Economic Benefits of Precise Positioning

Matt Higgins
Principal Survey Advisor, Queensland Government, Australia
Vice President, International Federation of Surveyors (FIG)
President IGNSS Society, Australia

Presentation Outline

- **A Broad Definition of GNSS Infrastructure;**
- **Background to Precise Positioning;**
- **Recent Australian Studies of the Economic Benefits of Precise Positioning;**
- **Precise Positioning moving to the Mass Market.**

GNSS as Broad Infrastructure

Underlying Systems
Capacity Building
Research and Development
Industry Development
Institutional Arrangements
Standards
User Access

A broad definition of Infrastructure

"Hard and Soft Infrastructure"

From Local to Global

	Local	National/Regional	Global
Underlying Systems	➢Local Augmentations ➢GNSS and Non-GNSS	➢Regional Augmentations	➢Space Segment ➢Control Segment ➢Ground Segment
Capacity Building	➢Schools ➢Universities ➢In-House Training ➢Local Workshops	➢National and Regional Conferences	➢International Conferences ➢Assist Developing Countries
Research and Development	➢Universities ➢Government Researchers	➢National Groupings of Researchers	➢International Cooperation in R&D
Industry Development	➢Local Industry Clusters ➢Industry Development Agencies	➢National Industry Bodies	➢Conferences ➢Business Networks
Institutional Arrangements	➢Local Industry Clusters ➢Working Groups	➢National Policies ➢Space Agencies ➢Coordinating Local Activities	➢UN International Committee on GNSS ➢Bi-Lateral Agreements
Standards	➢Project Specifications	➢Legislation ➢National Standards and Guidelines	➢International Standards ➢Global Activities ➢Data Formats
User Access	➢Local Communications Solutions	➢National Communications Networks	➢Civil Signals ➢Downlinks eg Galileo

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COMPASS

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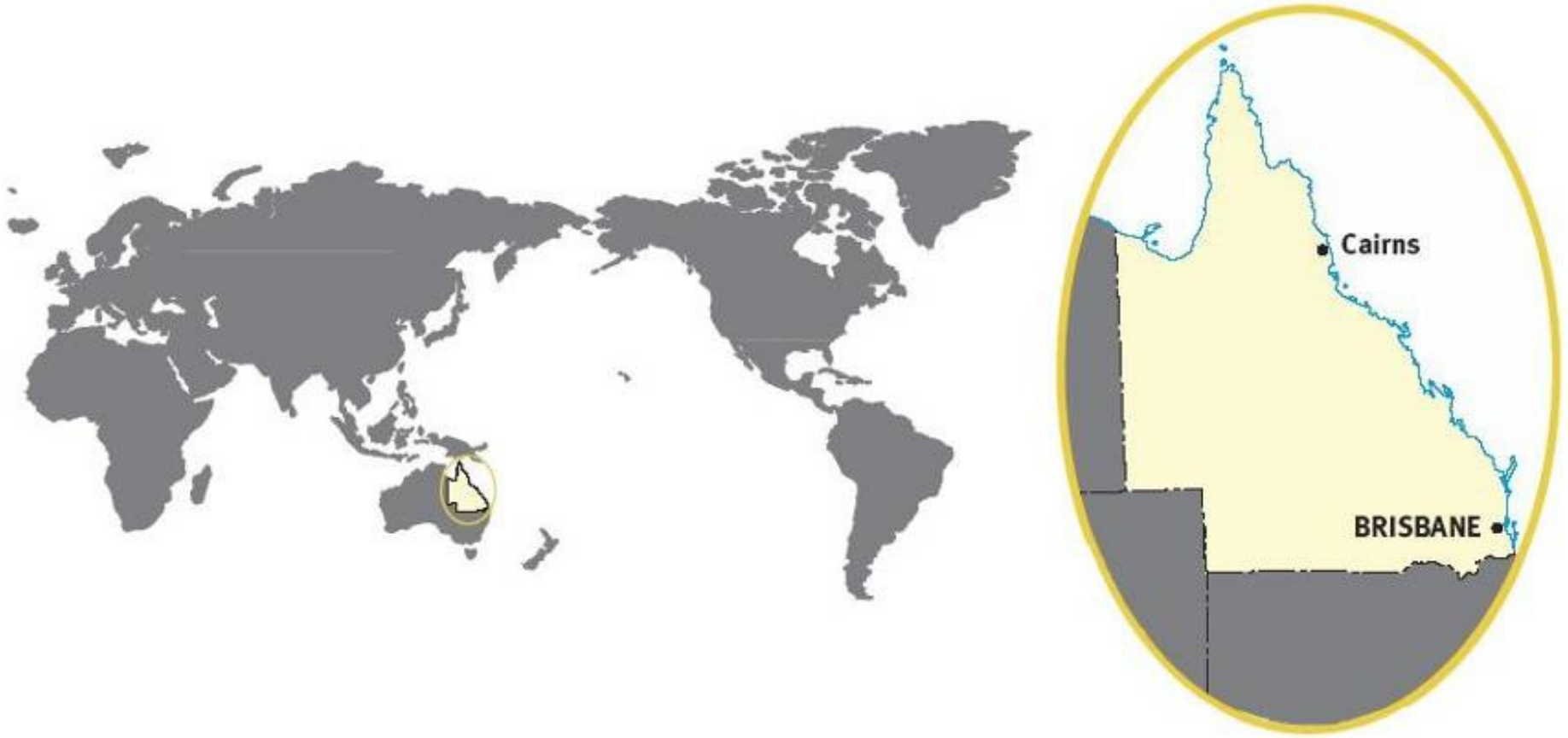
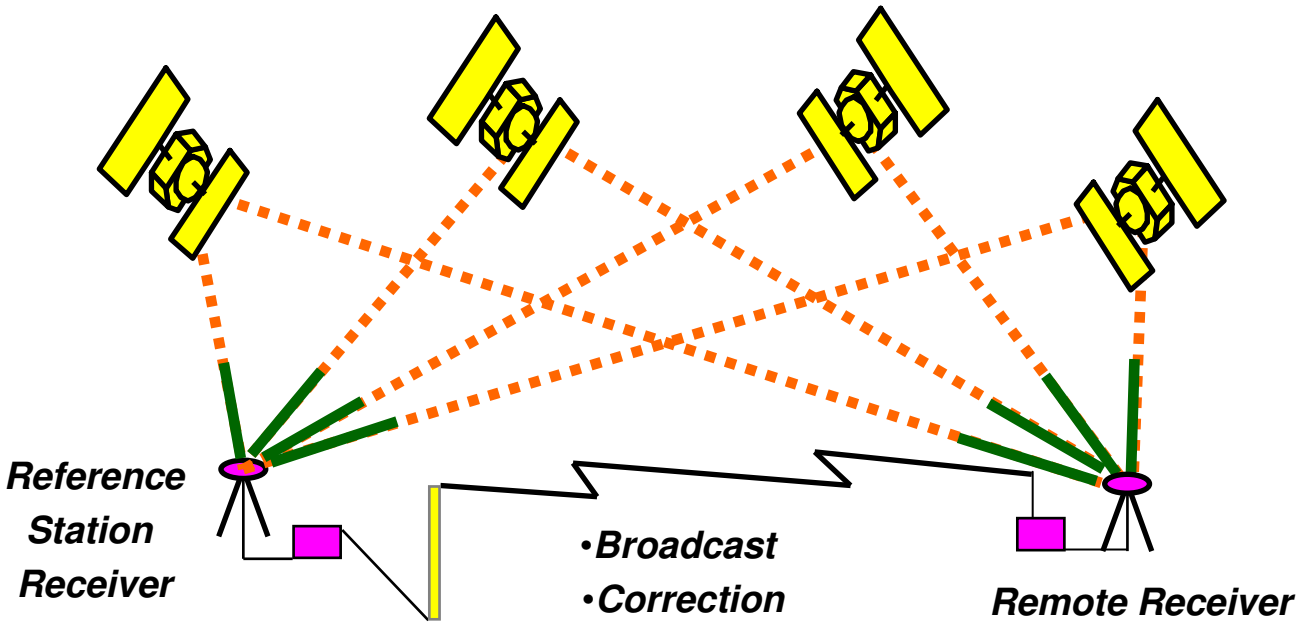
Ground Stations for Global Systems



- Geographic Position makes Australia a very useful location for Sensor/Monitoring Stations for Global and Regional GNSS

Precise Positioning



If User has access to GNSS Reference Receiver(s) and Communications…

"Real Time Precise Positioning"

GNSS in Queensland

- Combined area of France, Germany, Italy, Spain and Belgium (2 times Texas);
- Population 4 Million, Greater Brisbane 1.7M;
- Climate: Tropical to Sub-Tropical;
- Large areas with very sparse population;
- Major Industries are Mining and Agriculture (They are becoming reliant on GNSS);
- Globally Significant Industry Cluster in Machine Guidance.

Economic Benefits from GNSS

- Time for survey control for photogrammetric mapping from 4 months down to 1 week;
- Rail track survey costs reduced by 80% through GNSS based automation.

•Lorimer 2007

From Surveying to Machines

- *BUT*… Surveying is no longer the major market for centimetre accuracy;
- Guiding heavy machinery used in Agriculture, Construction and Mining;
- *"Machine Guidance"*

Economic Benefits – Agriculture

- GNSS machine guidance can be applied widely in the grain, cotton, sugar and horticultural sectors of agriculture;
- Using “control traffic farming” can significantly reduce input costs;
- Condamine study findings:
  - Annual Yields up 10%;
  - Fuel and oil costs reduced 52%;
  - Labour costs reduced 67%;
  - Crop gross margin up by ($110);
- An estimated 10-15% of grain growers in Australia use GNSS for machine guidance;
- Increasing uptake requires better reference station infrastructure.

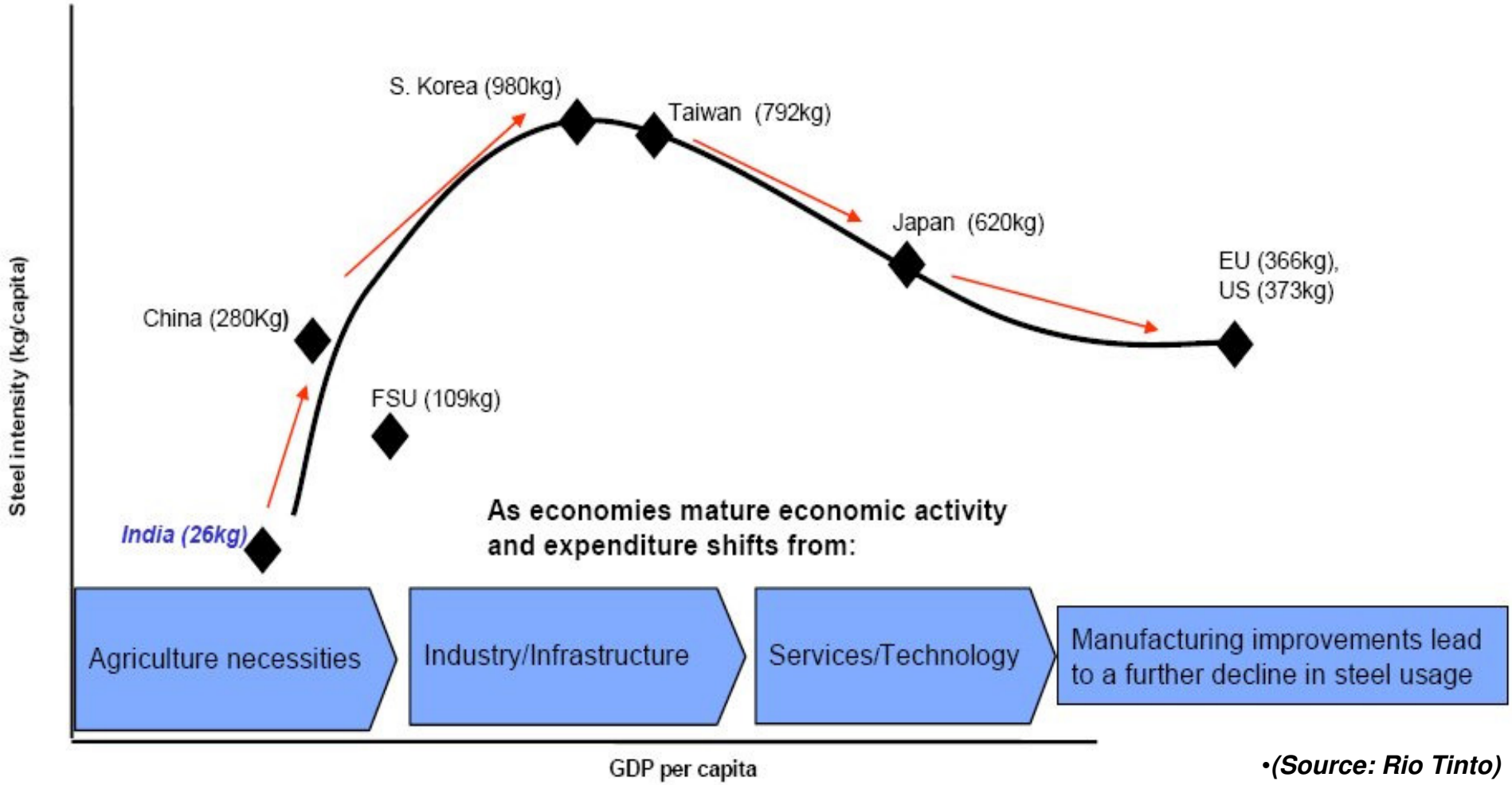
Economic Benefits - Construction

- In civil engineering, machine guidance is delivering significant increases in productivity and improved on-site safety;
- Using GNSS machine guidance and other innovative techniques the Port of Brisbane Motorway was completed six months ahead of schedule (30% reduction in time required), with a 10% reduction in total project costs, 10% reduction in traffic management costs and 40% reduction in lost time injuries.

Economic Benefits - Mining

- In open cut Mining, precise GNSS is used for a variety of tasks including surveying, grading, dozing, drilling, collision avoidance and fleet management;
- Productivity increases are as much as 30% by adopting GNSS.

GDP Growth vs Steel Demand



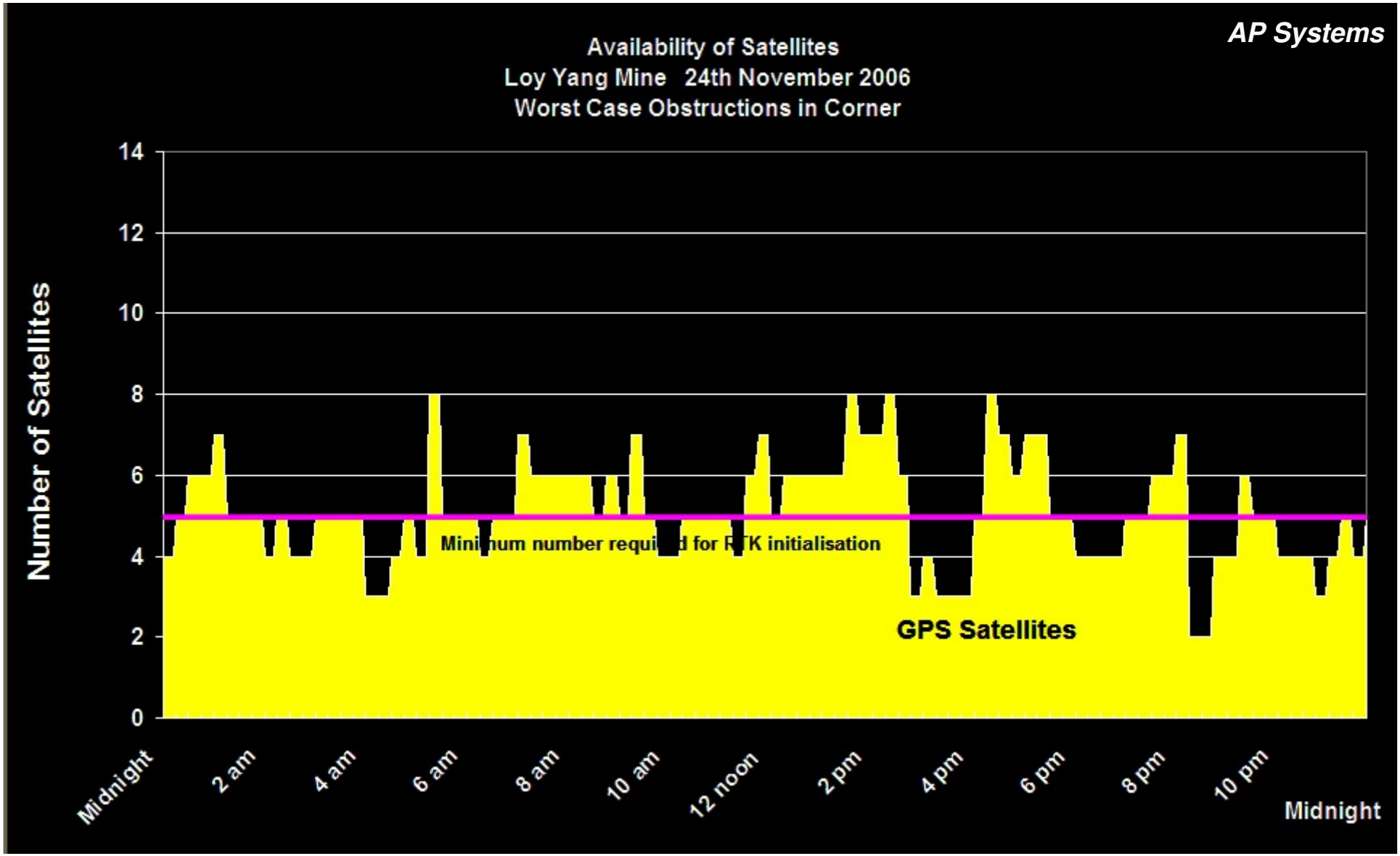
•***(Source: Rio Tinto)***

Mining Automation

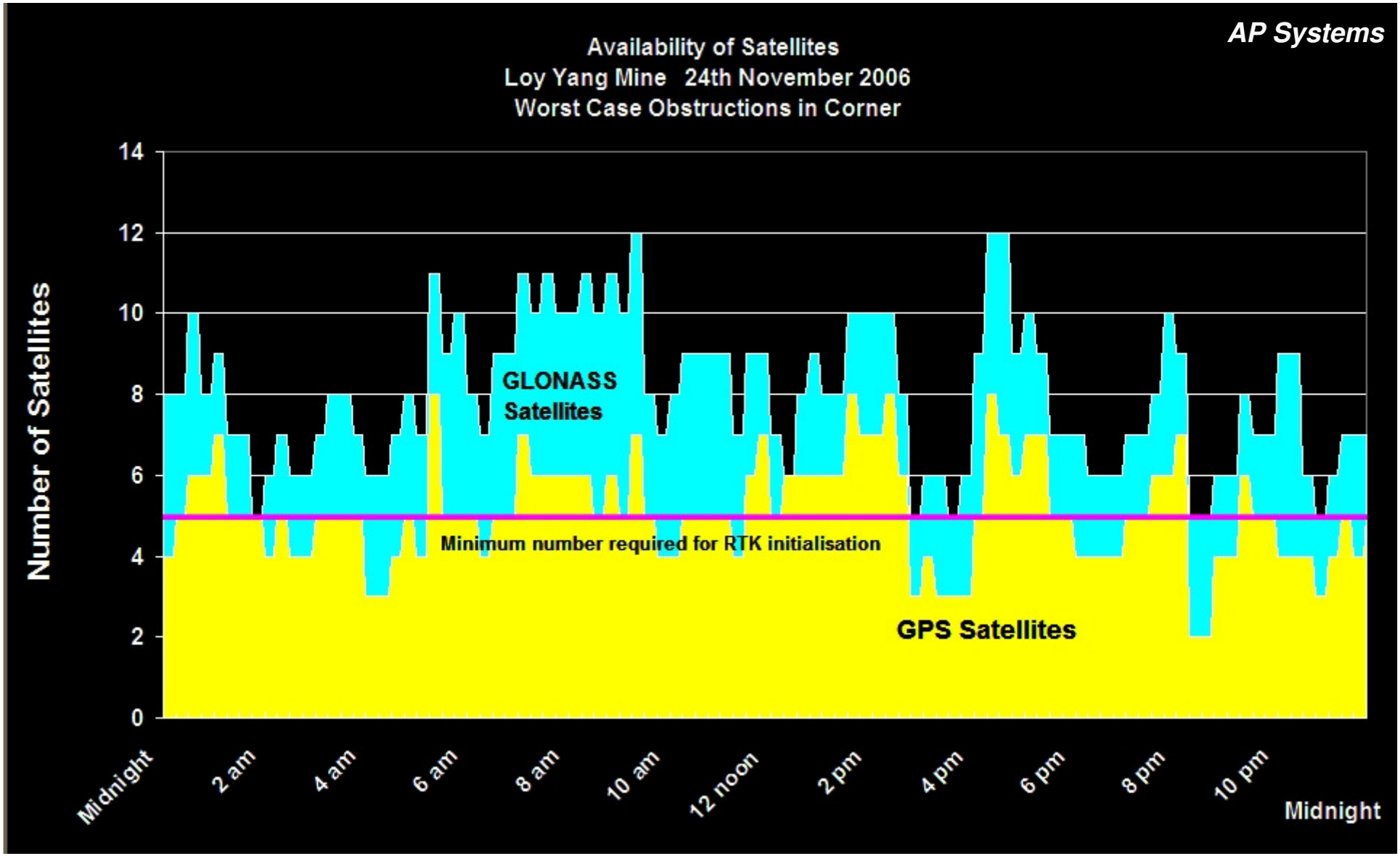
- Driverless trucks ferry their loads around the mine with the synchronized perfection of a ballet, reporting to the workshop as maintenance falls due or faults are predicted. The processor makes constant fine adjustments to itself to win more metal for less energy, water and time from the ever varying stream of ore. Even the excavators and draglines do much of their operational thinking for themselves.
- The absence of people is perhaps the biggest revolution since humankind first laid pick to rockface. But far from being excluded from the equation, the operators are ensconced in an urban mission centre a couple of thousand kilometres away, running the mine “hands off”, scrutinizing its functions in minute detail from an avalanche of data, and tweaking them ever closer to the technical limits to win the edge in the fiercely competitive world of resources in the 2020s.

(*Source: Rio Tinto Review Sep 2007)*

Value of Extra Signals

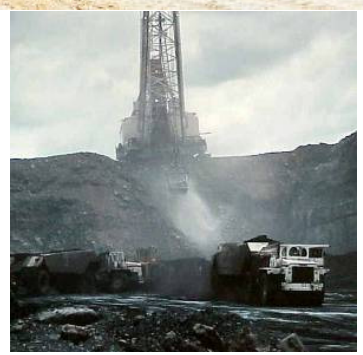


Value of Extra Signals



Benefit Across Australia

- Recent study found productivity gains with potential cumulative benefit $73 to $134 billion over next 20 years - in agriculture, construction and mining alone;
- Significant environmental benefits, such as reduced carbon footprint through greatly improved fuel efficiency.



Reduced Carbon Footprint

Australia						
	Million Ha	**CO_2-e Kg/Ha**	**Tonnes**	**$/Tonne**	**Traded Value**	**Households**
Total	25	300	7.5M	$20	$150M	>500,000

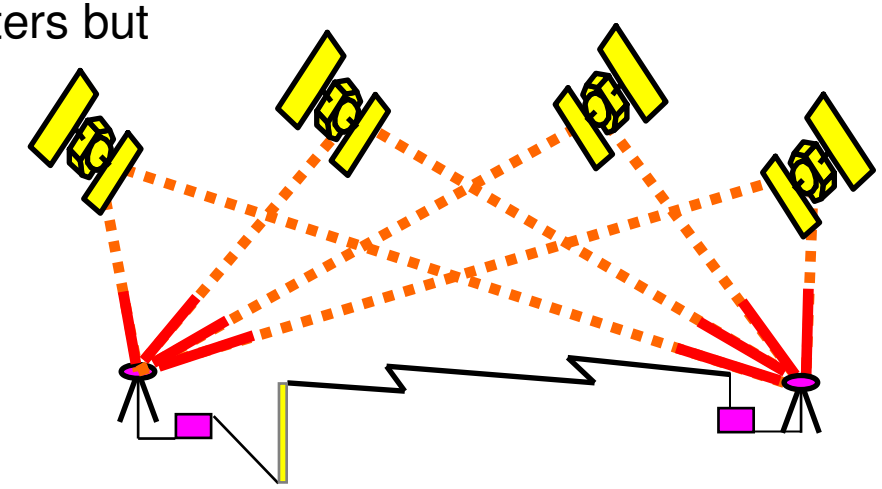
This is in Agriculture alone!

•Allen Consulting Group, 2007

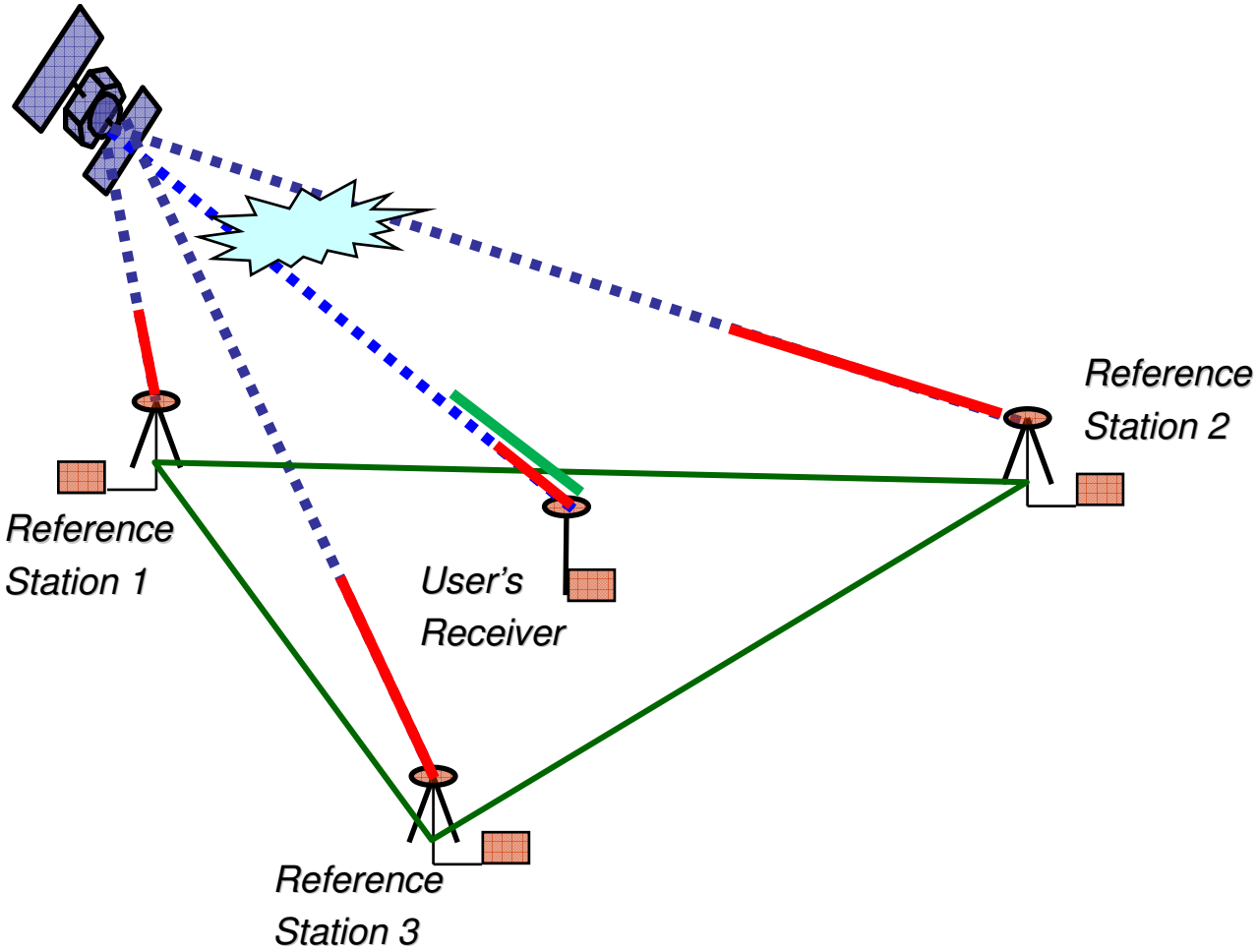
Ad-hoc vs Infrastructure

- Majority of users are running their own dedicated reference stations;
- Problems include:
  - Duplication and wasted expenditure on unnecessary reference stations;
  - Lack of interoperability between equipment;
  - Lack of adherence to standards - coordinate systems, quality and data communications;
  - Steep learning curve = early adopters but limited take up across industries.

•Need to move from
ad-hoc
to
infrastructure.



Single vs Multiple Reference Stations

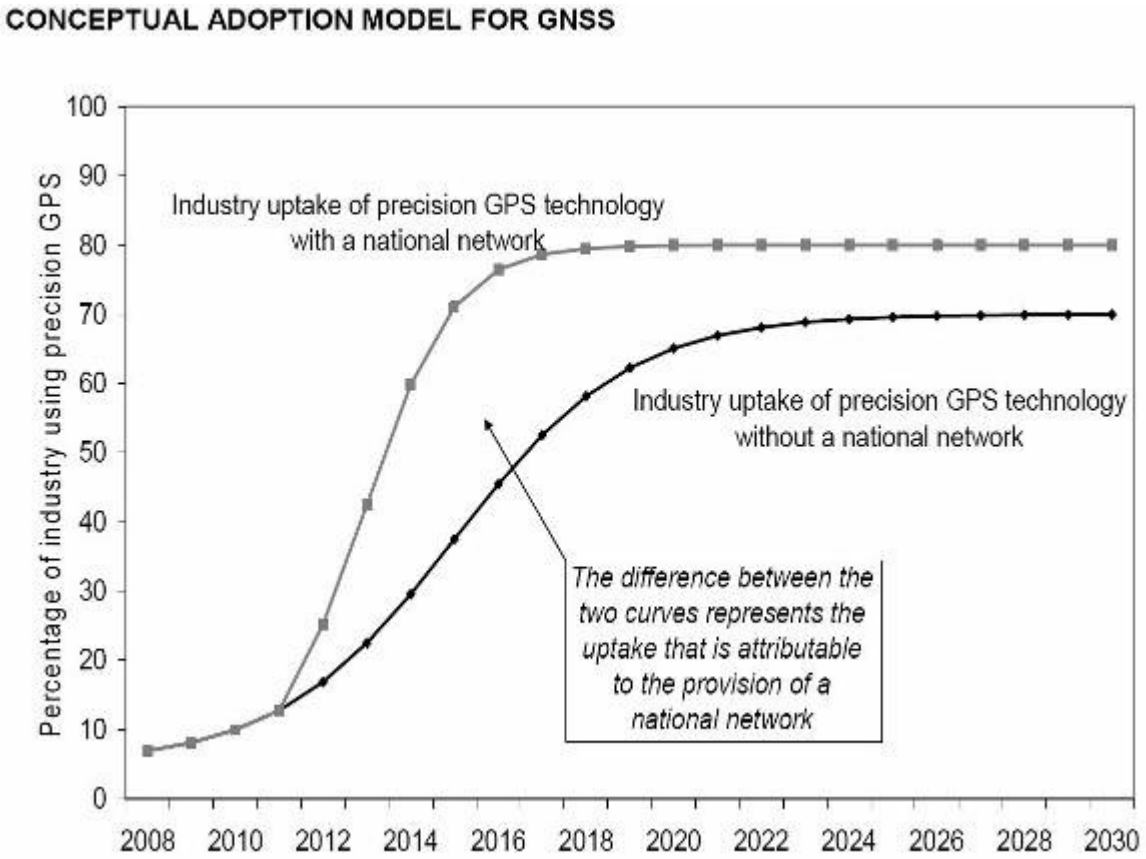


Positioning Infrastructure

- Network of Continuously Operating Reference Stations placed at a spacing of 70km covering the area of interest;
- Feeding data to a Control Centre that process the data and computes corrections that are sent to the users' GNSS receiver;
- Requires state of the art communications for gathering data from the Reference Stations and delivering corrections to users;
- Better reference station coverage and more reliable communications improve productivity;
- Best practice approaches need two way communications which allows precise location based services – "virtual wrench";
- Many countries have national coverage;
- Australian state of Victoria has just committed funds to achieve statewide coverage;
- Figure shows SunPOZ service in SE Qld.

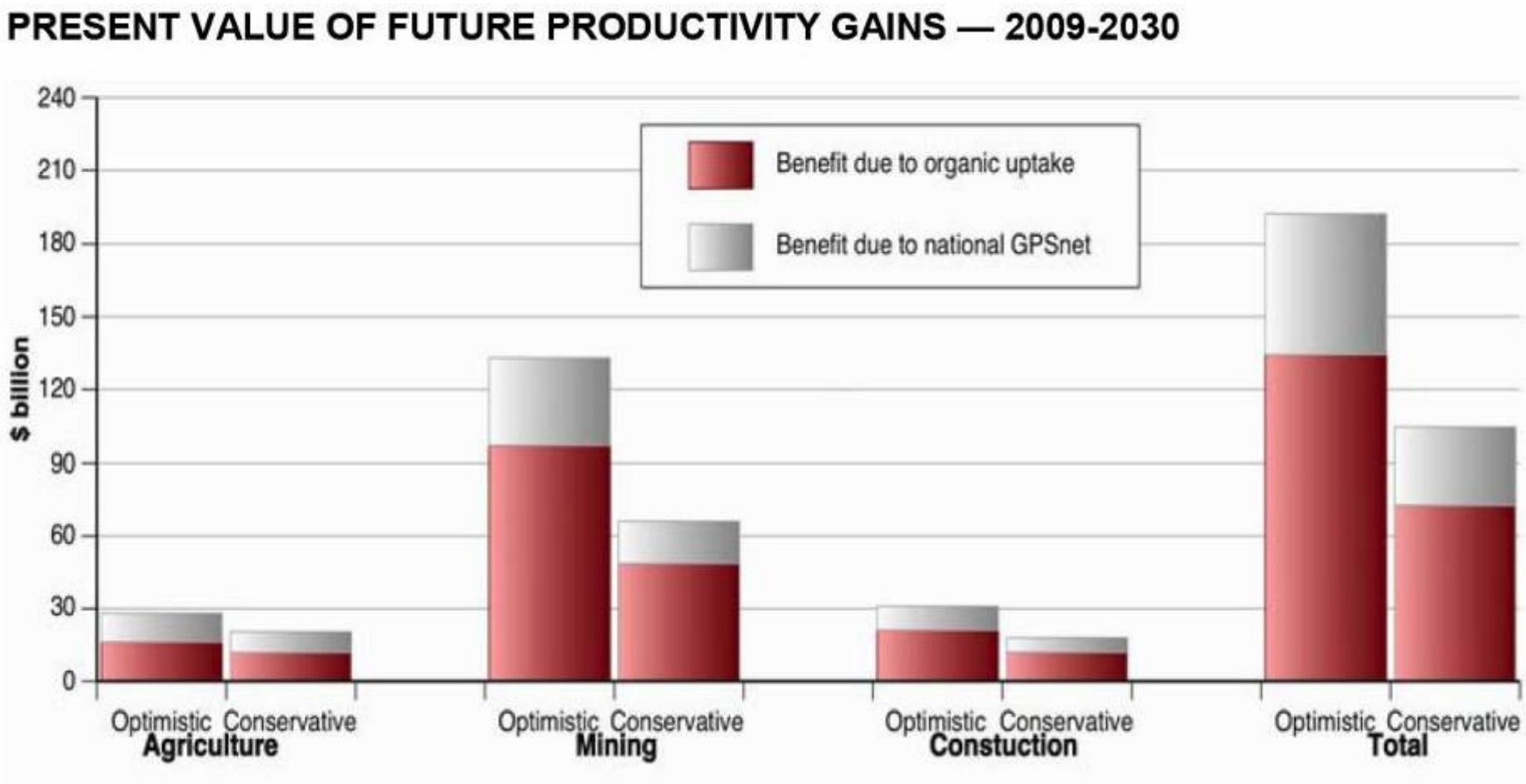
How to Increase Adoption Rates

- The study also found that a coordinated roll-out of national network of reference stations (rather than solely market forces) would increase total uptake and rate of uptake;
- Additional cumulative benefit $32 to $58 billion (gross) to 2030.



Allen Consulting 2008

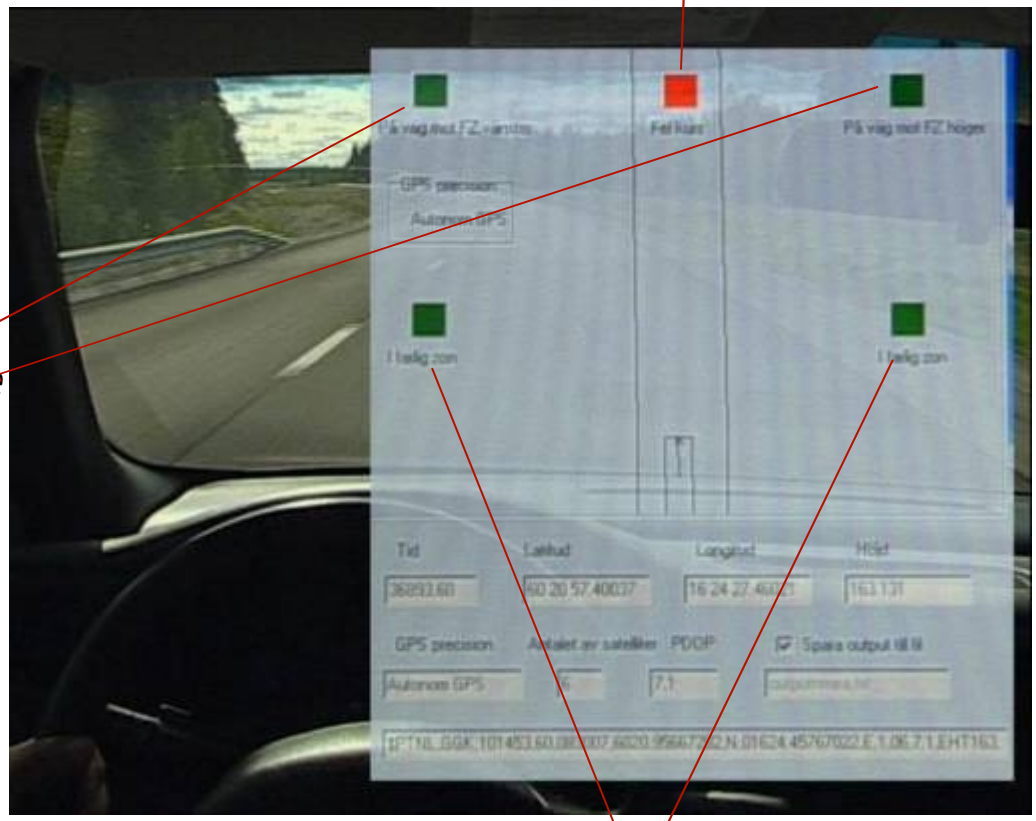
Benefit Across Australia



Allen Consulting 2008

From Industrial Machines to Cars

•*Wrong course*



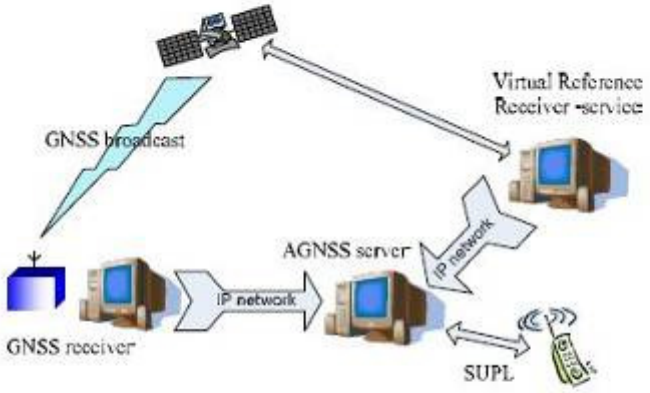
•*Heading into dangerous zone*

•(Horemuž, 2008)

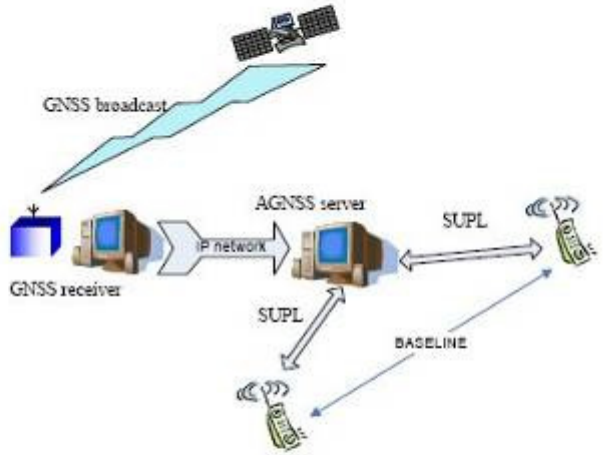
•*In dangerous zone*

Coming to Mobile Phones!

mobile-RTK : Two options



- Assistance data server has an interface to regional Virtual Reference Receiver - service



- Assistance data server works as a router
  - Establishes data connection between the two terminals

A-GNSS Phone sales will reach 400 Million per year by 2011

•(Wirola, 2008)

NOKIA

Professional to Mass Market