

INNOVATION  
DEFENCE  
SECURITY



## Innovating to make products secure

At Airbus, innovation in terms of aircraft security involves both onboard systems and manufacturing environments. The latter include production, assembly and testing facilities: critical phases of a programme during which the aircraft on the ground is especially vulnerable. Innovation is focused on

the two major types of threats: physical threats and cyber threats. It should be noted that the two big international aircraft manufacturers are in competition in all areas except when it comes to aircraft safety. Airbus is thus collaborating with its American counterpart to make air transport more secure.

# Innovation

## weapon against conventional physical threats



Airbus is working with airport authorities and airline companies to come up with technological solutions to face the range of physical threats liable to affect flight security, whether hijackings or the detection of bombs onboard the aircraft.

Airbus is thus working to increase the level of protection on the flight deck, the nerve centre of an aircraft, to prevent intrusions. Work is notably focusing on the design of reinforced cabin doors (lighter material that is resistant to bullets of a certain calibre and to violent break-ins) as well as the installation of an airlock system that provides a second layer of security (privacy door or secondary barrier).

Controlling access to the cockpit through biometrics is also an area of innovation and could make it possible, for example, to define a level of access for each crew member that could be reconfigured as needed. This technology could also be applied to the activation of flight controls to restrict their use to the pilots only. Making the work

of the latter more secure is crucial, and solutions have been implemented that involve over-pressurisation of the flight deck to enable the evacuation of smoke and to prevent toxic gases from getting into the cockpit.

To innovate is also to be capable of meeting all the new regulatory requirements established by certification authorities. Since the 11 September 2001 attacks,

Airbus, like all civilian aircraft manufacturers, must, for every aircraft, define an area of greater resistance in which an explosive found onboard could be placed and confined (as decided by the captain), to limit the effects of any explosion that might occur. To design these “least risk bomb location” (LRBL) areas, on both the A380 and the A350, it was necessary to set up an area of the aircraft far from the cockpit and free of any critical cables, hydraulic circuits and fuel lines that might be altered by the projection of very-high-energy particles. Airbus envisioned and designed this LRBL area so that it would be capable of absorbing the shockwave (blast) of an explosion without weakening the integrity of the aircraft structure. Adaptation work is being carried out in parallel on previous-generation aircraft. In addition to these solutions, and to make these aircraft increasingly more secure, Airbus has also been working closely with innovative SMEs that are designing highly resistant bags in which such an explosive could be placed and which would contain the effects of a blast and limit shrapnel injuries.

# Innovation

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weapon against new physical threats



The emergence of new threats to passenger air transport has led Airbus to study and develop novel technologies to counter MANPADS (portable surface-to-air missiles), blinding lasers or other civilian drones.

Finally, Airbus Group divisions are also innovating through their internal processes. Indeed, all processes involving the definition, development, manufacturing and operation of aircraft are reviewed and updated through a Product Security Management System (SMS) to ensure that Airbus Group's cyber security goals are taken into account at all stages of an aircraft's lifecycle.

The cyber security of products is gradually becoming

part of the company's DNA. Protection of military, government and business aircraft against MANPAD firings has led Airbus Group to work in partnership on counter-measures that integrate a detection system capable of detecting and blinding the seeker of a potential missile.

The proliferation of lasers that can be bought for a few tens of dollars, and whose power of several watts can travel over several dozen kilometres, represents a serious threat for pilots during take-off and landing. Particularly dangerous for approaching night-time flights, with pilots being tired and the aircraft's fuel tanks nearly empty, these lasers can damage the retina and force pilots to accelerate once again and remain in a holding pattern.

While the placement of polarising filters on the cockpit is one solution being considered, it is currently very difficult to filter several multi-coloured laser frequencies. Airbus has chosen to innovate with breakthrough technologies, by teaming up with the world's only manufacturer of nanotechnology-based multi-frequency filters. The solution is currently in the industrialisation stage and could be applied through the use of a filter placed directly on the windows of the cockpit. For its next generation of aircraft, Airbus is working with windshield manufacturers on the design of glass that directly integrates this anti-laser filter into the windshield.

Small civilian drones, now available at low cost and easy to use, are also a threat during airport approach phases. Although they are not a hazard for an aircraft during the landing phase, when the need for power is less, the speed is lower and the engines are capable of absorbing what would amount to a "bird strike," this is not the case when it comes to take-off (need for power, full reservoirs). While working on innovations when it comes to absorption of a drone impact, Airbus Group is providing airport authorities with assistance and advice making it possible to envision new ways of enhancing security.



## Innovation

benefiting cooperation with counter-terrorism units

Airbus is working closely with anti-terrorism units by notably providing them with up-to-date technical files on its aircraft in service. And by developing innovative solutions, such as onboard video cameras. Offered as a catalogue option for certain models, such as the A380, they enable the cockpit to directly receive images of the cabin without opening the door of the cockpit, enabling crews to monitor passenger activity. The cameras can also be used as evidence in the event of harassment or unusual behaviour. They might also be used by counter-terrorism units, in preparing an assault in the event of a hijacking.



# Innovation

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## weapon against cyber threats

Attacks aimed at computer systems are liable to have an impact on all of Airbus Group's products, including satellites, helicopters and launchers... In the field of cyber security, to innovate is to design solutions that ensure the protection of aircraft and their manufacturing environment against deliberate or non-deliberate attacks, a virus being capable of spreading across a system and, in fact, going beyond its source's target. For Airbus Group, this involves integrating these solutions well in advance, into the principle of the system architecture itself. On the A380, flight controls have therefore been placed on a different network than that of controls affecting passengers or cabin crew. Airbus Group must then ensure that this partition of systems is not modified by operators, for example, by the interconnection of two partitioned systems. Hence the intense lobbying effort to have certification authorities carry out inspections.

The supply chain, very important on production and assembly sites, is closely monitored by Airbus Group. Notably by ensuring that all the software used for the design or control of the aircraft are integrated. Since the A380, Airbus has required an electronic signature from its suppliers, making it possible to ensure the integrity, and the origin, of the software, and to serve as a tracking tool in the event of a problem. This is a major challenge for Airbus, a pioneer in the field with the A380 programme. These monitoring procedures have become a worldwide standard adopted by all manufacturers for all new models of aircraft. All Airbus and Airbus Helicopter products in service are currently being upgraded to benefit from these control measures, and the group is simultaneously working on making the downloading of software on its aircraft more secure.

Making all production sites more secure involves an industrial monitoring system that enables Airbus Group to ensure the trustworthiness of its suppliers. This involves detailed security auditing procedures. Airbus continues to innovate in terms of protection against cyber threats to ensure the security of the operational lifecycle of its aircraft. Whether to protect the aircraft's wireless communications with ground control—an A380 or an A350 receives its flight plan and sends its maintenance report to the airline's operations department using wireless networks—or during phases of a flight. Airbus is helping to make future air traffic communications more secure as part of the European SESAR programme and the U.S. NEXTGEN programme. As well as onboard systems, notably in-flight entertainment systems (IFE), occasionally targeted by hackers trying to break into them for recreational purposes. The same goes for credit card terminals used for duty-free payments. To counter these threats to the potential commercial impact, Airbus Group is working in partnership with innovate SMEs on independent algorithms for detection (through Big Data) that enable the aircraft to automatically, and without assistance, detect the source of an attack. It is also working on a mechanism enabling all the Group's partners involved in the operational life to have access to a common catalogue of threats.

In parallel, Airbus Helicopters has made a commitment to its government clients with Science and Technical Projects, aimed at defining, in collaboration with its industrial partners, cyber security architectures and mechanisms that will equip future government helicopters.

# Innovation

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for defence requirements



## MBDA : Innovation

MBDA is implementing an innovation strategy that takes the specificities of defence markets into account: it must be efficient (to meet the needs of the armed forces), resilient (a product's development takes a long time and its lifespan is important) but also effective (defence budgets are very limited). Given the government's role in the funding of defence activities, it is vital for MBDA to steer its innovation policy in close partnership with the DGA, in order to have optimal knowledge of evolving operational requirements (capabilities, concepts of use, support, etc.) being considered by the domestic customer in the next 10 to 20 years. This knowledge is the result of an ongoing dialogue with the DGA and defence headquarters, in which the manufacturer can make a useful contribution by offering its vision of the evolving market. MBDA is thus able to identify optimal innovations and technologies to be implemented to satisfy future requirements. This makes it possible to achieve resilience in the company's innovation policy. The latter is carrying out independent actions in the area of innovation, which are either internal to the company, or carried out at its initiative with external partners. Among the internal actions:

- **A network of experts** that is clearly identified, to serve as technical references in their areas of expertise and notably in charge of stimulating innovation..
- **Innovation Boosters**, resources put in place to help MBDA teams solve difficult problems thanks to the use of problem-solving techniques (NEMO2, TRIZ, YU-MAN, etc.), implemented by 50 internal facilitators trained in these techniques.
- **The IDEA Challenge**, which makes it possible for company employees to offer suggestions and answers to specific questions asked by an MBDA team. Over the last 10 years, nearly 7,000 ideas have been submitted and 700 of them have been rewarded. The effectiveness of this tool will be reinforced by an in-house social network that is currently being set up.
- **The Concept Visions Challenge**, organised each year and enabling a team of 10 young engineers from four MBDA countries to spend three months working on proposals for innovative concepts based on technologies accessible beyond a 20-year horizon and aimed at ensuring a given operational capability (e.g., long-distance land strike launched from the sea). The result is presented at the Paris and Farnborough Air Shows.

- **Innovation Corners**, allowing a team to rapidly present (two hours using educational panels and demonstrations) the principal advances in its field of activities to all interested staff members.

- **Annual Innovation Awards**, aimed at identifying the eight most important innovations of the year. Like those awarded for the establishment of MBDA's specialised Franco-British centres of industrial excellence, the CAMM missile's Solid State seeker or the interception of a European ballistic missile by the Aster system.

- **Innovation Labs**, where the company allocates a limited budget (50 to 100 K€) over a short period (six to nine months) making it possible to bring an idea to the concept stage prior to the possible launch of a project.

In the case of actions with external partners, MBDA has largely developed Open Innovation, via its participation in a number of initiatives:

- **Cooperation**, most often formalised by partnership agreements, with numerous research centres in France and in Europe, such as ONERA, the Institut de Saint-Louis, the CEA, Ecole Polytechnique, Cranfield University).

- **Club Rapid (Pacte Défense PME)**, which allowed



MBDA to meet with, over the past year, nearly 70 innovative SMEs in the defence field, identified by the DGA, and to conduct exchanges with them in order to better understand their potential contributions to the French missile industry.

- **Pacte PME**, which enables the company to more widely identify French SMEs likely to offer innovative solutions in precise areas. Nearly six working days on 10 distinct themes allowed MBDA to meet with 100 SMEs in 2015, with concrete follow-up being planned with several of them.ch.

- **Centres for Competitiveness**, such as Astech.

- **Innovative start-ups**, with discussions underway on the implementation of a Corporate Venture-Capital-type of initiative, strengthening innovation and ties with start-up companies likely to offer key competitive advantages for the company.

## COUNTERING new threats,

## MAKING a difference on theatres of operation and on the export market

### AIRBUS DS Innovation : ARBS refuelling systems



Le ravitailleur A330 MRTT (Multi Role Tanker Transport) d'Airbus Defence & Space est proposé avec le système de ravitaillement en vol le plus avancé au monde : l'Aerial Airbus Defence & Space's A330 MRTT (Multi Role Tanker Transport) is offered along with the world's most advanced in-flight refuelling system: the Aerial Refuelling Boom System (ARBS). Located under the rear fuselage, it is controlled remotely from the cockpit by a Remote Aerial Refuelling Operator (RARO). Thanks to a stereoscopic vision system and laser infrared lighting, the latter can operate by both day and night, regardless of weather conditions. The ARBS' refuelling pole, which is 18.2 metres long, provides it with a geometric shape that is three times the size of that of the KC-135 and provides the best performance on the market in terms of transfer speed (4,600 litres at 50 psig), reducing refuelling time accordingly.

## AIRBUS Helicopters: Tiger MKIII

At Airbus Helicopters, programmes underway are aimed at enhancing the maturity of those technologies likely to be integrated into an MKIII version of the Tiger helicopter.

In particular, research and studies are being carried out on the improvement of features in the area of survivability, interoperability and maintenance, with a strong goal of reducing costs over the lifecycle of the aircraft.



**INNOVATE** by building on the lessons learned  
by forces in combat

