CGI 5-GENIUS
5G Enhanced Navigation with Integrity for UAV Systems

CGI

Leveraging 5G technologies to complement or backup Global Navigation Satellite Systems (GNSS) for positioning

Leading a consortium around a team of world-renowned experts, CGI is developing the proof of concept for a hybrid positioning algorithm, combining 5G signals of opportunity with GNSS services to achieve increased positioning resilience and integrity.

The project focuses on a real-world drone flight test as well as developing the use case and requirements definition for a future hybrid positioning system. Key project members include:

NATS   **US UNIVERSITY OF SUSSEX**   **u-blox**

Drone Applications

The possibilities for drone applications will significantly expand with safe navigation beyond visual line of sight (BVLOS). Drones able to fly BVLOS safely can operate over larger distances, facilitating a number of critical use cases such as those below:

Mapping city streets

Parcel distribution and delivery

Construction project aerial survey

Persistent incident surveillance

Inter-hospital supply

Long-range heavy goods transport

Air taxi

For safe BVLOS flight the drone position will need to be shared with air traffic service providers, local and law enforcement authorities, government agencies, and crucially other similarly equipped airspace users, as a basis for Detect and Avoid. Currently, drone position, navigation and timing (PNT) tend to be derived solely using Global Navigation Satellite Systems (GNSS).

Drone Application critical use cases

- Search and rescue surveillance
- Inter-hospital supply
- Infrastructure inspections
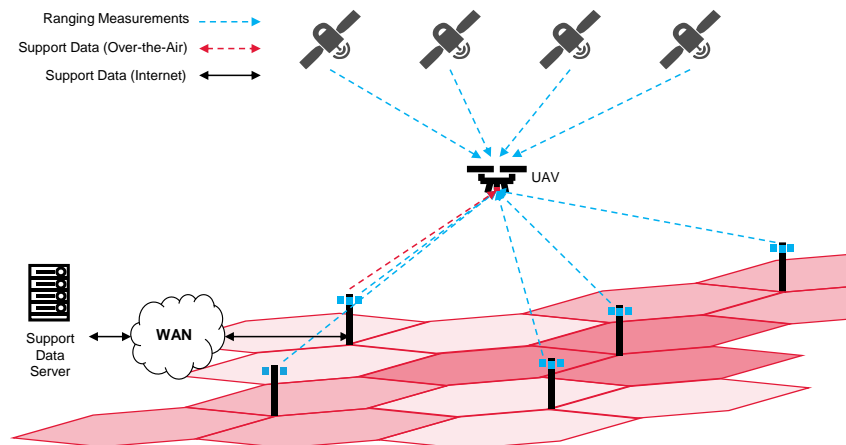- Parcel distribution and delivery
- Air taxi

GNSS Vulnerabilities

Challenges related to GNSS interference and satellite visibility are well documented. The increase in GNSS dependency coupled with the occurrence of GNSS interference raises the need for alternative and complementary solutions for PNT assurance. In 2021, CGI completed a survey of GNSS interference across the UK. Every sensor detected GNSS interference in some form, and sensors in urban environments detected over 50,000 events during a 2-month period. Such interference – potentially causing drones to fall from the sky or collide with obstacles – is becoming ever more prevalent.

5G Safety Assurance

With its stronger power, frequency diversity, larger bandwidths at higher frequencies and dense network deployment, 5G has the potential to provide a resilient positioning technology complementary to GNSS and with the necessary assurance in scenarios where GNSS is challenged or denied. Incorporating 5G signals into a hybrid navigation solution can deliver additional corrections to enhance GNSS accuracy and integrity whilst also boasting the ability to retain a positioning ability when GNSS is unavailable.

Flight Tests

Under this project, CGI successfully developed a hybrid positioning algorithm that fuses 5G and GNSS ranging measurements, as well as components for a Support Data Service that would enable wider adoption of this technology. **Fusing 5G with GNSS demonstrated significant benefits to positioning accuracy and availability, compared to GNSS only, as well as providing backup horizontal positioning during GNSS outage**. The project culminated with flight tests, successfully achieving the following objectives:

- To capture live GNSS and 5G signals in a representative environment for drones flying in urban/suburban areas, enabling the benefits of fusing GNSS and 5G signals for navigation to be demonstrated (the Proof-of-Concept objective).

- To understand the diversity of transmitters and the relative strength of 5G signals received at different drone altitudes and on different operating bands (the Discovery objective).

"GNSS interference is listed as the root cause of 10% of drone crashes within our UK databases."

Leading Drone information provider

About CGI

Insights you can act on

Founded in 1976, CGI is among the largest IT and business consulting services firms in the world.

We are an IT Systems Integrator working to advise, build and operate bespoke, technically complex, mission-critical information systems. Bringing innovation to our clients using proven and emerging technologies, agile delivery processes and our expertise across space, defence, intelligence, aerospace and maritime, all underpinned by our end-to-end cyber capability.

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