

# NEW COMMUNICATIONS INFRASTRUCTURE IS CENTRAL TO ACHIEVING TRAJECTORY-BASED OPERATIONS

**EUROCONTROL is at the heart of research into evolving communications, navigation and surveillance technology into more integrated, digital services**

The current generation of communications, navigation and surveillance (CNS) infrastructure is showing limitations in the face of an array of challenges, including traffic growth, spectrum efficiency, security and new entrants such as remotely piloted aerial systems (RPAS). Air traffic control is close to capacity in high-density areas and calls for modernisation of operations along with enhancements in CNS equipment. Fundamental to improvement is the automatic exchange of trajectories and flight-related data between the air and the ground, using digitised exchanges to increase automation and reduce human intervention to maintain aircraft separation.

EUROCONTROL coordinated the production of a CNS roadmap in 2018 as part of the revised ATM Master Plan (See *CNS roadmap shows evolutionary path to an integrated future*, Skyway Spring/Summer 2018) which gives air navigation service providers (ANSPs), regulators, industry and airspace users insight into how CNS/ATM infrastructure will evolve over the next 20 years. In coordination with US agencies, research activity is driving concept development in the context of International Civil Aviation Organization (ICAO) standardisation. The roadmap outlines evolutionary development of the CNS infrastructure into a more integrated operational concept — where previously each element was considered as a separate domain. It highlights opportunities arising from satellite-based solutions to introduce cross-domain synergies through the use of data across different applications, increasing competition and lowering cost. In place of technology mandates, the roadmap advocates a performance-based approach.

The communications infrastructure in particular needs to evolve to provide a robust framework to support trajectory management. Modernisation began more than a decade ago with implementation of the Pan-European Network Service (PENS), a dedicated Internet Protocol (IP)-based ground network serving Europe's air traffic industry. Along with the introduction of Voice over IP international communication standards, these internet services support a more flexible infrastructure which is changing from legacy point-to-point communication to a fully meshed network whereby each actor, whether an ANSP or airspace user, can access information in a cheap and efficient way. This new communication infrastructure also comes with risks, for example to cybersecurity, requiring specific safe-guarding measures, says Liviu Popescu, IP expert at EUROCONTROL.

The change is also reflected in air-ground communications, where the gradual adoption of the software-defined radio and internet technology is accelerating the shift from analogue to digital. The current infrastructure is based on VHF data link (VDL) Mode 2 technology, but this has limited bandwidth capacity and does not support full trajectory management, so other technologies are being developed to support and increase data exchange in the future. These include satellite communications (SATCOM), which is already used in oceanic airspace; AeroMACS broadband 4G wireless system, which is in place at some airports, and L-band digital aeronautical communications system (LDACS), which is expected to be standardised by 2018.

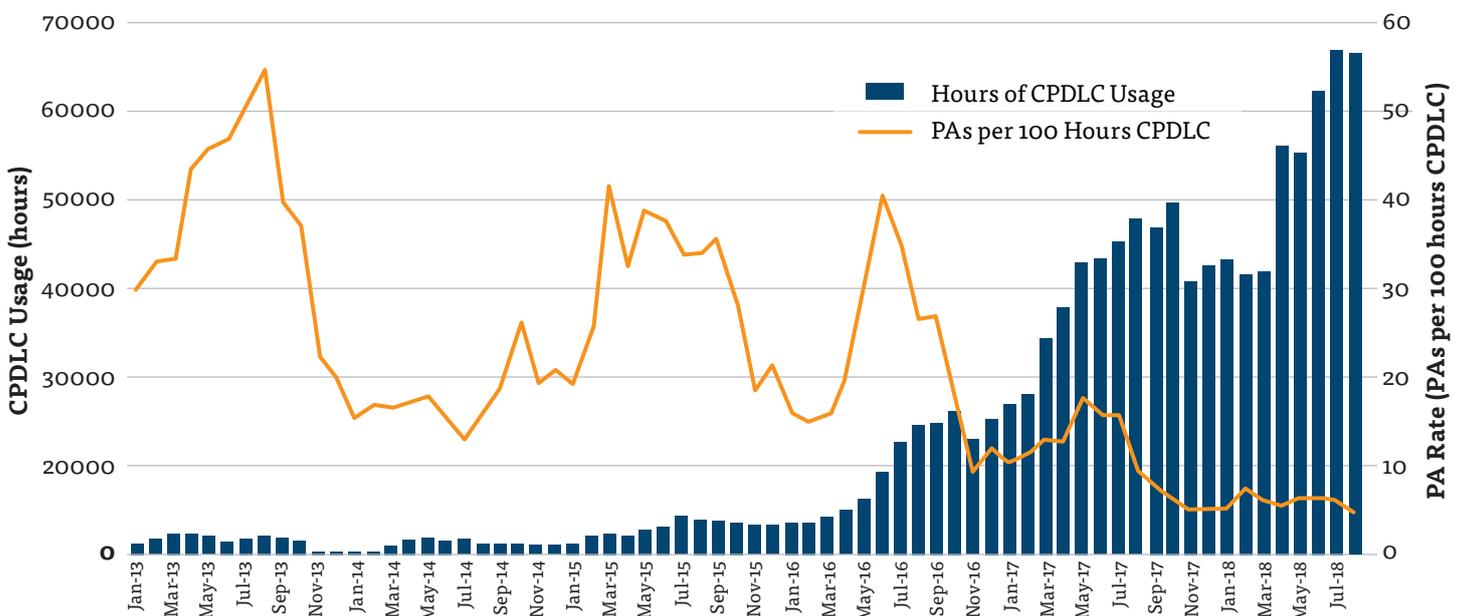
Europe's efforts to modernise VDL M2 infrastructure encountered difficulties in 2015, when the region failed to meet the European Commission's mandate to implement Aeronautical Telecommunications Network (ATN) data-link services. The unusually high number of disconnections between the ground infrastructure and airborne avionics – known as Provider Aborts (PAs) – led the European Aviation Safety Agency (EASA) to conclude ATN was not sufficiently robust to support data-link services. ANSPs and airspace users are now making significant progress towards meeting a revised Commission deadline of 2018 for ground infrastructure, and 2020 for airborne equipage.

EUROCONTROL Head of the Communication and Frequency Coordination Unit, Jacky Pouzet, says the air segment is progressing, with about 40% of aircraft already equipped, and the ground infrastructure is expected to be operational by the end of 2018 — at least in the core area of Europe based on SESAR Deployment Manager (SDM) plans. "Things are progressing, but the difficulty is for the ANSPs and airlines to meet the deadline. The airlines have invested about €450 million, but the service is not always available on the ground." Moreover, the current mandate relates to version B1 ATC technology, rather than more recent B2, which includes the Automatic Dependent Surveillance-Contract (ADS-C) capability necessary to support trajectory management. ADS-C delivers data such as position, speed and importantly navigational intent, directly from the Flight Management System (FMS) on board the aircraft. This data enables air traffic control to generate trajectory alerts, for example updating estimates for a downstream waypoint directly to the FMS.

B2 is standardised and ready to be validated then further deployed. The technology has already been used to support initial four-dimensional (4D) flight trials in Europe, and 4D trajectory demonstrations by the US Federal Aviation Administration (FAA). "ATN B2 is backwards compatible with ATN B1 and can operate with any technology, such as SATCOM," says Pouzet. "There is no mandate for the time being, but we believe that by 2025 most new aircraft will be equipped with ATN B2." A rule-making group working for EASA is preparing the ground for just such a mandate, and the SDM should include ATN B2 research and validation activities in the second Common Project (CP2) programme due for publication in late 2018, channelling Commission funds to support implementation.

European agencies meanwhile are looking at how long VDL Mode 2 (VDL M2) can support the growing volume of data-link communications, especially for new aircraft, before it runs out of bandwidth. "It is important to understand how long we can expect VDL M2 to support data link needs which are expanding and to actively work on developing additional bandwidth for the future," says David Isaac, EUROCONTROL's Datalink Performance Monitoring Manager. The Network Manager publishes regular status reports which show where controller pilot datalink communications (CPDLC) over the ATN is operational, along with the number of provider aborts. These have fallen steadily from around 30 per 100 operating hours a few years ago, to around 4.4, as shown in the graph below. The target is to bring these down to one or less. Multi-frequency plays a growing role, and airspace users now have access to four frequencies compared with only one in 2016, enabling VDL M2 to continue to operate.

Long-Term PA Rate



In the interim, the emphasis is on demonstrating new technology, such as LDACS for aviation safety and critical communications and the use of commercial technologies for other exchanges, under the SESAR programme. *“We have to encourage SESAR to proceed with the validation process of LDACS relatively quickly,”* warns Jacky Pouzet. *“The technology has been developed, spectrum has been booked, and if we do not act quickly we may have problems keeping the spectrum.”* The challenge is also to define the concept for full 4D trajectory management, ahead of it being mature enough for implementation.

New technologies will do more than simply replace VDL M2. For example, new radios with time-keeping capabilities can measure the distance between mobile radio and ground stations, supporting both on-board navigation and surveillance from the ground. This potential to reduce the number of systems in operation, while not yet mature, is recognised in the CNS roadmap. *“The idea is to see how we can reduce the number of boxes and antennae that you need on board the aircraft to reduce the cost. When you use new technology which performs better and costs less than the old technology, you reduce the cost of the ground infrastructure as well,”* says Pouzet, providing a glimpse of what the CNS/ATM infrastructure might look like in 2030.

Experts now have to work together to develop the new models and integrate all the players, like nodes within a network, to provide the necessary data for safe operations. This can only work if CNS evolution is addressed globally with all the actors participating in data exchange.

**“For the first time ever,  
the average number of  
provider aborts have fallen  
steadily from 30 to 4.4”**

**Jacky Pouzet**

Head of the Communication and  
Frequency Coordination Unit, EUROCONTROL

