Agnet® over Satcom White Paper

Satellite connectivity to extend the 4G/5G coverage

AIRBUS

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Executive summary

Airbus Defence and Space combines its Agnet market-leading mission-critical communications (MCX) solution with its extensive knowledge of satellite communications (satcom) to provide reliable, flexible and secure operational communications across the globe.

With their low latency, high throughput, global coverage, quality of services and guaranteed service levels, Low Earth Orbit (LEO) satellite constellations like OneWeb are well suited to supporting critical communications services such as voice, group communications, data, location sharing and video.

Public Safety and other organizations with critical communications needs can benefit from such satellite connectivity, especially during natural disasters, cyberattacks or other disturbances that could create congestion or even loss of connectivity in terrestial networks.

Airbus Defence and Space has pioneered global connectivity for more than four decades and is a world leader in satcom and ground infrastructure networks.

The evolution of satellite communications

The development of LEO satellite constellations has come a long way since the launch of the world's first commercial satellite communications in 1965. The satellite sector has gained momentum with the development of the systems such as Global Positioning System (GPS), the Iridium system and the launch of microsatellites, all opening up new possibilities for scientific research, earth observation and enhancements in communications. The miniaturization of satellite components and the development of advanced manufacturing techniques

has enabled the production of more satellites at lower cost, paving the way for large-scale LEO satellite constellations.

Recent advances have seen the emergence of large constellations such as OneWeb and Starlink. Together, these projects aim to deploy thousands of satellites to provide global broadband internet coverage. Euroconsult* expects that satellite launch rates will experience a four-fold increase by 2032 to hit an average of more than 1,700 satellites launched each year, a dramatic increase from around 380 satellites per year over the past decade.

As we move into a more digital world characterized by video, mobile communication and on-demand services, we anticipate a development of hybrid offers, combining commercial satellite communications and 5G/6G mobile services that can adapt to growing user demand and expectations.

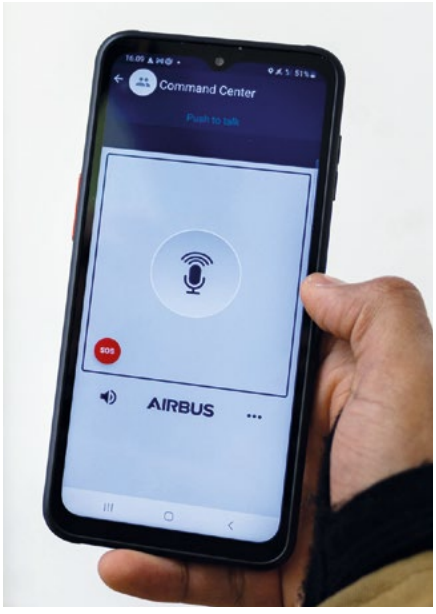
Agnet – a new era of secure collaboration

Agnet from Airbus is a critical communications solution for sharing information instantly, reliably and securely to support group collaboration. The solution meets the needs of public safety and private organizations in sectors that include Transportation, Utility and Industry (TUI), Healthcare and Event Security. It provides efficient communication in both routine and emergency situations for police, first responders, firefighters, maintenance workers, private security and other operators working in the field.

With voice, data, video and location services, Agnet provides actionable data and the ability to reach the right people in the field. It enhances situational awareness, improves the user experience, increases safety and optimizes operational efficiency.

As the next-generation critical communication solution, Agnet is fully compatible with 4G/5G and works with LEO satellite constellations, currently available on OneWeb. It gives professional smartphone users reliable access to critical communications services which deliver far more than push-to-talk over broadband, such as multimedia messaging and push-to-video capabilities.

Read more: Secure group collaboration for professional users https://www.securelandcommunications.com/agnet



* [Euroconsult] Pleney, Lucas et al., Euroconsult Space Economy Report 2022, 9th Ed., January 2023.

Attaining global mission-critical coverage

Public safety and other professional users are accustomed to using highly capable, secure communications systems such as TETRA, Tetrapol and P25 narrowband solutions.

When transitioning from narrowband towards broadband technologies, there may be concerns about the reliability and coverage of commercial 4G/5G networks – especially for public safety organizations relying on Agnet for their critical communications.

To address this concern, Agnet over Satcom helps ensure global connectivity by supporting the use of deployable networks and satellite communications. This makes Agnet the best choice for public safety and critical industry organizations which can take full advantage of new capabilities offered by 4G/5G with the option of satellite connectivity for their critical communications.

Airbus provides expert support

Agnet over Satcom is an example of extensive technology collaboration within Airbus. By combining its expertise in delivering resilient, safe and secure mission-critical connectivity with its vast knowledge of satellite communications, Airbus can offer field-proven end-to-end solutions for public safety and other critical organizations.

When an organization adopts mission-critical capabilities, Airbus's comprehensive expertise and experience provides support from planning and integration to maintenance tailored to operational needs and covering the entire ecosystem of mission-critical solutions. Airbus can deliver the full solution of Agnet and OneWeb connectivity that is field proven and ready to use.

Read more: Agnet collaboration solution together with LEO satellite services demonstrated in Northern Finland
https://www.securelandcommunications.com/news/airbus-demonstrated-low-latency-broadband-leo-satellite-services-in-northern-finland

Read more: NITECH: NATO Innovation and Technology - 5G exercise in Latvia where Agnet over Satcom facilitated secure multimedia connections (pages 74-75)
https://issuu.com/globalmediapartners/docs/nitech10

How satellite connectivity extends capacity and coverage

Transition to broadband
The transition from narrowband to 4G/5G broadband technologies for critical communications is taking place globally. Driven by rising security challenges, the aim is to increase the efficiency and safety of operations and to ensure the safety of societies. The key enablers include the evolution of mobile broadband, ICT technologies and 3GPP standardization.

Professional users, including public safety and defence organizations, have demanding communications needs that exceed those of consumers and enterprises. Their requirements include high availability and reliability, robust cybersecurity and extensive coverage as incidents can occur anywhere. Fluent group communication and collaboration, achieved by Agnet, are also essential.

New technologies for building broadband coverage and capacity
The critical communications industry has several decades of experience in designing and building narrowband networks with necessary coverage, so the key design principles are well mastered. A relatively small number of radio sites has been sufficient because the networks have operated at low frequency bands and the devices use high transmission power. In addition, external antennas are usually used.

Building similar coverage and availability in 4G/5G networks is more challenging due to their higher frequency bands. The networks require many more base stations, yet still risk leaving blind spots. In addition to good coverage, good capacity with high bit rates is also

needed to support new applications, such as the real-time video in groups capability offered by Agnet.

Satellite communications with deployable networks offer flexibility

A mix of solutions is needed to provide the wireless broadband coverage and capacity that professional users require. Satellite communications, especially LEO constellations, is a valuable technology in the toolbox. This, combined with deployable networks (so-called "tactical bubbles") is a solution that complements terrestrial 4G/5G networks for critical communications needs.

Deployable networks are typically installed on a mobile platform like a vehicle, vessel, or drone. They comprise a base station, radio mast/antenna, core network, operations and maintenance capability, transmission solution and local application servers if needed. Rapid setup is crucial, with installation times aimed at a few minutes rather than hours. Permanent installations on a vehicle or vessel support critical use cases because they are always available, anytime, anywhere.

Deployable networks with a satellite connection can be used to build coverage and capacity in areas where a terrestrial network is not economically viable, such as mountainous or coastal areas. Alternatively, they can be used as a backup during communication breaks caused by storms, power outages or serious crises. They can also help overcome interruptions due to cyberattacks, or to provide extra capacity in extensive situations like wildfires and conflicts. Sporting events or international summits can also be covered. Agnet and deployable networks offer a powerful combination for various exceptional professional communications needs.

Events

Thousands of spectators in a sporting event such as a Formula 1 race or an Olympics venue can temporarily overload otherwise reliable 4G/5G coverage. Connectivity during international summits between heads of state and other dignitaries must be available at all times due to the nature of the events and their high security demands. Event organizers, security, emergency workers and other critical organizations can rely on Agnet during these events when satellite connectivity is in place to offer extended coverage.

Remote areas

Rural areas, mountains and coastal areas may not be covered by standard 4G/5G connectivity due to scarce population and lack of infrastructure. Permanent coverage can be built to ensure connectivity for workers who provide essential services in remote areas – healthcare, maintenance, repair and other workers. The wide geographic coverage required by public safety can be complemented with satellite connections in remote areas.

Disaster relief

Natural disasters such as floods and wildfires, or major incidents like environmental disasters or cyberattacks may require temporary backup to communications services during relief efforts. Public safety organizations that use Agnet can continue their crisis management mission without interruption when communications are backed up with satellite connectivity.

Prepared for serious crises

Should a natural disaster, cyberattack, or military conflict disrupt traditional infrastructure, satellites offer resilient and immediate connectivity. Covering remote or isolated areas, they ensure uninterrupted communication that aids emergency coordination and essential service maintenance. Serving as a robust backup during terrestrial network failures, satellites enhance crisis resilience by providing reliable communications crucial for national security, disaster management and public safety in serious crises.

EVENTS

REMOTE AREAS

DISASTER RELIEF

PREPARED FOR SERIOUS CRISES

From GEO to LEO: the evolution of satcom connectivity

Since the late 2010s, the satellite communications industry has entered an era of change. The most prominent new trend has been the launch of megaconstellations with hundreds to thousands of LEO satellites. The development has been enabled by falling launch prices and increased payload volumes, as well as the mass production of satellite hardware based on commercial-off-the-shelf (COTS) solutions. Compared to traditional GEO (Geostationary) services, megaconstellations are enabling new and previously unimaginable connectivity in even the most remote and difficult-to-serve geographies.

The key advantage of LEO connectivity is its performance: LEO megaconstellations offer both low latency and high throughput, a capability that arises from the large number of high throughput satellites used.

Yet blazing performance is not the only advantage of the emerging constellations. The distributed nature of the systems makes them very robust against eavesdropping, tracking and jamming. The physical composition of the LEO architecture creates high security and reliability of megaconstellations. Handover periods between individual satellites are short while a dense constellation allows connectivity to switch to a satellite with a stronger signal should an adversary jam one or multiple satellites.

While the emerging constellations are a major step towards world-wide ubiquitous connectivity, future technologies, like standardized 5G non-terrestrial networks (NTN) and its evolution in the forthcoming 6G will continue to enhance the capabilities. One major innovation envisioned for this future mobile connectivity is the seamless integration of terrestrial and satellite connectivity into everyday mobile handsets.

OneWeb: 5G-like connectivity over satellites

OneWeb is a satcom constellation of 648 broadband communication satellites evenly spaced in a 1,200 km LEO. The constellation comprises 12 polar orbiting planes of 49 satellites each, enabling truly global coverage, including the typically difficult-to-serve high polar regions. Low orbital altitude and the dense constellation of satellites enables latency below 100 ms and consistent throughput ranging from tens to hundreds of Mbps. Agnet has been comprehensively tested with the OneWeb network and has been verified to work out-of-the-box with quality of experience comparable to that of terrestrial 4G/5G mobile networks. Thus, OneWeb connectivity can support Agnet communications during planned and unplanned incidents.

While the satellites themselves are often the most prominent part of a network, they are not the only component. Ground infrastructure is also a crucial part and is the point where user traffic is handed over to the satellites. OneWeb's ground segment consists of earth stations also known as Satellite Network Portals (SNP), which communicate with the satellites via large parabolic antennas. These are in turn connected to a set of global Points-of-Presence (PoP) via a dedicated MPLS (Multiprotocol Label Switching) fiber network. PoP is a demarcation point where two or more networks are connected to each other, or practically speaking where traffic is handed over from OneWeb to the customer or vice-versa. One clear advantage of the architecture is that user systems may be connected to the OneWeb PoP over a dedicated connection, avoiding handover of data to the open Internet.

End users interact with the OneWeb system through a satellite transceiver, also known as a user terminal. OneWeb offers a set of professional grade terminals available from several suppliers. Varying form factors from lighter flat panels for mobile applications all the way to larger and more powerful dual-parabolic systems ideal for fixed installation are available. Terminal choice can be tailored to the needs of the customer with options available for fixed and mobile land uses as well as maritime connectivity.

Critical operations require uncompromising security

High security of data is essential in critical communications due to the operational needs of users. Information about public safety operations or sensitive information about people in emergency situations is confidential and should be protected from unauthorized access. This prevents the misuse of data, for example to preserve the integrity of an investigation. User privacy is also essential to ensure that personal information is kept confidential.

Authorities need reliable and secure communication channels to effectively coordinate emergency situations. Data security breaches and mistrust in communications would endanger the coordination of operations. In addition, securing communication networks is essential to prevent service disruptions that can affect the ability to communicate and collaborate.

Any compromise in information security can also undermine public trust. With data security, authorities can demonstrate their commitment to protecting the public and maintaining the confidentiality of sensitive information.

In addition to operational needs, authorities may encounter legislation that requires the protection of sensitive information in, for example, policing.

Agnet and OneWeb security

Agnet over Satcom consists of the Agnet critical communications solution and satcom services that provide connectivity over OneWeb. The solution offers effective security and data protection measures to meet the most demanding needs of all professional users. There are three key principles of information security – confidentiality, integrity and availability (referred in the industry as the CIA Triad).

Confidentiality: Ensuring that sensitive information is accessible only to authorized individuals or systems and that unauthorized access or disclosure are prevented.

Agnet's access control uses the registration of services with mandatory user authentication and authorization procedures based on user credentials. To ensure the confidentiality of Agnet communications, all traffic is encrypted using either TLS (Transport Layer Security) or SRTP (Secure Real-time Transport Protocol) methods or a VPN (Virtual Private Network), depending on the chosen model. End-to-end encryption can also be used, ensuring confidentiality between communicating parties.

OneWeb satellite network data security is based on a multi-layered architecture that protects against unauthorized access and cyberattacks. All user data is encrypted with AES encryption, which is a widely used family of standard encryption algorithms. OneWeb also has a secure authentication system to ensure only authorized users can access user data.

When Agnet is used with OneWeb, both Agnet's and OneWeb's encryption methods are used simultaneously. This provides good protection for confidential communication and ensures that only authorized users have access to the service. The use of end-to-end encryption provides one more layer of encryption.

Integrity: Guaranteeing the accuracy and reliability of data by protecting it from unauthorized alteration or corruption, maintaining its consistency and trustworthiness throughout its life span.

Agnet's and OneWeb's access control and traffic encryption also protect the integrity of communications by preventing unauthorized access and data alteration. For example, Agnet real-time communication is

protected against replay attacks that maliciously retransmit intercepted traffic, potentially leading to unauthorized access or operations. Agnet relies on the SRTP protocol, which uses a hash algorithm to provide integrity, message authentication and replay attack protection. This helps to ensure user confidence in the reliability and trustworthiness of communications.

An important security aspect in satellite communication is the architecture of the terrestrial infrastructure between the satellite ground stations and the data centers providing user services. The connection of OneWeb ground stations is based on a dedicated and secure global MPLS (Multiprotocol Label Switching) network, which ensures data confidentiality and integrity. Dedicated connections can be extended to the user's data centers, which enables controlled and secure networking. This avoids the need to route confidential information over the Internet.

Availability: Ensuring that data and information are accessible and usable when needed, minimizing downtime and disruptions to critical systems.

Ensuring the service availability of a complex communication solution like Agnet calls for a multifaceted solution. The chain of activities starts with software design and includes product verification, service deployment and maintenance of the production environment and ends with the communication service consumed by users.

All these elements have been taken into account in Agnet's design to maximize the availability of the service to professional users. For example, Agnet software engineering is based on the best DevOps practices, including static code analysis and automated penetration testing. For the software platform in the production, regular software updates are provided, including emergency patches if any vulnerabilities are identified. Furthermore, Agnet's architecture supports geo-redundant data centers in different locations. Security events of Agnet can also be integrated into the SOC (Security Operations Center), which provides the organization with a single view of its information security situation.

Satellite communication services address availability issues of terrestrial networks and thus improve the availability of services. Satellite networks are not vulnerable to the same infrastructure service deviations as terrestrial networks, for example service breaks of base stations or their transmission network. OneWeb even has multiple backup satellites in orbit ready to enable quick activation if one of the active satellites fails. The wide coverage of satellite services helps to implement communications services quickly and cost-effectively, practically anywhere even where terrestrial services are not available. OneWeb offers 99.7% global coverage, including polar regions.

OneWeb also provides traffic prioritization matched to customer needs. For example, voice communication can be given a higher priority to ensure that voice packets in the network use a fast lane over other traffic. Another QoS (Quality of Service) mechanism of OneWeb is to provide users with a guaranteed bit rate, not just the best effort service. This Committed Information Rate (CIR) makes a variety of committed uplink and downlink bit rates available to suit user needs.

In addition, Network Operations Centers (NOCs) provide 24/7 monitoring, maintenance and emergency service for the ground segments and customer network connectivity.

Stay connected in even the most demanding situations

The Agnet mission-critical communications (MCX) solution offers an effective way for organizations to move their communications into the future and adopt 4G/5G broadband capabilities.

Agnet is based on 3GPP standards that enrich communication and collaboration with multimedia, location and video. These capabilities allow professional users to make the right decisions quickly and act faster to help make their field operations more dynamic and secure.

This, combined with technical expertise and a deep understanding of organizational communication needs, makes Airbus a trusted partner in the deployment of secure communication and collaboration solutions.

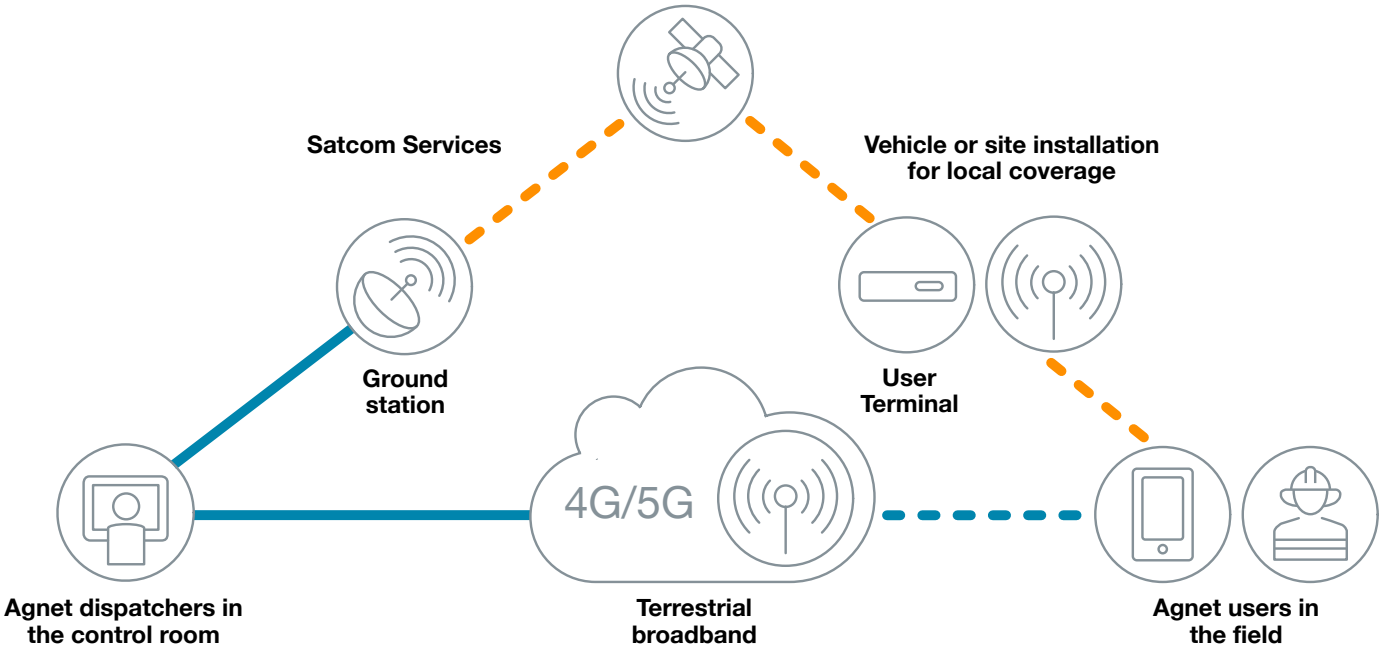
Agnet together with Satcom Services based on low-latency broadband LEO satellite constellations offer the best of both worlds for next generation critical communications.

- Designed for demanding collaboration
- Share information instantly, reliably and securely in the field
- Voice, data, video and location services in real time
- Dispatching to track multiple situations simultaneously
- Choice of compatible smart devices and accessories
- Compatible with LEO satellite constellations, currently available with OneWeb

After setting up the LEO satellite connectivity service, Agnet operates seamlessly, in the same way as with any other IP-based network - no additional integration work is required.

Agnet over Satcom offers added resilience and extended coverage and capacity for professional users to continue to communicate without interruptions in even the most demanding situations.

Satellite connectivity for Agnet users



Read more: Secure collaboration solution Agnet https://www.securelandcommunications.com/agnet

Read more: Satcom Services https://securecommunications.airbus.com/en/satcom-systems

Airbus expertise in satellite technologies and critical communications

Modern societies benefit from a stable societal fabric that enables the free flow of ideas, people, money, goods and services. That stability is based on the rule of law, accountable institutions, protected borders, productive ecosystems and a well-functioning digital and physical infrastructure, among other things.

Those who ensure our security and keep our society running need advanced equipment and efficient technological solutions. Airbus has always been at the forefront of innovative technologies. The pioneering spirit that has redefined the aerospace industry has also driven innovation in space and communications systems. Products and services in our portfolio contribute to the environment and safety in ways that help our customers to meet their objectives in sustainability, security and operational efficiency.

Earth-observation
Earth-observation satellites and solutions help to monitor deforestation, analyze sea-level rises or ensure global food security by providing actionable, near real-time insights. Integrating OneAtlas satellite imagery from Airbus with other data sources can further enrich the understanding of an evolving threat landscape. Delivery of actionable intelligence helps public safety and defence organizations to respond to their challenges more rapidly and with greater certainty.

The OneAtlas digital platform provides flexible and easy access to premium satellite imagery, geospatial analytics and industry-specific insights. OneAtlas provides access to a suite of Earth Observation data, including Airbus's most advanced 30 cm resolution imagery from the two identical Pléiades Neo satellites.

Read more about satellite imagery and geospatial data: https://intelligence.airbus.com/

Secure satellite communications
Airbus provides a wide range of communications services around the globe. Our experience in satellite communications allows us to tailor and optimize the service to each customer, taking into consideration their equipment, objectives and budgets. We are experts in delivering a fully managed Satcom Service. We are able to tailor any mix of airtime, terminals and networking, together with unrivaled support and logistics to allow us to deliver high quality satellite connectivity for critical operational environments anywhere in the world.

Read more about secure satellite communications: https://securecommunications.airbus.com/

Critical communications
Airbus has long-standing relationships with numerous organizations, some spanning decades. Airbus is the market leader in large nationwide public safety networks in Europe. Almost two million public safety professionals use Airbus solutions every day. This has given Airbus an excellent understanding of the requirements and needs of critical communications organizations. This, combined with our heritage and best-in-class capabilities for network services and solutions in satellite communications, makes Airbus the trusted partner in critical communications – now and in the future.

Read more about critical communications: https://www.securelandcommunications.com/

Whatever the technological solution, customers can be confident that Airbus can deliver a state-of-the-art solution that works seamlessly and securely from end-to-end on land, sea, air, space and cyberspace.

AIRBUS

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