Benefits Of GNSS Receiver
In The Era Of Multi-Systems

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To understand the GNSS receiver, it becomes important to understand the multi-systems

The world of GNSS is changing fast:

➢ GPS is under modernization;

➢ GLONASS is on the way to be globally available;

➢ The development of COMPASS is going ahead;

➢ GALILEO is being built continually;

➢ The Japanese and the Indian regional systems are becoming a reality.

OUTLINE

Part Ⅰ : Some Techniques And Testing (Or Simulation) Result Of GNSS Receiver

Part Ⅱ : Potential Application In The Future

Part Ⅲ : As GNSS Receiver Manufacturer, What We Concerned?

Part Ⅰ

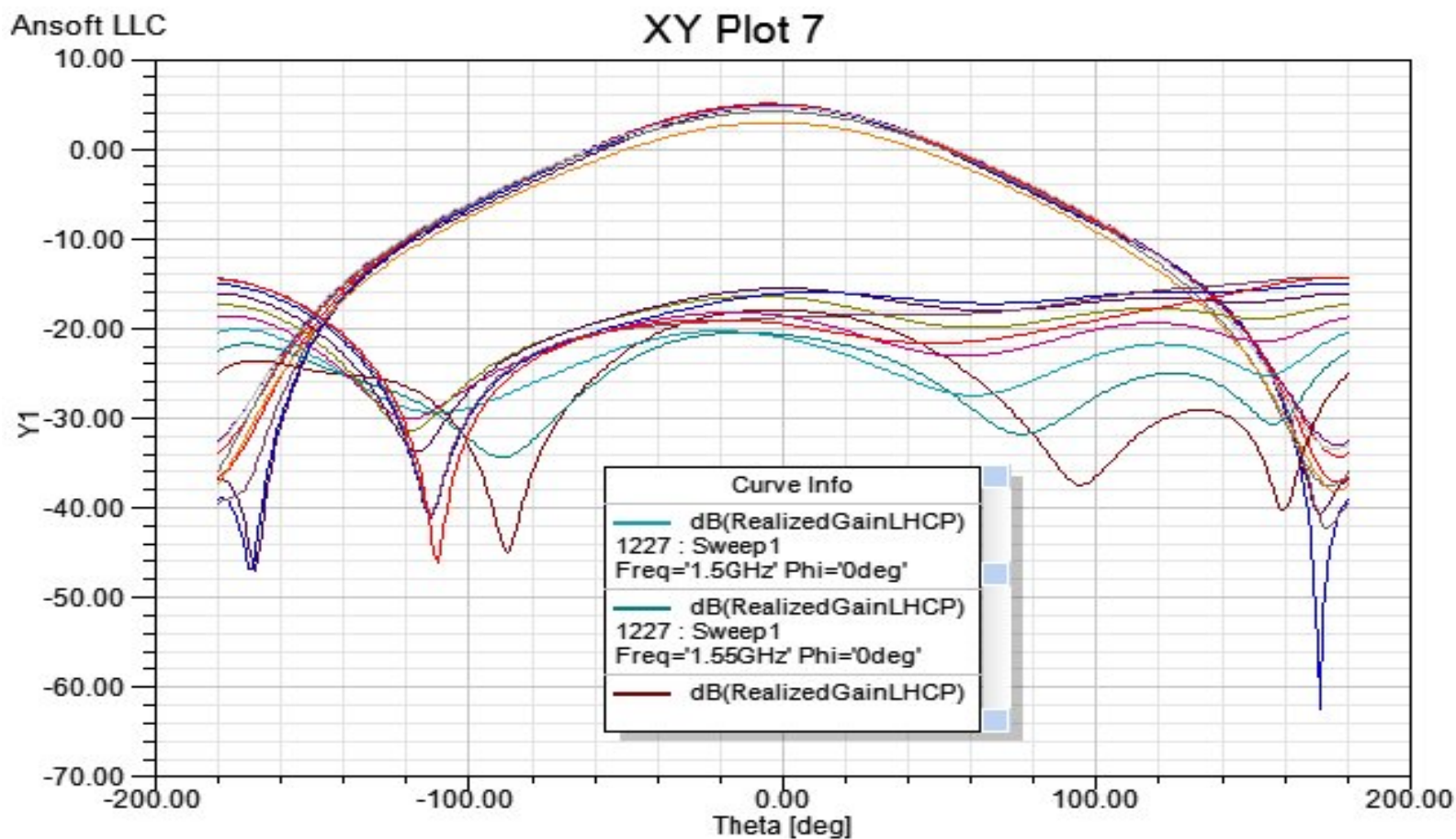**Some Techniques And Testing (Or Simulation) Result Of GNSS Receiver**

1.1 Antenna

- Frequency bandwidth cover 1.1G-1.6G, can support all GNSS system;

- Antenna phase center is steady-going;

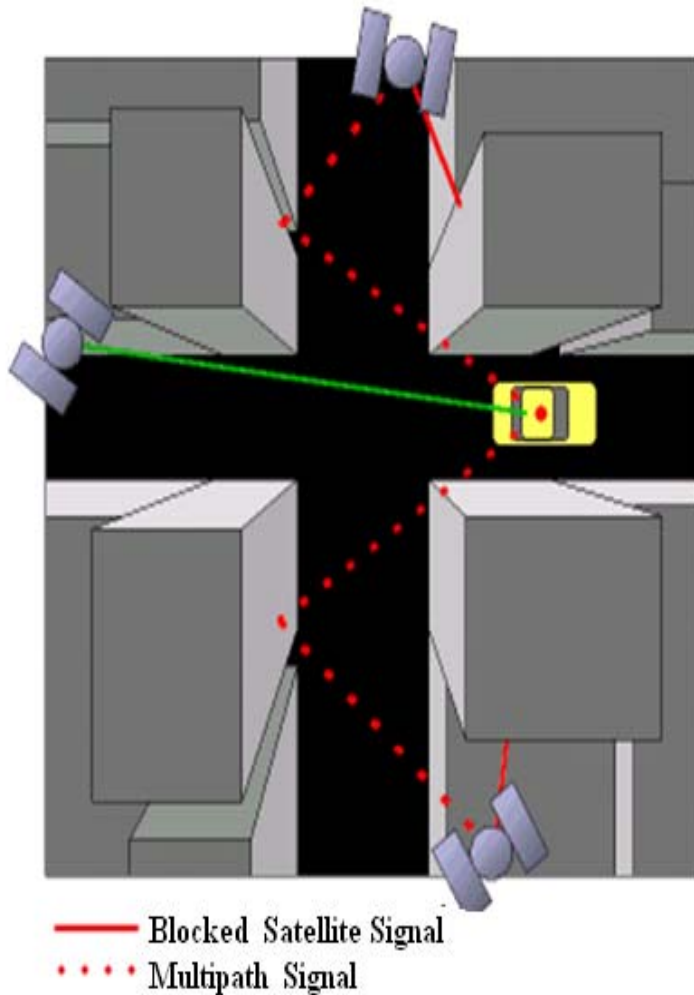- To be applicable under any weather.

Gains of Antenna

Ansoft LLC — XY Plot 7

Curve Info
dB(RealizedGainLHCP)
1227 : Sweep1
Freq='1.5GHz' Phi='0deg'

dB(RealizedGainLHCP)
1227 : Sweep1
Freq='1.55GHz' Phi='0deg'

dB(RealizedGainLHCP)

1.2 Multipath Mitigation
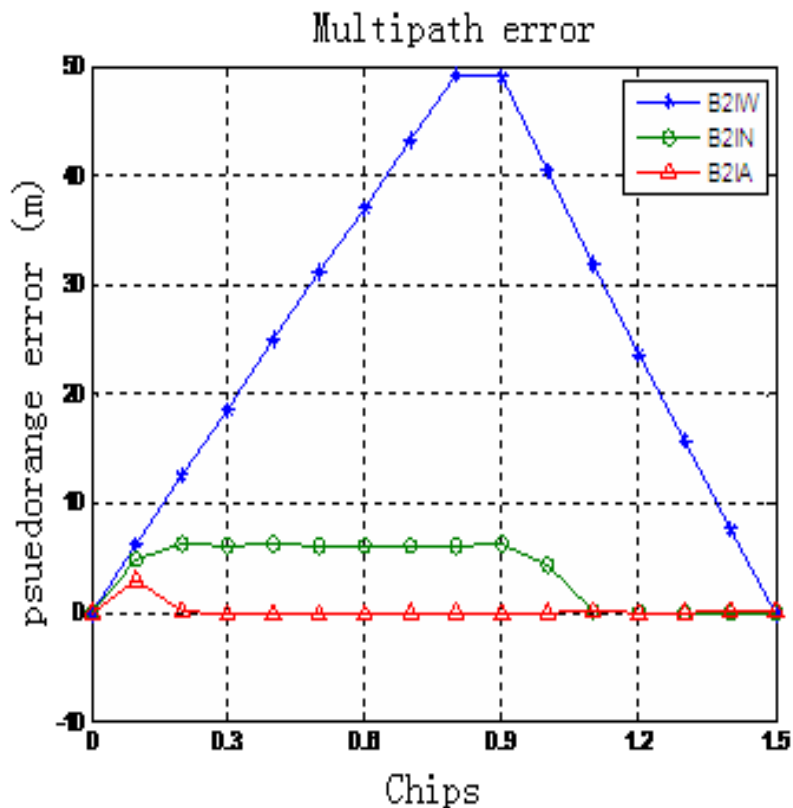

Blocked Satellite Signal
Multipath Signal

- Multipath is commonly happened in the city

- Satellite signal bounces before hitting antennae

- Causes include buildings, vehicles, etc…

- Provides inaccurate positional reading

Testing Result of Multipath Mitigation (1)

Multipath error

Chip rate: 2.046MHz

○—— Wide correlation

○—— Narrow correlation

△—— Anti-multipath correlation

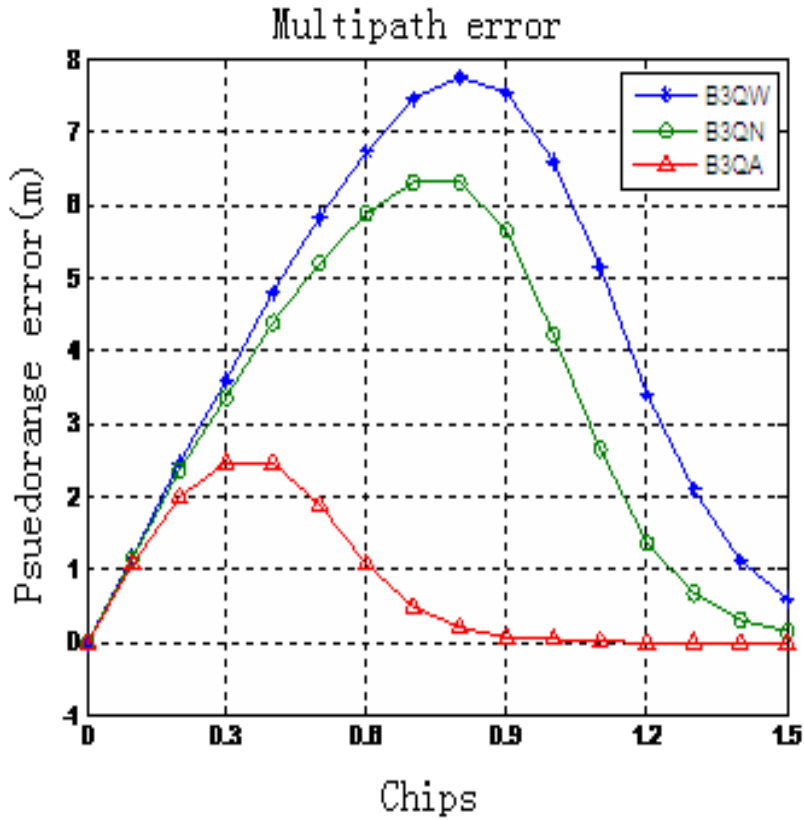Multipath error has been eliminated about 98%

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Testing Result of Multipath Mitigation (2)

Multipath error

Chip rate : 10.23MHz

○—— Wide correlation

○—— Narrow correlation

△—— Anti-multipath correlation

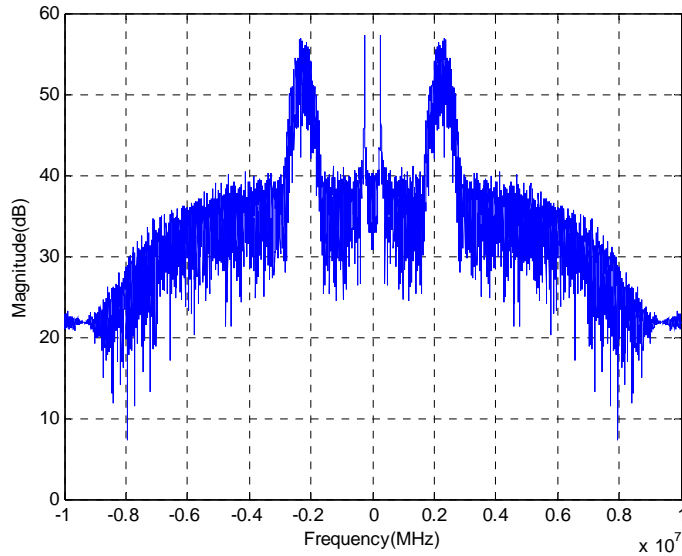Multipath error has been eliminated about 80%.
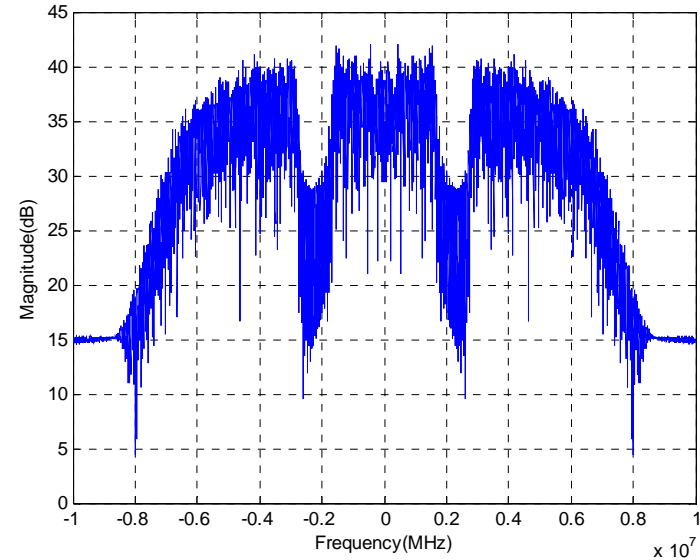
1.3 Anti-Interference

- Work in complex electromagnetic environment without accident.

- Some techniques will provide greater protection against intentional or unintentional radio frequency interference.

Simulation Result of Anti-Interference

Signal Spectrum with Interference

Signal Spectrum by Anti-interference Processing

This result has proved that the single frequency interferences and narrow-band interferences have been cancelled effectively.

The capability of anti-interference is beyond 50dBc for the narrow interference within 10% band-width of signal.
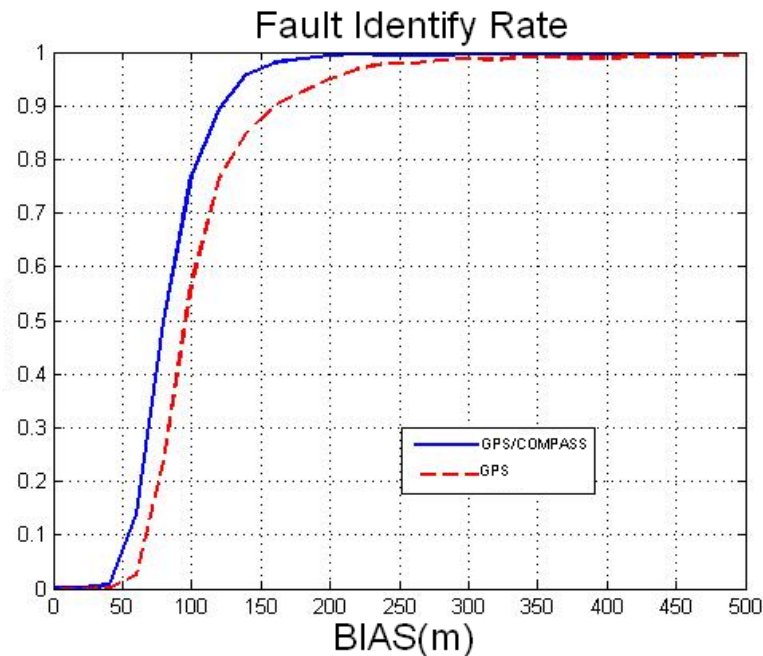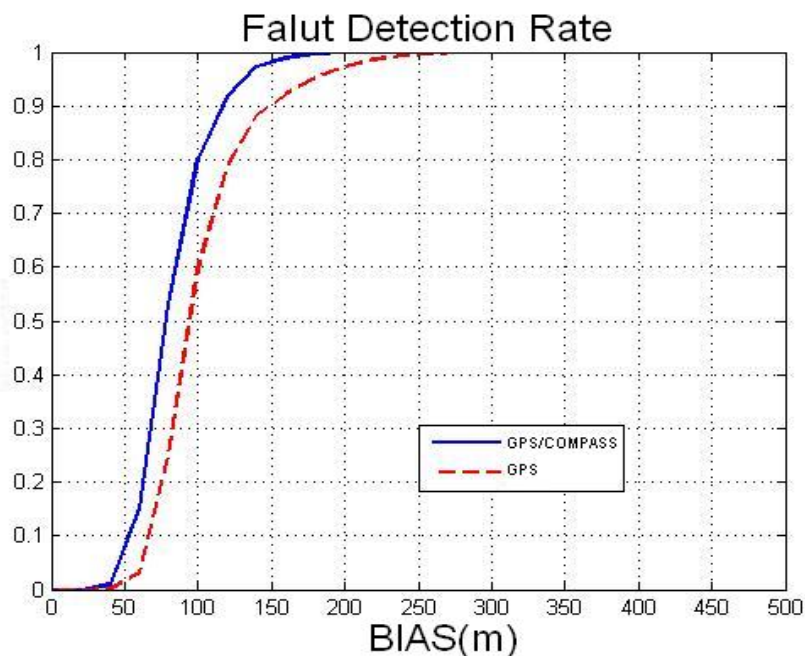
1.4 Signal Quality Monitoring

- Integrity monitoring is an important technique in the development of GNSS receiver.

- Gives notice to end-users when the receiver can not provide correct navigational information.

- Multi-system can provide more information to do this by GNSS receiver.

Simulation Result of Fault Detection and Identify

When the pseudorange bias is same, fault can be detected and identified more efficiently by GPS/COMPASS than by GPS only, improve about 10%.
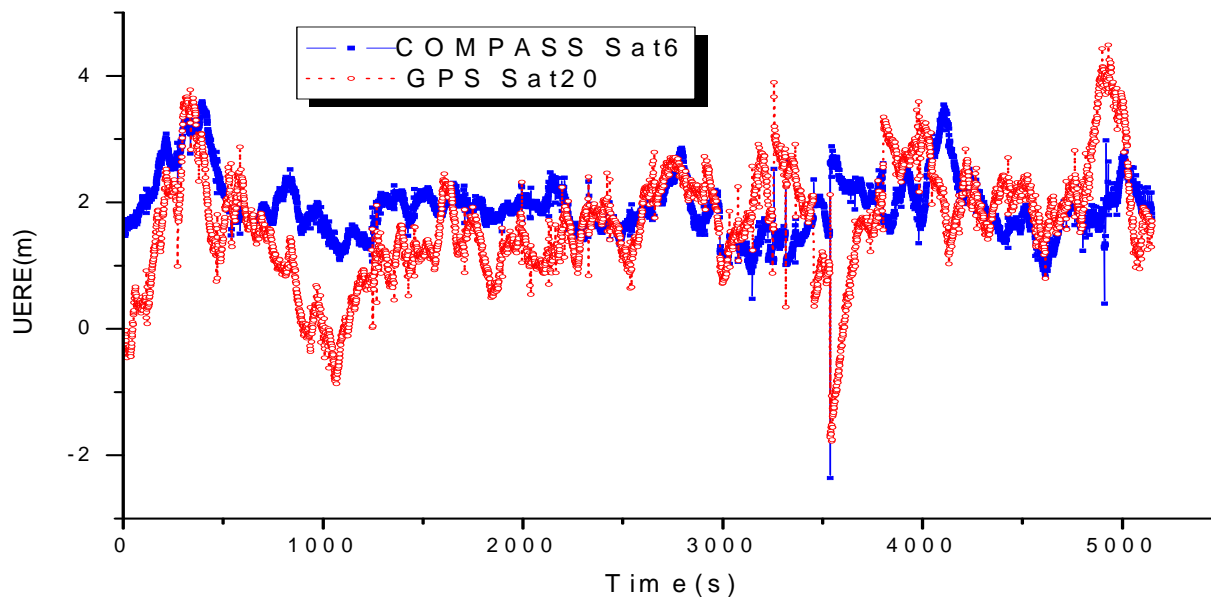
1.5 Accuracy Analysis

Accuracy evaluation method:

Position error = PDOP X UERE

There are some figures and statistics of comparative results between the GPS/COMPASS and GPS :
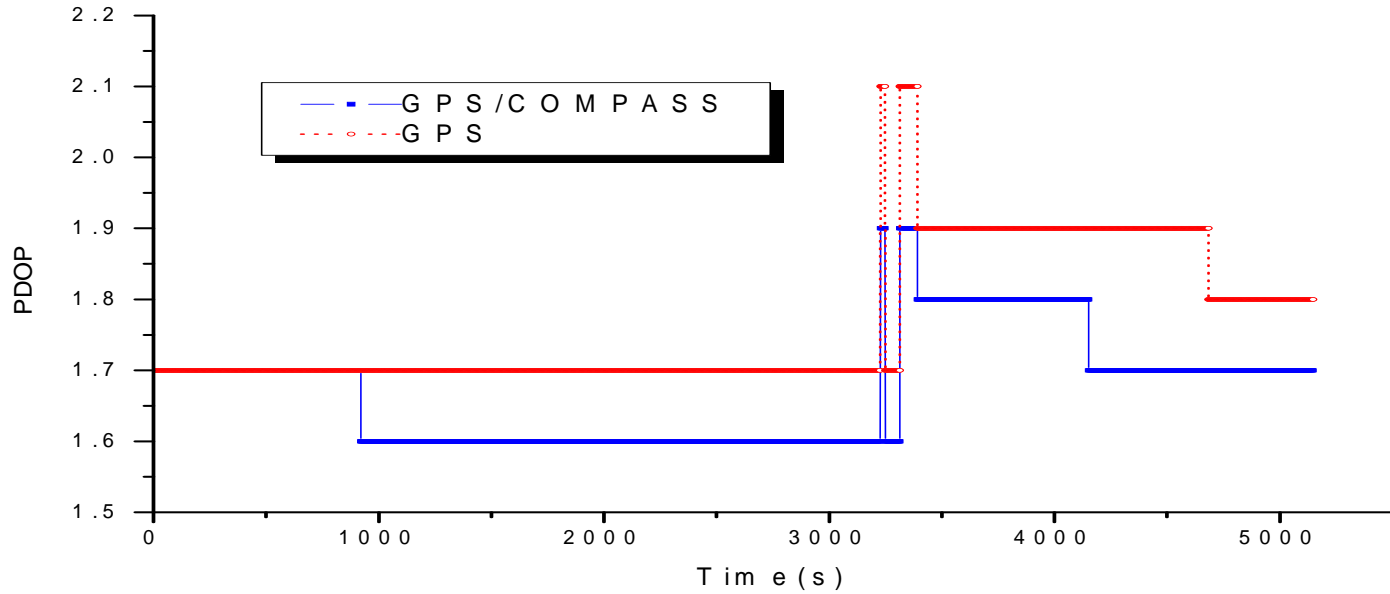
(1) UERE Comparison

UERE(m)	Min	Max	Mean	Std
GPS	-1.78	4.483	1.753	0.904
GPS/COMPASS	-2.361	3.596	1.839	0.469

(2) PDOP Comparison

PDOP	Min	Max	Mean	Std
GPS	1.742	2.195	1.767	0.097
GPS/COMPASS	1.633	1.982	1.672	0.078

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(3) Position Error Comparison
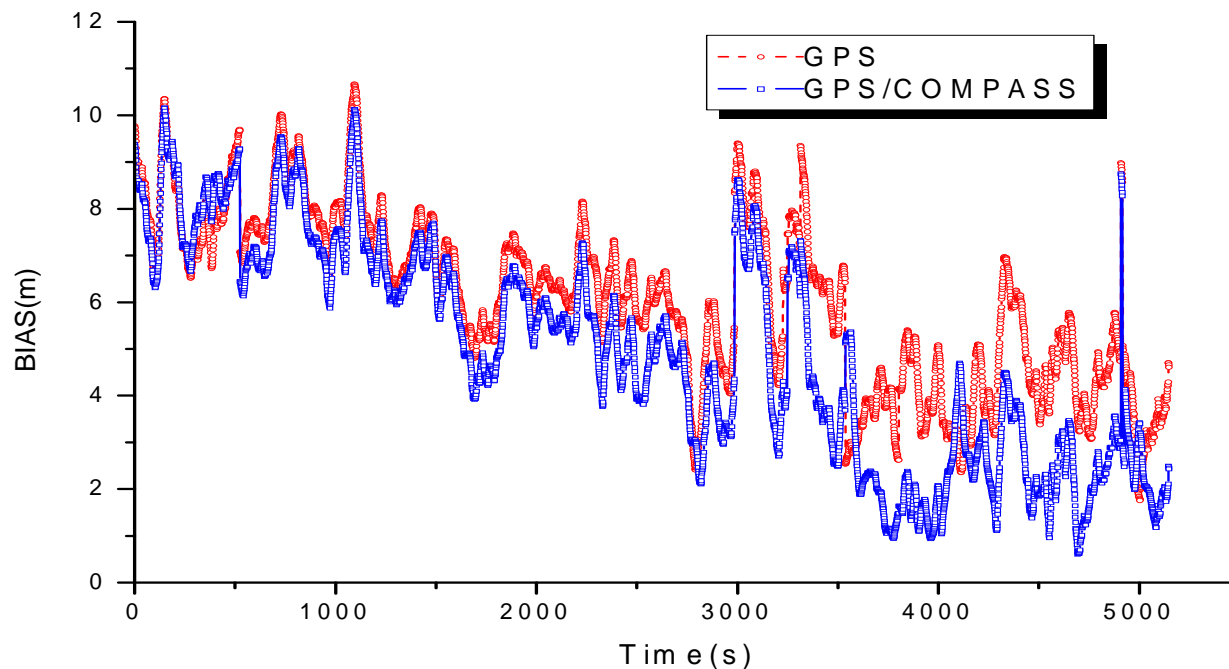
BIAS(m)	Min	Max	Mean	Std
GPS	1.753	10.663	6.073	2.350
GPS/COMPASS	0.602	10.160	5.497	1.842

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So,

GNSS receiver has many benefits to the almost all end-users.

It deserves more attention in the era of multi-systems.

Part Ⅱ

Potential Application In The Future

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GNSS receiver will be an important equipment for the
next generation of air transportation system, train control
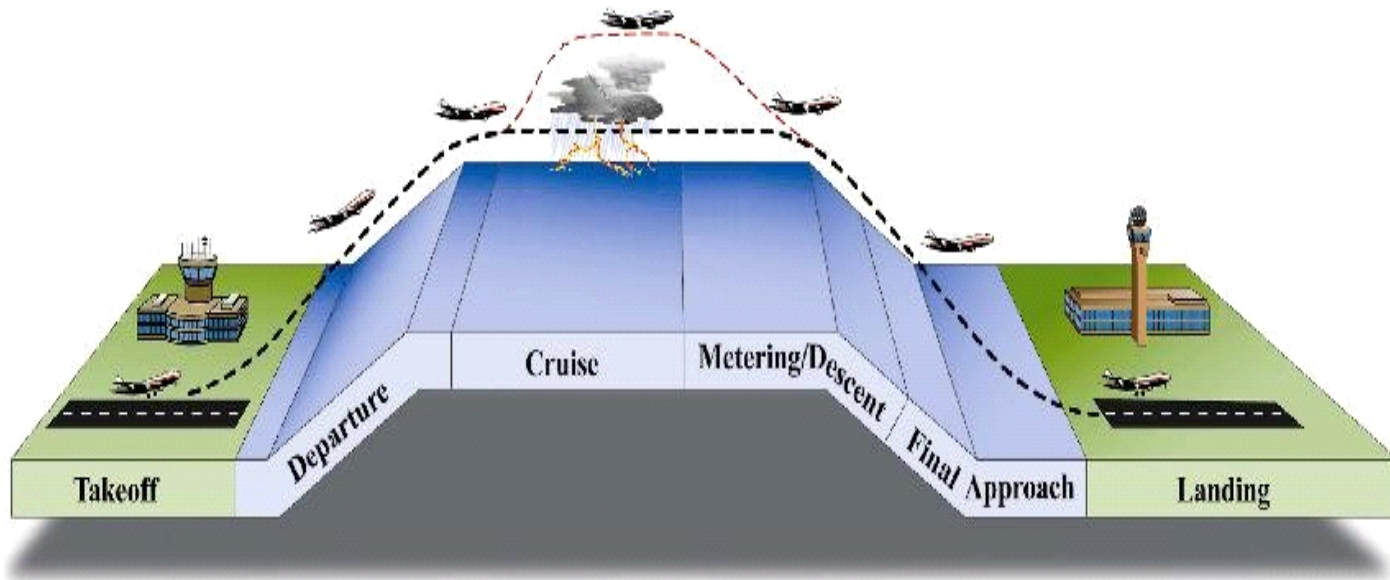and maritime applications, to provide seamless worldwide
service .

GNSS Aviation Applications

The application of GNSS in aircraft is becoming increasingly common.
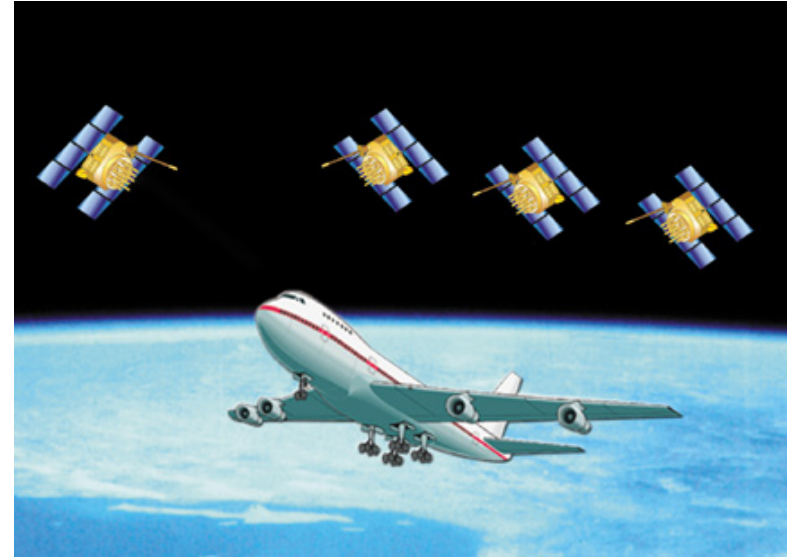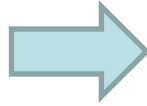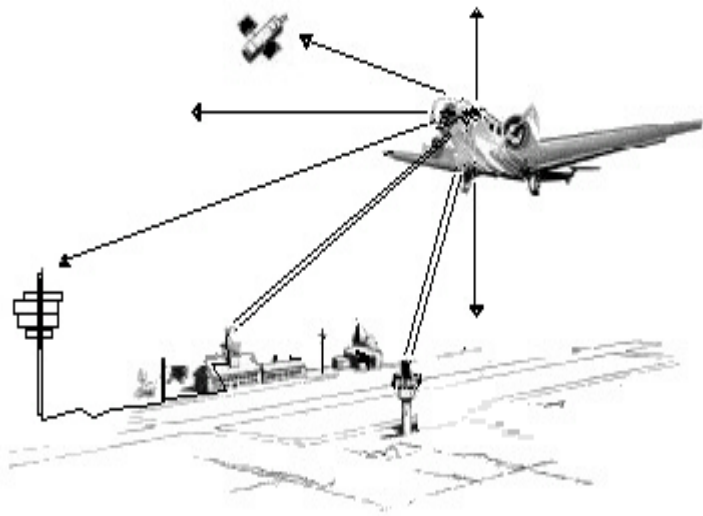COMPASS will provide difference information and integrity message to end-users, just like WAAS.
It is possible to use GNSS receiver as a primary navigation manner for aviation in China area.

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Stand-alone GNSS non-precision and Cat. I approach will also become possible in China area.

Part Ⅲ

As a GNSS Receiver Manufacturer What Do We Concerned?

As receiver manufacturers, we hope:

(1) The signals of multi-constellation have common
      carrier frequencies, moderate bandwidth and
      in-complicated modulation.

➤ To reduce cost and complexity of GNSS receiver

As receiver manufacturers, we hope:

(2)   Data-less signal component

➢ Pilot carrier improves tracking threshold
➢ Better for high precise phase measurements

As receiver manufacturers, we hope:

(3)   Satellites orbit from different navigation system should be planned reasonably to get the best geometric arrangement in multi-systems.

➤ To obtain the most optimized performance characteristic (such as DOP, accuracy, integrity etc…).

Thanks

for your attention!