International Federation of Surveyors
Fédération Internationale des Géomètres
Internationale Vereinigung der Vermessungsingenieure

Global Navigation Satellite Systems and Global Surveyors

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Outline of Presentation

- ***Outline of FIG***
- ***Global Issues and the Surveyor***
- ***Surveying with GNSS***
- ***What Surveyors need from Future GNSS***
- ***Roles FIG Can Play***

What is FIG?

- ***Federation of national associations and is the only international body that represents all surveying disciplines***
- ***FIG was founded in 1878 in Paris***
- ***Recognised non government organisation (NGO) by UN***
- ***Over 110 countries represented in FIG***
- ***230,000 Surveyors around the World in the Member Associations***

How is FIG administered?

- ***General Assembly of member assoc's annually at FIG working week or congress - debates and approves policies***
- ***Implemented by Council***
- ***Technical Work by Commissions***
- ***Day-to-day management through FIG permanent office in Denmark***

The FIG Commissions

1. *Professional Standards and Practice*
2. *Professional Education*
3. *Spatial Information Management*
4. *Hydrography*
5. *Positioning and Measurement*
6. *Engineering Surveys*
7. *Cadastre and Land Management*
8. *Spatial Planning and Development*
9. *Valuation and Real Estate Management*
10. *Construction Economics and Management*

Also Standards Network

Commission 5 Working Groups

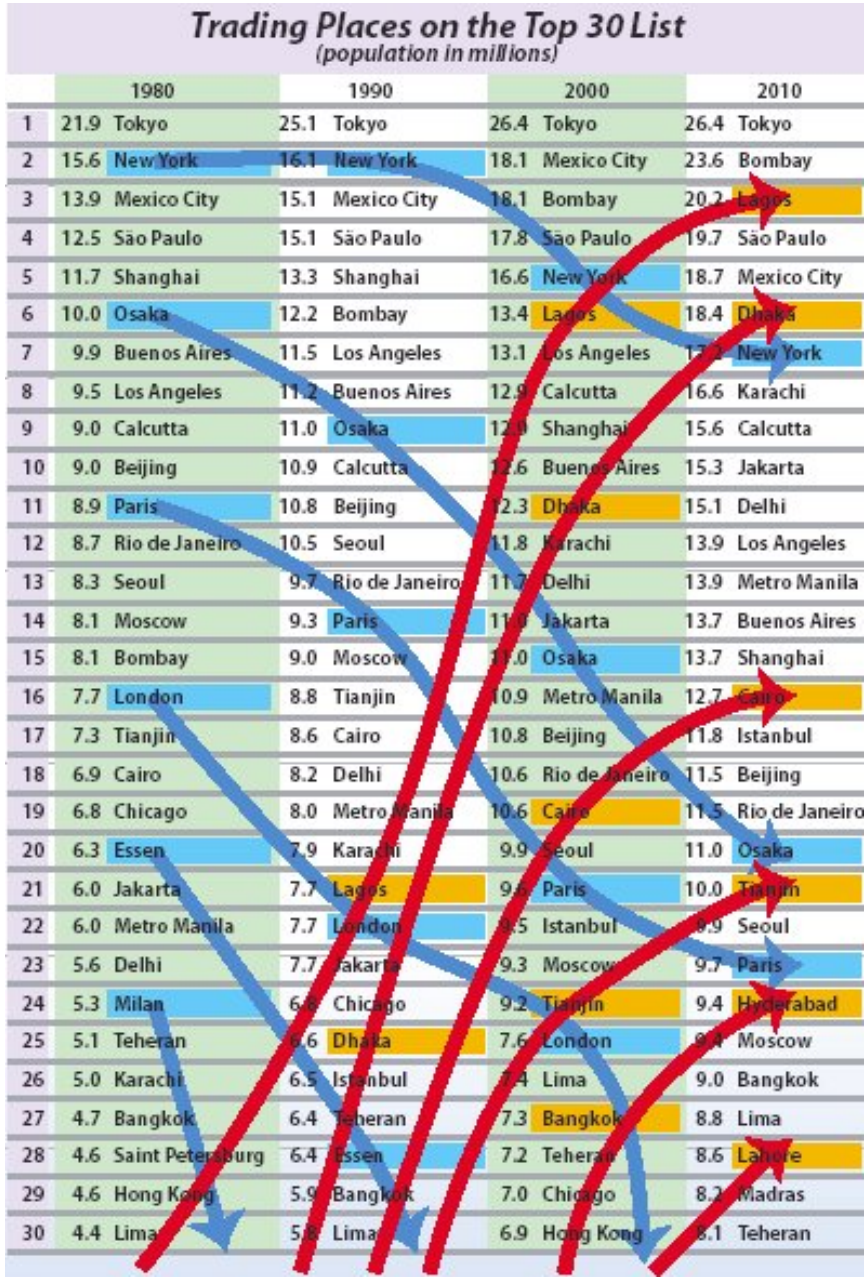
1. ***Standards, Quality Assurance and Calibration***
2. ***Reference Frame in Practice***
3. ***Integrated Positioning, Navigation and Mapping Systems***
4. ***Low Cost Surveying Technology and Techniques for Developing Countries (Joint with Com 3 and 7)***

Com 5 also Administers MoU with International Association of Geodesy

Global Issues and the Surveyor

- ***United Nations Organizations***
  - ***Habitat (MoU with FIG)***
  - ***Food and Agriculture Organization (FAO) (MoU with FIG)***
  - ***Committees on Geographic Information Infrastructure***
  - ***GNSS Action Team***
- ***International Standards Organization***
  - ***ISO TC 211 - GI/Geomatics***
  - ***ISO TC 172 - Instruments.***

The State of the World's Cities Report 2001



Trading Places on the Top 30 List
(population in millions)

	1980	1990	2000	2010
1	21.9 Tokyo	25.1 Tokyo	26.4 Tokyo	26.4 Tokyo
2	15.6 New York	16.1 New York	18.1 Mexico City	23.6 Bombay
3	13.9 Mexico City	15.1 Mexico City	18.1 Bombay	20.2 Lagos
4	12.5 São Paulo	15.1 São Paulo	17.8 São Paulo	19.7 São Paulo
5	11.7 Shanghai	13.3 Shanghai	16.6 New York	18.7 Mexico City
6	10.0 Osaka	12.2 Bombay	13.4 Lagos	18.4 Dhaka
7	9.9 Buenos Aires	11.5 Los Angeles	13.1 Los Angeles	17.3 New York
8	9.5 Los Angeles	11.2 Buenos Aires	12.9 Calcutta	16.6 Karachi
9	9.0 Calcutta	11.0 Osaka	12.9 Shanghai	15.6 Calcutta
10	9.0 Beijing	10.9 Calcutta	12.6 Buenos Aires	15.3 Jakarta
11	8.9 Paris	10.8 Beijing	12.3 Dhaka	15.1 Delhi
12	8.7 Rio de Janeiro	10.5 Seoul	11.8 Karachi	13.9 Los Angeles
13	8.3 Seoul	9.7 Rio de Janeiro	11.7 Delhi	13.9 Metro Manila
14	8.1 Moscow	9.3 Paris	11.0 Jakarta	13.7 Buenos Aires
15	8.1 Bombay	9.0 Moscow	11.0 Osaka	13.7 Shanghai
16	7.7 London	8.8 Tianjin	10.9 Metro Manila	12.7 Cairo
17	7.3 Tianjin	8.6 Cairo	10.8 Beijing	11.8 Istanbul
18	6.9 Cairo	8.2 Delhi	10.6 Rio de Janeiro	11.5 Beijing
19	6.8 Chicago	8.0 Metro Manila	10.6 Cairo	11.5 Rio de Janeiro
20	6.3 Essen	7.9 Karachi	9.9 Seoul	11.0 Osaka
21	6.0 Jakarta	7.7 Lagos	9.6 Paris	10.0 Tianjin
22	6.0 Metro Manila	7.7 London	9.5 Istanbul	9.9 Seoul
23	5.6 Delhi	7.7 Jakarta	9.3 Moscow	9.7 Paris
24	5.3 Milan	6.8 Chicago	9.2 Tianjin	9.4 Hyderabad
25	5.1 Teheran	6.6 Dhaka	7.6 London	9.4 Moscow
26	5.0 Karachi	6.5 Istanbul	7.4 Lima	9.0 Bangkok
27	4.7 Bangkok	6.4 Teheran	7.3 Bangkok	8.8 Lima
28	4.6 Saint Petersburg	6.4 Essen	7.2 Teheran	8.6 Lahore
29	4.6 Hong Kong	5.9 Bangkok	7.0 Chicago	8.2 Madras
30	4.4 Lima	5.8 Lima	6.9 Hong Kong	8.1 Teheran

UN Habitat

- ***Habitat's overriding goal is urban poverty reduction, which is being advanced through two global campaigns,***
  - *Secure Tenure*
  - *Urban Governance*
- ***Both of these campaigns require accurate spatial information***
- ***Surveying to mapping to land titling to a property market to a mature economy.***

Food and Agriculture Organization

- *By 2005, over half the world's people will live in cities.*
- *In developing world's cities food supply and distribution chains will be badly strained*
- *Sustainable Development – Key Concept*

The Role of GNSS and Spatial Information

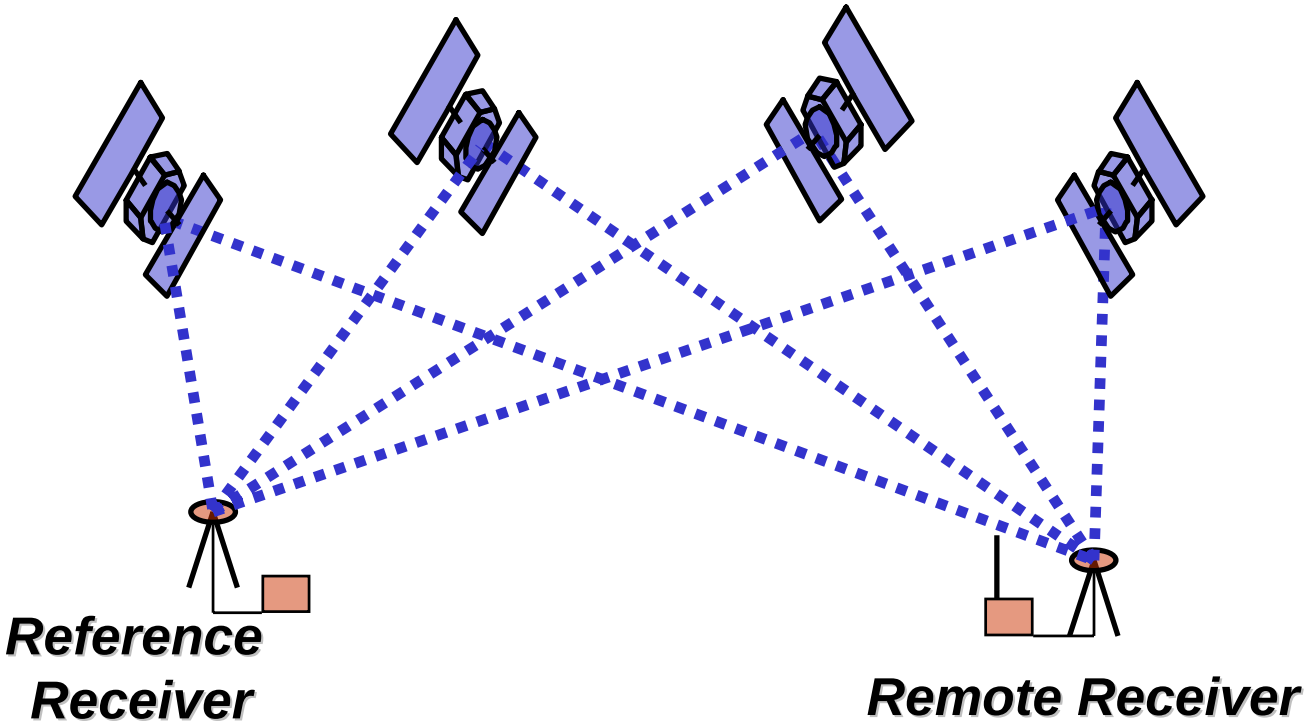
- ***Over 80% of Government decisions involve a Spatial component – "Where?"***
- ***Accurate and Timely Spatial Information is required to deal with priorities of Habitat, FAO etc***
- ***GNSS is a key technology for capturing accurate spatial information.***

GNSS Surveying

3 Levels of Accuracy from GNSS

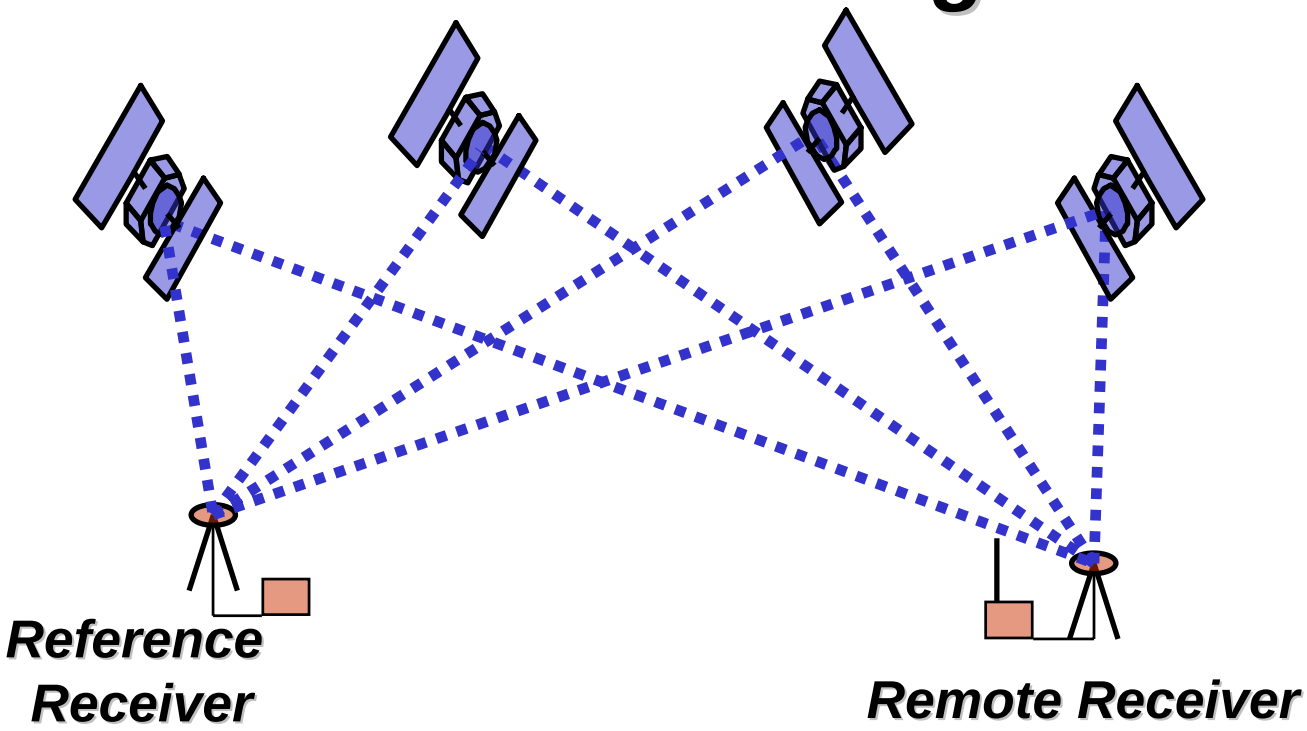
- ***Single Point Positioning***
- ***Differential Positioning (Pseudorange Measurements)***
- ***GNSS Surveying (Carrier Phase Measurements)***

GNSS Surveying



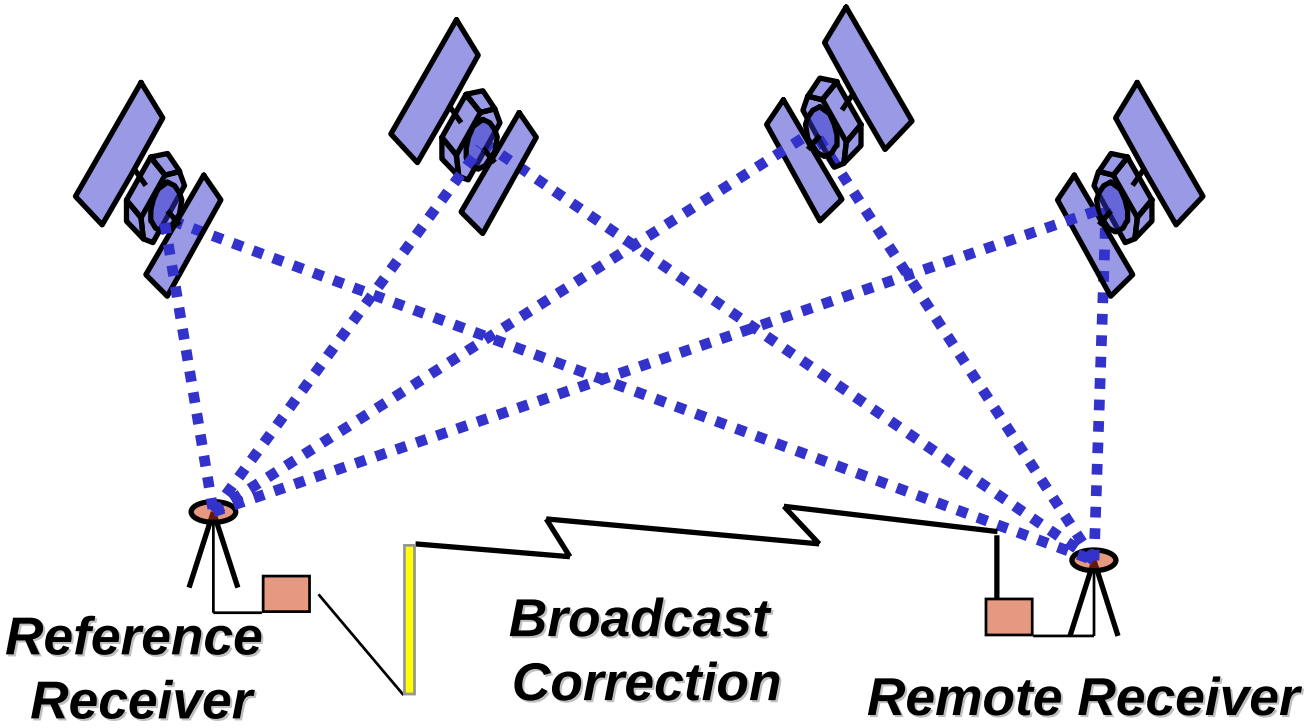
- 1985 – 4 satellites – 4 hours per day
- Observation period per new point several hours
- Data post processed

Improved Coverage, Equipment and Processing



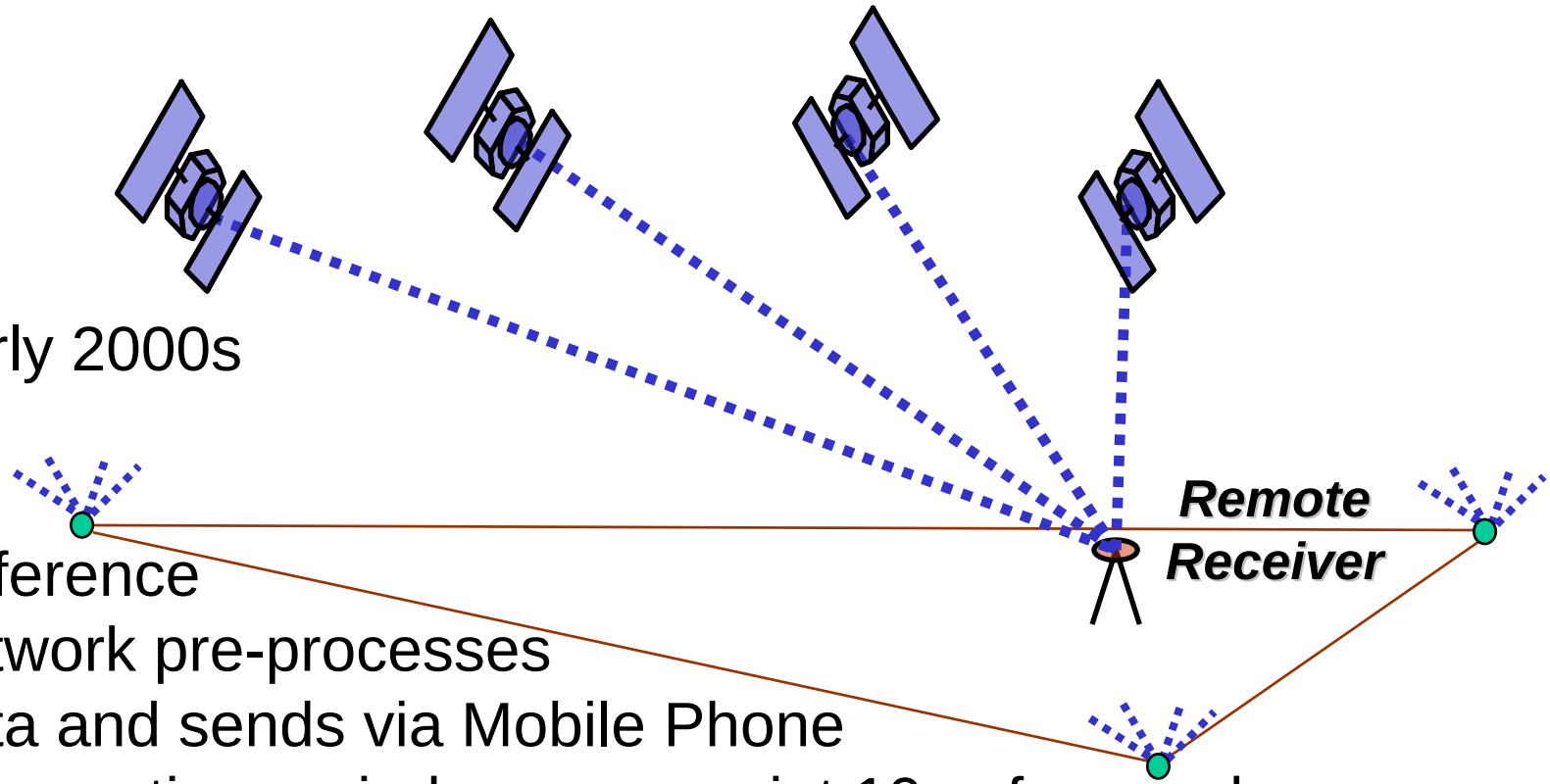
- Early 1990s - More satellites – 24 hour coverage
- Observation period per new point 10s of minutes
- Data post processed

“Real Time” GNSS Surveying



- Mid-1990s – Reference Data via Radio – 5+ SVs
- Observation period per new point 10s of seconds
- Data post processed in “Real Time”
- Emergence of Receivers tracking Glonass

Networked Reference Stations



- Early 2000s
- Reference
  Network pre-processes
  Data and sends via Mobile Phone
- Observation period per new point 10s of seconds
- Data processed in Real Time
- Users work as though they are stand-alone
- Network is becoming Infrastructure

Networked Real Time Surveying

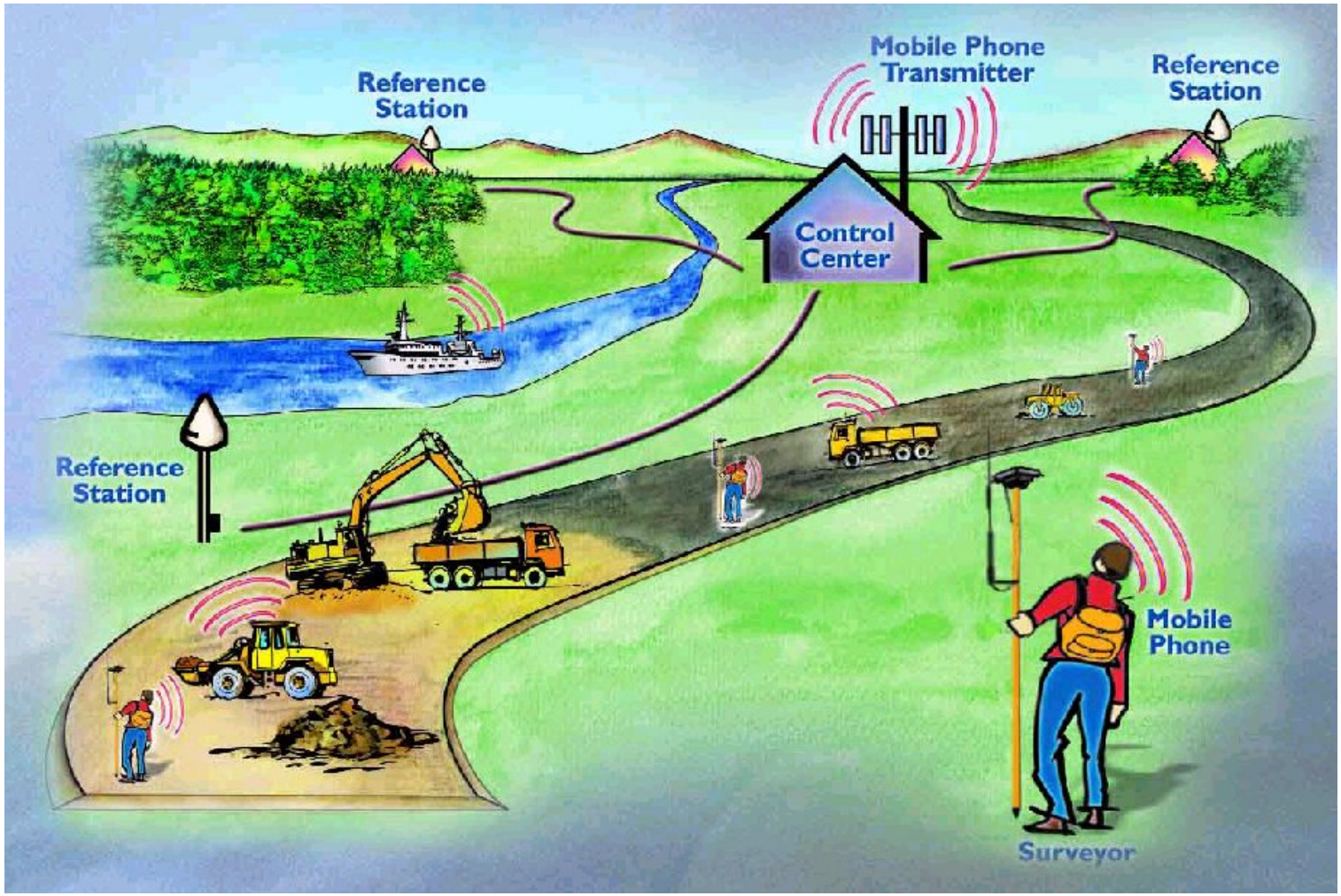


Diagram from Trimble Terrasat

What Surveyors need from Future GNSS

Issues for GNSS Surveying

- *Latest techniques squeeze mm from least possible amount of data, in real time, using all SVs in view and multiple frequencies*
- *Towards more efficiency and reliability:*
  - *L2 C/A receivers and processing less complicated*
  - *L5 will give better redundancy, accuracy, efficiency and reliability*
  - *Glonass has demonstrated advantage of extra satellites, especially where masking occurs*
  - *Gallileo will add all of this again*
- *Concern - Cost to upgrade equipment to take advantage of new developments?*

FIG

Roles
FIG Can Play

Surveyors, FIG and UN GNSS

- ***Survey market - small numbers but high value***
- ***Intelligent users at "top end" of accuracy***
- ***FIG well placed to help with UN Action***
  - ***Committed to developing country issues***
  - ***National Delegates to many Commissions working in GNSS applications***
  - ***Can assist with implementing and publicising reports and road maps***
  - ***GNSS Education – FIG Database - over 240 institutes with 425 courses in 64 countries***
  - ***Working with IAG on Reference Frame matters and helping GNSS users understand issues***
  - ***Agree need for GNSS Coordination Board***

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