

The Essential Role of Aircraft Automation in Air Mobility

James Owen, Blue Bear Systems Research

GUAAS 2022

The Essential Role of Aircraft Automation in Air Mobility

- The global airspace is becoming increasingly busy with an ever increasing demand for air mobility and the need for true interoperability between piloted and unpiloted platforms in crowded environments.
- In order to cope with these increasing pressures the instantiation of multi-modal aircraft automation using agile, modular architectures is essential in successfully and safely opening up new capabilities in Air Mobility – in urban and extra-urban use cases.
- The use of increased automation allows for the deployment of piloted and unpiloted systems with high reliability and predictability, whilst resulting in less burden on the operators, regulators, airspace managers as well as reducing cost and logistics.
- This reaches its highest capability and benefit when instantiated in concert with the commensurate levels of supporting digital infrastructure and developments in operational architecture and regulation.
- Aircraft automation must therefore be framed within a supporting ecosystem that integrates the autonomy on board the platform into a cohesive developmental and operational environment that provides full end-to-end integration of the capability, as well as preserving traceability and assurance.
- As such, whilst aircraft automation is essential to our development, it should be conceptualised and implemented as part of a full *ecosystem*.

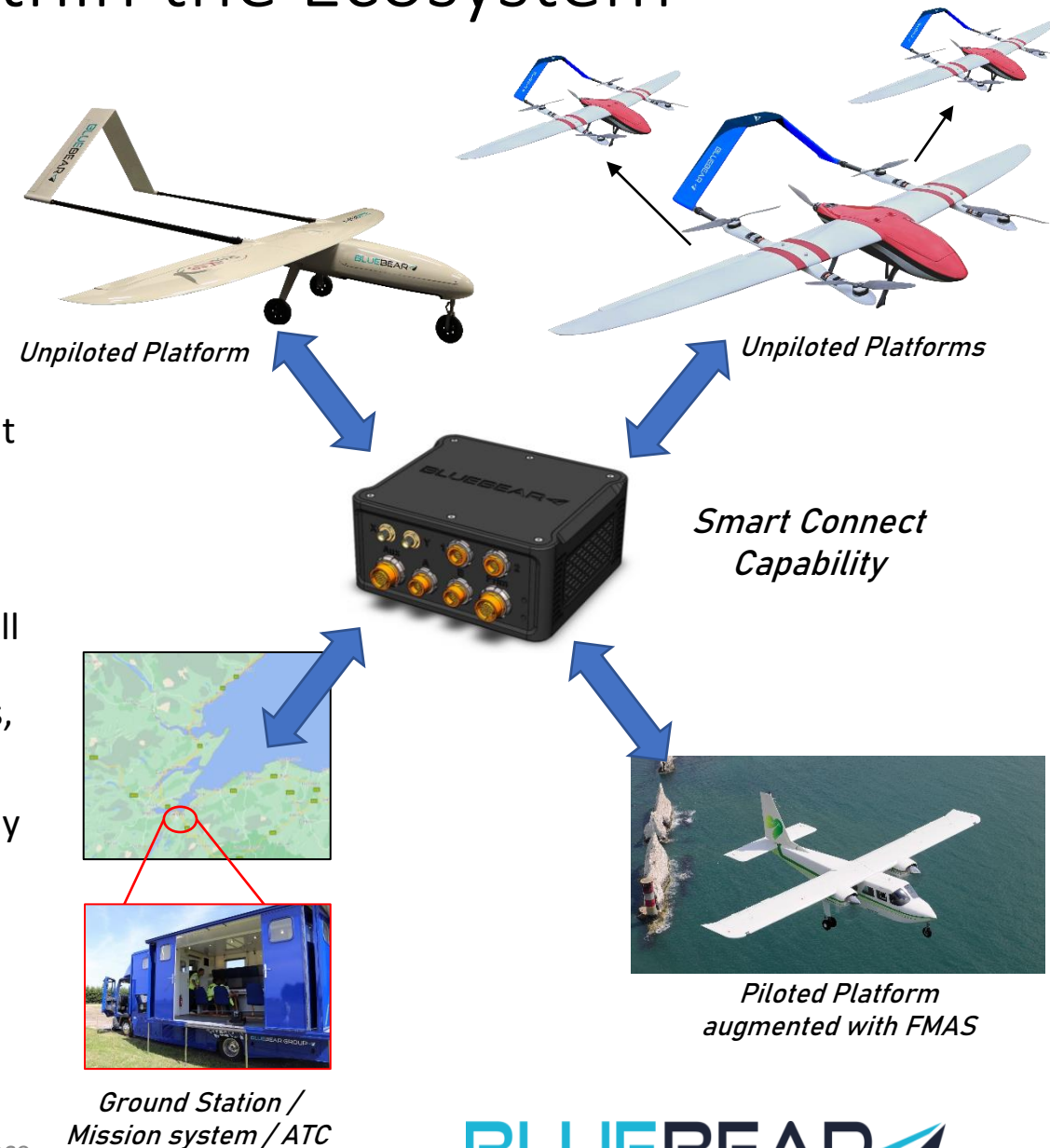
Platform Automation

- Agile, modular automation and autopilot systems can be utilised in the operation of a range of platforms – both unpowered and powered.
- In unpowered platforms, the use of true autonomy is essential in deployment of BVLOS capabilities as well as the management of problems of operational multiplicity and management of crowded airspace.
- Ensuring that platforms are enabled to operate safely and reliably without constant control inputs from a human pilot is essential to allow operation within a crowded airspace, and to enable many of the nascent use cases: delivery, logistics, inspection and surveillance.
- Automation within powered platforms is just as important, as it opens use cases that presently prevent the competition of sub-regional aviation against conventional, congested means of transport.
- By equipping powered platforms with modular, agile automation systems, flights are made safer and more reliable, the use and certification of Single Pilot Operation Aircraft is enabled and, combined with other development (electric and hydrogen-electric power trains, for example), sub-regional aviation becomes much more competitive with carbon intensive, congested conventional transport.



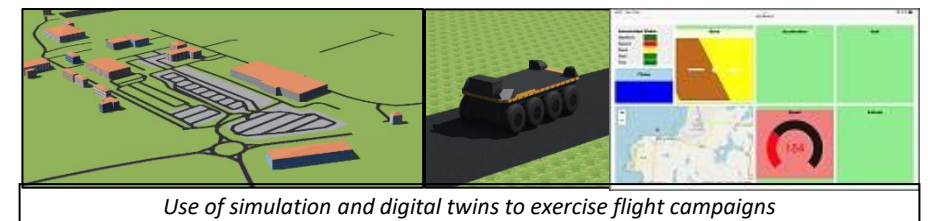
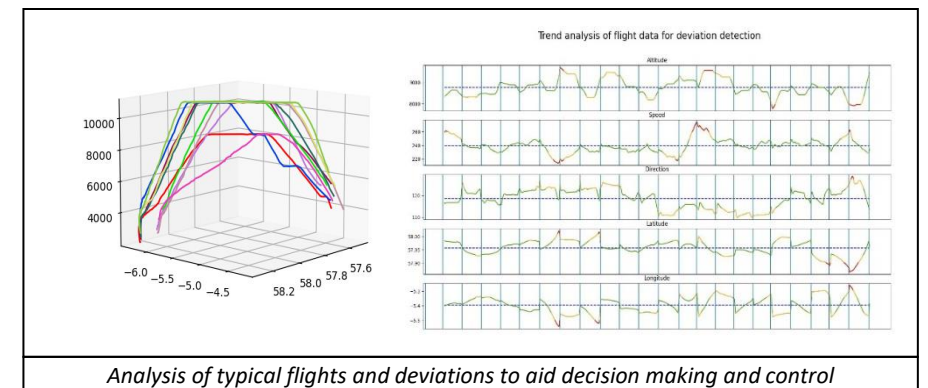
The Role of Automation within the Ecosystem

- Automation allows for the increasing integration of aircraft into a digital ecosystem that allow interoperability across platform and airspace types, whilst enabling tactical and strategic deconfliction.
- This requires the adoption of cornerstone technologies to enable the connectivity of the platforms and their integration into the ecosystem – such as SmartConnect.
- SmartConnect allows platforms to be connected to a digital ecosystem that seamlessly bridges the on board systems of the aircraft with Blue bear autopilot systems, ground stations and mission systems to allow for single node and multi-nodal connectivity.
- Coupled with Blue Bear’s state of the art mission systems, this creates a full digital ecosystem that allows for the end-to-end capability of true autonomy for platforms, whilst ensuring that operators, mission managers, UTM/ATMs have a full picture of all operations.
- On-board automation of the platform – piloted or unpiloted – must be fully integrated into this kind of operational ecosystem in order to be able to operate and interoperate successfully and safely.
- This cohesive environment also allows for potential information exchange to and from external ecosystems to give awareness and digital synergy.



Automation, Simulation, Agile Digital Assurance

- Highly automated aircraft systems and supporting ecosystems are also able to take advantage of agile developmental methods such as digital twins, simulated environments, digital verification and assurance.
- The operation of platforms can be replicated, exercised and rigorously explored within a simulated environment, using fully representative digital twins of the platform and on board systems, which can be validated with real world flight data.
- Developments in functionality, control, communications and operation can all be developed and de-risked within this ecosystem, therefore reducing the burden of real world testing.
- The entire flight envelope of a platform, as well as the operational constraints of its use within different paradigms can be fully exercised.
- More digital development allows for the deployment of agile digital assurance tools, utilising MBSE and modular architectural methodologies in the design, reducing the cost and time burdens of development whilst preserving traceability and assurance.



The Essential Role of Aircraft Automation in Air Mobility

- In order to enable the future airspace to operate with the demands for urban and extra-urban mobility, both in piloted and unpiloted platforms, use of aircraft automation within an appropriate operational architecture is essential.
- This must be complimented with a supporting ecosystem that integrates the autonomy on board the platform into a cohesive developmental and operational environment
- This holistic approach to autonomy and automation enables huge benefits for the aerospace industry as it moves to address ever more demanding and challenging needs.
- Blue bear Systems Research are actively leading and participating in cornerstone programmes for the future of aircraft automation and air mobility, such as Project HEART, Airspace of the Future, NAVISP and many more.
- Through deployment of its world leading capabilities in BVLOS operation, platform automation, critical mission systems, digital operational ecosystem and cornerstone technologies such as SmartConnect, Blue Bear Systems Research will continue to drive the development and deployment of aircraft automation and agile, innovative methodologies within the industry.

