

Research Activities and Education in TUMSAT

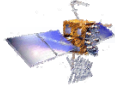
2011/09/07 @ ICG-6

Akio Yasuda

Tokyo University of Marine Science &
Technology



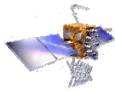
Content



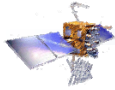
- Etchujima Campus of Tokyo University of Marine Science and Technology
- Stuffs and Researches at Lab. of Satellite Navigation
- GPS/GNSS Symposium in Japan
- Introduction of Institute of PNT of Japan
- Introduction of Multi-GNSS Asia (MGA)
- The 3rd AOR-WS
- Introduction of G-Spatial Expo 2012
- Summary

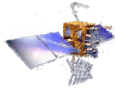
TUMSAT, Etchujima Campus

(Faculty of Marine Technology)

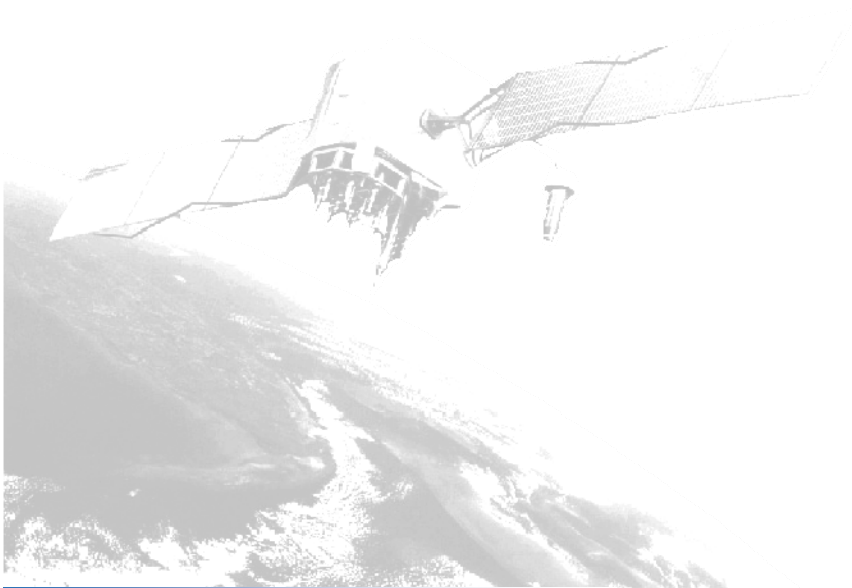


Laboratory Building

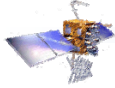




Staffs and Research Activities in our Laboratory

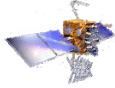


Research Staffs and Students



- Professor Akio Yasuda
- Professor Harumasa Hojo
- Associate Professor Nobuaki Kubo
- Assistant Professor Chunming Fan
- Research Fellow **Tomoji Takasu**
- Research Fellow Takuji Ebinuma
- D3 2 D2 1 D1 0 M2 7 M1 4
- Research Student 1
- Under Graduate Student 5

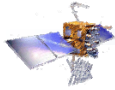
Research subjects 1/3



- Precise Orbit/Clock Estimation Tool for Multi-GNSS Network
(JAXA)
- Precise Point Positioning with QZS-LEX signal
(JAXA)
- GPS+QZS+IMES Integrated Positioning
(JAXA)
- Development of Multi-GNSS High Accuracy Positioning Tool for GSI Reference Stations
(GSI)

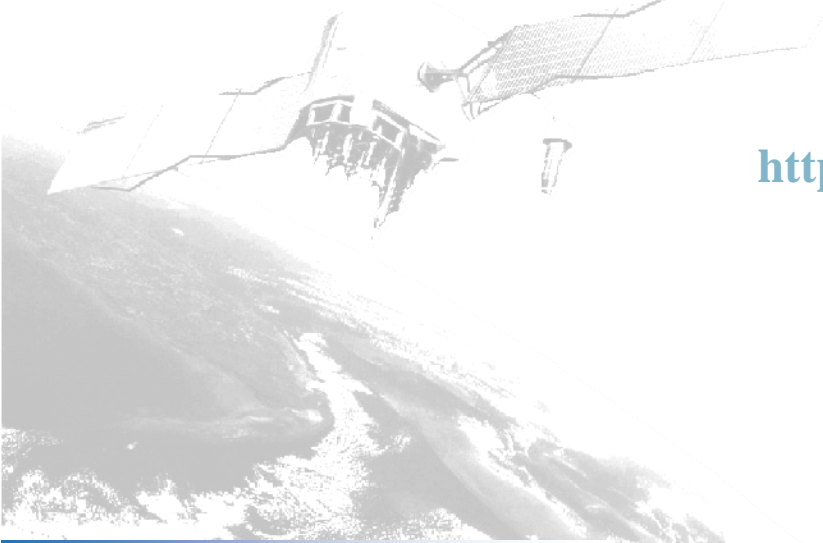
Inside the Red Bracket : Sponsor

RTKLIB

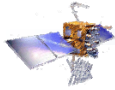


- **Open source program package for RTK-GPS**
 - Has been developed by Mr. Takasu since 2006
 - Latest version: 2.4.1
- **Portable C library + several positioning APs**
 - GUI APs on Windows
 - Console APs on Linux etc...

<http://gpspp.sakura.ne.jp/rtklib/rtklib.htm>

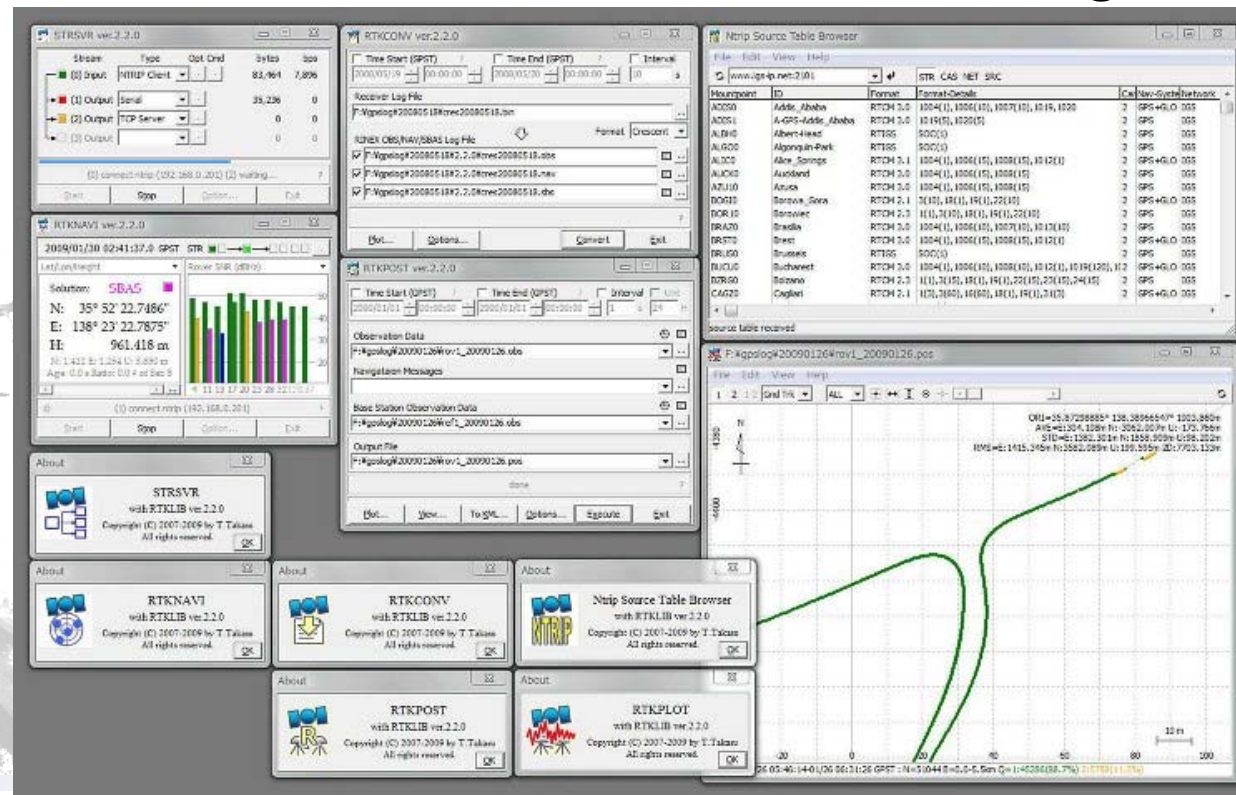


Application Programs (APs)

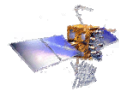


- RTKNAVI** : Real-time positioning
- RTKPOST** : Post-processing baseline analysis
- RTKPLOT** : Plot raw observation data and solutions
- RTKCONV** : RINEX converter for raw receiver log

...



GNSS Availability for 24 hours @Tokyo 2011/02/06



EL>15°

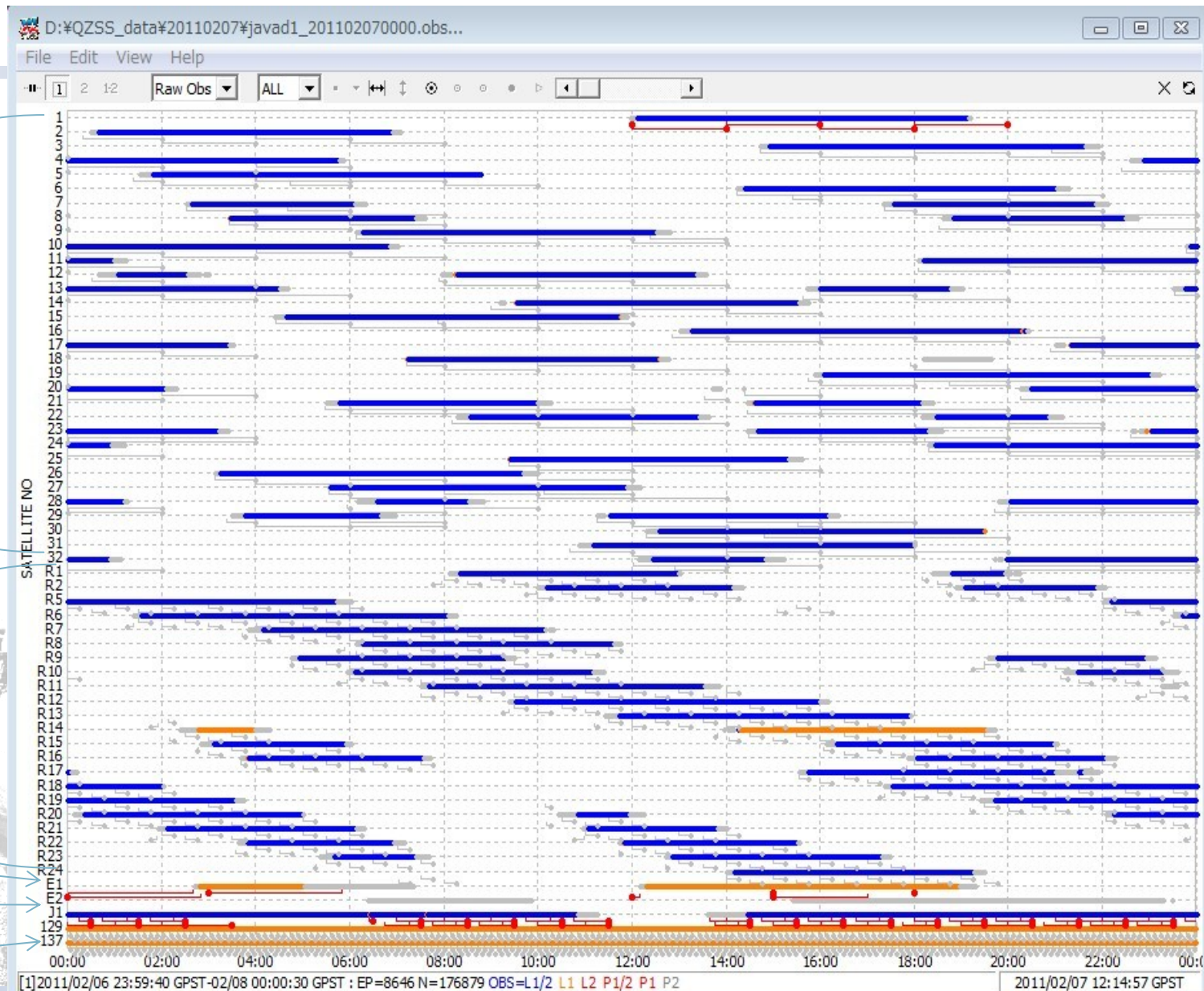
GPS

GLONASS

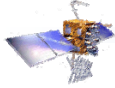
GALILEO

QZSS

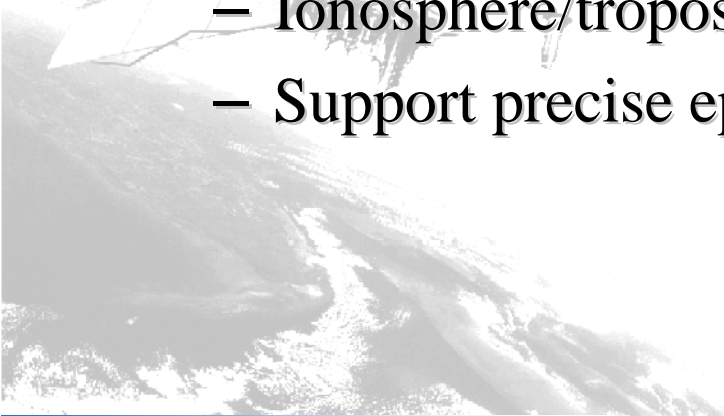
MSAS



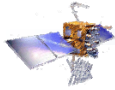
RTKPOST: Post Processing Analysis



- Input : standard RINEX OBS/NAV files
- Positioning mode:
 - Kinematic/Static/Moving-Baseline
- Smoother solution
- High-rate analysis with GEONET 30s free data
- long baseline analysis (<1000 km)
 - Ionosphere/troposphere estimation
 - Support precise ephemeris (SP3)



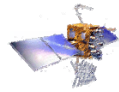
Research subjects 2/3



- Long-Term Predicted Ephemeris for GPS Satellite
(Japan Radio Co. Ltd.)
- Improvement of Positioning Dependability by
Multi-GNSS for Train Control
(Railway Technical Research Institute)
- QZSS synchronized Road marker and Timing
applications
(Ministry of Education)



QZSS synchronized Road marker and applications



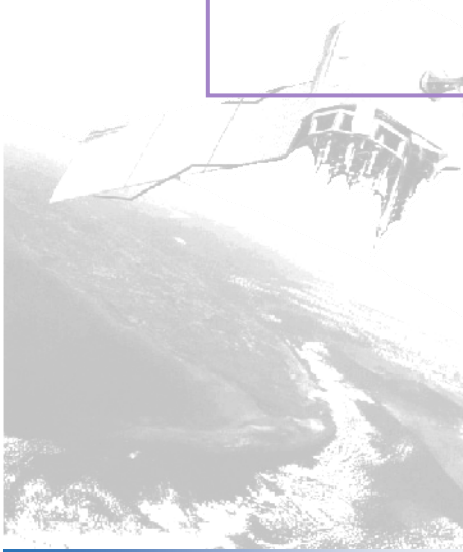
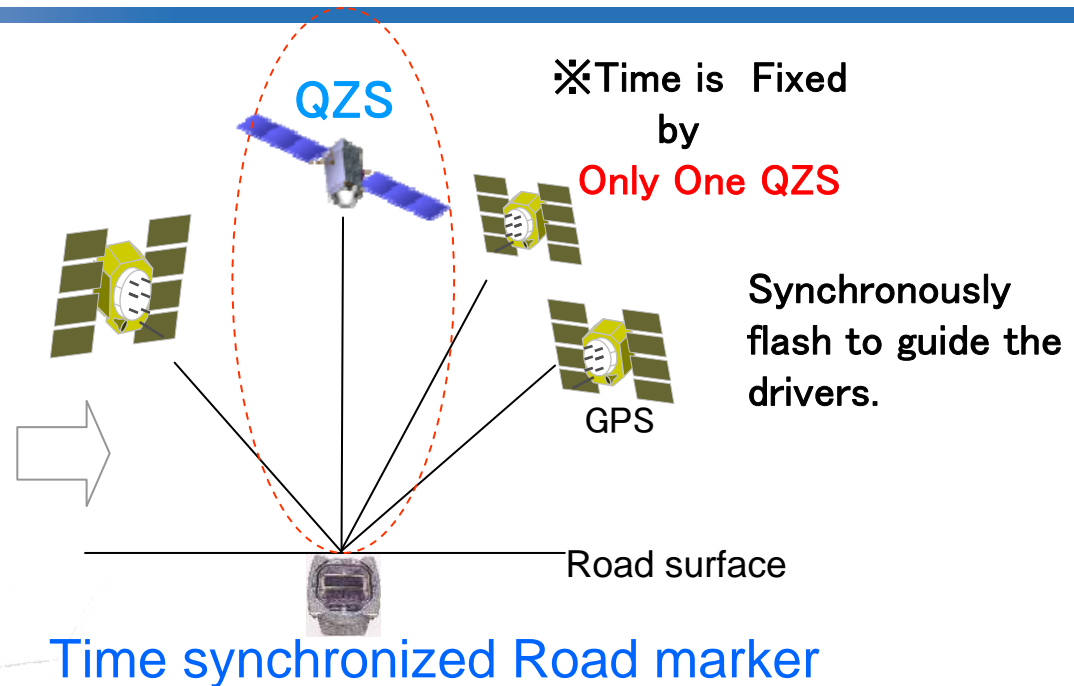
Road marker



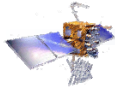
Road stud with solar battery (existing)

+

Precise synchronization device by QZSS

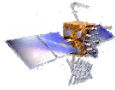


Research subjects 3/3



- Evaluation of Correction data from MSAS and L1-SAIF of QZSS
(Satellite Positioning Research and Application Center)
- Application of GPS positioning to ubiquitous sensor network
- Remote Sensing by GNSS Positioning and Signals
- Development of Software Defined Receiver to resolve the new GNSS signals
- Mitigation of Multipath

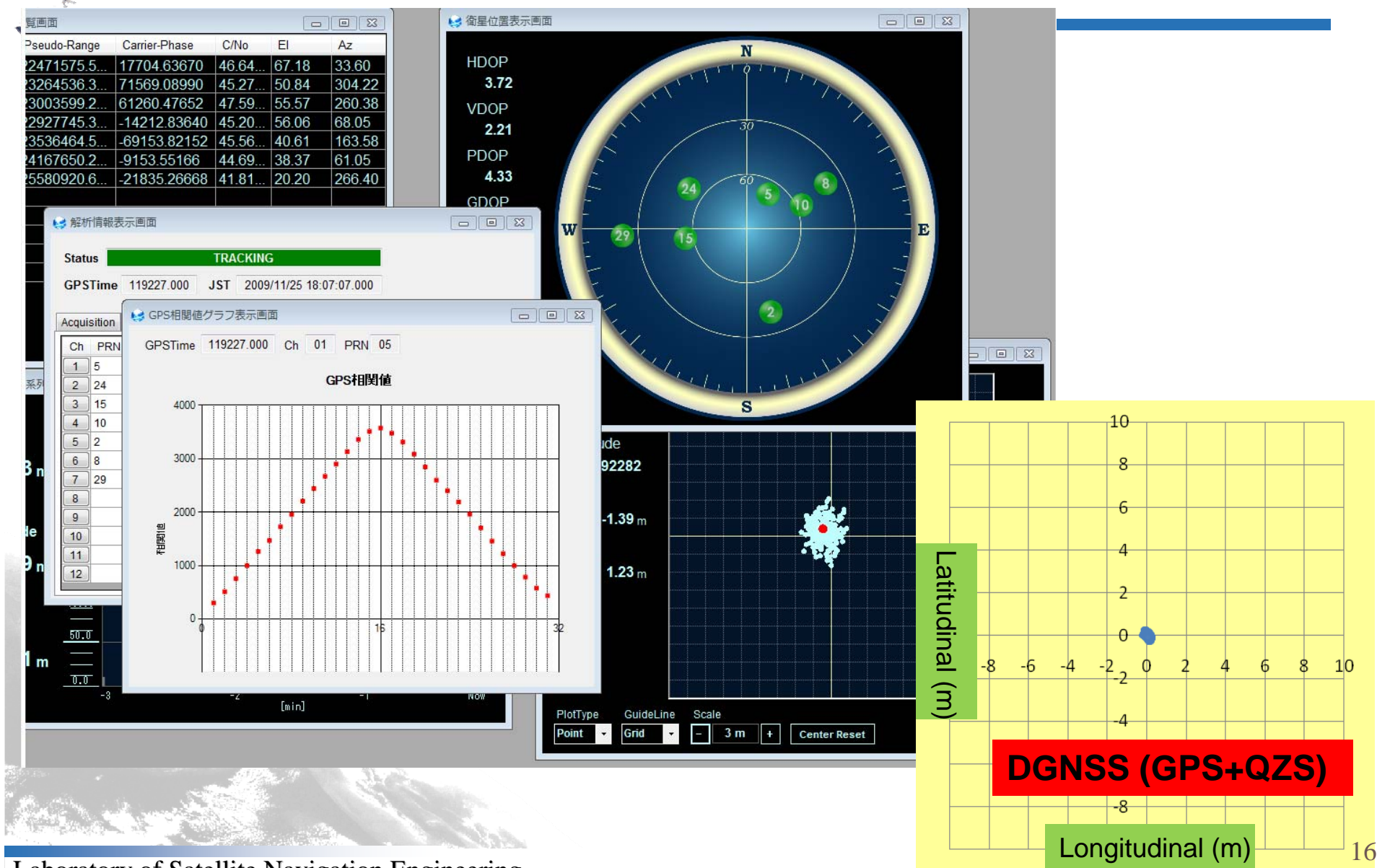
Software GNSS Receiver



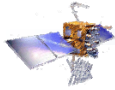
- Our laboratory has developed software GNSS receiver since 2008.
- Software receiver is capable as a platform for the development of a future GNSS receiver. It is useful both for education and research.
- At present, we have finished development of single-frequency GPS + QZSS post-processed software receiver .



GUI Example of DGNSS



Ongoing Projects



- We are developing two types of receiver as a platform of GNSS receiver.

High-Sensitivity Positioning (single-frequency)

Research and education in the
field of high-sensitivity area

Car navigation use
Mobile phone use

Frontend
(IF=4MHz SF=16MHz
Bw=4MHz)

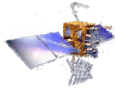
Precise Positioning (multi-frequency)

Research and education in the
field of high accuracy area

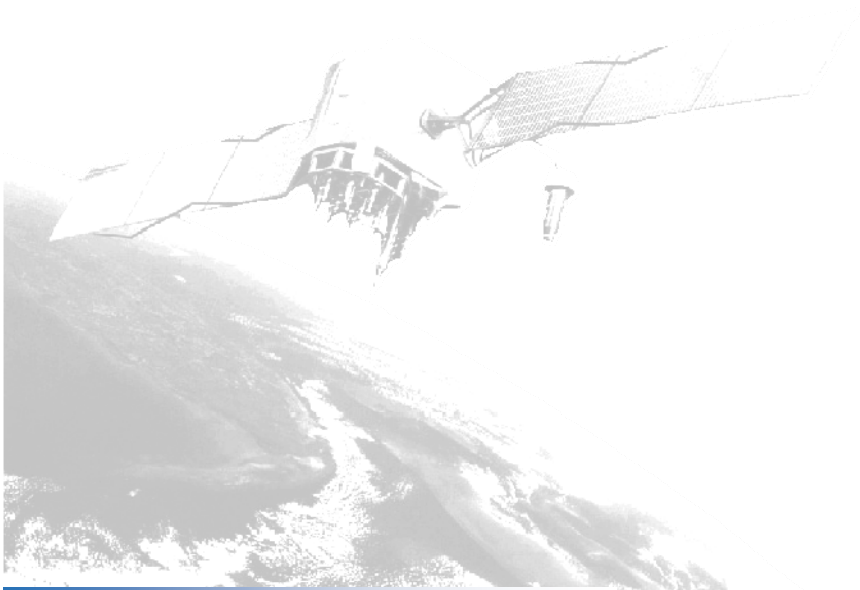
Geodetic use
RTK use

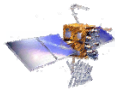
Frontend
(IF=12MHz SF=40MHz
Bw=13MHz)

Both of them will be quite useful for the research and education in GNSS.



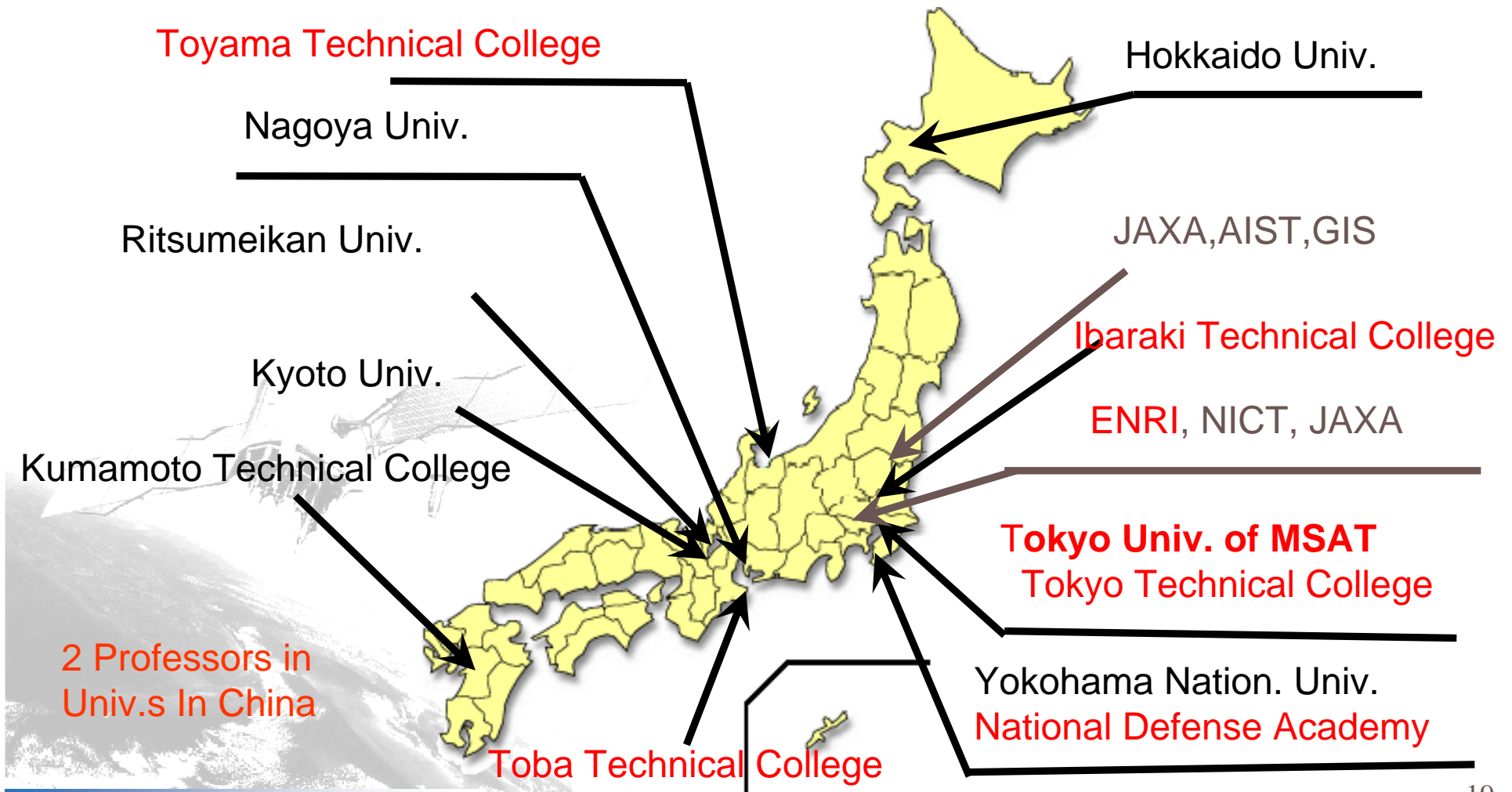
Graduates studying in GMSSS Fields

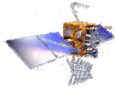




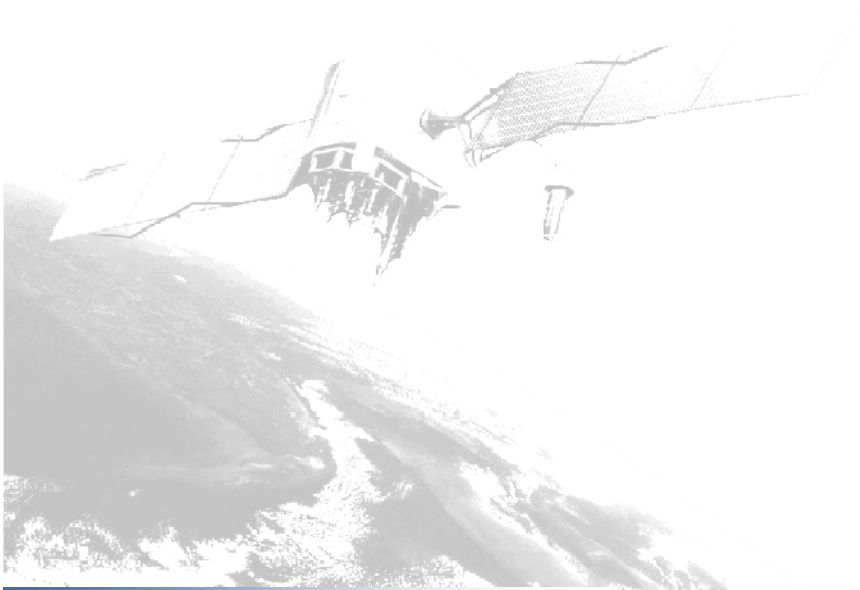
GNSS Research and Education Institutes

There is a graduate from our Lab. at TUMSAT in red letter institute

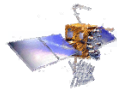




Social Contributions National and International



History of Our GPS/GNSS Symposium



*International Symposium

Participants from

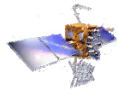
China, Korea, Taiwan, Australia, India, Malaysia, Thailand, Singapore, Turkey, Brazil, US, UK, EC countries, etc

Will be held 14-17, Nov. this year in Sydney

<http://ignss.org/Home/tabid/56/Default.aspx>

No. of Participant Date

- 1. 320 28/11/1996
- 2. 310 13-14/11/1997
- 3. 380 26-27/11/1998
- 4. 400 24-26/11/1999
- 5. 410 15-17/11/2000
- 6. 410 14-16/11/2001
- 7. 350 11-13/11/2002
- **8.* 440 15-18/11/2003**
- 9. 350 17-19/11/2004
- 10. 320 16-18/11/2005
- 11. 350 15-17/11/2006
- 12. 300 21-23/11/2007
- **13.* 420 11-14/11/2008**
- 14. 380 30/11-01/12/2009
- 15. 280 04-06/11/2010
- 16. 26-28/10/2011

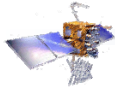


Institute of PNT of Japan

- Established i n November 2009
- Newsletter Quarterly, On-line Transaction
- Annual meeting in April and Symposium in fall are main events.
- 300 members presently
- President is Akio Yasuda

<http://www.gnss-pnt.org/>

Multi-GNSS Asia (MGA)



- MGA
 - Is the organization to operate Asia Oceania Multi-GNSS Demonstration Campaign
 - Was established on 4th Sep, 2011 in Tokyo
 - Will open its “Call for participation” with adopted “Terms of Reference” very soon
- MGA website : www.multignss.asia
- As MGA’s recommended activity, JAXA will start “Call for Multi-GNSS Joint Experiment”



Asia Oceania Multi-GNSS Demonstration Campaign



- The campaign consists of Three main activities

Multi-GNSS Monitoring Network



Application Demonstration

Disaster Mitigation



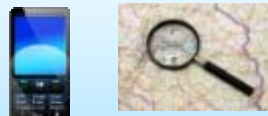
Precise Positioning



ITS



LBS



Other, ionospheric observation etc

Regional Workshop

1st Asia Oceania Regional Workshop on GNSS, 25,26 JAN, 2010, @ Bangkok, Thailand



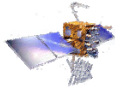
195 Participants, 18 Countries, 95 Organizations

2nd Workshop, 21,22 Nov. 2010 @ Melbourne, Australia



3rd Workshop, 1-3rd Nov. 2011 @ Jeju Island, Korea:

3rd Asia Oceania Regional Workshop on GNSS



- Date
 - Pre-workshop event (Discussion Session): Nov. 1st, 2011
 - 3rd AORWS: Nov. 2nd and 3rd, 2011
 - Venue
 - PHOENIX ISLAND, Jeju, Korea
 - Hosted by
 - GNSS Technology Council (GTC), Korea Aerospace Research Institute (KARI), Japan Aerospace Exploration Agency (JAXA), Satellite Positioning Research and Application Center (SPAC)
 - Supported by
 - International Committee on GNSS (ICG) and International GNSS Service (IGS)
- MGA website : www.multignss.asia



G-spatial EXPO 2012

"When & Where" - Information Changes Our Lives, Now and in the Future

is decided to be held from June 21 to 23,
2012 @Pacifico.Yokohama

G-Spatial EXPO 2010 /09/19 - 09/21 <http://www.g-expo.jp/en/index.html>

189 exhibitors

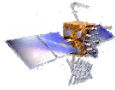
36,819 visitors

36 Lectures, Symposiums and Seminars (3 days)

Participants 3,838



Summary



- Introduce the research activities in TUMSAT
- Many subjects related to QZSS development
- RTK-LIB for software study for GNSS positioning
- SDR for hardware study for tracking and acquiring GNSS
- Enough potential to teach high level GNSS technology
- Promoting International Contribution by accepting more foreign students is the next step.