist of
 - GNSS antenna(2freq. high end)
 - GNSS receiver(2freq. high end)
 - PC(windows)
 - strsvr (RTKLIB SW)
- estimate local correction
 - Linux PC
 - ◇ need to time synchronization
 - rtkrvc_rtc(RTKLIB SW developed by JAXA)
 - LCLRTC(RTKLIB SW developed by JAXA)
- rover station
 - GNSS antenna(2freq. high end)
 - GNSS receiver(2freq. high end)
 - Linux PC
 - rtkrvc_rtc(RTKLIB SW developed by JAXA)
- others
 - ntrip caster
 - PC



Participants at NAMRIA

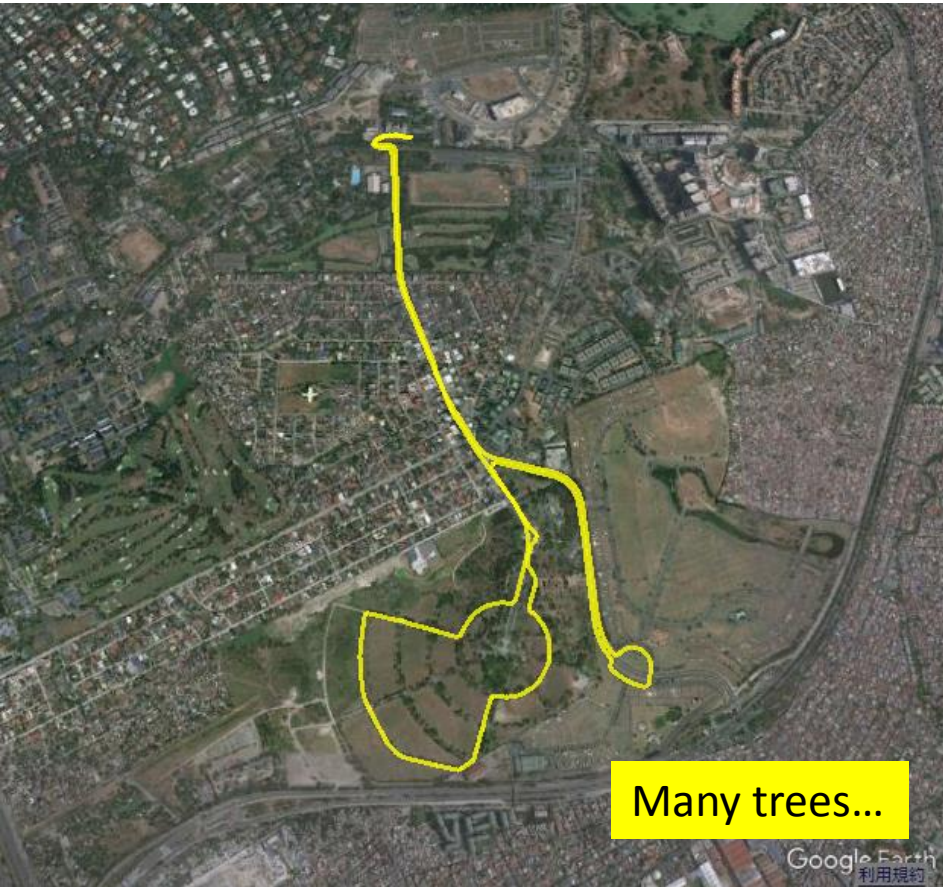


Test Car



Test course

(suburban and urban near NAMRIA)



Suburban



Urban

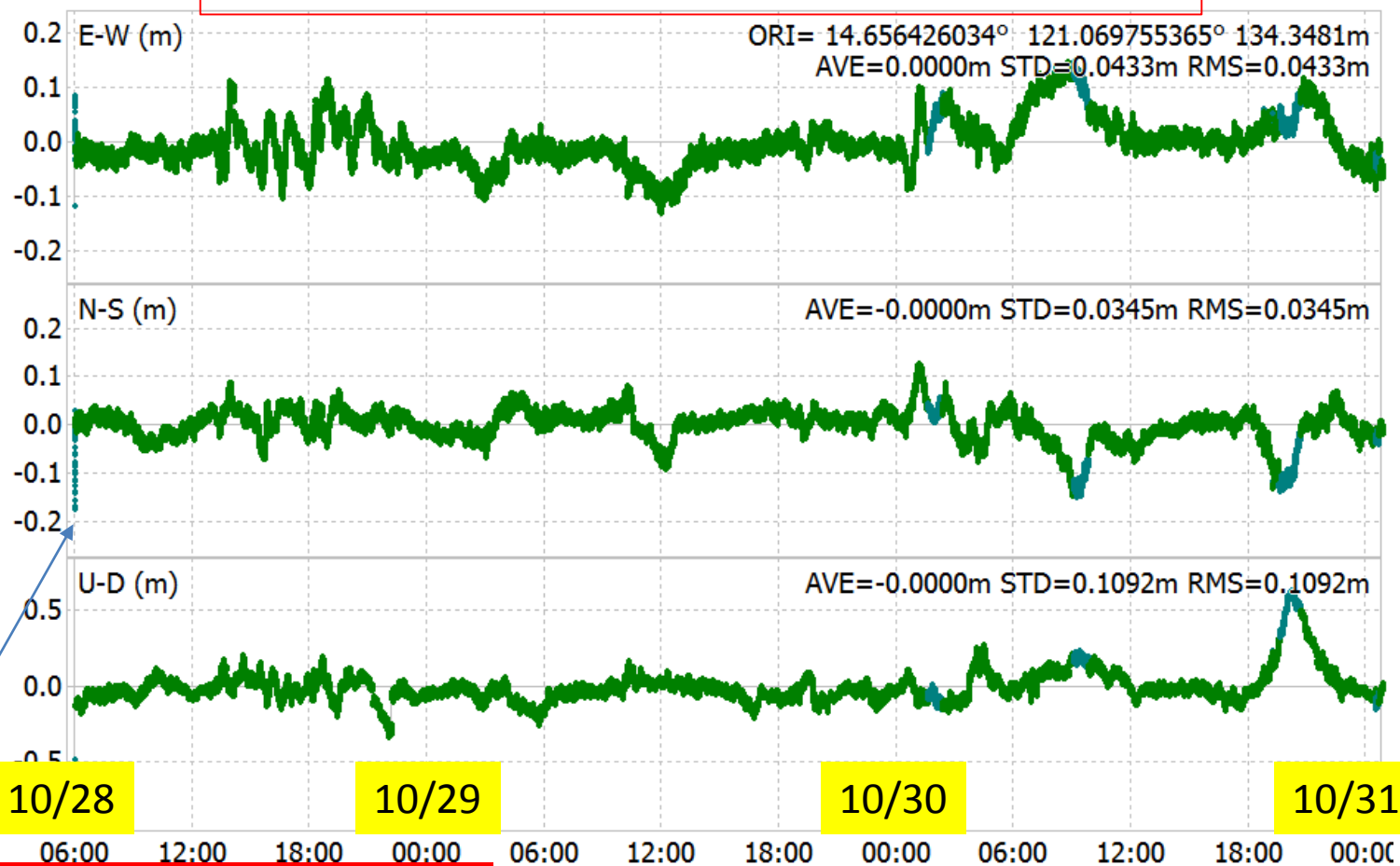
Reference station (NetR9) installed in NAMRIA was used.

Static Test for Local PPP



2016/10/28-11/6

- Precise orbit and clock via internet from JAXA
- Local correction data was generated in NAMRIA
- Rover station is UP (14 km away from NAMRIA)



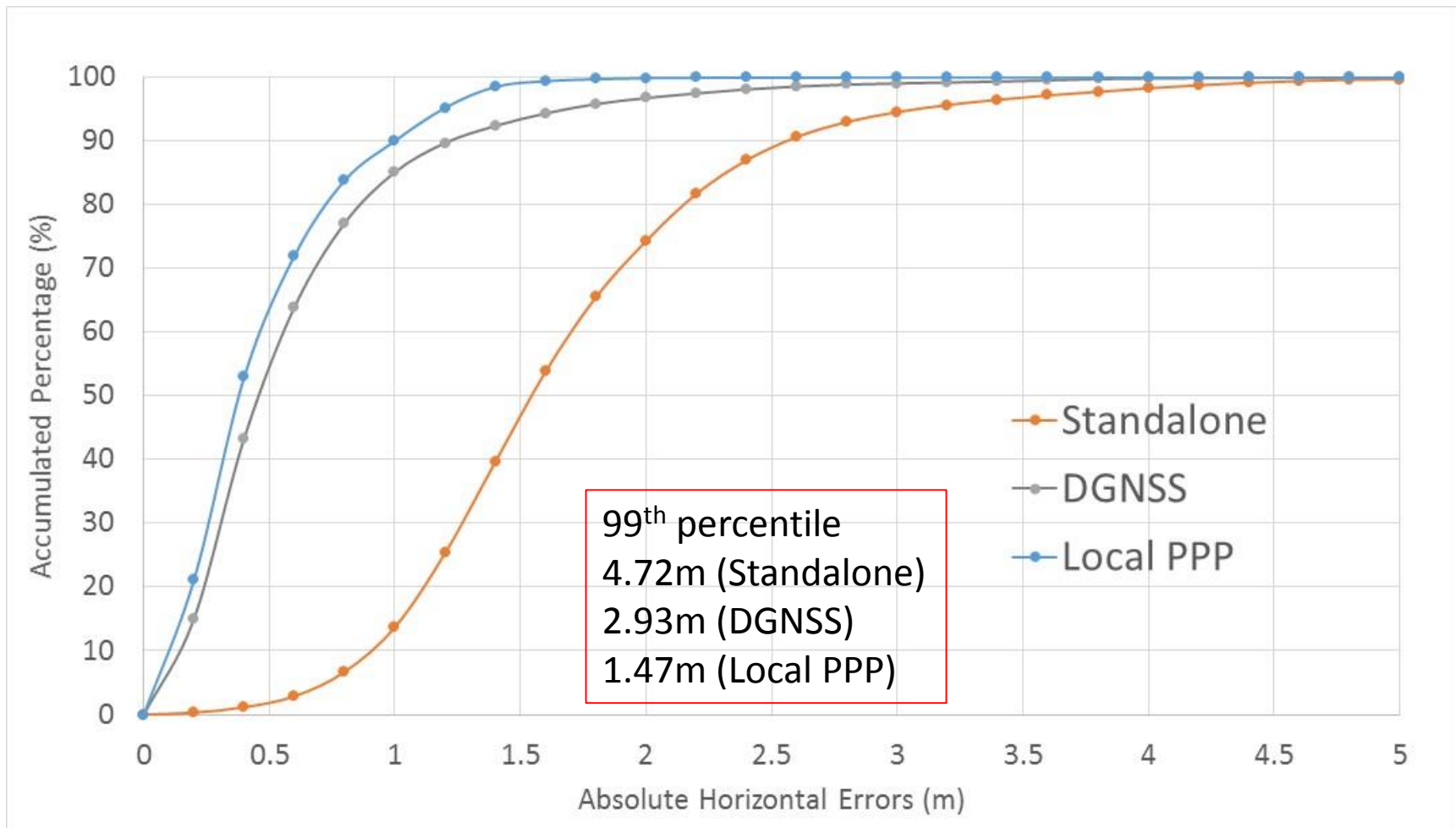
Quick convergence within a few minutes

Car Test in Suburban

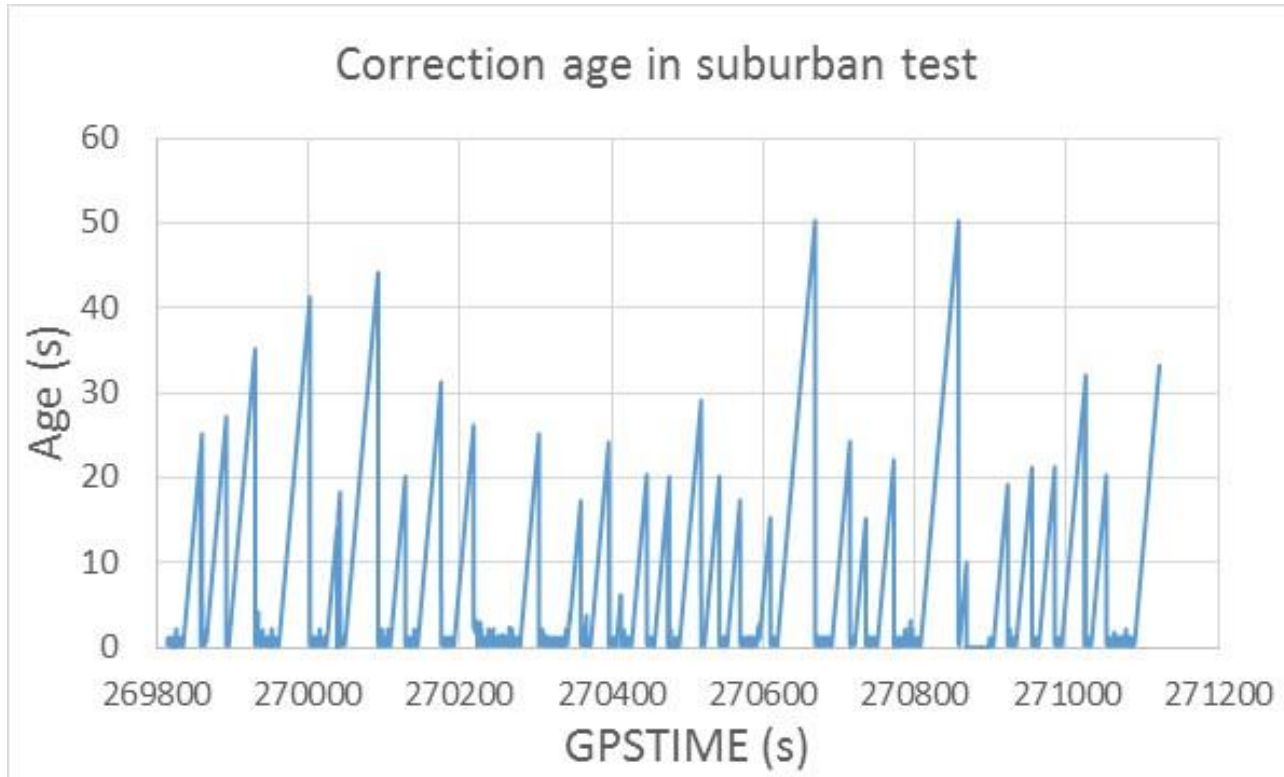


-1st run case-

- Almost 80% of reliable reference positions were produced using post-processed RTK (we improve more)



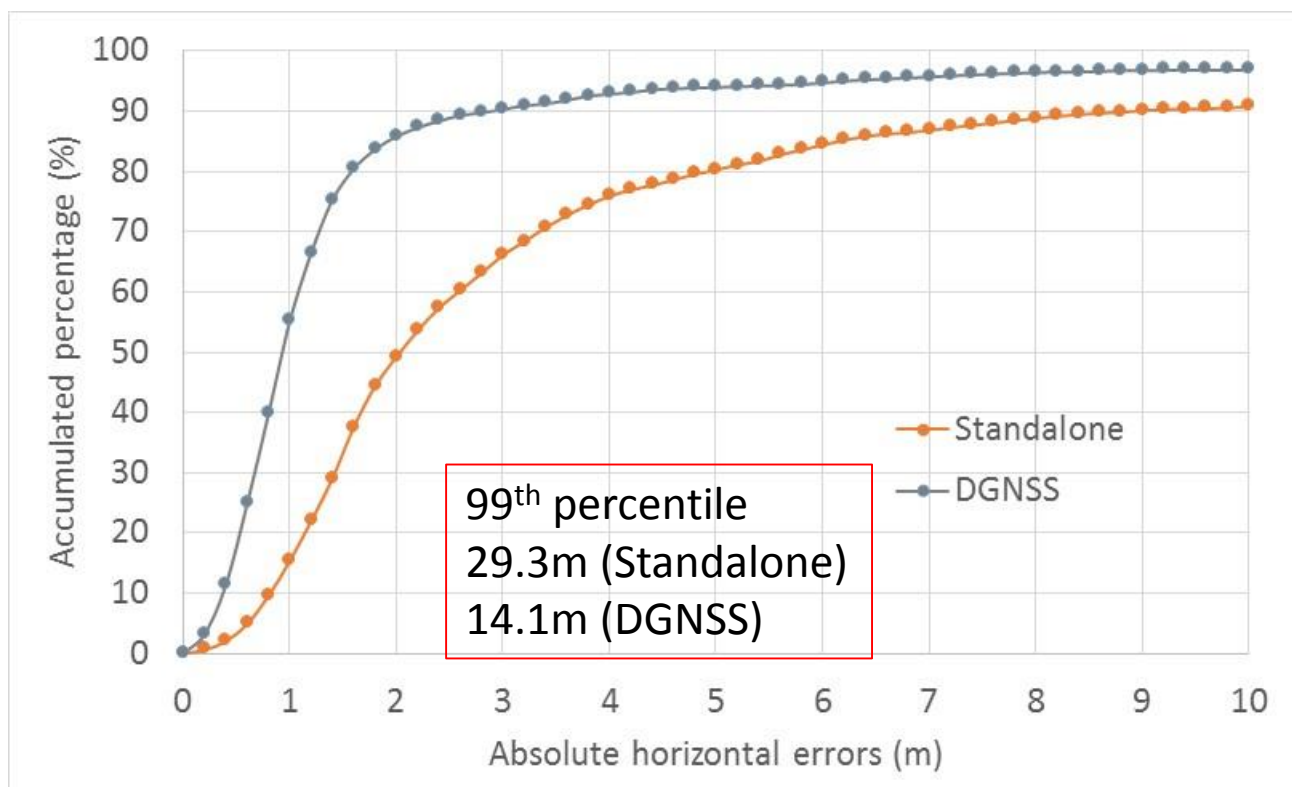
Big issue...



- **Availability of WiFi router was significantly low.** It is difficult to evaluate real-time local PPP because we definitely need the stream data of local correction, precise orbit and clock.

Car Test in Urban

- Almost 60-70 % of reliable reference positions were produced using post-processed RTK (we improve more)





Collaboration with Russia

- JAXA has collaborated with St. Petersburg National Research University of IT, Mechanics, and Optics (NRU ITMO).
- GESTISS has just started to collaborate with this research group in terms of joint experiment.
- We will support their activities such as PPP software implementation for volcanic disaster prevention system



Summary

- Documents including test manual were prepared.
- Initial joint experiment in Manila was successful.
- Performance of the static local PPP was as we expected.
- WiFi connection is vital for GNSS test.
- 100 % reference position is better using high-end gyro and speed sensor.
- Preparing reference stations is very important.

- We are going to do another joint experiment in Hanoi (Vietnam).



Thank you very much for your cooperation !
People from UP and NAMRIA