



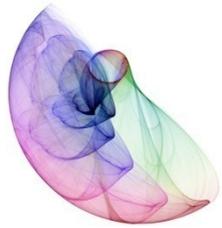
GNSS Based Transportation Infrastructure Technology

September 6, 2011

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Korea Aerospace Research Institute

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I. About Research



Research

Title

- GNSS Based Transportation Infrastructure

Support

- Ministry of Land Transportation and Maritime (Korea Institute of Construction & Transportation Technology Evaluation and Planning)

Goal

- Development of GNSS based Transportation Infrastructure Technologies for the ground transportation.

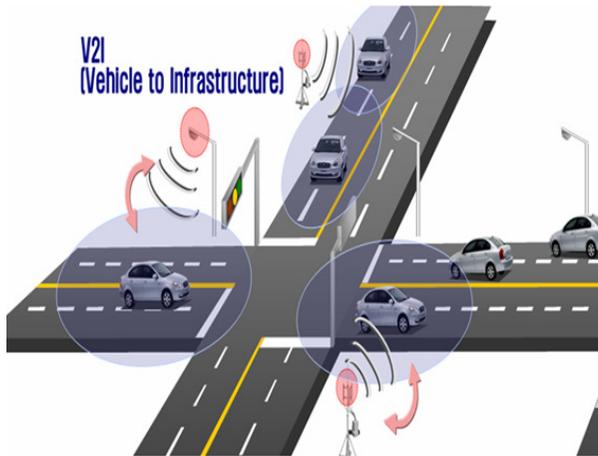
Schedule

- Phase 1 : 2009. 11. ~ 2011. 10 (2years)
- Phase 2 : 2011. 11. ~ 2014. 10 (3years)

Current Status and R&D

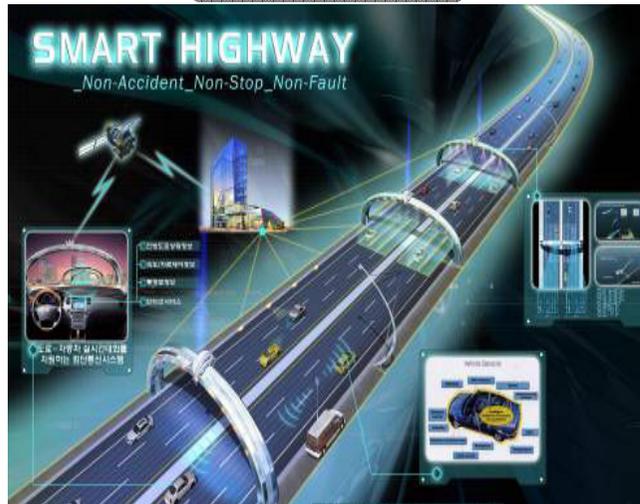
- Road traffic congestion costs 10 bUS\$/year
- Safe, reliable and environmental-friendly transport system
 - ✓ Increase personal mobility
 - ✓ Save cost and time
 - ✓ Reduce fuel consumption and CO2

U-Transportation



Accurate and reliable positioning required securing safety in high speed

Smart Highway



Precise positioning required for lane classification

Transport logistic



High reliable positioning required for freight tracking

Next generation transportation vehicles



Accurate and reliable positioning required for securing safety and service efficiency

GNSS based Transportation Infrastructure

Needed New Infrastructure



Increased Traffic demand

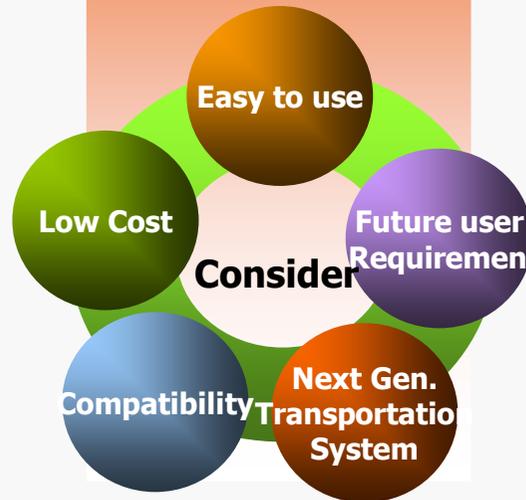
Efficiency of Traffic Management System

Increasing Efficiency & Safety

Required New Infrastructure

GNSS Based Transportation Infrastructure

Required GNSS based New Infrastructure



Accurate/Reliable Position information

Vision

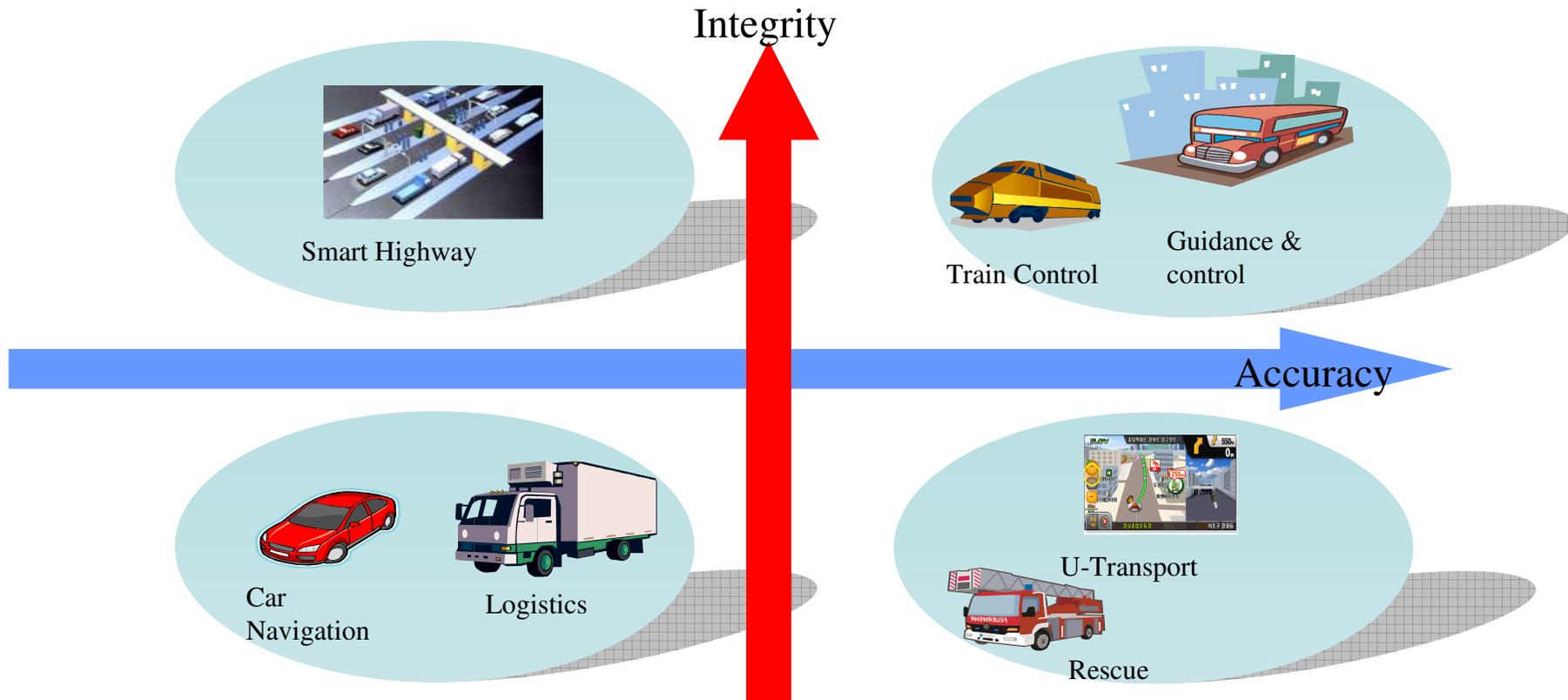


For New Concept of Ground Transportation

GNSS base Transportation Infrastructure

Requirements on GNSS for Land TPT

- High Accuracy and Integrity
 - ✓ U-Transport < 1.5m, 10-2
 - ✓ Train Monitor and Signal Control < 1.0m, 10-5
 - ✓ Vehicle Guidance & Control < 0.2m, 10-5



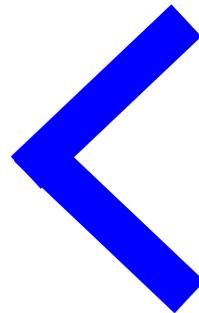
Challenge in Land Applications

- GNSS environment for Land Application is much harder than Air and Sea
 - ✓ Low visibility, weak signal, multipath, etc.



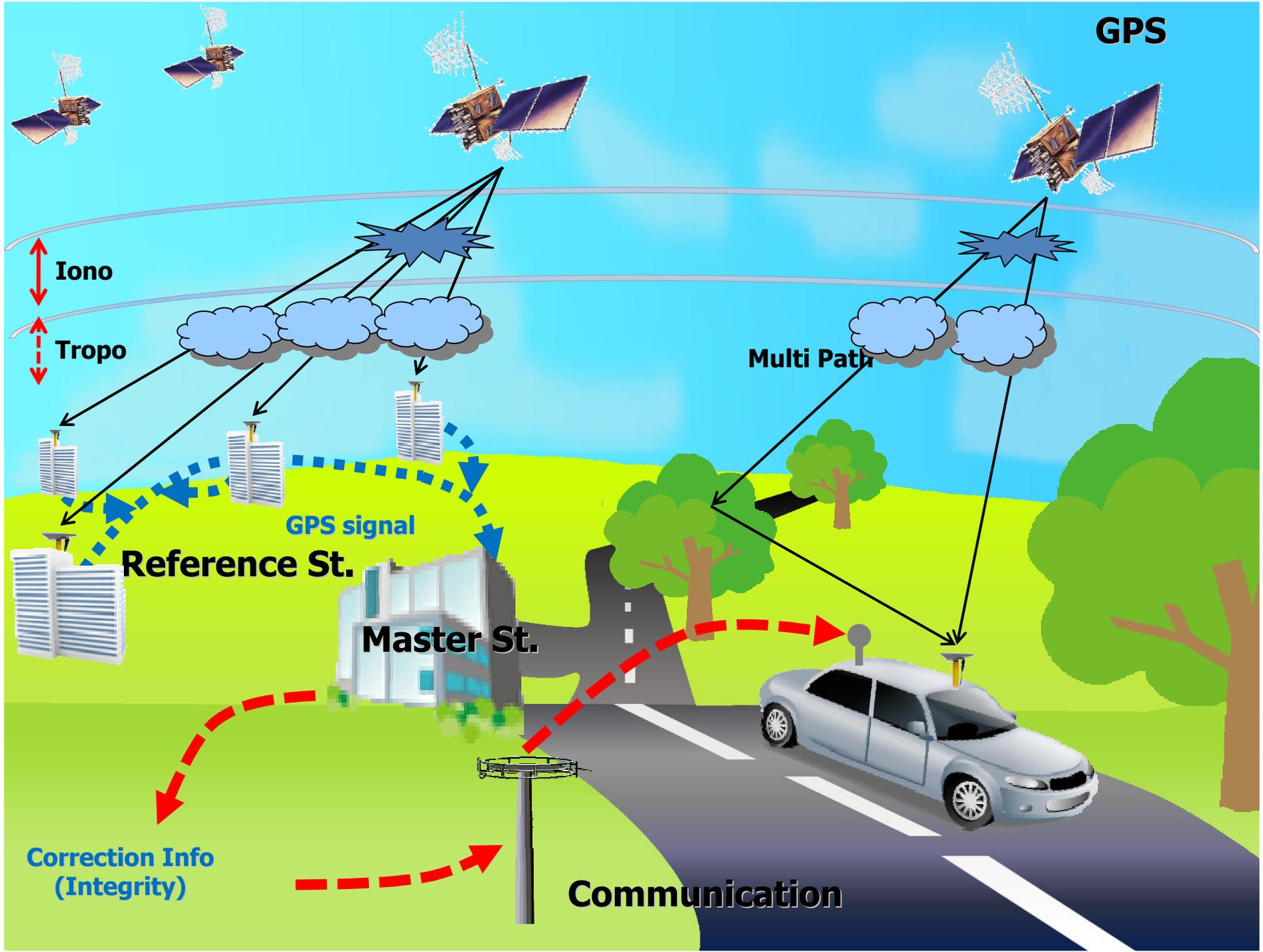
Good Visibility
on Air and Sea applications

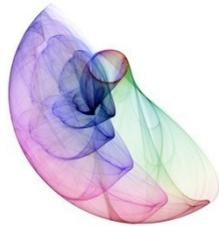
Difficulties



Bad Visibility
on Land applications

We cannot meet the requirements with GPS alone





II. Research Contents

Objective

- Provide the precise and reliable positioning service
- Capable of recognizing lane on the road



Open Filed



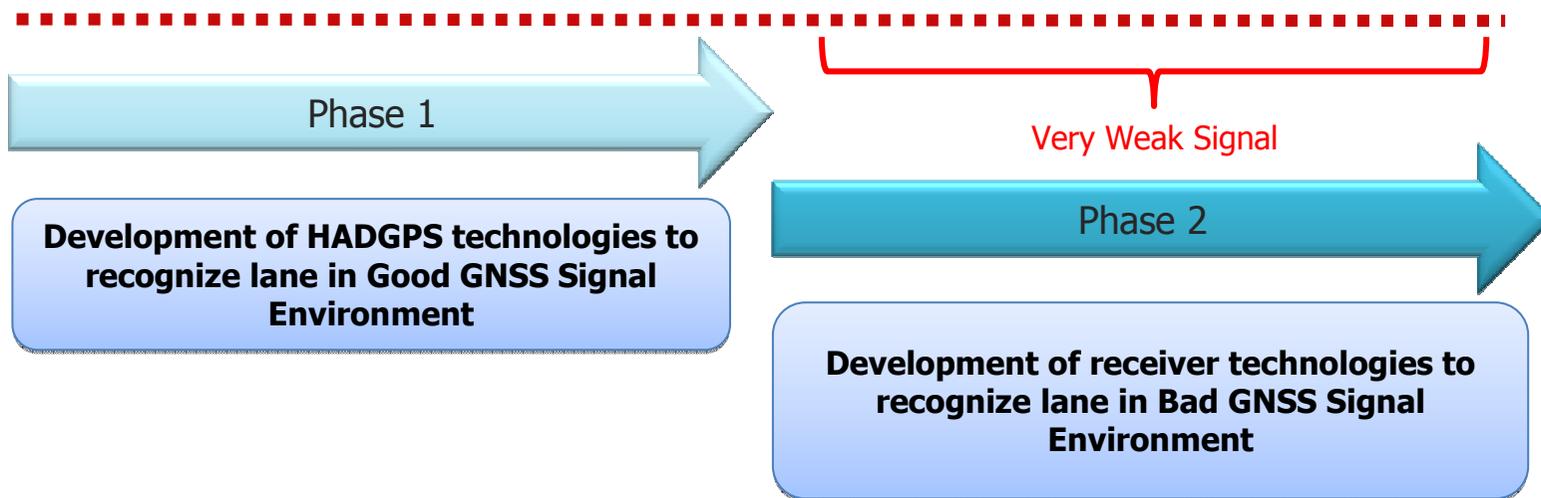
Intermittent
Signal Blockage



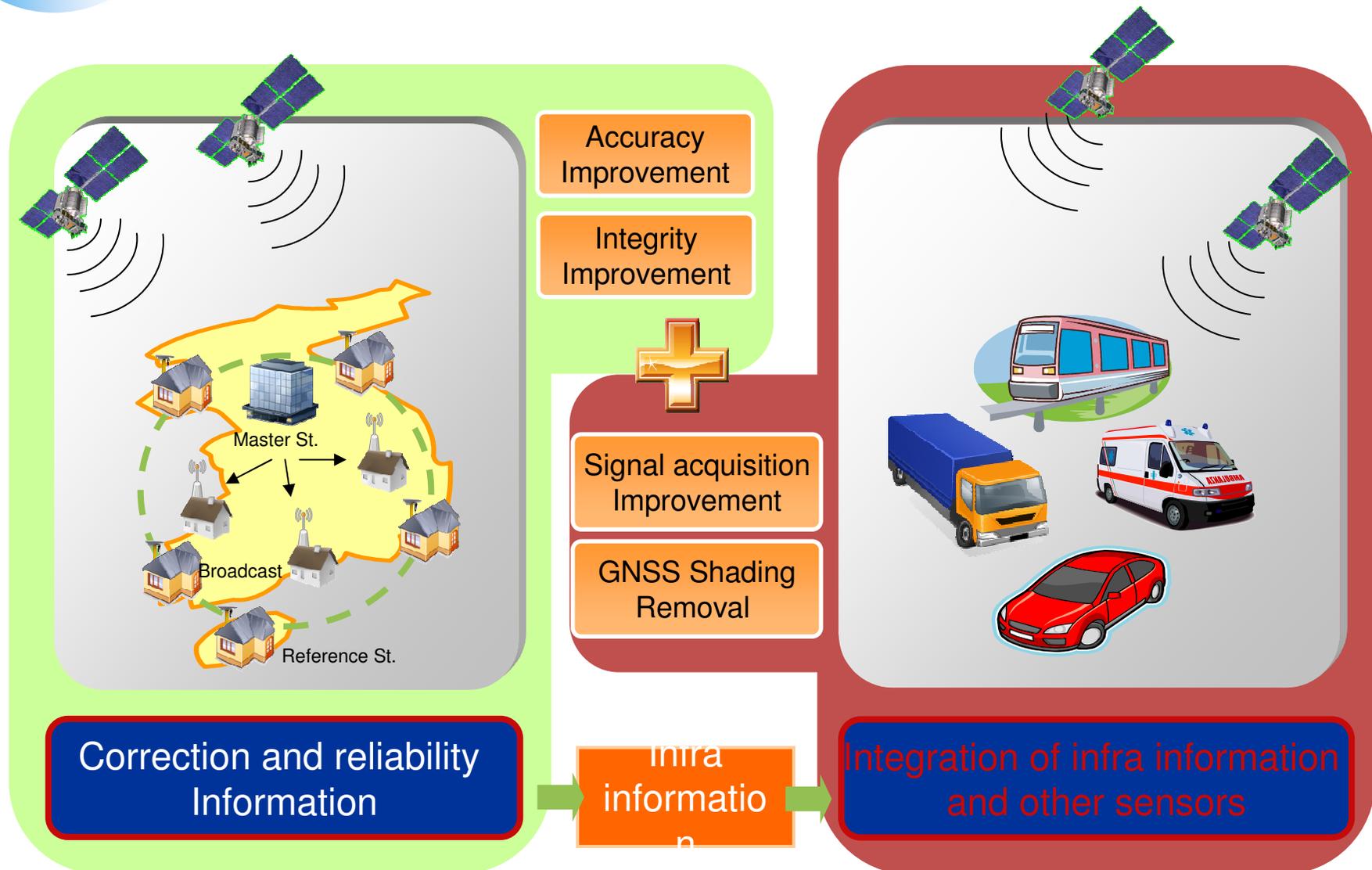
Low Signal
Strength



Urban Canyon

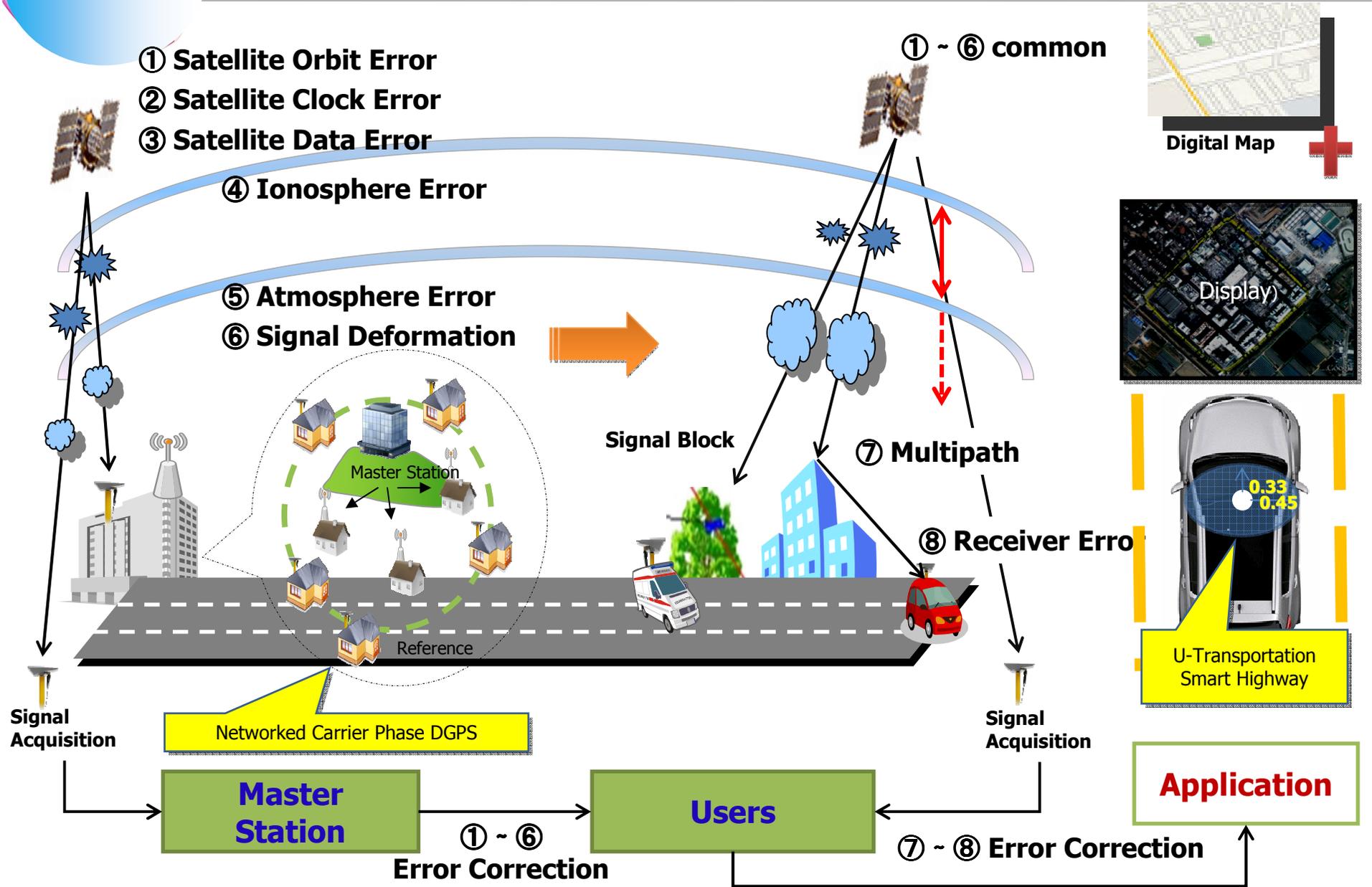


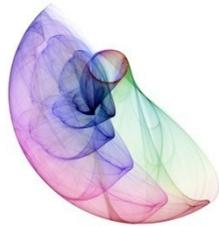
GNSS based Transportation Infrastructure



*** Land Application must be low cost for general user**

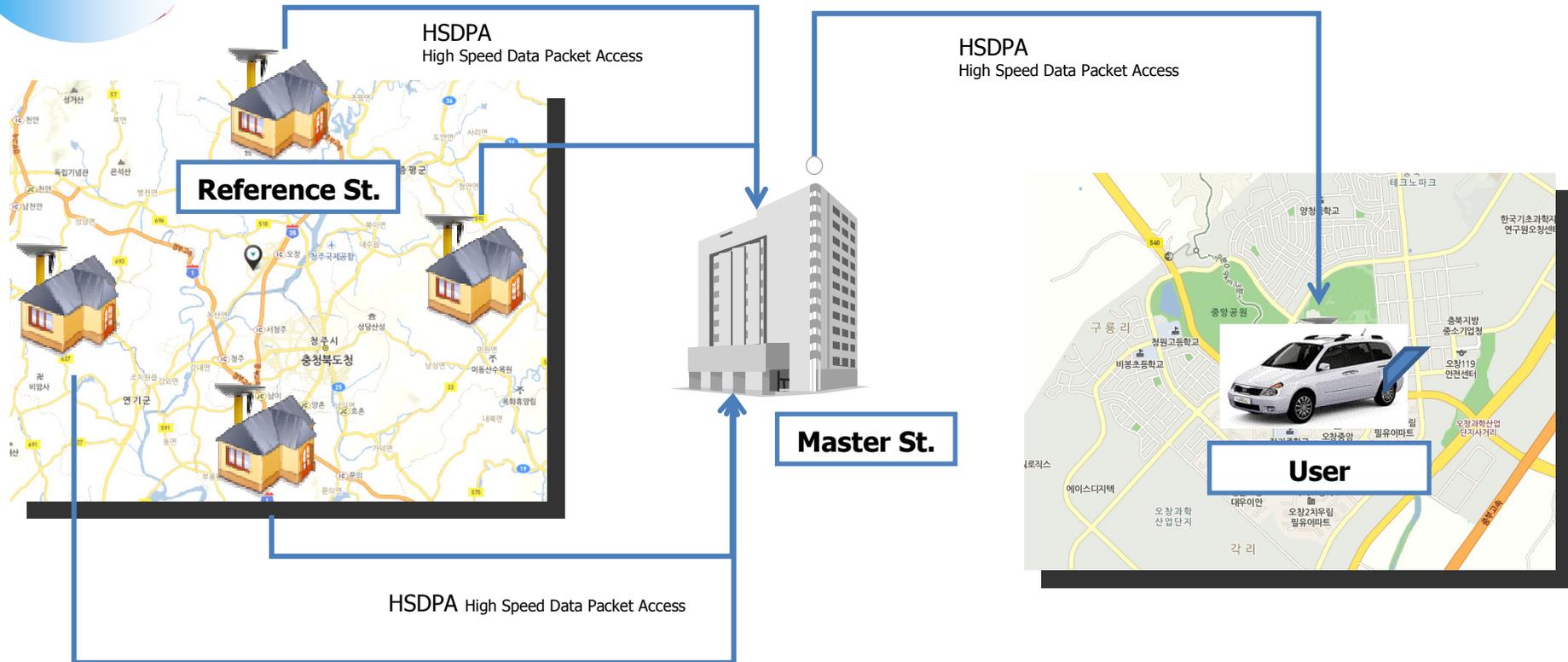
The System Concept





III. Phase I Test & Evaluation

Phase 1 System Test & Evaluation



Reference (Movable)

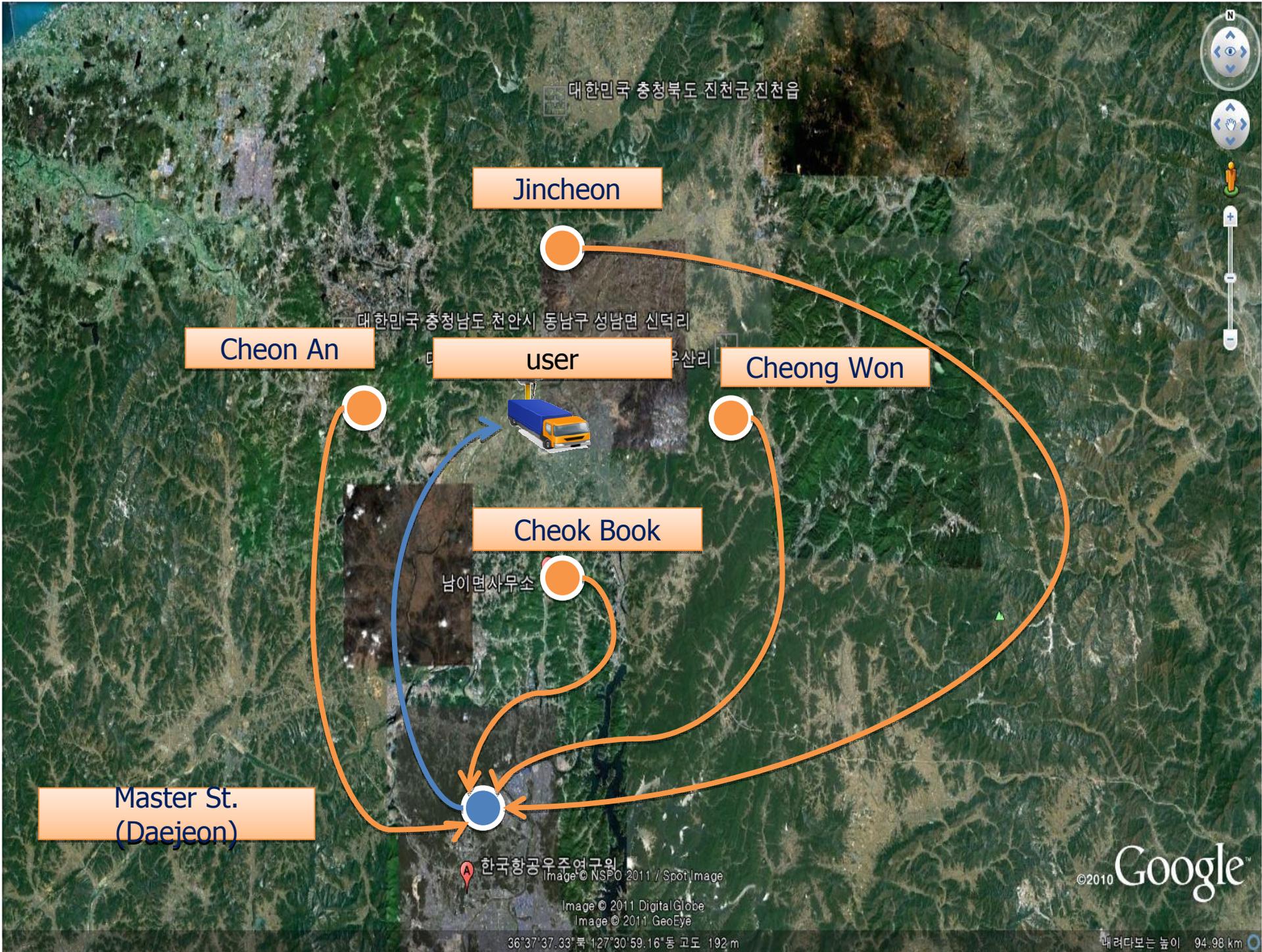
- 4 Reference Stations(base line at least 30~40km)
- Collecting GPS Data & sending to the Master station

Master St.

- Daejeon KARI
- Receiving GPS & ref Raw Data
- Computing Correction Info
- Broadcasting Correction Info

User (car)

- Receiving GPS data
- Receiving Correction Data
- Computing position



Jincheon

Cheon An

user

Cheong Won

Cheok Book

Master St.
(Daejeon)

Image © 2011 Digital Globe
Image © 2011 GeoEye

36°37'37.33"북 127°30'59.16"동 고도 192 m

©2010 Google

내려다보는 높이 94.98 km

System Test (Infra) 1

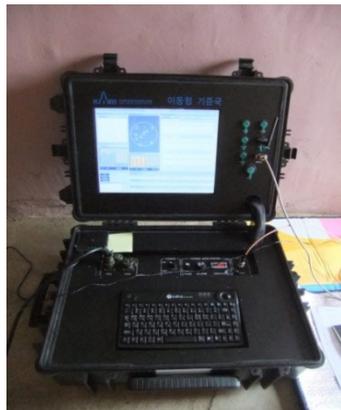
Potable Ref



Master St.



Monitoring System



Ref Data processor



Master Data Processor

Master Station (1)

국토해양부 한국건설교통기술평가원 KICTEP

국토해양부 한국건설교통기술평가원 KICTEP

수신국1

오차정보생성

수신국3

수신국2

수신국4

감시국

다중 기준국 기반 신호이상 감시

중양국 제어

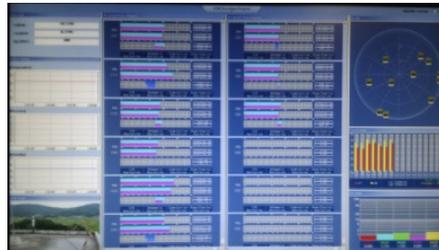
위성항법기반 교통인프라 기술개발

중양국 테스트베드 초기모델

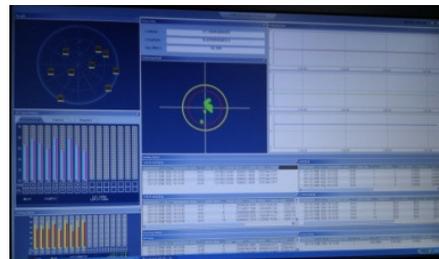
Master Station (2)



Ref1



Ref2



Monitoring St.



Correction Info



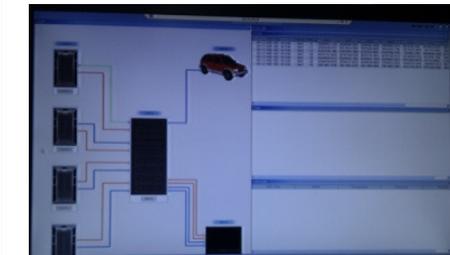
Ref3



Ref4



Integrity Monitor



Status of Processing

System Test (User)

User



Data Processor



Display

Moving Monitoring St.



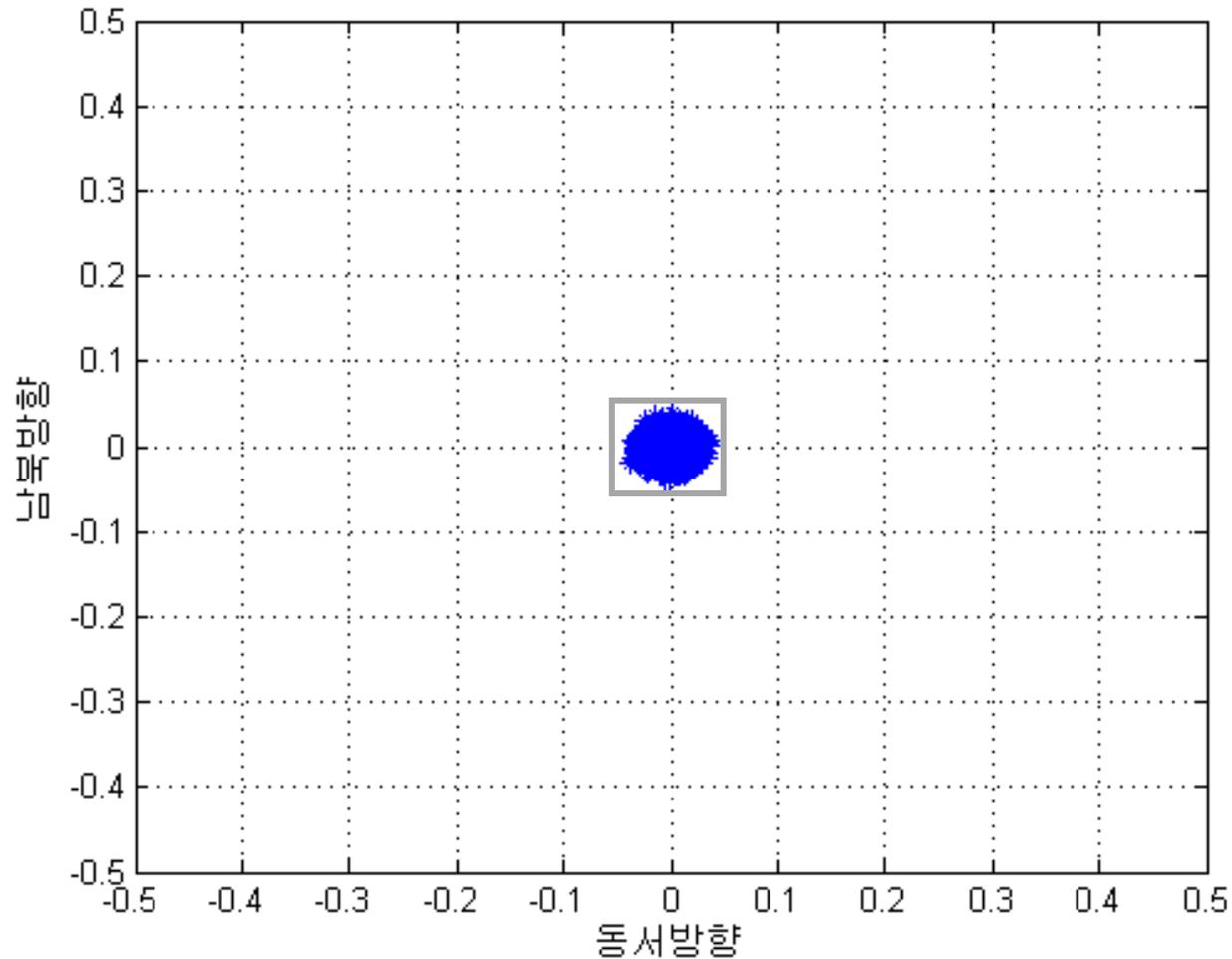
Data Processor



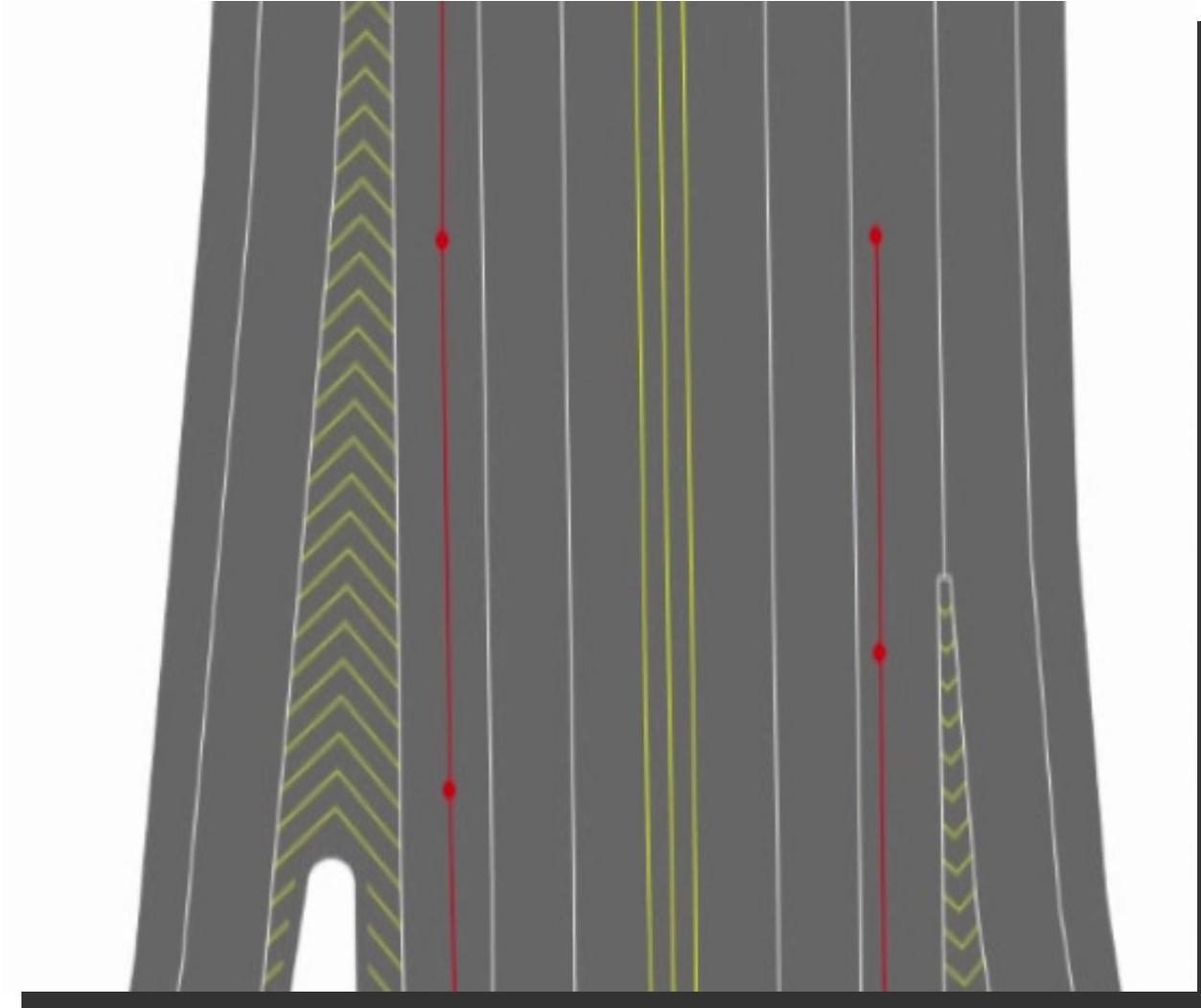
Display

Positioning Test

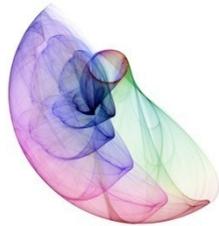
- 2-D Static Real-time Positioning (about 40Km base line)



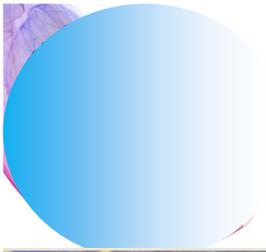
Driving Test (lane following)



Driving Test with Van



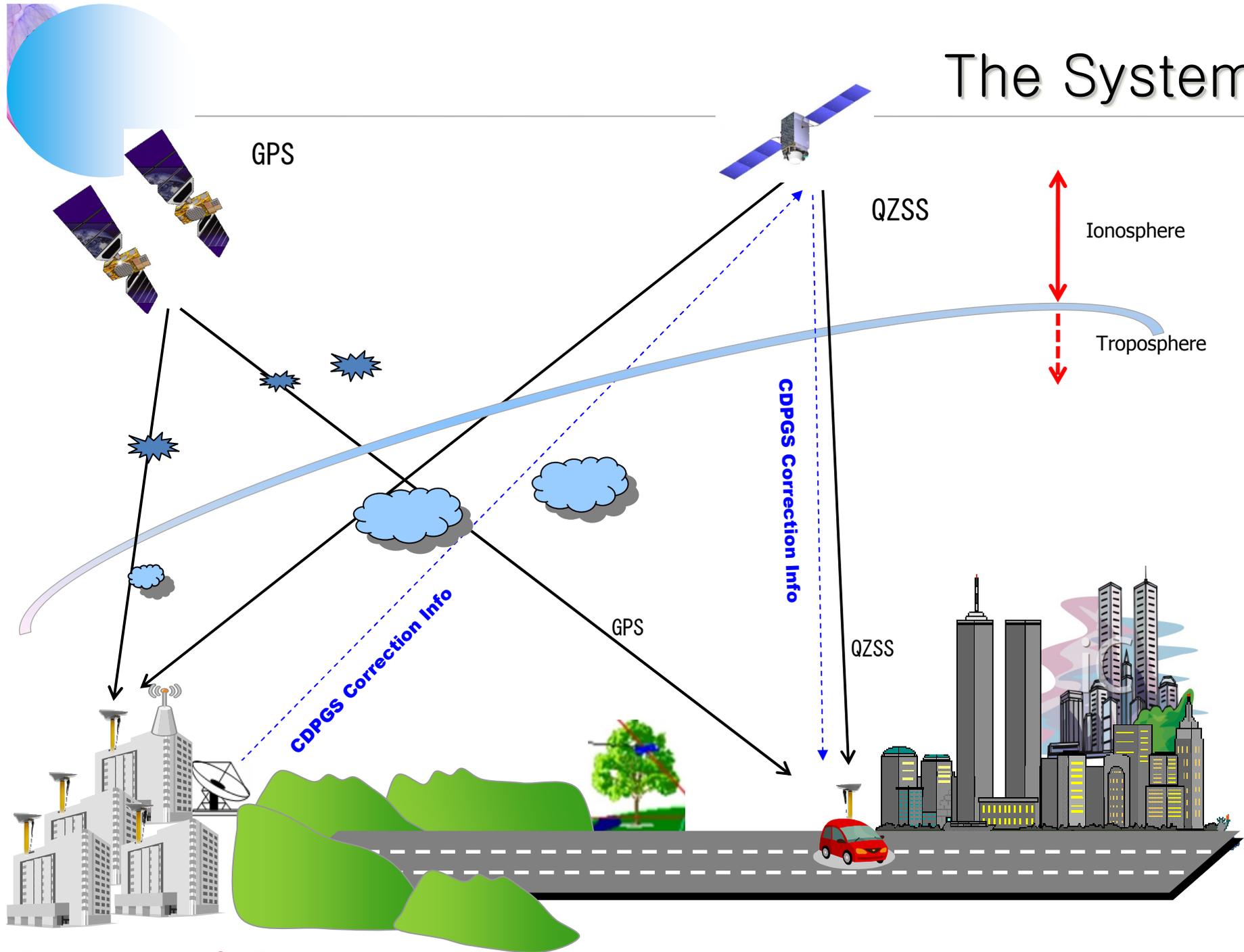
IV. Collaboration on QZSS



Test-Bed



The System



Transportation Infra-Structure