

US Air Force - SAF AQI

By Dr Gerald R Sayer



Operation of UAS in the Non-Segregated NAS

Progress is being made towards safe and seamless integration of unmanned aircraft systems (UAS) into all classes of airspace. Stakeholders Public Military and Civil plus Commercial need to work diligently together to make this goal become a reality this decade! The Next Generation System (NEXTGEN) and the Single European Sky Air Traffic Management (ATM) Research (SESAR) program are opportunities for UAS Integration for both the US and European airspace structure which are currently limited in capacity and adaptability.

Next Gen is to transform the US NAS by 2025 including the busiest airports. SESAR is a plan of Traffic Management modernization by 2020. The goal of both is to improve the safety, security, and efficiency of their airspace system. Figure 1 is a view of today's NAS and tomorrow's NEXTGEN airspace system.

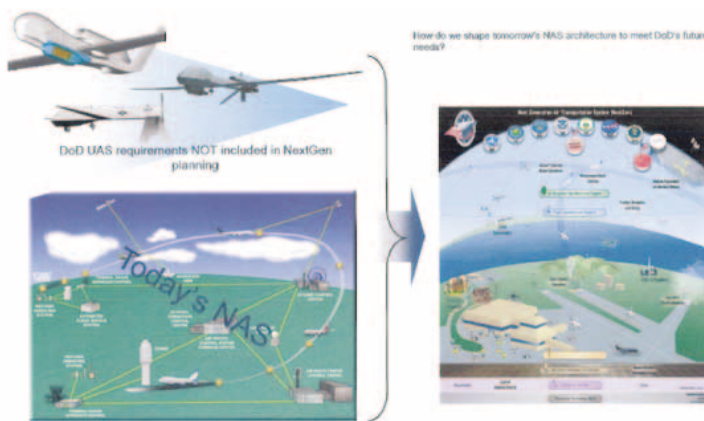


Figure 1

Although currently the US DOD UAS requirements are not included in the NEXTGEN plans, the FAA's JPDO is commencing work in this important area. Under NEXTGEN ATC will switch to ATM as the new equipage will be space based; examples are ADS-B surveillance, 4DTrajectory management RPN, CNS/ATM, Network enabled Information Access, Weather assimilated into decision making, etc. These are all driving requirements for aircraft avionics and operational procedures worldwide.

The integration of UAS in Civil Airspace is not the end goal but rather will enable UAS to maneuver, that is, to

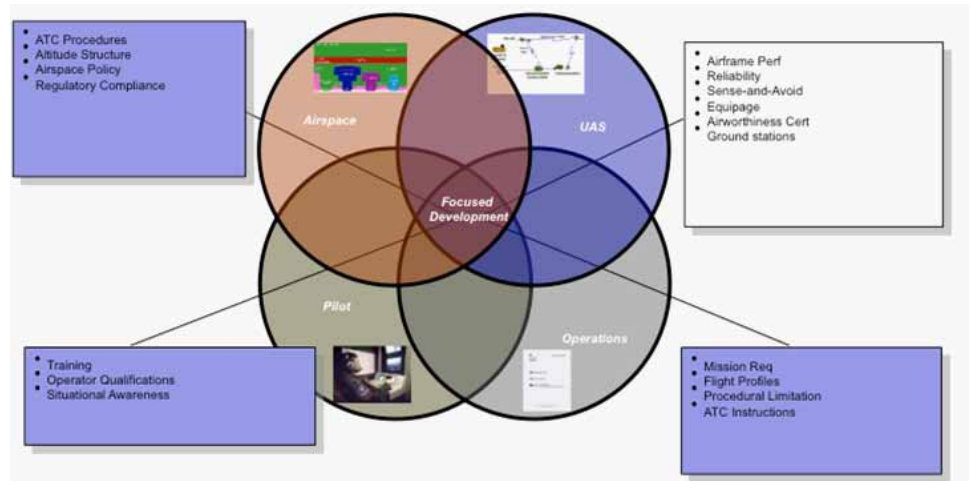


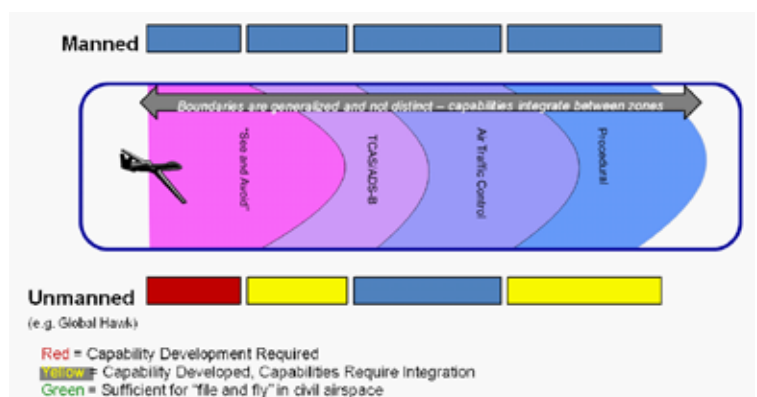
Figure 2

go to relevant locations to both train and perform their missions while assuring safety of the air space. This is inherent in Global Access requirements and fundamental to Airpower and Military utility.

Figure 2 presents a look at Remotely Piloted Aircraft Airspace Integration which is also a representation of the JUASCOE's 5 Pillars (discussed below).

For the RPA airworthiness certification of both hardware and software of the whole system i.e. the aircraft, ground station and data links. The 5 Pillars are major challenges derived from the JUASCOE CBA and draft ICD in 2009. These are Airworthiness (AW), Operating Standards and Procedures (OSP), Pilot/operator (PQ)), Sense and Avoid (SAA), and Equipage (EQ). In addition there are three other challenges: command and control link spectrum, ability to avoid hazardous conditions, and the establishment of the appropriate levels of safety for routine operation of UAS in Civil Airspace. A key OSP is lack of a policy for "loss links". Work is commencing on upgrading MILHDBK 516B to include UAS criteria and certification process. Sense and Avoid both ground

Figure 3



(GBSAA) and airborne systems (ABSAA) are needed to meet 14 CFR Part 91.111 and .113 which requires vigilance and do no harm. All the DOD's Services are pursuing both SAA approaches. UAS operators must understand not only their own systems capability but also the rules of each class of airspace. Training is essential to establish levels of qualification. Operating standards and procedures (from 14CFR 91.113) are currently under development for UAS. Equipage/avionics is changing and UAS need to integrate and test them e.g. ADS-B, 4DT, CNS/ATM, etc. Currently UAS cannot operate routinely in the NAS as they require TFRs (Temporary Flight Restrictions) and COAs (Certificate of Waiver or Authorization). These are restrictive and a poor use of airspace. System Safety analyses are ongoing, where TLOS (Target Level of Safety) is the most current approach for UAS. Although quantitative metrics have not been assigned a, at a minimum it will probably be 3x10⁻⁶ collisions per flight hour (equivalent to an F-16). The "view of Airspace Integration is displayed in Figure 3 comparing the status of manned and unmanned aircraft today.

The US OSD Airspace Integration Strategy which is pursued by the UAS Task Force with its 5 IPTs (Interoperability, Airspace Integration, Frequency and Bandwidth, Research and Engineering and Sensors and Payloads).

It is the vision of the OSD that Public Military UAS will be seamlessly integrated and interoperable with other users of the NAS, operating safely, efficiently and compatibly to insure overall safety is not degraded in accordance with FAA guidelines. For military operations UAS will operate with manned aircraft in and around airfields using CONOPS (Concept of Operations) making pilot/operators on or off board distinctions transparent to ATC (Air Traffic Services) authorities, airspace regulators, and other airspace users. Guiding precepts for UAS Airspace Integration n operations are: Do NO Harm, Conform rather than Create, and Set the Precedent. SDOs (Standard Development Organizations) both National and International offer a forum for the UAS community to develop consensus-based standards. Incremental steps are needed to meet these Airspace Integration challenges, some are tactical or near term and others are strategic or longer term.

The results of implementing this strategy are:

- Recommended changes to existing policies and procedures;
- Establishment of Standards and Regulations to enable UAS Integration into the NAS; and
- Technical solutions (certifiable) to meet these standards. UAS vary depending on which UAS Group they fall into based on airspeed, max gross weight and operating altitude.

The European Defence Agency announced in October of 2009 at the ICAO Global Traffic Management Forum in Montreal their major strategic technology program in the Sense and Avoid area called MIDCAS. Its mission is to demonstrate a UAS Mid-air Collision Avoidance System; standardization of an approach for a common transatlantic way forward. This four year project is funded at 50 million Euros with up to 13 European Industrial companies participating and Sweden as the lead nation.

Looking ahead for 2010 and beyond:

- ASTRAEA has received funding this year and will exploit synergies with the MIDCAS program which should benefit progress in SAA solutions
- The FAA's small UAS Aviation Rule Committee produced a document in late 2009 which is going thru the approval process expected by late 2011. This covers UAS in Group 1 and some 2s, aircraft up to 55 pounds.
- Due Regard operations are important for military aircraft operations operating over the oceans. The US Navy's

BAMS UAS program is developing an on board radar to provide a self separation capability by 2012.

- The 2010 National Defense Agency Act requires the DOD, DOT and DHS to deliver a plan for increased NAS access by summer of 2010.
- The USAF will conduct a surrogate MQ-9 SAA demonstration late spring of 2011 followed by a demo on a MQ-9 in 2012.
- The DOD expects to stand up many more UAS locations in the US and internationally over the next few years. Global Hawk examples are squadrons to be stood up at Grand Forks, ND, Anderson AFB in Guam, Sigonella, Italy and the Euro Hawk in Germany all in 2011. The DOD is working on foundational activities such as:
 - updating Mil HDBK 516-B to add UAS criteria for certification purposes
 - improving Pilot/Operator training and standards
 - addressing procedural issues for class D/G airspace, COA reform, ATC terminology, lost link/divert guidelines self separation, collision avoidance criteria and operating area rules
 - pursuing material technology such as GBSAA, ABSAA, self- separation/ collision, weather avoidance, ADS-B, 4DT, etc.
- The World Radio Communications Conference to be held in January-February 2012 in Geneva, Switzerland where frequency and bandwidth spectrum for UAS control and communication data links.

There is much to do to achieve the desired end state of safe and routine access to civil airspace for all UAS Stakeholders. The challenges and potential materiel and non materiel solutions are not trivial and will require continued effort and funding to achieve world wide access to civil airspace. We are at the dawn of a new era in aviation and All must cooperate to have routine operation of UAS in the World's Airspace a reality.

Dr Gerald R Sayer
US Air Force

