WHITE PAPER

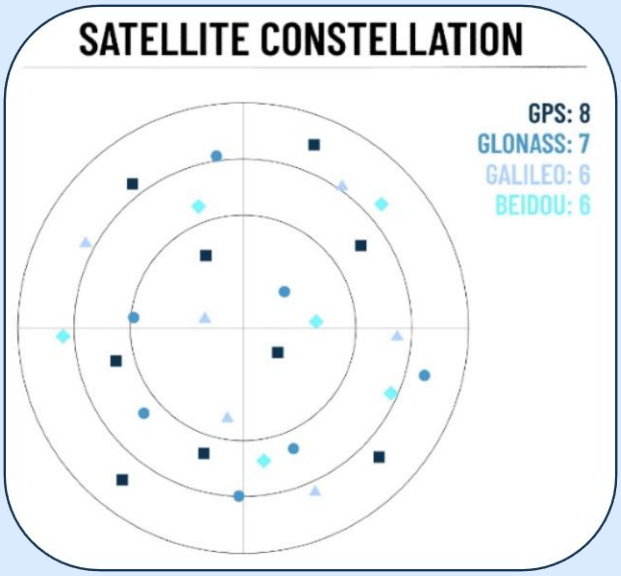
MULTI GNSS

GeneSys
Sensor Systems, Service & Smiles

MULTI GNSS

TOPICS

- GLOBAL NAVIGATION SATELLITE SYSTEMS
- GROUND TRUTH
- REAL WORLD ANALYSIS
- URBAN SPACE
- RTK2
- KPIs



FROM GPS

TO GNSS

In 1978, the first American satellite was launched into an earth orbit. Since then, determining one's own position has been possible with this global satellite system. The term GPS (Global Positioning System) has since become the standard synonym for all satellite-based navigation systems. But the reason why it is incredibly important to talk about GNSS (Global Navigation Satellite System) nowadays and why GNSS enables a major increase in the performance of inertial navigation systems is explained in this whitepaper.

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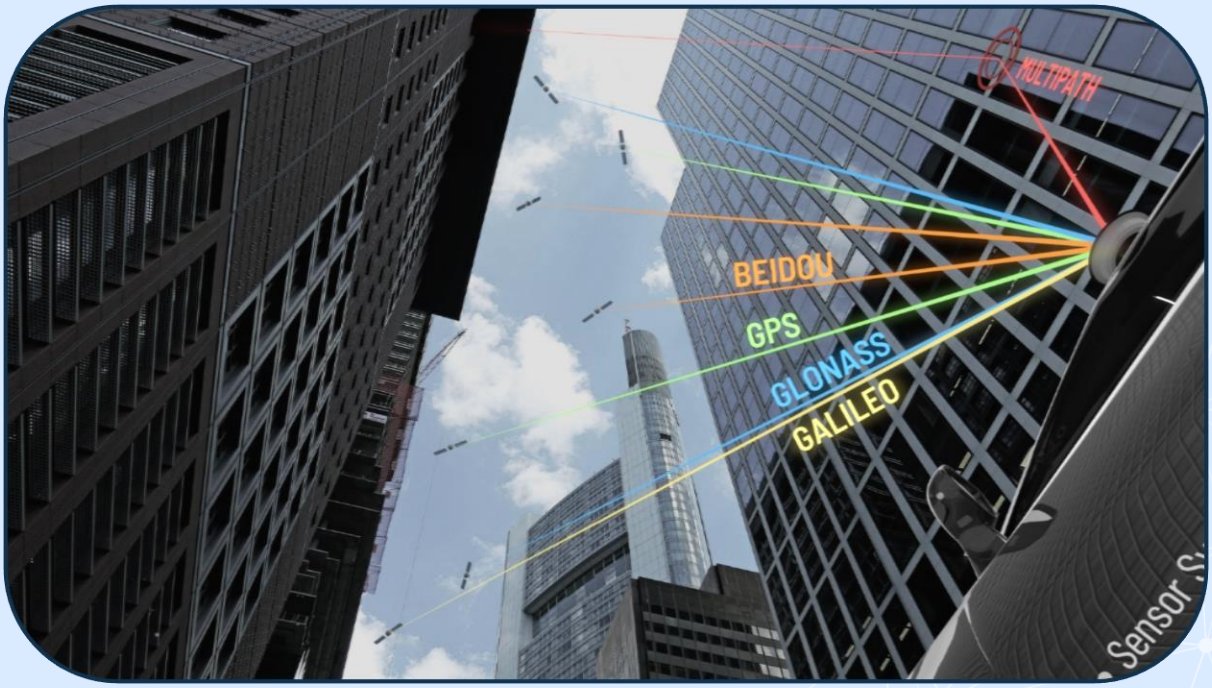
THE CHALLENGE

SIGNAL SHADOWING

GNSS stands for Global Navigation Satellite System and includes the satellite systems GPS, GLONASS, GALILEO and BEIDOU. For a valid and very precise position solution, the GNSS receiver requires at least 6 different satellite signals. Modern GNSS receivers are capable of using all satellite systems simultaneously and intersecting the best satellite signals in each position. This enables navigation in situations where one satellite system alone would not be adequate, such as in urban canyons or tree-lined avenues. The situation becomes particularly critical when the GNSS receiver receives reflected satellite signals: the so-called multipath effect. In such cases, the receiver may include incorrect information when calculating the position solution, resulting in decreased accuracy. The more satellites the GNSS receiver can use for solution determination, the greater the likelihood of compensating for or eliminating these multipath effects.



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REAL WORLD ANALYSIS

INTERURBAN MEASUREMENTS

To put theory into practice, a vehicle was equipped with two inertial systems (ADMA-G) and measurement data was generated in a real environment. Urban space is playing an increasingly greater role in the automotive industry and is proving to be the biggest challenge for GNSS receivers. For this reason, the measurement drive will be taken through the city center of Ulm in Germany.

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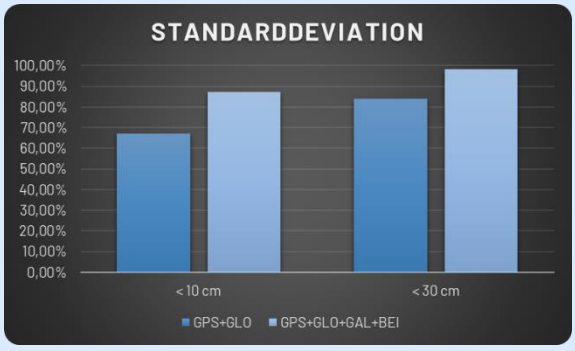
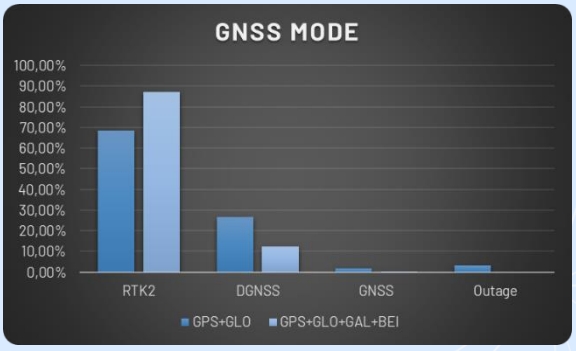
PERFORMANCE INCREASE

MEASUREMENT RESULTS

The automotive manufacturers and suppliers work with KPIs (Key Performance Indicator). In order for measurement data to be used to validate studies, certain KPIs must be met. For example, a standard deviation of 10 cm for positioning data can be defined as a KPI for Ground Truth data. For this measurement scenario, 66.93% of the measurement data could be used for validation if GPS and GLONASS satellite systems were activated, and even 87.34% if GPS, GLONASS, GALILEO and BEIDOU satellite systems were activated. The user would thus have to drive 20.4% less distance to get valid measurement data.
The standard deviation is therefore better because the system with Multi GNSS measures a significantly larger percentage in RTK2 mode, since the quantity of satellites used is much larger on average.
Overall, an upgrade to Multi GNSS with all four satellite systems clearly shows that a significant performance increase can be achieved, especially in environments with challenging conditions for the GNSS receiver. Particularly when KPI's need to be met and measurement data needs to be validated, this upgrade can save a lot of time as less distance needs to be driven.





CONCLUSION

RECOMMENDATION

GeneSys is confronted almost daily with new measurement scenarios. Many scenarios have shown that Multi GNSS represents a strong option for handling situations where only few satellites are available. This is especially true for urban areas, but also for environments with many objects next to the lane.
We therefore recommend in any case to provide a GNSS activation for the GNSS receiver in the inertial system (INS) during measurement campaigns as soon as the system is exposed to poor or only adequate GNSS signal strength.

GNSS MODE	GPS + GLO	GPS + GLO + GAL + BEI
RTK2	68.50 %	87.34 %
DGNSS	26.62 %	12.52 %
GNSS	1.72 %	0.15 %
Outage	3.16 %	0.00 %

STDDEV	GPS + GLO	GPS + GLO + GAL + BEI
< 10 cm	66.93 %	87.33 %
< 30 cm	83.93 %	98.17 %

THE EXPERT

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