United Nations / United Arab Emirates / United States of America
Workshop on the Applications of
Global Navigation Satellite Systems

Satellite-based navigation systems and their application in Kyrgyz Republic

Azamat Dyikanbaev

Leading expert of electromagnetic compatibility analysis department

State Communication Agency under the

Government of the Kyrgyz Republic

Satellite based location technologies

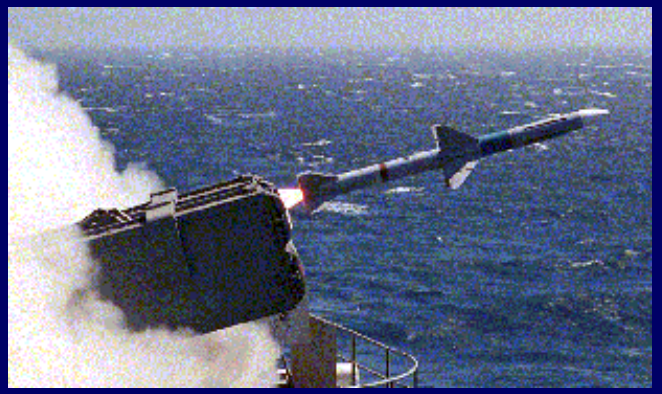
- GPS
- A-GPS
- GALILEO
- GLONASS

?
Q & A

Navigation: How can I go there? DIRECTION from my position to another location

«Position: Where am I? Name THIS location»

«Proximity information: What is nearby? Name a FEATURE'S location near my position»



♦Navigation Technologies - Present

- Primary

GPS (USA)

GLONASS (Russia)

- Secondary

WAAS (USA)

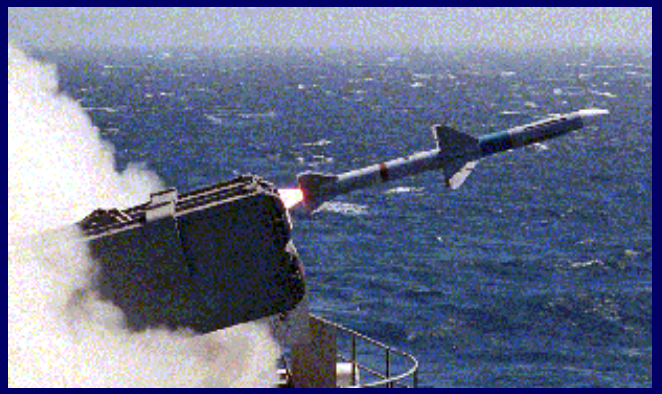
Partially operational

EGNOS (Europe)

Deployed, not operational

MSAS (Japan)

Deployed, not operational



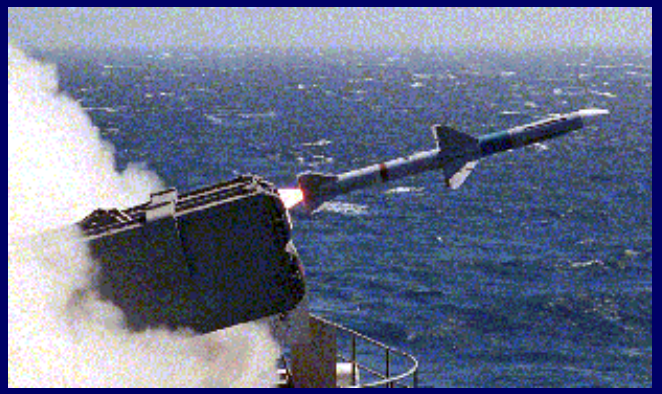
Navigation Technologies - Future

- Primary

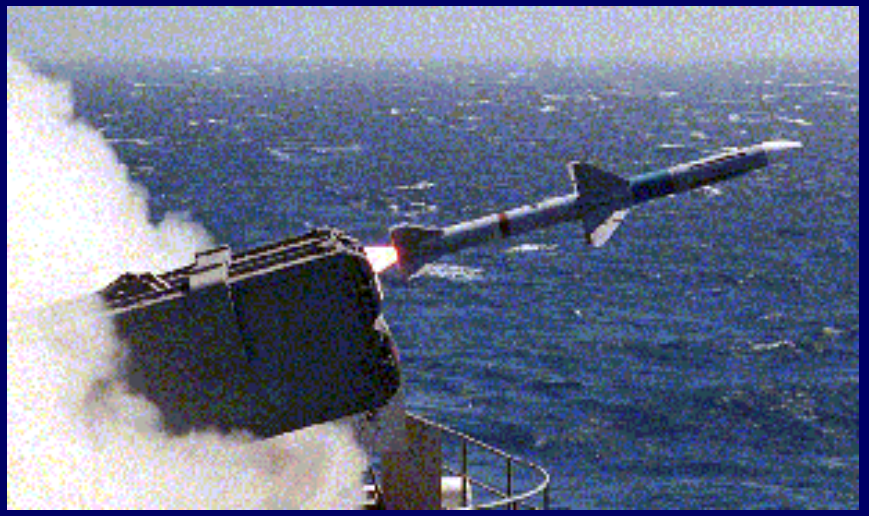
Modernized GPS (USA)
Modernized GLONASS (Russia)
Galileo (Europe+India+China+)
QZSS (Japan)
IRNSS (India)

- Secondary

WAAS (USA)
LAAS (USA)
EGNOS (Europe)
MSAS (Japan)
GAGAN (India)



Global Positioning System



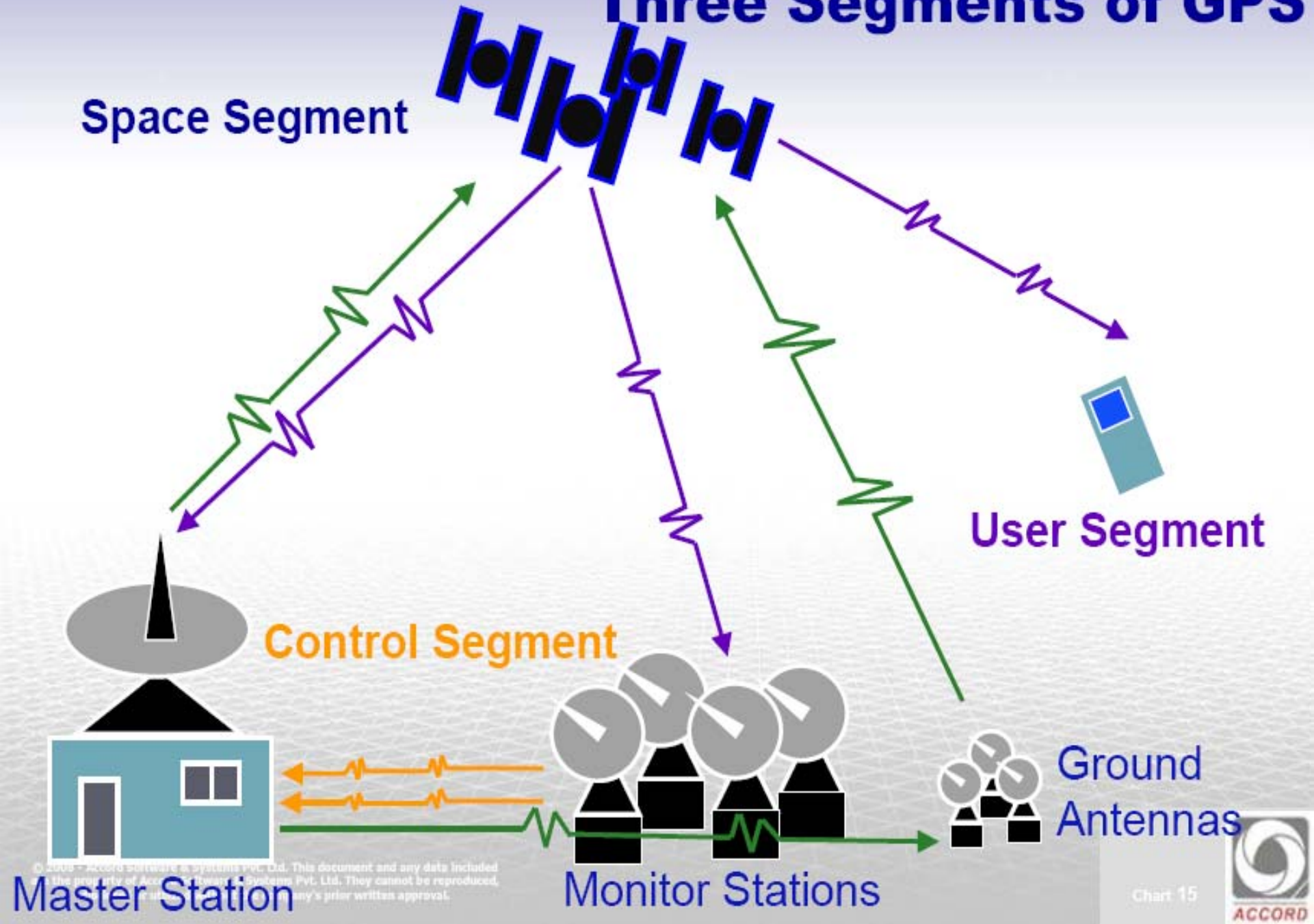
GPS Defined

GPS is a space-based radio navigation and timetransfer system capable of providing navigation data to users on or near the surface of the Earth any-time, any-where and under any-weather conditions with immunity to intentional/unintentional jamming

GPS History

1969—Defense Navigation Satellite System (DNSS) formed
1973—NAVSTAR Global Positioning System developed
1978—first 4 satellites launched
Delta rocket launch

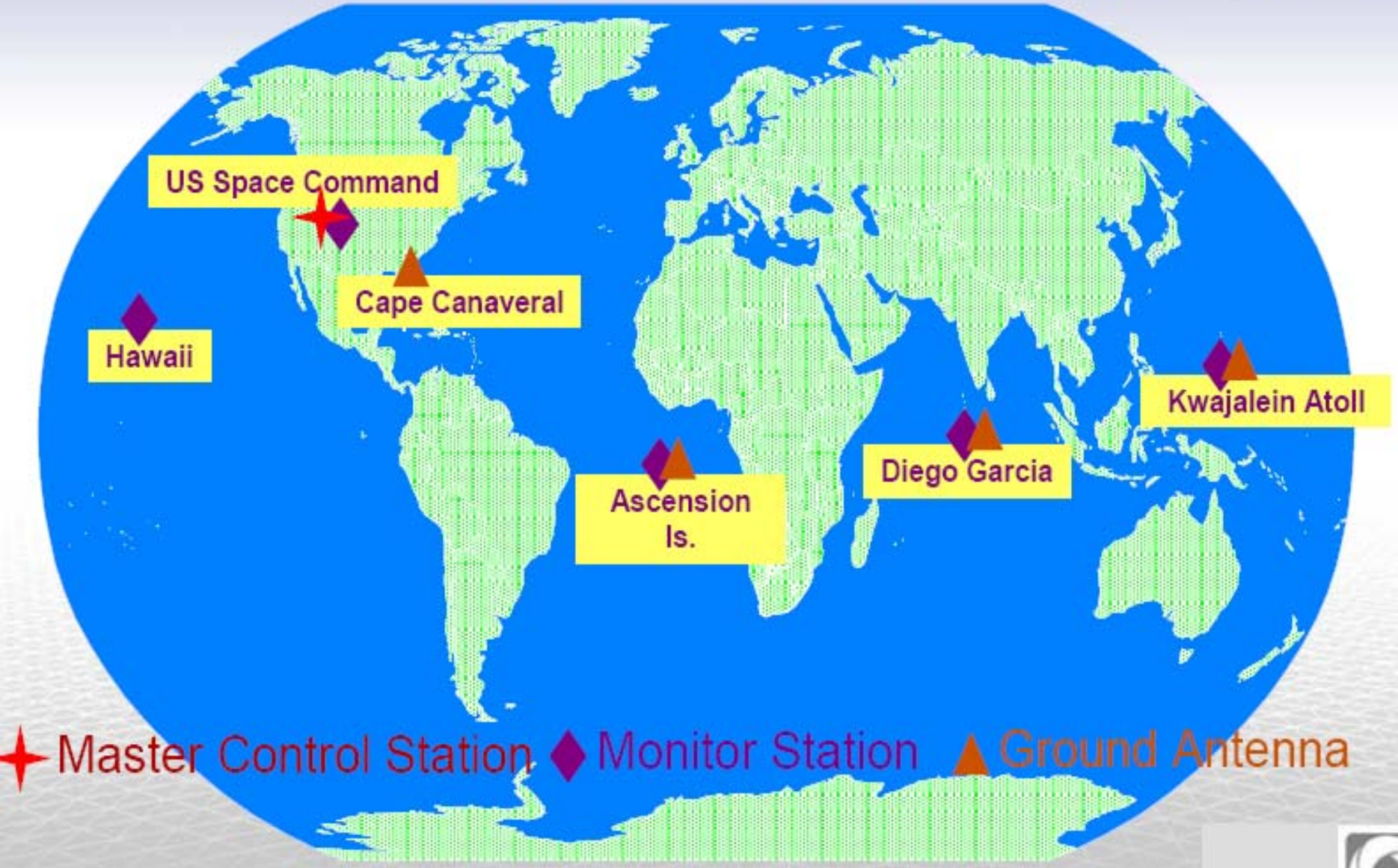
Three Segments of GPS



© 2008 - Accord Software & Systems Pvt. Ltd. This document and any data included in it is the property of Accord Software & Systems Pvt. Ltd. They cannot be reproduced, disclosed or used without the company's prior written approval.

ACCORD

Control Segment



© 2008 - Accord Software & Systems Pvt. Ltd. This document and any data included are the property of Accord Software & Systems Pvt. Ltd. They cannot be reproduced, disclosed or utilized without the company's prior written approval.

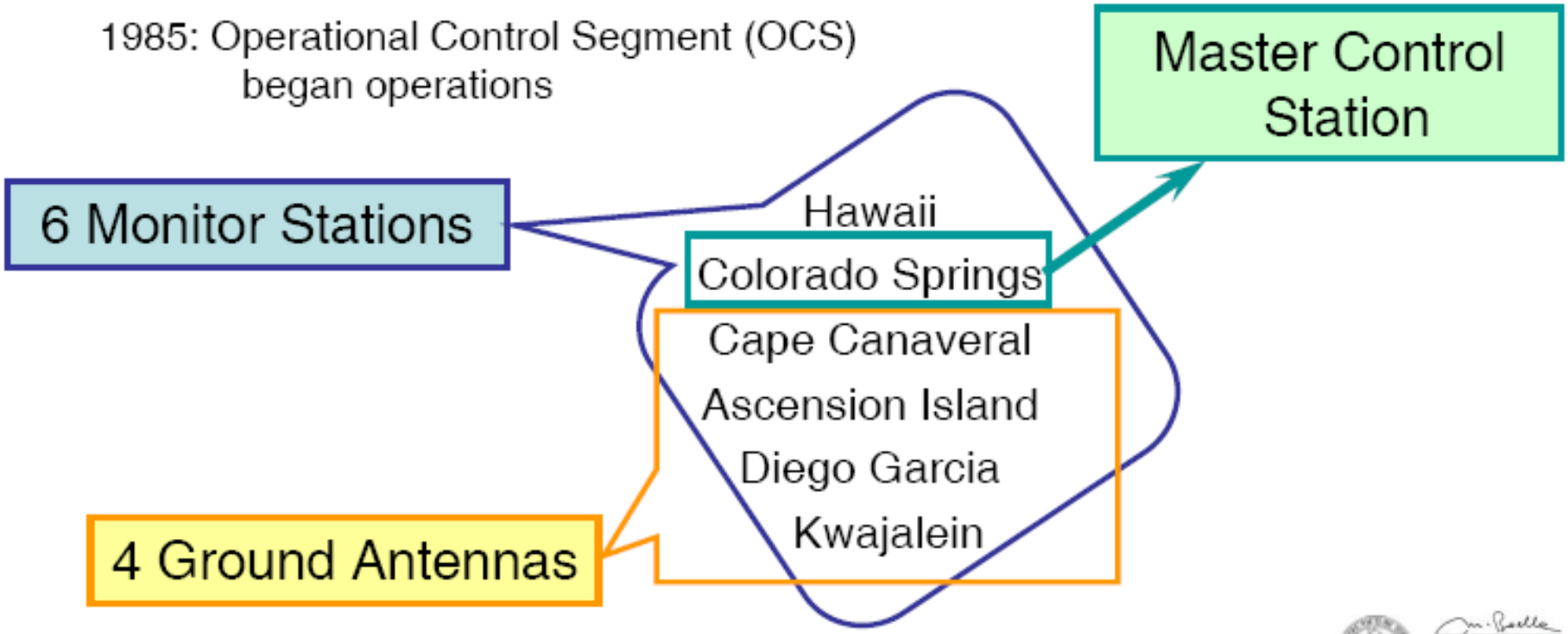
ACCORD

GPS Architecture – Control Segment

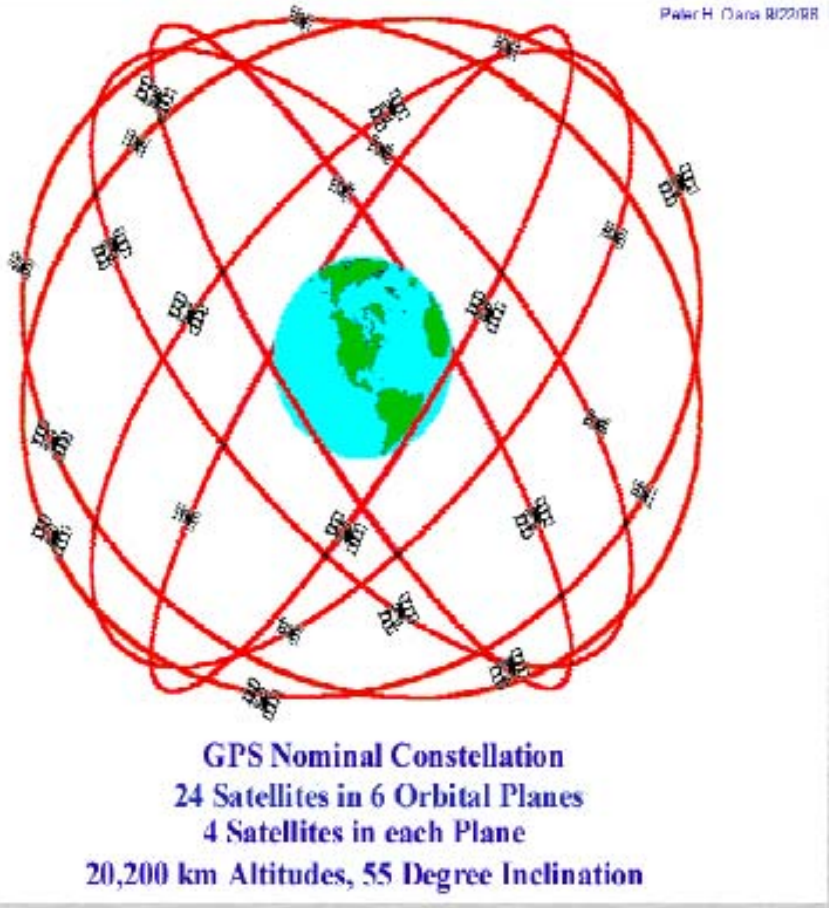
Objectives:

1. Maintain each satellite in its proper orbital position (station keeping)
2. Make corrections and adjustments to the satellite clocks and payload
3. Track the GPS satellites, generate and upload the navigation data to each satellite
4. Command major relocations in the event of satellite failure to minimize the impact

1985: Operational Control Segment (OCS) began operations



Space Segment



GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

- GPS Constellation
  - 24 satellites (Space Vehicles or SVs)
  - 20,200km altitude (12 hour orbit period)
  - 6 orbital planes (55° inclination)
  - 4 satellites in each plane

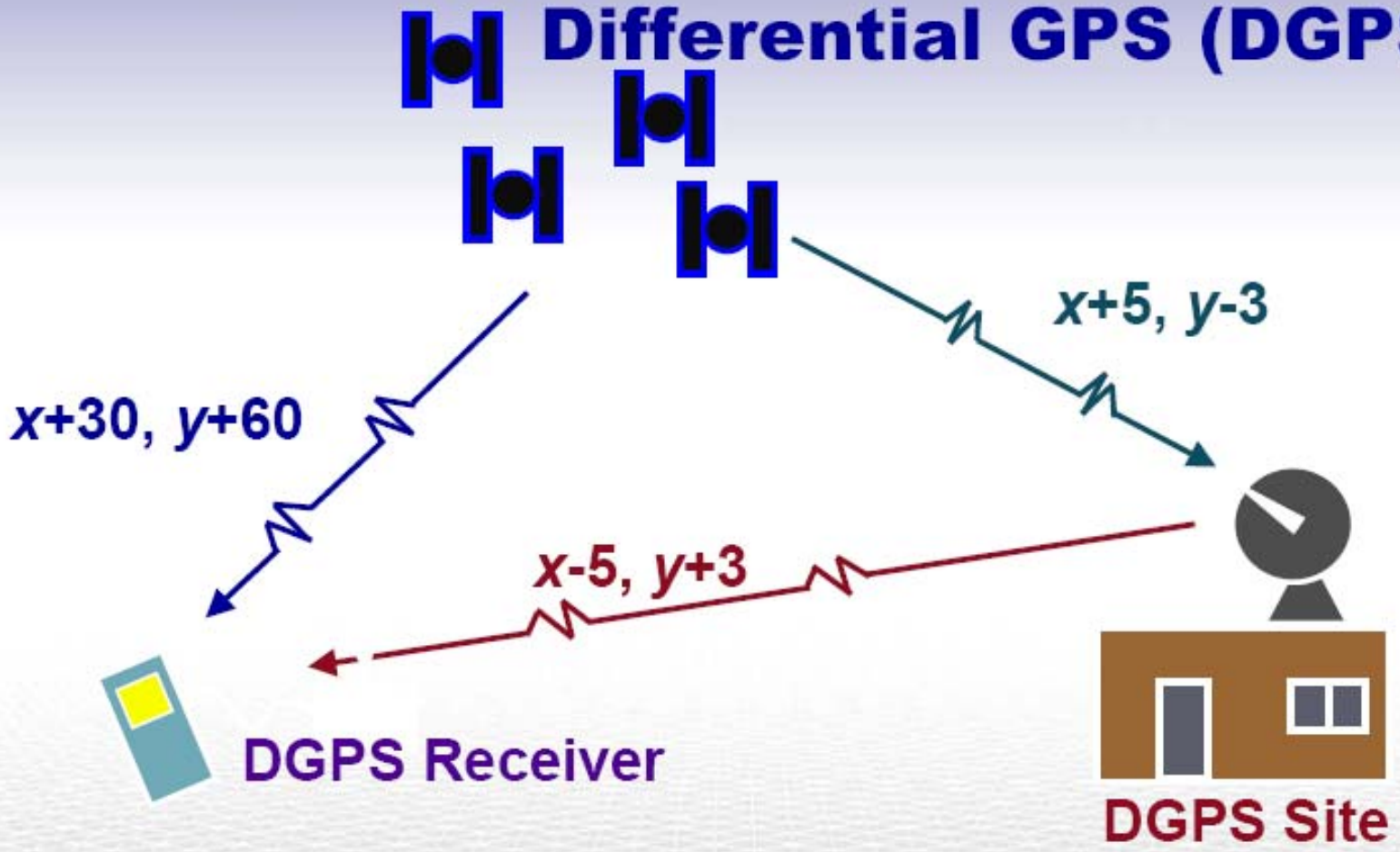
© 2008 - Accord Software & Systems Pvt. Ltd. This document and any data included are the property of Accord Software & Systems Pvt. Ltd. They cannot be reproduced, disclosed or utilized without the company's prior written approval.

ACCORD

User Segment

© 2008 - Accord Software & Systems Pvt. Ltd. This document and any data included are the property of Accord Software & Systems Pvt. Ltd. They cannot be reproduced, disclosed or utilized without the company's prior written approval.

Differential GPS (DGPS)



DGPS correction = *x*+(30-5) and *y*+(60+3)

True coordinates = *x*+25, *y*+63

True coordinates = *x*+0, *y*+0

Correction = *x*-5, *y*+3

© 2008 - Accord Software & Systems Pvt. Ltd. This document and any data included are the property of Accord Software & Systems Pvt. Ltd. They cannot be reproduced, disclosed or utilized without the company's prior written approval.

ACCORD

WAAS/ EGNOS/ MSAS

Geostationary
WAAS satellites

GPS Constellation

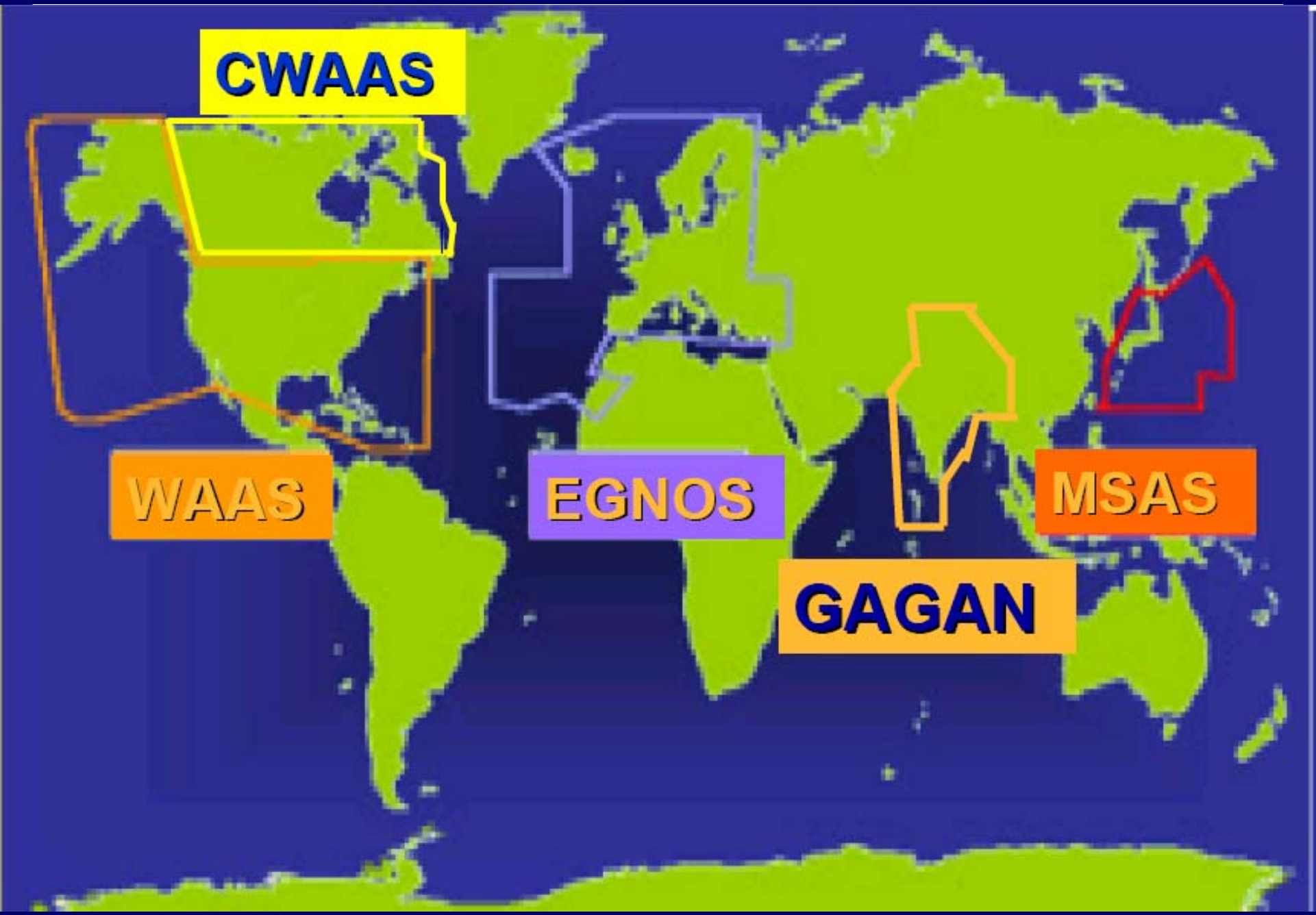
WAAS Control
Station (West Coast)

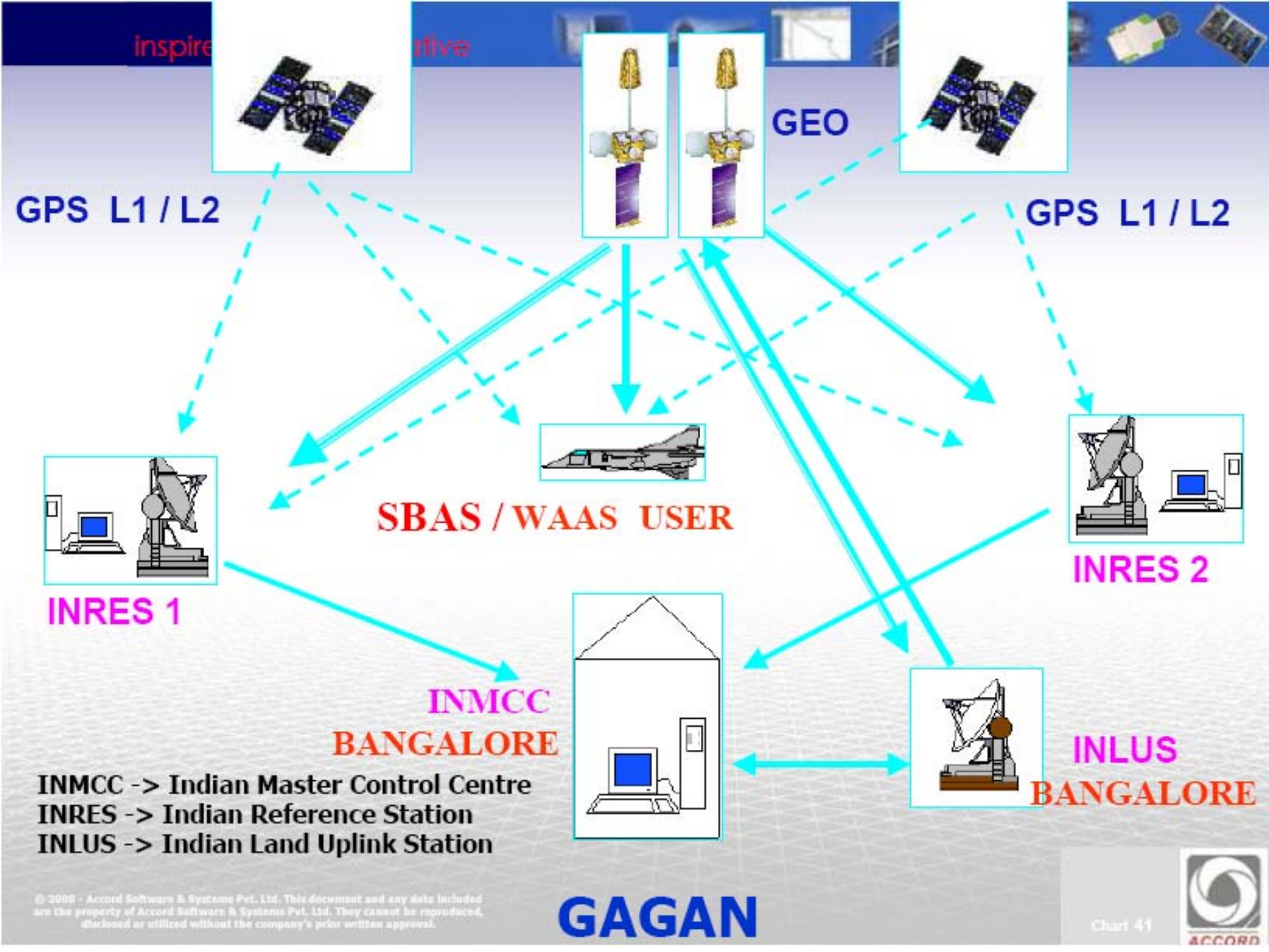
Local Area System (LAAS)

WAAS Control
Station (East
Coast)

© 2008 - Accord Software & Systems Pvt. Ltd. This doc
are

ACCORD


CWAAS
WAAS
EGNOS
GAGAN
MSAS



© 2008 - Accord Software & Systems Pvt. Ltd. This document and any data included are the property of Accord Software & Systems Pvt. Ltd. They cannot be reproduced, disclosed or utilized without the company's prior written approval.

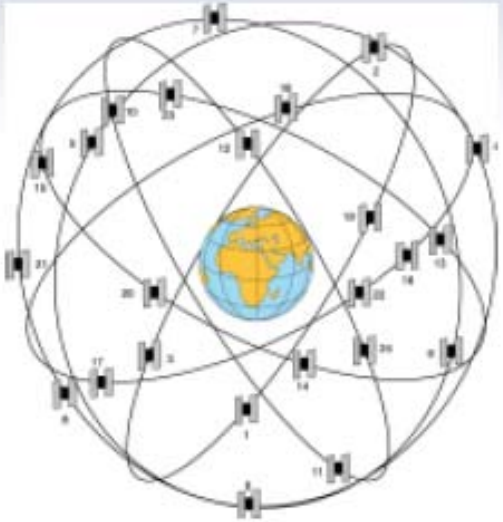
GLONASS

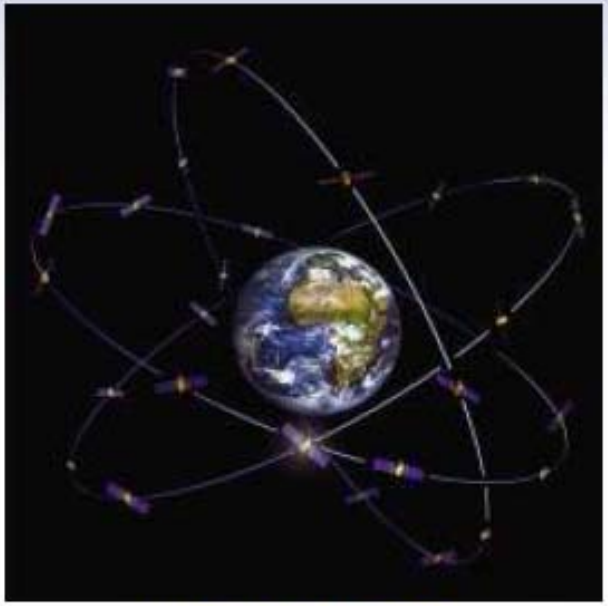
- GLONASS is Russian equivalent of GPS
- First a launched in 1982
- FDMA technique is used
- Satellites are at 65 deg inclination and at 19 thousand KM orbit

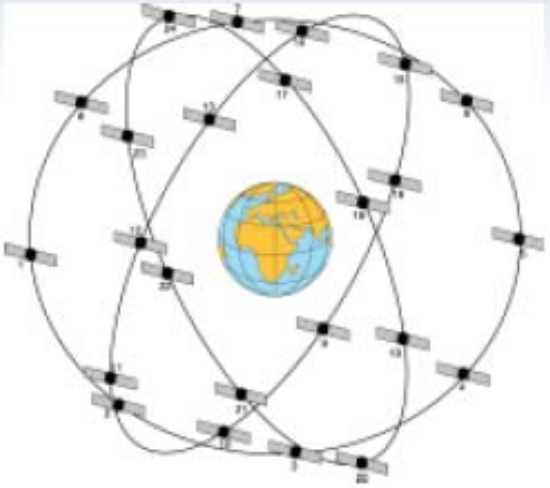
GALILEO

- Galileo is European eqivalent of GPS
- A total of 30 satellites are planned
- Satellites shall be placed at 23616 km orbit
- The first experimental satellite is launched in January, 2006

Comparison of GNSS Systems







GPS

- 6 orbital planes
- 24 satellites + spare
- 55° inclination angle
- altitude 20200 km

GALILEO

- 3 orbital planes
- 27 satellites + 3 spare
- 56 ° inclination angle
- altitude 23616 km

GLONASS

- 3 orbital planes
- 21 satellites + 3 spare
- 64.8° inclination angle
- altitude 19100 km

© 20 Accord ... are the proper ... disclosed or utilized without the company's prior written approval.

ACCORD

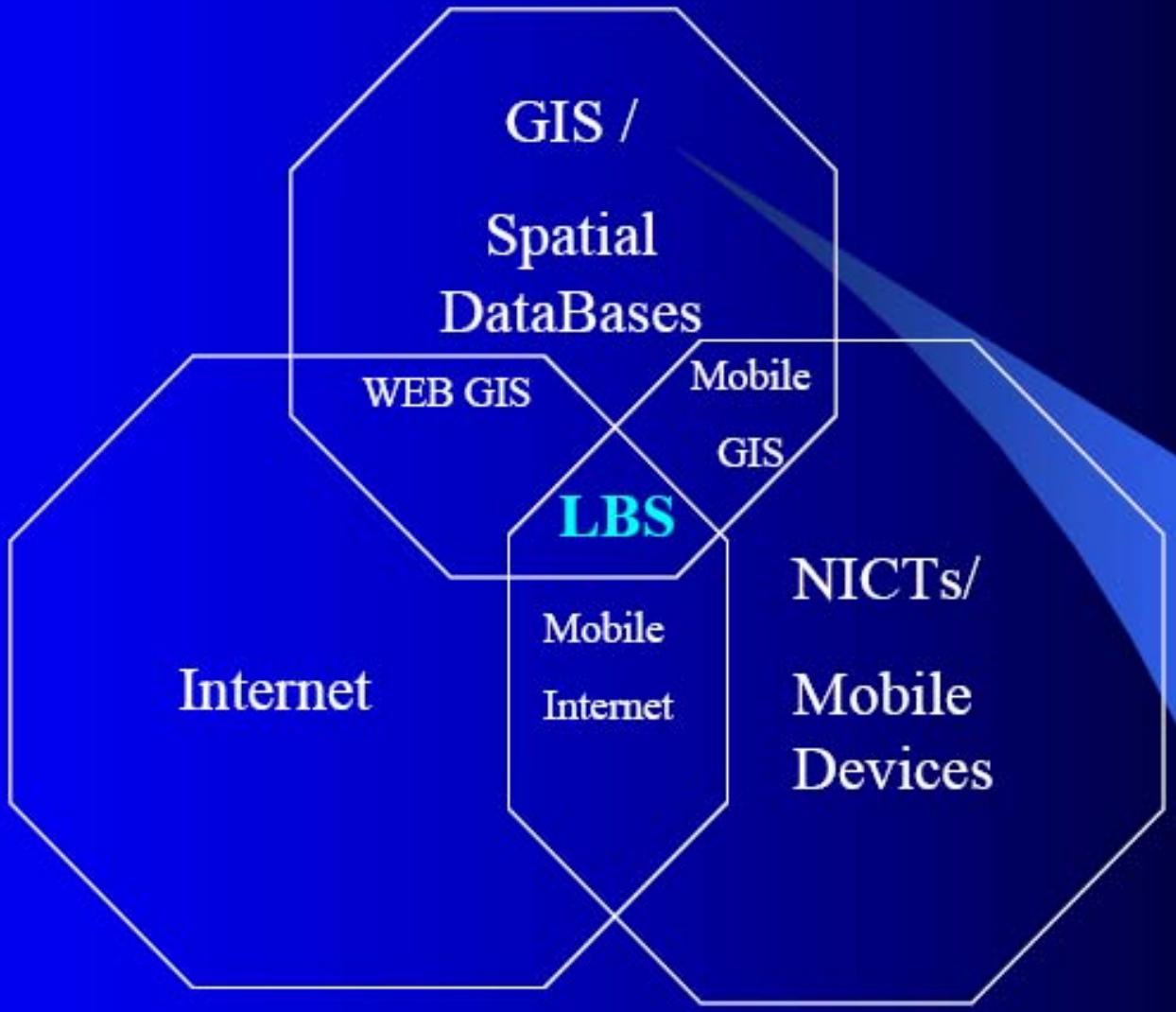
LBS

(Location Based Services)

LBS

What is LBS?

- Information services accessible with mobile devices
- Through mobile wireless network
- Presenting mobile device position by using GIS for an application


GIS /
Spatial
DataBases
WEB GIS
Mobile
GIS
LBS
Internet
Mobile
Internet
NICTs/
Mobile
Devices

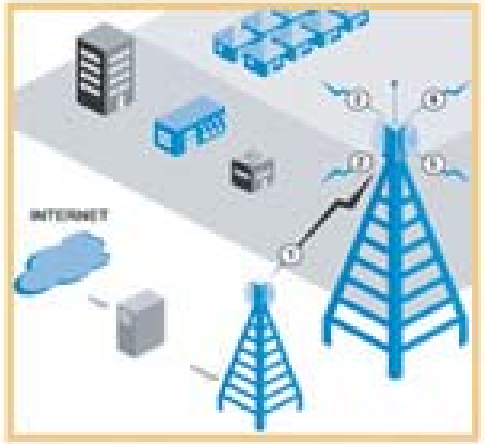
Components of LBS

MOBILE DEVICE (USER)

POSITIONING

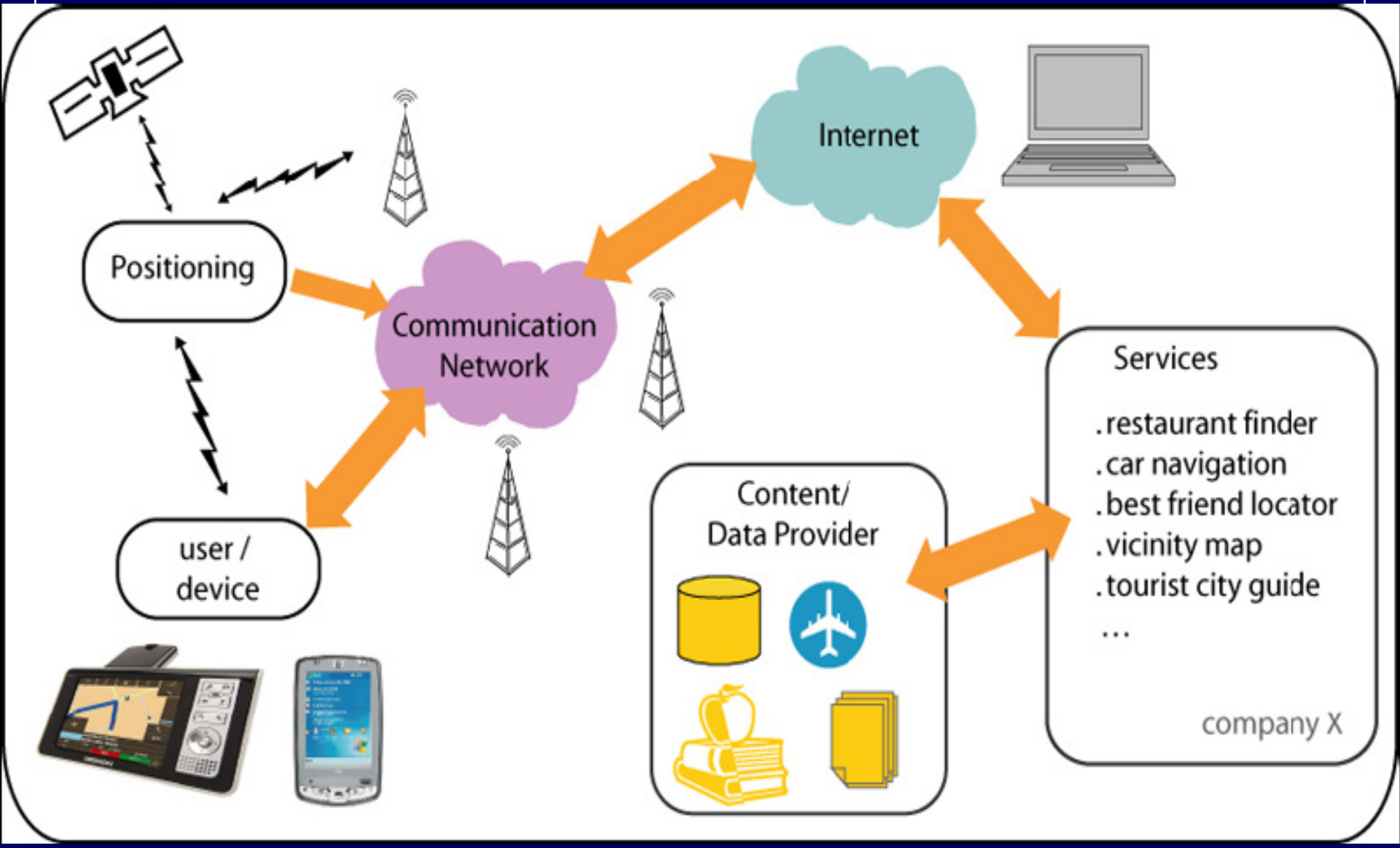
SERVICE AND CONTENT PROVIDER

COMMUNICATION NETWORK

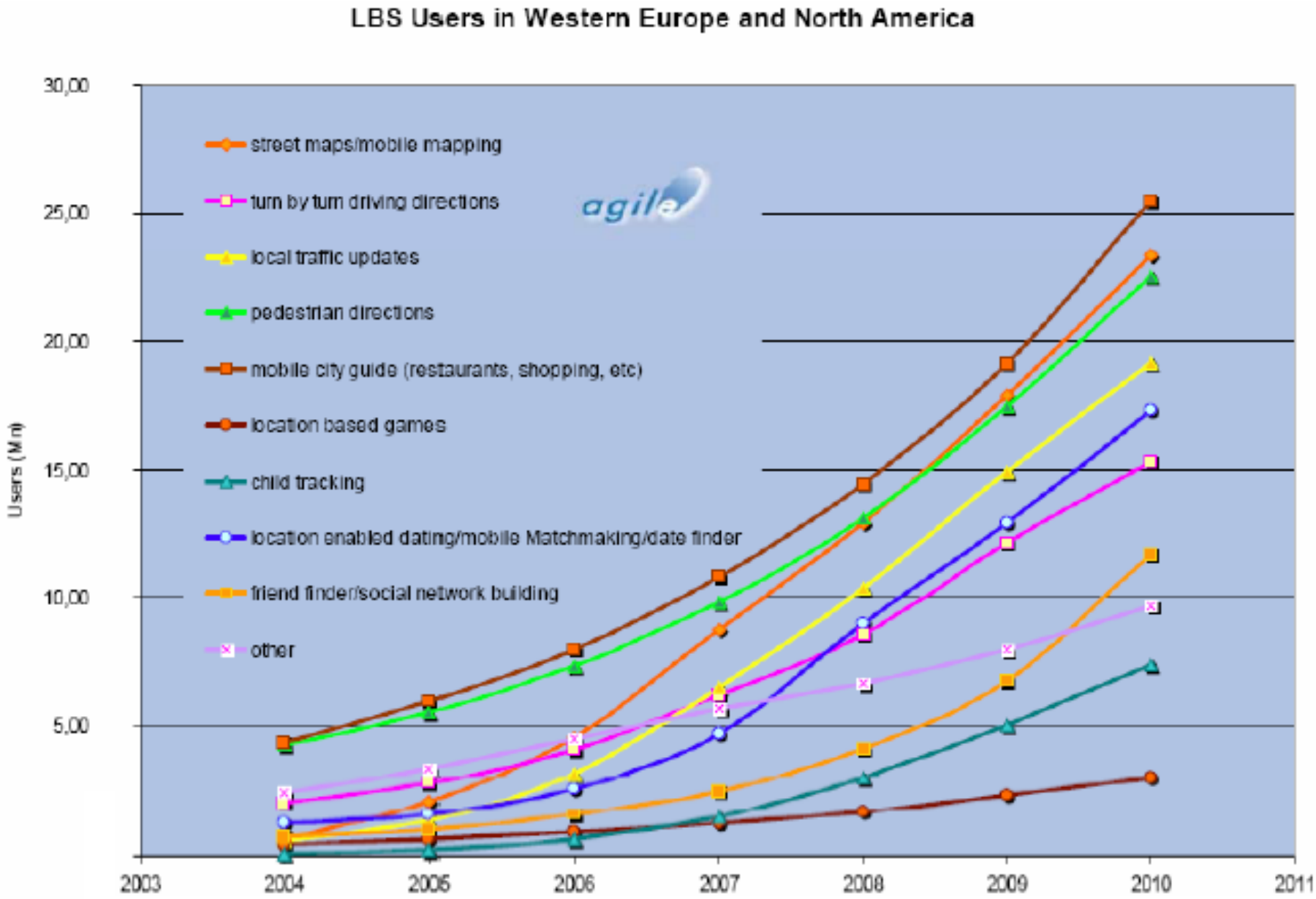


Geo Database

LBS Components and Information Flow



LBS Users


LBS Users in Western Europe and North America
Users (Mn)
30,00
25,00
20,00
15,00
10,00
5,00
2003
2004
2005
2006
2007
2008
2009
2010
2011
street maps/mobile mapping
turn by turn driving directions
local traffic updates
pedestrian directions
mobile city guide (restaurants, shopping, etc)
location based games
child tracking
location enabled dating/mobile Matchmaking/date finder
friend finder/social network building
other
agile

Some examples of location-based services

Requesting the nearest business or service, such as an ATM or restaurant

Turn by turn navigation to any address

Locating people on a map displayed on the mobile phone

Receiving alerts, such as notification of a sale on gas or warning of a traffic jam

For the carrier, location-based services provide added value by enabling services such as:

Resource tracking with dynamic distribution. Taxis, service people, rental equipment, doctors, fleet scheduling.

Resource tracking. Objects without privacy controls, using passive sensors or RF tags, such as packages and train boxcars.

Finding someone or something. Person by skill (doctor), business directory, navigation, weather, traffic, room schedules, stolen phone, emergency calls.

Proximity-based notification (push or pull). Targeted advertising, buddy list, common profile matching (dating), automatic airport check-in.

Proximity-based actuation (push or pull). Payment based upon proximity (EZ pass, toll watch).

Applications: Location Based Services

1. Emergency Services – Search & Rescue, vehicle break down location
2. Navigation Services – Point to point route, Information on traffic etc.
3. Information Services – Local maps, Notification of near by places of interest.
4. Tracking and Management Services – Mobile supply chain management, Vessel/vehicle monitoring etc.
5. Billing Services – Dynamically charge particular users of a particular service depending upon their location when using or accessing the service.
6. Outlook – Augmented Reality – See-Through Devices: Usually worn on the head, overlay graphics and text on the user's view of the surroundings.

2
SEARCH & RESCUE SATELLITES
3
LOCAL USER TERMINAL
4
MISSION CONTROL CENTER
1
DISTRESS CALL UTILIZING EMERGENCY BEACON
5
RESCUE COORDINATION CENTER

Conclusion

After all, we need measurements of space and time for almost all our activities and LBS provides these.

Hence, LBS will influence our life more than any other technological advent.

köszönöm תודה! děkuji

mahalo 고맙습니다

---

thank you

謝謝 shie shie 谢谢 danke

Ευχαριστώ merci شكرا

どうもありがとう gracias

adyikanbaev@mail.ru nta@infotel.kg