

マルチGNSSアプリケーション -持続性のある 地域経済成長への貢献-

How Multi-GNSS Applications
Contribute to Sustainable
Regional Economic Growth

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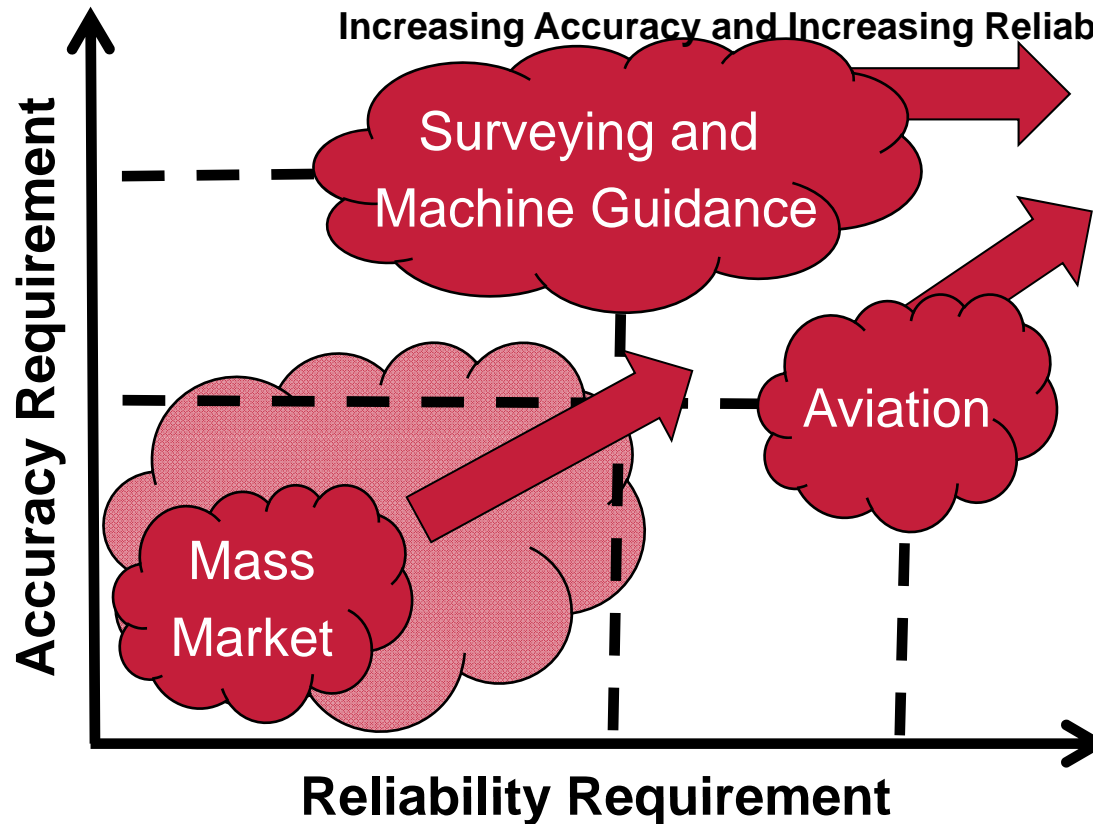
概要 (Presentation Outline)

- 多数のGNSS Applicationsの中から、高度なApplicationに着目
Huge Number of GNSS Applications so I will concentrate on High End Applications rather than Mass Market ~ typically Enabled by Ground Infrastructure;
- GPS単独利用下での、高度なApplicationの経済/環境への効果は、
Economic and Environmental Benefits of High End GNSS Applications in “GPS Only Era”;
- マルチGNSS下では、それらの効果が更に増大する。
Enhancing those Benefits in “Multi-GNSS Era”;
- アジアオセアニア地域においては、これらの効果が最大化する事を踏まえ、「マルチGNSS実証キャンペーン」について検討をすすめる。
Ensuring that the Asia Oceania Region Maximizes the Benefits – *Issues to Consider for the Multi-GNSS Demonstration Campaign.*

なぜ高度なApplicationsに着目するのか？ Why High End Applications?

- 1) マルチGNSSに対するニーズは、全て、精度向上・信頼度向上に係わるものである。

The need for Multi-GNSS is all about
Increasing Accuracy and Increasing Reliability.



- 2) 高度なApplicationにおいて、更なる高精度・高信頼度実現のために、最初に投資が行われる。

The high end applications are the first to afford the investment to achieve higher accuracy and higher reliability (and the most likely to measure the benefits).



航空への適用効果 GBASの紹介



•航空会社の便益

Airline Benefits

- Schedule reliability
- Reduced track miles
- Increased signal stability
- No on-board procedure database
- Improved surface movements
- No false lobes / ghosts
- Low visibility takeoff
- Cost effective solution
- Minimal retraining

*AirService Australia 2009*

• 空港の便益

Airport Benefits

- Replaces ILS 計器着陸システムからGBASへの置換
- Covers all runway ends
- Flexible approaches
 - Terrain Issues
 - Environmental
- Reduced real estate
 - No sensitive areas
 - Reduce Critical zones
- Increases capacity
 - Reduced down time
 - Flexible use airspace
 - Displaced thresholds
- Reduced costs & maintenance
- Flexible siting



AirService Australia 2009



精密測位Applicationの経済効果



- 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.



- 測量分野は、もはや大きな市場ではない
BUT... Surveying is no longer the major market for centimetre accuracy;
- 農業、工事、鉱山での
重機ガイダンスによる利用が進む
Guiding heavy machinery used in Agriculture, Construction and Mining;
- “Machine Guidance”
がkeyword



- **GNSS machine guidance**は穀物、綿花、砂糖キビ、園芸分野に広く適用されている。 GNSS machine guidance can be applied widely in the grain, cotton, sugar and horticultural sectors of agriculture;
- **精密農業は大きなコスト低減をもたらす**

Using “control traffic farming” can significantly reduce input costs;

- **Condamine study findings:**
 - **年産出量10%増** Annual Yields up 10%;
 - **燃料コスト52%減** Fuel and oil costs reduced 52%;
 - **労働力コスト67%減** Labour costs reduced 67%;
 - Crop gross margin up by (\$110);

- **オーストラリアの穀物農家の推定10～15%は、GNSSをmachine guidanceに利用**

An estimated 10-15% of grain growers in Australia use GNSS for machine guidance;

- **基準点整備により、上記効果の更なる増加が見込まれる**

Increasing uptake requires better reference station infrastructure.



IGNSS 2008

- In civil engineering, machine guidance is delivering significant increases in productivity and improved on-site safety;
- Using GNSS machine guidance on Port of Brisbane Motorway contributed to significant savings, completed six months ahead of schedule (30% time reduction), 10% reduction in total project costs, 10% reduction in traffic management costs, 40% reduction in lost time injuries (Lorimer, 2007);
- A recent study comparing conventional road construction to using Caterpillar's AccuGrade machine guidance products. Better finish grade and a safer working environment with 100 percent increase in productivity and 43 percent reduction in fuel consumption.



Lorimer 2007

- 露天掘り鉱山では、GNSSが様々な仕事に適用されている。In open cut Mining, precise GNSS is used for a variety of tasks including surveying, grading, dozing, drilling, collision avoidance and fleet management;

- GNSSの適用で生産性が30%向上

Productivity increases are as much as 30% by adopting GNSS.

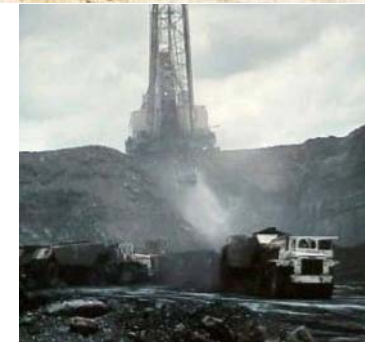
•Lorimer 2007



- **CRCG**とビクトリア州政府が**Allen Consulting Group** にオーストラリア全体の経済効果予測を発注

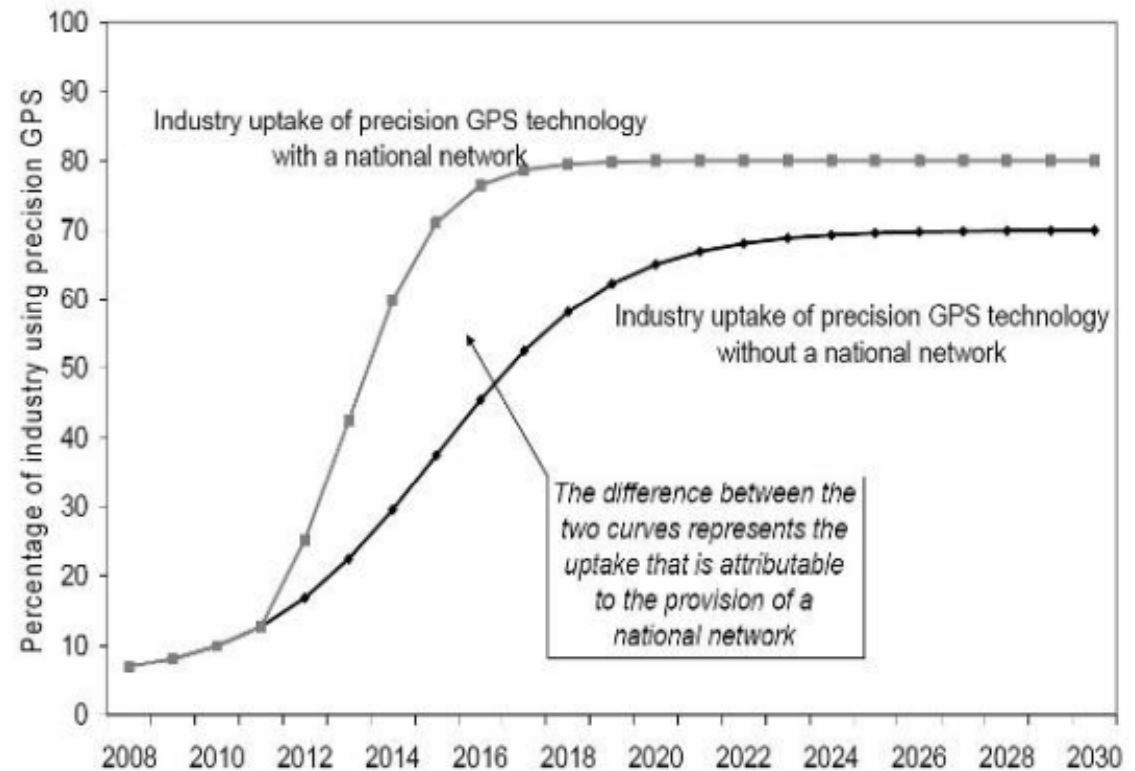
Cooperative Research Centre for Spatial Information and Vic Govt funded Allen Consulting Group to estimate the benefits across Australia;

- **農業・IT施工・鉱山分野において、今後20年間で累計\$73 to \$134 billion の潜在的経済効果を生むとの予測結果** Found productivity gains with potential cumulative benefit of **\$73 to \$134 billion over next 20 years** - in agriculture, construction and mining alone;



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

CONCEPTUAL ADOPTION MODEL FOR GNSS



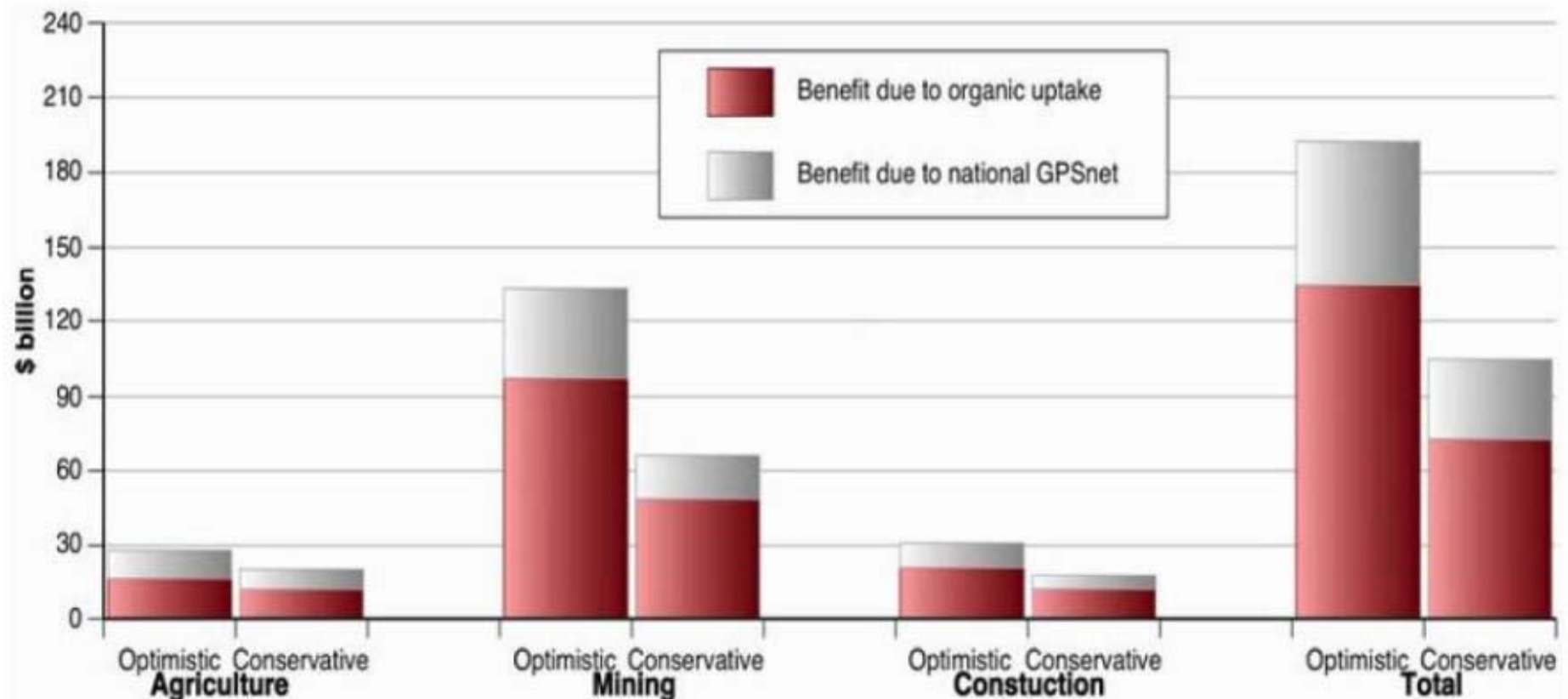
Allen Consulting 2008



オーストラリア全体の経済効果

Benefit Across Australia

PRESENT VALUE OF FUTURE PRODUCTIVITY GAINS — 2009-2030



Allen Consulting 2008



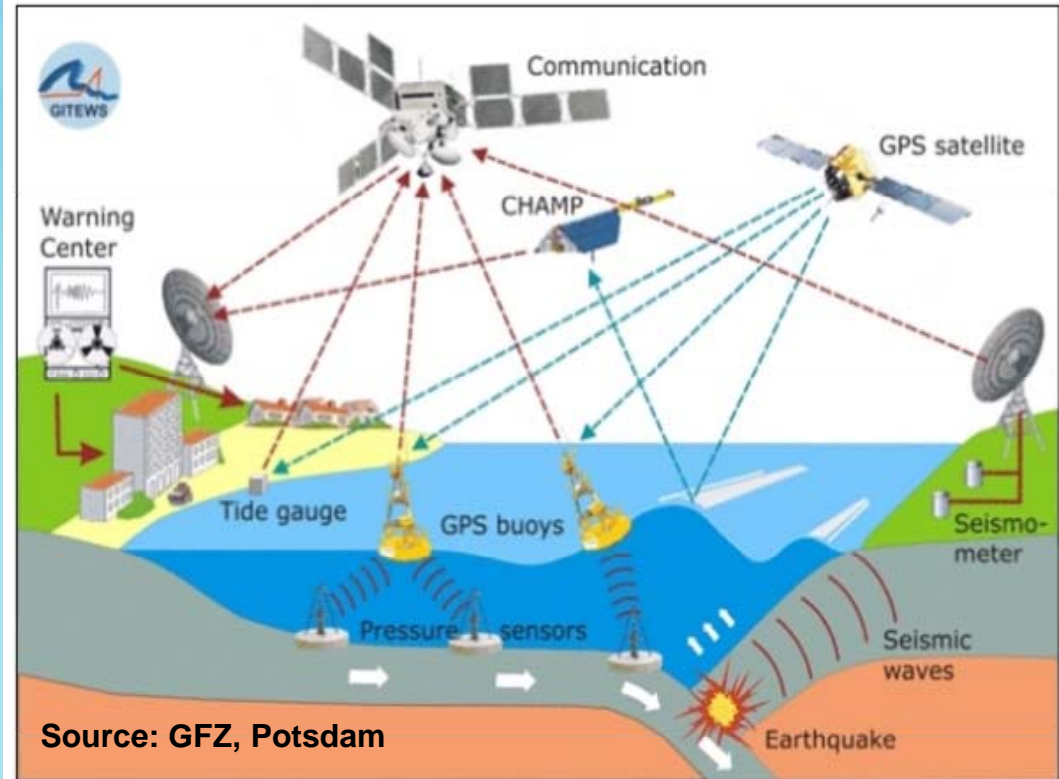
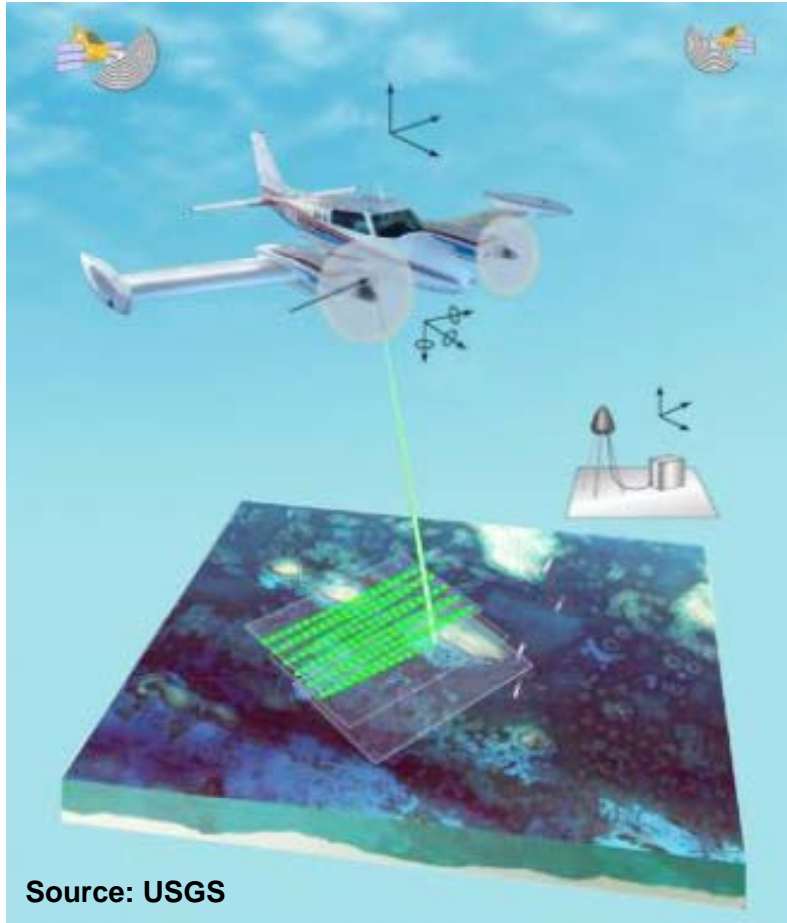
気候変動に対する GNSSの適用 GNSS for Adapting to Climate Change

Adaptation refers to the adjustments we can make to help us cope better with changes in our climate.



気候変動に対する GNSSの適用

Adapting to Climate Change





気候変動に対する GNSSの適用 GNSS for Mitigating Climate Change

**Mitigation refers to interventions designed
to reduce the sources of emissions or
interventions that can increase the absorption of emissions**



- Significant proportion of the Economic Benefit from Precise Positioning comes from Fuel Savings:
 - **52% less fuel in Wheat farming;**
 - **43% less fuel in Road construction**
- **Less Fuel = Less Carbon Footprint.**



Australia Wheat Crop						
	Million Ha	CO ₂ -e Kg/Ha	Tonnes	\$/Tonne	Traded Value	Households
Total	25	300	7.5M	\$20	\$150M	>500,000



- A number of studies have found that the use of GNSS for fleet management led to significant efficiencies. For example, Marketwire reports:
 - 25% reduction in idle times
 - 32% increase in fleet utilization
 - 22% decrease in fuel costs and a 31% drop in daily mileage
 - 23% boost in workforce productivity
- Even greater efficiencies are possible with live traffic data.





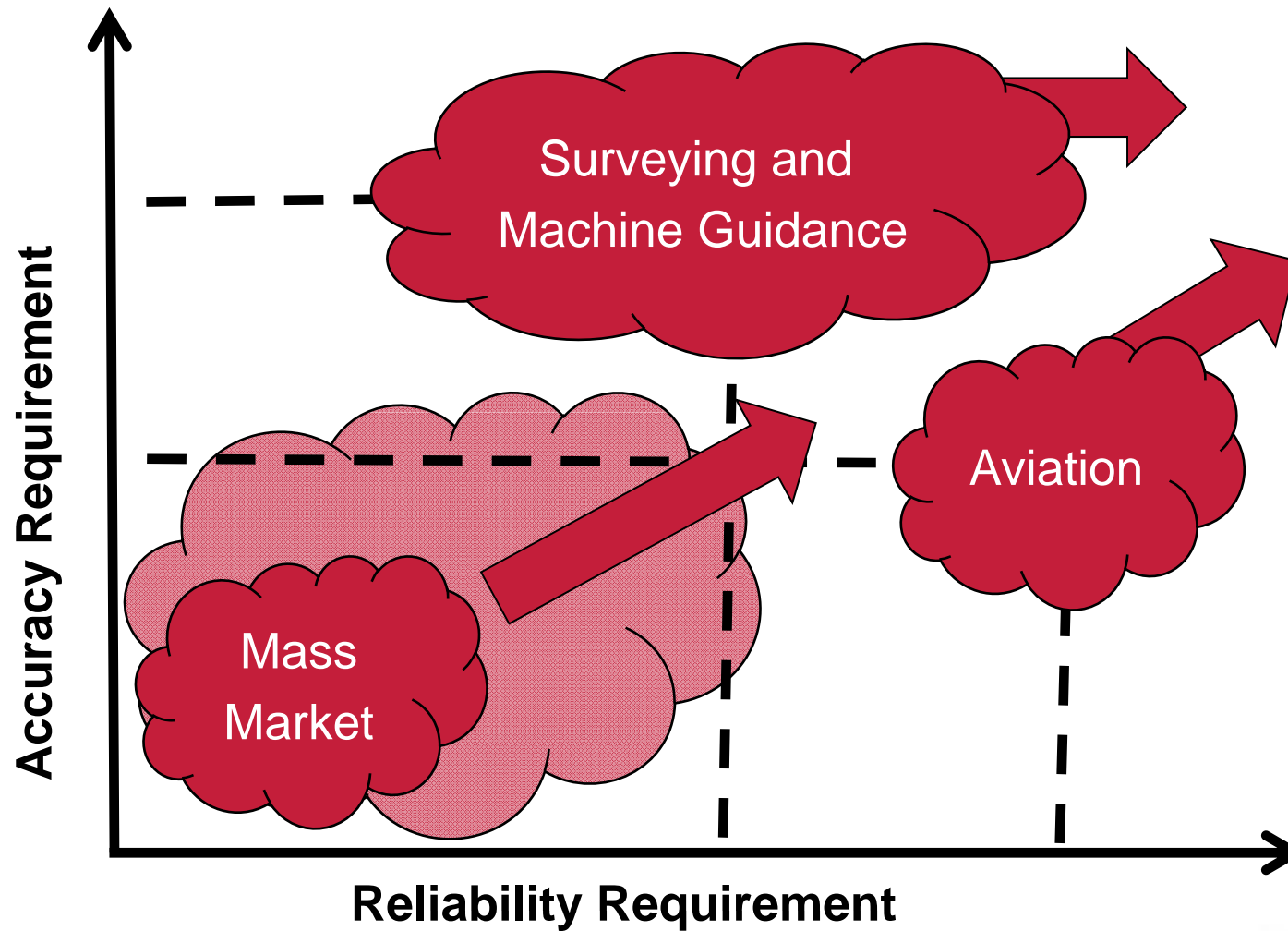
マルチGNSSの将来

What About the *Multi-GNSS* Future?



精度と信頼度の向上

Increasing Accuracy and Reliability



Aviation Example

•マルチGNSSの利点



Benefits of Multi-Constellation RAIM



- Combining signals from multiple constellations can provide significantly greater availability and higher performance levels than can be achieved individually •Availabilityの増加
- Potential to provide a safety of life service without requiring the GNSS service provider to certify each system to 10^{-7} integrity levels
•SoLサービスへの適用の可能性
- Creates a truly international solution
 - All service providers contribute
 - Not necessarily dependent on any single entity
 - Coverage is global and seamless
•単一のGNSSシステムへの依存からの脱却

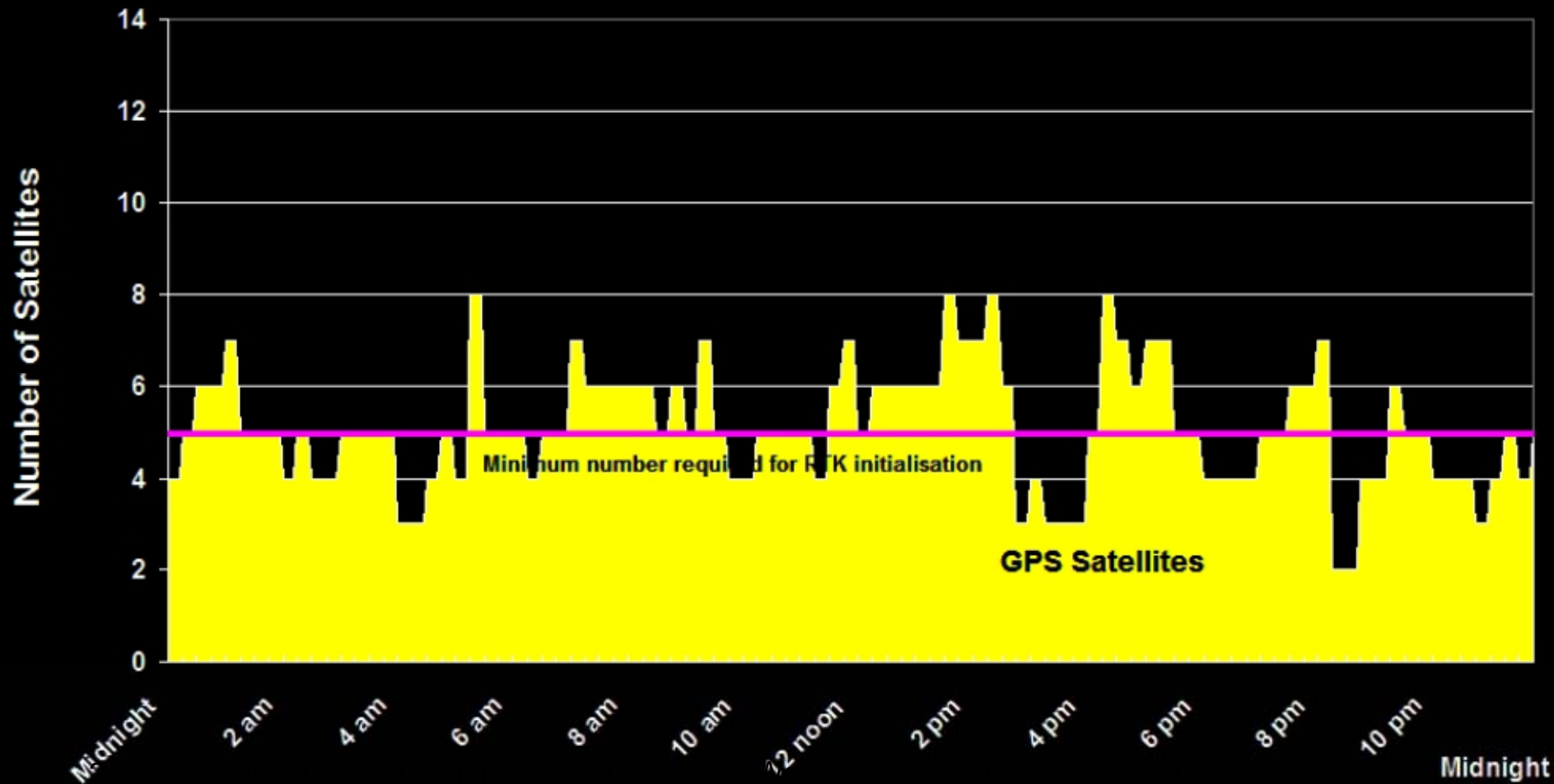
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露天掘り鉱山での事例

Mining Example

AP Systems

Availability of Satellites
Loy Yang Mine 24th November 2006
Worst Case Obstructions in Corner

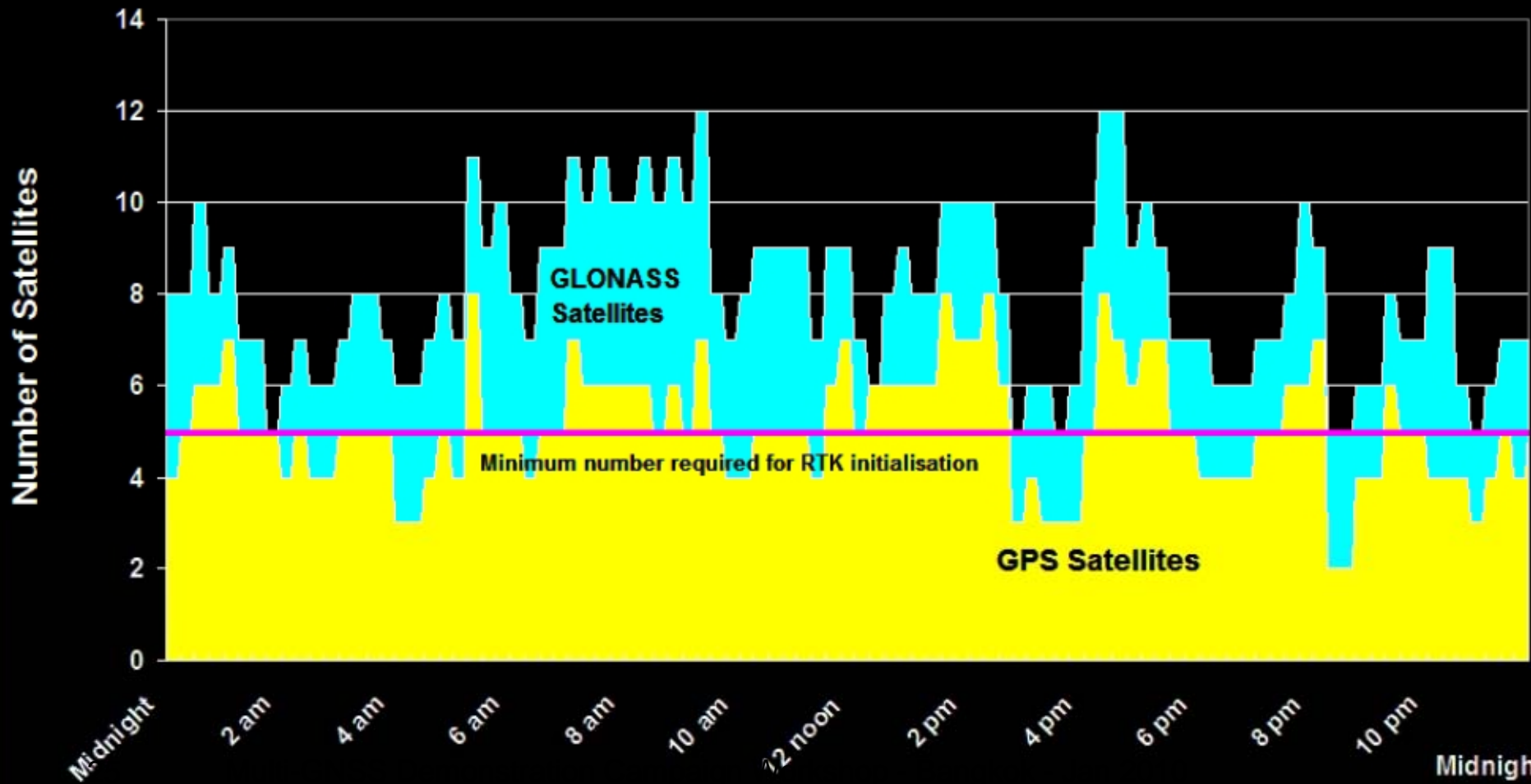




**GPS&GLONASSで5機以上の衛星が確保され
RTK測位が24時間可能となる (GPS+QZSでも同じ効果)
Value of Extra Signals**

AP Systems

Availability of Satellites
Loy Yang Mine 24th November 2006
Worst Case Obstructions in Corner



- Many industries are already demonstrating significant economic and environmental benefits from GNSS;
 - social benefits as well (not covered here);
- Multi-GNSS era will take that contribution to the *triple bottom line* to new levels;
- The Multi-GNSS Demonstration Campaign can make an important contribution to delivering that next wave of benefits across the Asia Oceania Region.

Thanks for your attention.

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