ICG WG-B Application SG Meeting

Emergency Services using Global Navigation Satellite Systems

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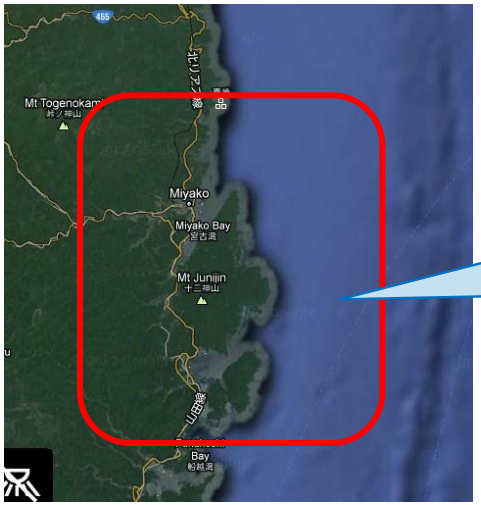
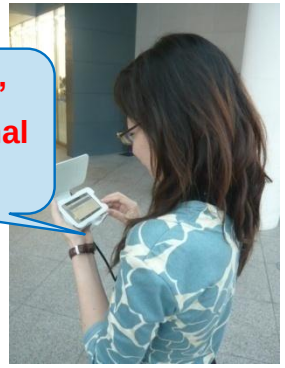
Background & Motivation

Tsunami

Problem - Damage with Area-based Alert Message



“Earthquake” Go to Regional Evacuation



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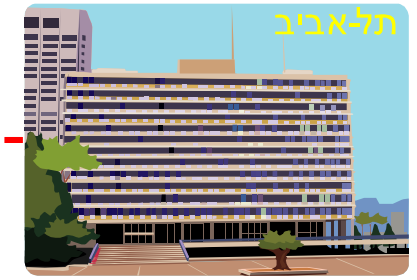
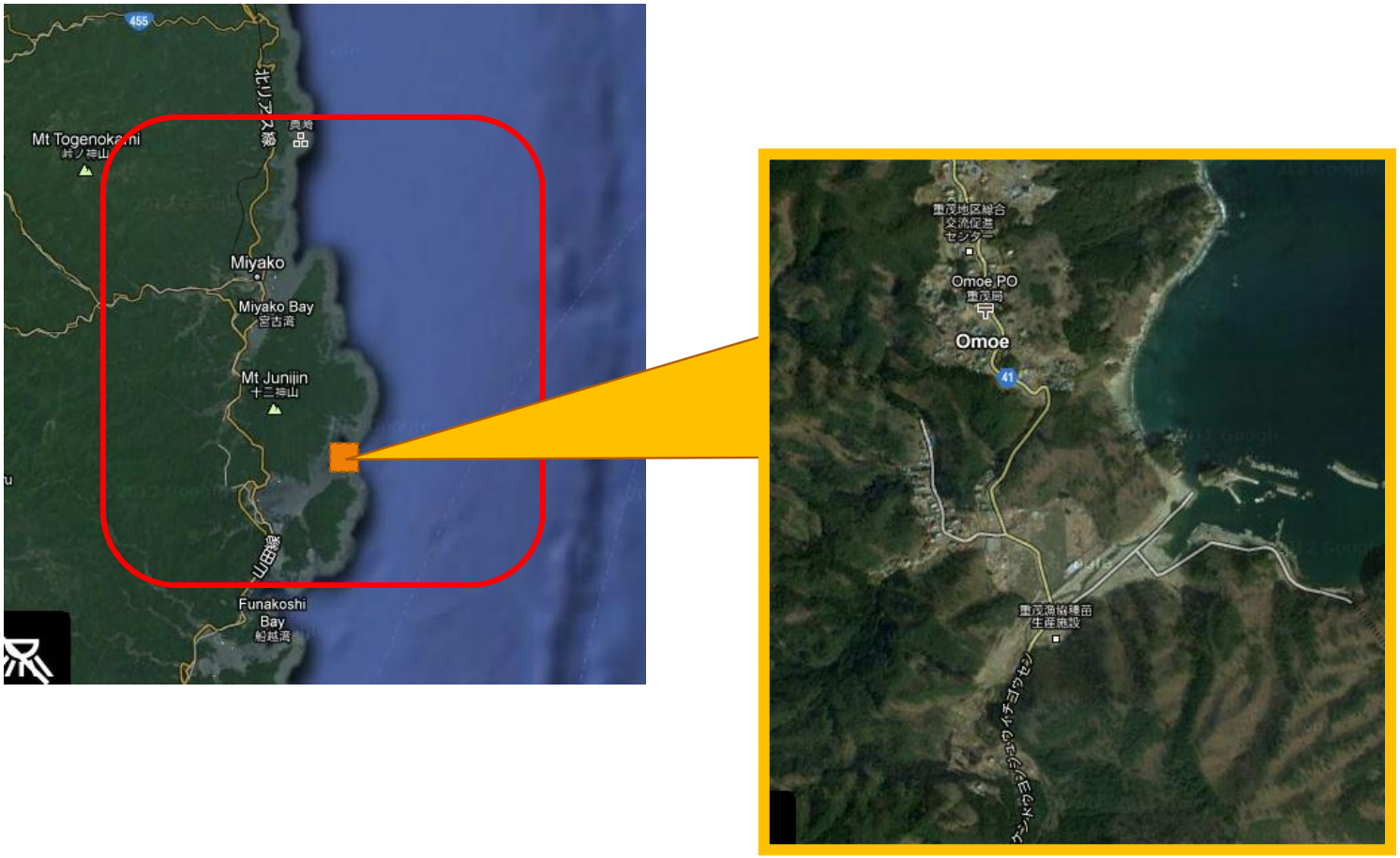
Alert Message



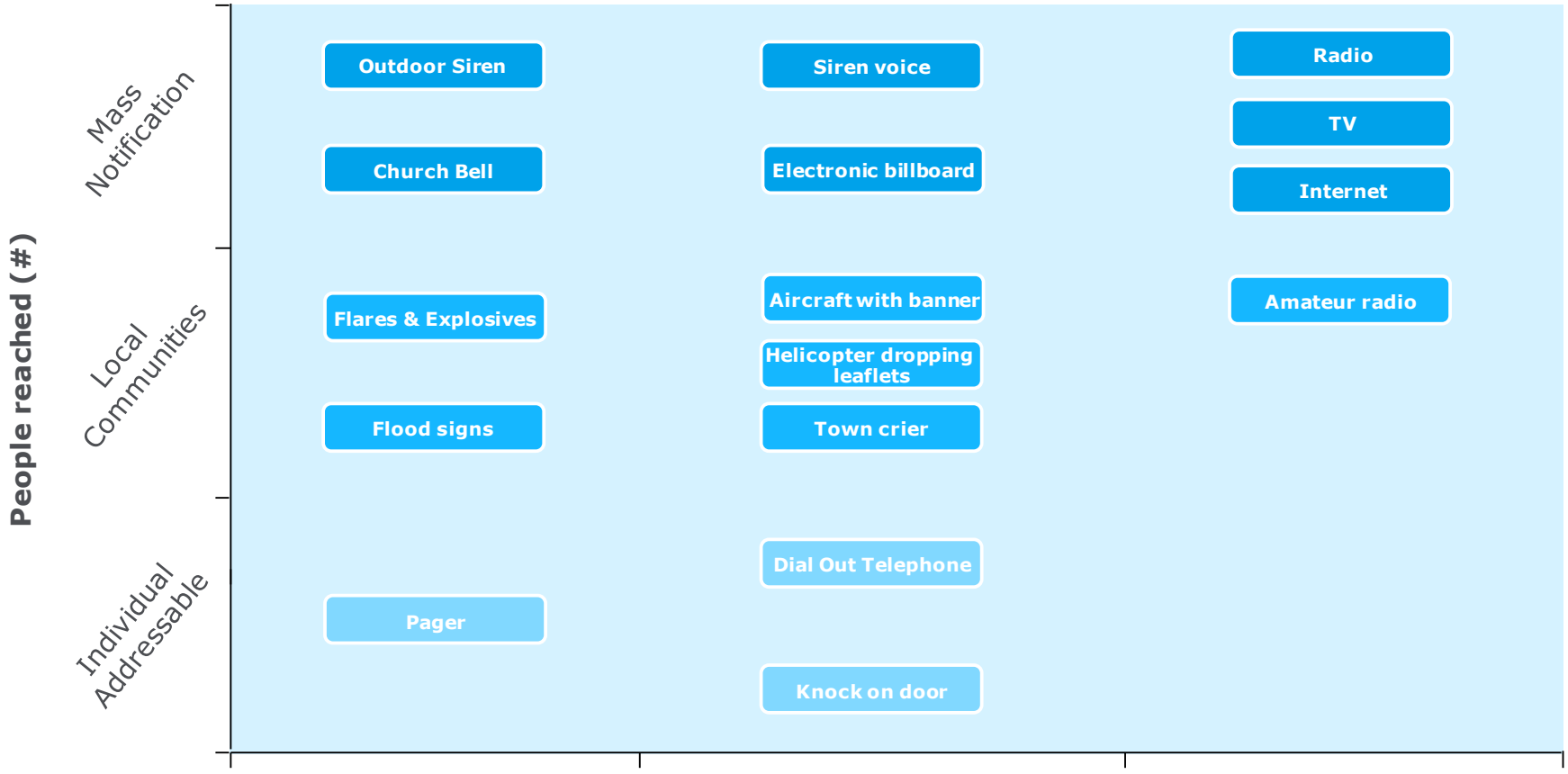
Disaster Management Center

Problem - Damage with Area-based Alert Message

4



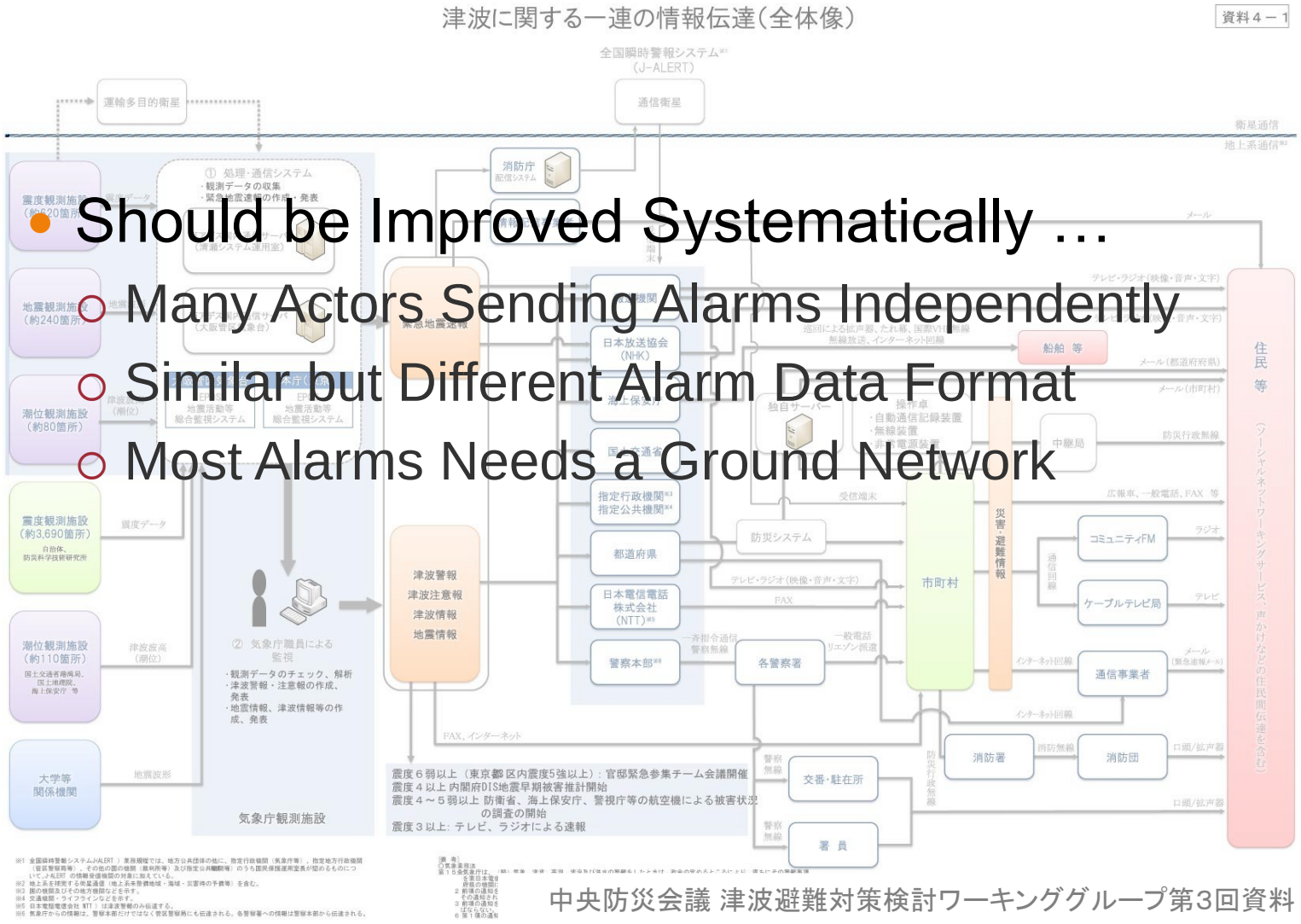
Alarm Systems Overview



Difficulties of Providing Personalized Alert Message

- Difficulties of maintaining a communication network
- Difficulties of sending alert message appropriate to the region
  - Promptness
  - Reliability
  - Availability
  - Reachability

Alarm Systems for Tsunami in Japan



- Should be Improved Systematically …
  - Many Actors Sending Alarms Independently
  - Similar but Different Alarm Data Format
  - Most Alarms Needs a Ground Network

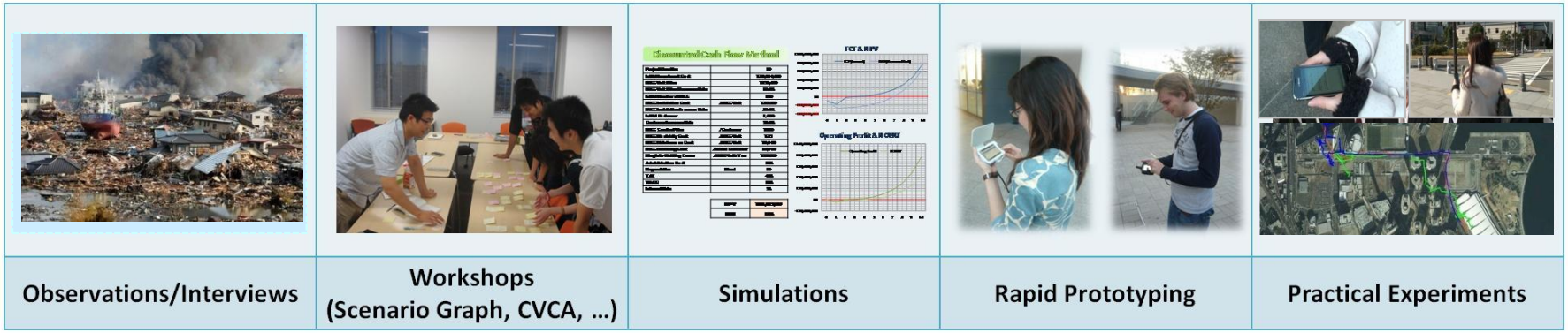
中央防災会議 津波避難対策検討ワーキンググループ第3回資料

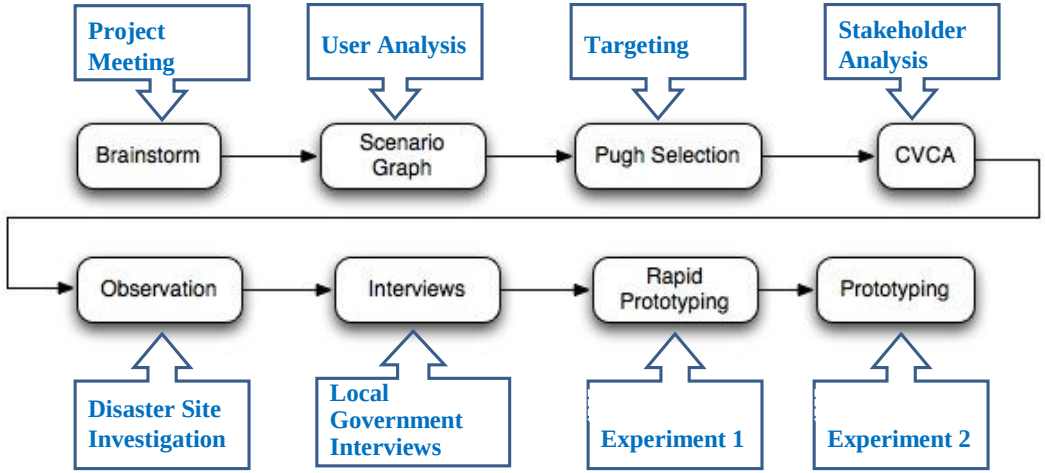
RedRescue Project

"Real-time Disaster Response using Location Data and Wide-area Small-capacity Data"

Research Approach

- From Requirement Definition to Practical Experiments





Alert Message is Personalized with QZSS Satellite

QZSS Satellite

Location / Service DB

Navigation Signal

Alert Message

Data (Map, Contents ..)

Location Data

Alert Message

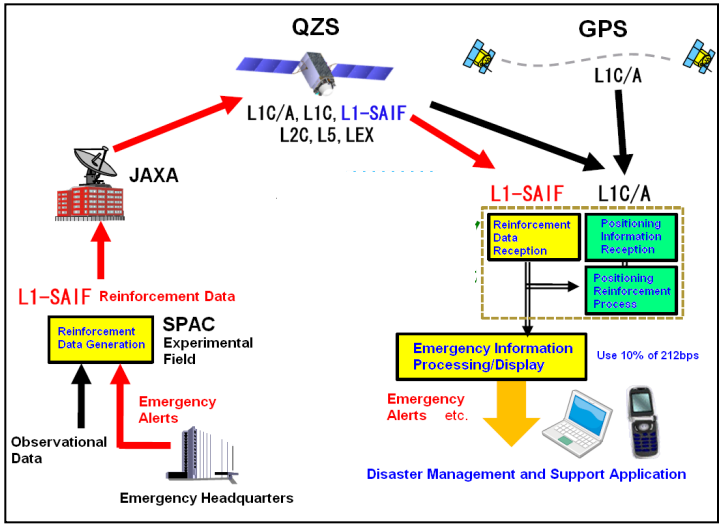
In front of a Building

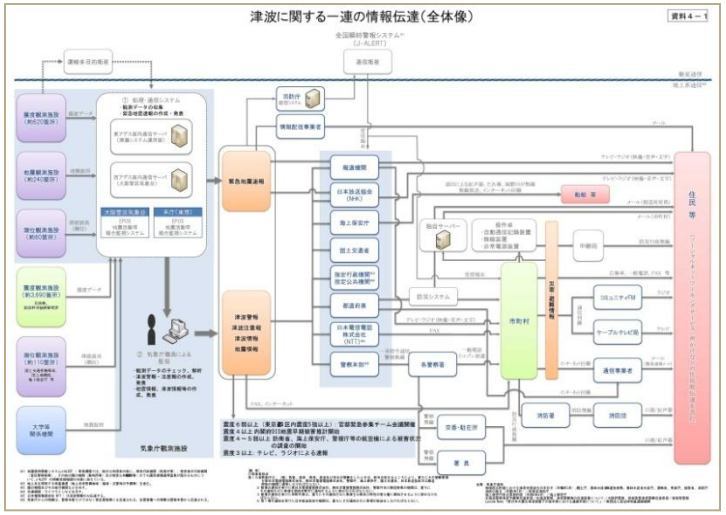
At Stadium

Disaster Management Center

System Configuration

- Compatible Data Format with Existing Alert Message System
- Alarm Message Can be Provided both GNSS Satellite and Ground Network.





Experimental Test with QZSS/GPS Satellites

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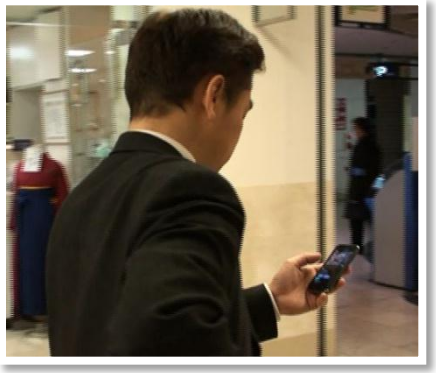
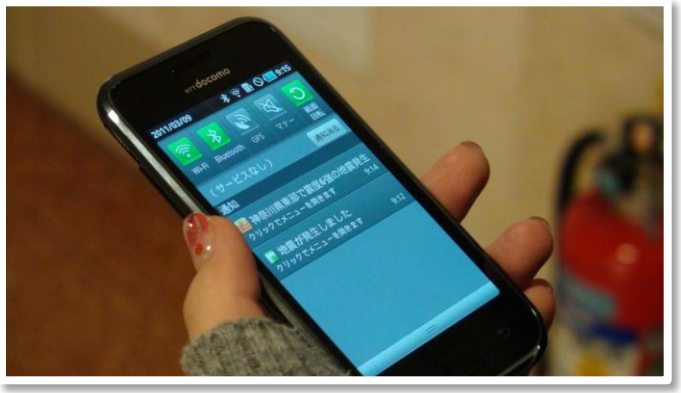
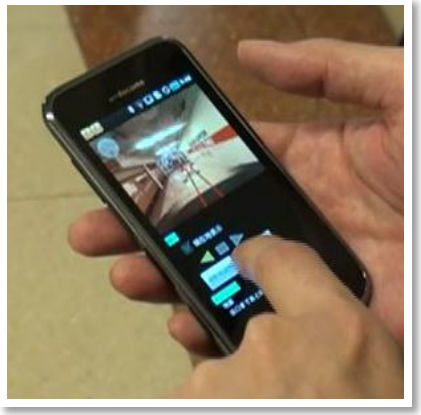






Why GNSS Satellite?

- GNSS Satellite provide world wide coverage.
- GNSS are the most popular “satellite communication” means.
  - 80% of Mobile Phone have a GPS chip (<1$).
- Sufficient transmission bandwidth available to accommodate Alert Messages.

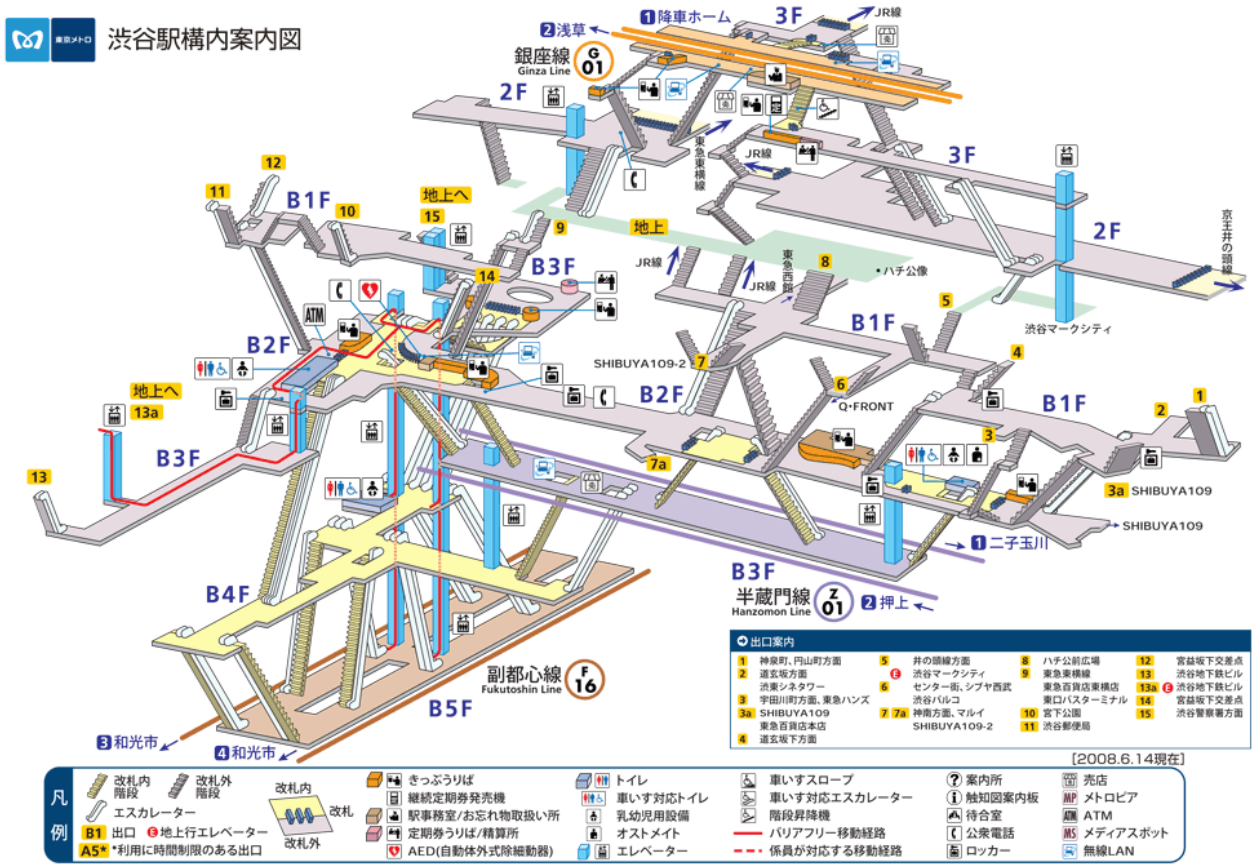
Indoor Positioning and Emergency Services

Our Lives: Indoor vs. Outdoor

- Most people spend more that 80% life time indoor
  - living, working, shopping, eating, and sleeping …

LBS
Target !

Shibuya Station



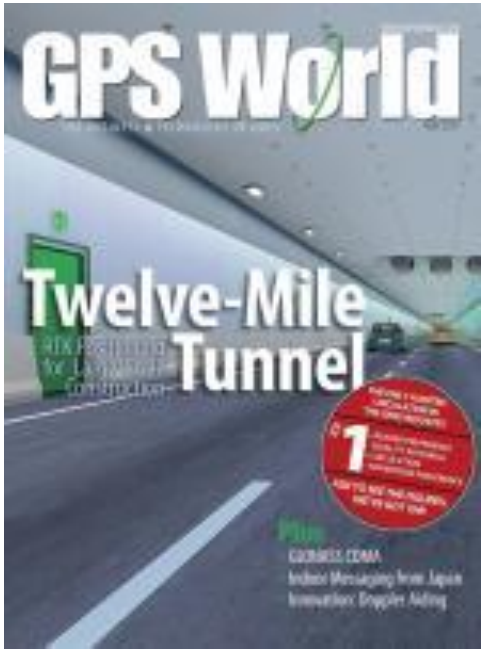
http://www.tokyometro.jp/station/shibuya/yardmap/index.html

IMES Project

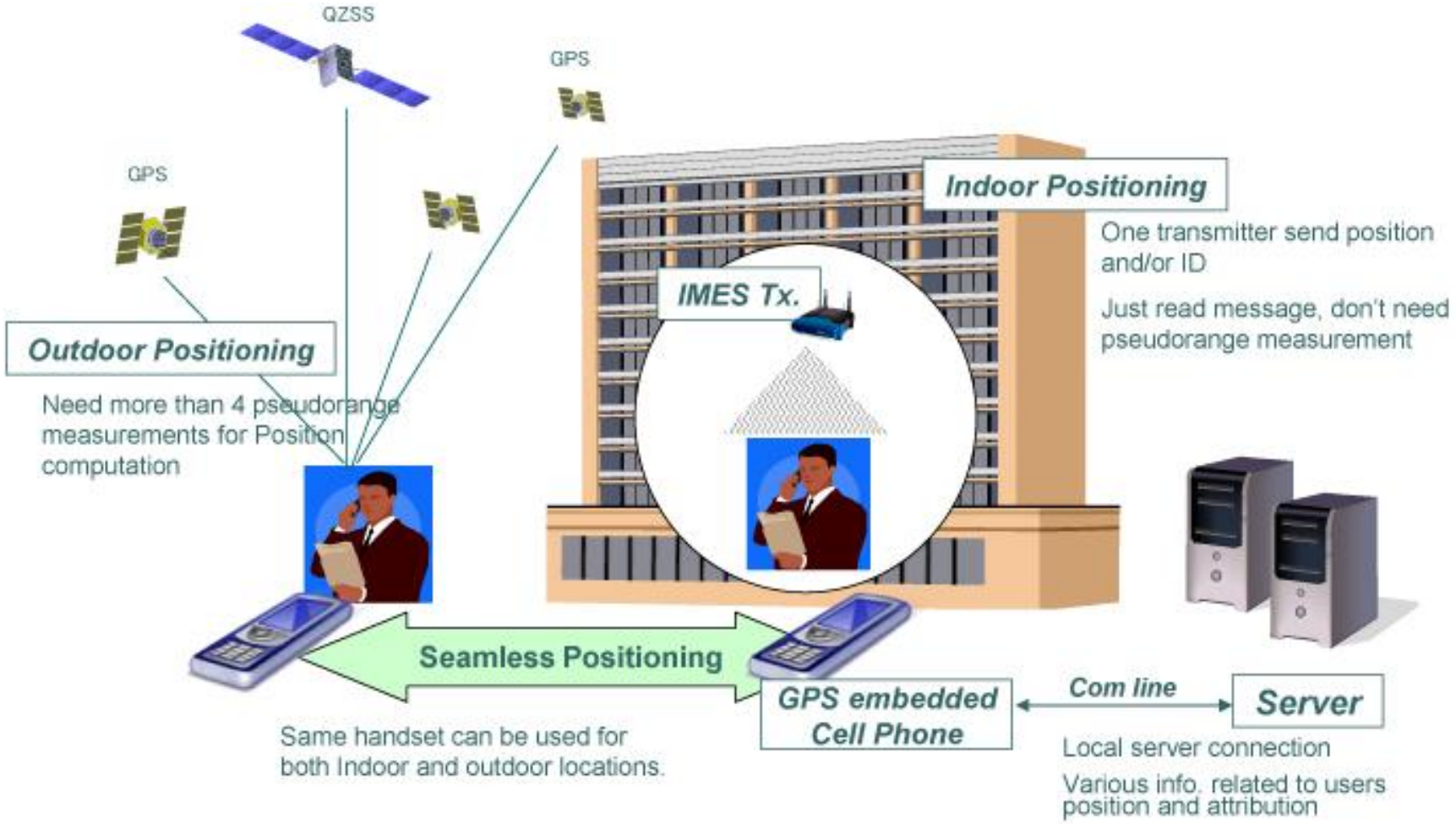
“Indoor MEssaging System“

GPS World Magazine, May 1, 2011

- Dinesh Manandhar, et.al., “Japan’s Indoor Messaging System: IMES”, GPS World, May 1, 2011



IMES Concept



IMES: Indoor Messaging System

- A basic idea of IMES is
  - originated from the framework of the Japanese positioning satellite system, Quasi Zenith Satellite System
- IMES transmitter can
  - transmit interoperative signal with L1C/A from GPS/QZSS
    - The same GPS receiver can acquire signals from satellites as well as indoor transmitters without serious modifications on existing receiver.
  - send its position data in three dimensions directly
    - No pseudo range measurement and time synchronization
- Main target is
  - GPS mobile phone receiver
    - Number of mobile phone in the world is 3.3 billion in 2007.

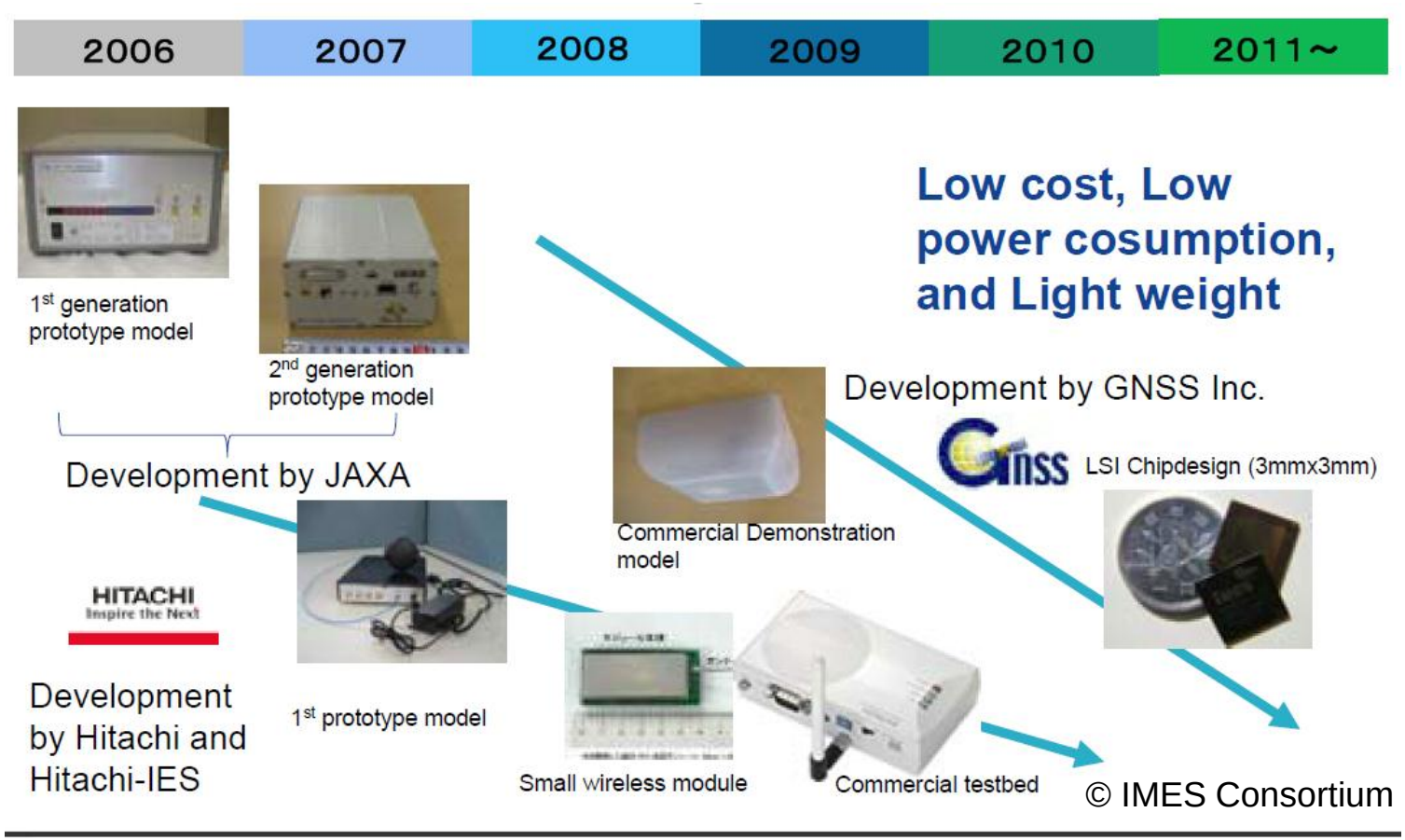
RF Properties: GPS and IMES

- Interoperative signal with L1C/A from GPS/QZSS for minimizing receivers' modifications

Item	GPS	IMES
RF Center Frequency	1575.42 MHz	1575.42+/-0.0082 MHz
PRN Code	1 - 32	173 - 182
PRN Code Length	1ms	1ms
PRN Code Rate	1.023 MHz	1.023 MHz
Navigation Message Rate	50bps	50bps
Modulation	BPSK	BPSK
Polarization	RHCP	RHCP

IMES Transmitters

- Two companies are developing/improving transmitters

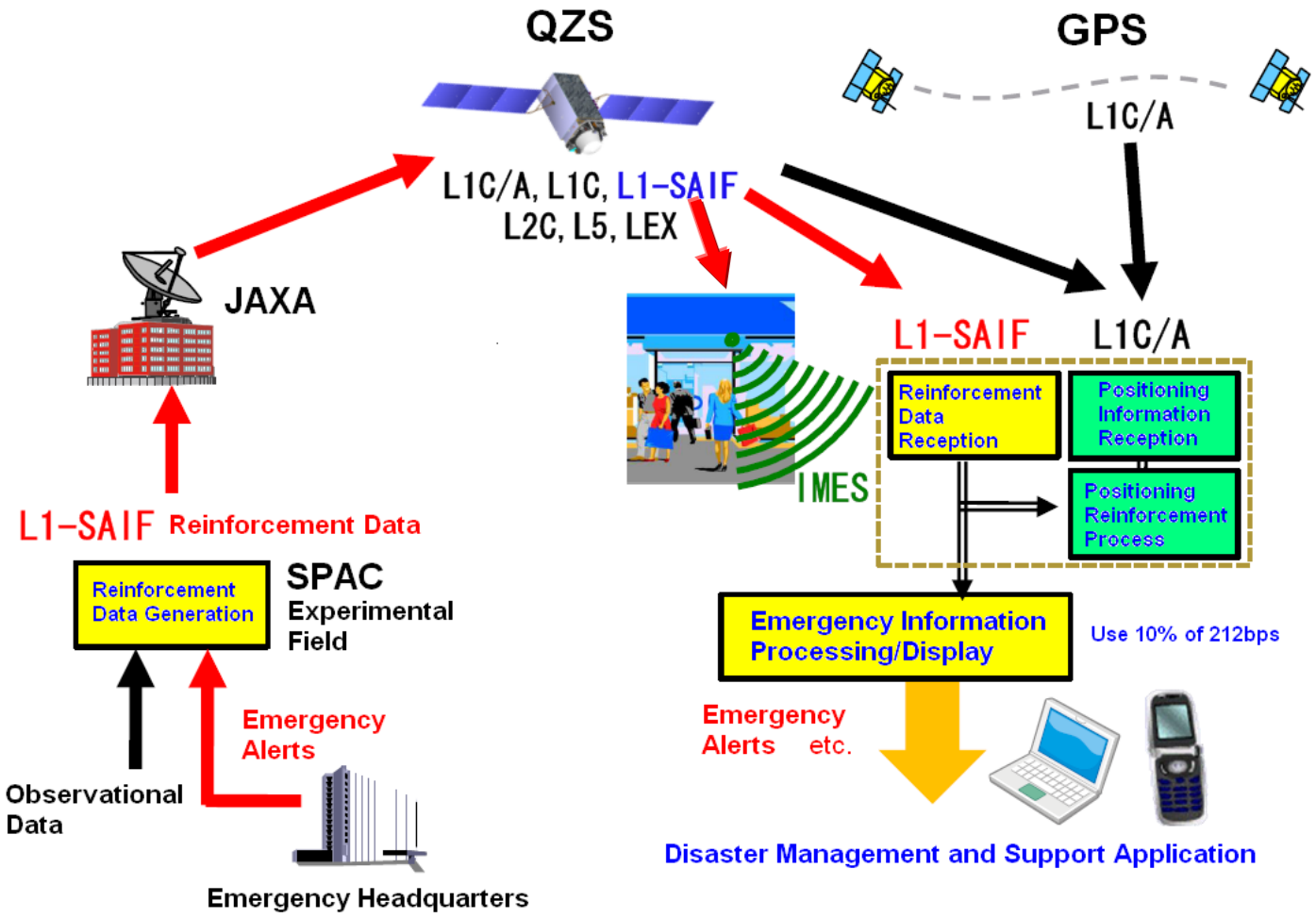


IMES Transmitters in Rise Buildings

RF Properties: QZSS and IMES

		Frequency Notes	Frequency Notes
	L1-C/A	1575.42MHz	• Complete compatibility and interoperability with existing and future modernized GPS signals • Differential Correction data, Integrity flag, Ionospheric correction • Almanac & Health for other GNSS SVs
	L1C		
	L2C	1227.6MHz	
	L5	1176.45MHz	
	L1-SAIF	1575.42MHz	• Compatibility with GPS-SBAS
	LEX	1278.75MHz	• Experimental Signal with higher data rate message (2Kbps) • Compatibility & interoperability with Galileo E6 signal
	IMES	1575.42MHz	

Seamless Alert Message with L1-SAIF and IMES



Conclusion

- Difficulties of Providing Personalized Alert Message
  - Maintaining a communication network
  - Sending alert message appropriate to the region
- Alert Message Personalized with QZSS L1-SAIF
  - GNSS are the most popular “satellite communication” means.
  - Sufficient transmission bandwidth available to accommodate Alert Messages.
- Indoor and Outdoor Seamless Alert Message
  - QZSS L1-SAIF and IMES (Indoor Messaging System)