ICAO RPAS 3

RPAS Operations, Impact on Commercial Airspace Users

September 2018

Safety is IATA's primary mandate

- It is critical to ensure that relevant risk assessment models and proper safety management systems are in place for RPAS operations.
- While the development around UAS technologies may provide opportunities, irresponsible use in close vicinity to airports and manned aircraft may pose a risk to civil aviation
- It could be said that; the risk associated with small UAS being used by people unfamiliar with or having little awareness of civil aviation and its regulations, only increases the need to develop the associated standards and regulations surrounding these activities

RPAS Operations; in general

- Access to airspace should remain available to all, providing each UAS is capable of meeting the pertinent conditions, regulations, processes and equipage defined for that airspace;
- New types of operations may need additional or alternative considerations, conditions, regulations, processes and operating procedures, with the objective to add only the minimum necessary to achieve safe operation;
- An RPA needs to have the functional capability to meet the established normal and contingency operating procedures for the class of airspace, aerodrome etc. when such procedures are available;

RPAS Operations; in general

- An RPA flight operation cannot impede or impair other airspace users, service providers such as air traffic management (ATM), aerodromes etc., or the safety of third parties on the ground and their property etc.;
- An RPA must operate in accordance with the Rules of the Air;
- An operator must meet the applicable certification/approval requirements; and
- When utilized, a remote pilot must be competent, licensed and capable to discharge the responsibility for safe flight.

RPAS Operations; Anti-UAS Measures

- IATA is working closely with governments and aviation agencies deploying anti-UAS measures to ensure that these measures are implemented following an appropriate safety assessment, in order to support:
  - Continuous monitoring of UAS activities;
  - Effective countermeasures that can be activated in time to prevent an UAS from entering an area of interest, including safety-sensitive areas such as final approach, missed approach and departure paths
  - Implementation within the airspace where there are substantiated safety and security risks caused by UAS activities. The risks should be able to appropriately justify associated infrastructure and operational costs for the anti-UAS measures such as:

RPAS Operations; Anti-UAS Measures

- Radio-frequency (RF) signal analyzer – to monitor, detect and analyze all relevant radio frequencies and supporting techniques, such as frequency hopping, which are used to control the UAS.
- The RF signal analyzer can be used in combination with a direction finder to locate the UAS operator. This technique is particularly applicable to FHSS (Frequency-Hopping Spread-Spectrum) UAS operating at 2.4GHz frequency band
- Uncooperative RADAR, optical (e.g. VDO and thermal tracking cameras) and acoustic technologies for detection of UAS flying autonomously that may/may not have a simultaneous radio control link
- RF Signal Jamming - selective jamming of the RF signal being used to control the UAS
- Wireless Local Area Network (WLAN) signal interruption - interruption of WLAN used by some UASs or broadcasting a set of radio communication (RC)/computer commands to “take control” of the UAS are possible. This technology should however be appropriately controlled to avoid instances of possible illegal sabotage or UAS hijack
- Use of UAS interceptors, UAS nets and trained predatory birds. These measures should be used with proper due regard to the safety of manned aircraft
- Other measures which create high risks and can cause dangers to other aviation stakeholders, such as the use of bullets and laser guns, should be avoided

RPAS Operations; Anti-UAS Measures

- It is essential that the aforementioned measures do not create unintended safety hazards and unmitigated risks to other aircraft and aviation infrastructures.
- Technologies that disrupt the command/control link between the UAS and operator must have mitigation procedures in place for UAS to maneuver during the ‘lost link’ stage
- UAS pre-programmed command functionality is not always guaranteed.

RPAS Operations; Anti-UAS Measures

- Interfering with radio frequencies being used by aircraft, air traffic management (ATM) systems and other legally authorized applications must be avoided.
- GPS/GNSS jammers and spoofing should not be used as anti-UAS measures as they can concurrently interfere with the operations of other aircraft.
- Technologies for protecting UASs against GPS/GNSS jamming and spoofing are being tested and expected to soon be commercially available.
- Anti-UAS RADAR-based systems used for ATM, such as primary surveillance RADARs for approach control and airport surface movement, need to be appropriately coordinated and empirically validated such that there will be no adverse impact to ATM.

RPAS Operations

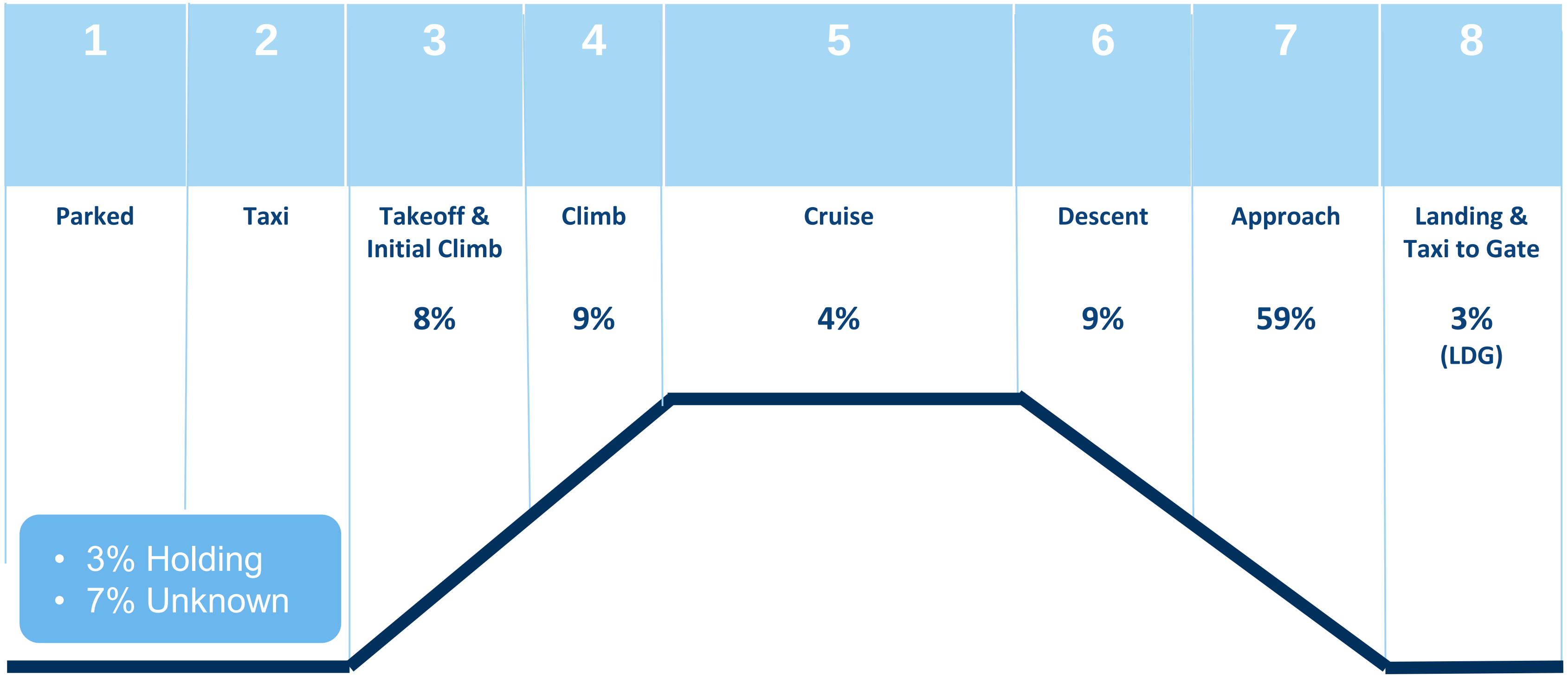
- UAS Traffic Management (UTM) will provide new opportunities for traffic management, separation standards, and airspace planning.
- Elements of UTM work could transition to and help advance Air Traffic Management (ATM).
- Future development of UAS and UTM systems could also help increase the level of safety in the airspace. In particular, automation and technological advances in the UAS industry could potentially be transferable and highly beneficial to the commercial aviation community.
- One critical factor to support advancements in UAS operations and UTM is the ease with which technical and performance data can be obtained.
- It is relatively cheap and quick to operate UAS compared with manned aviation.
- Regulatory authorities and relevant partners in the aviation value chain have quicker access to more operational data to help prove concepts and certify operations.

Operations in proximity to manned aircraft:

- At present, these missions may either be conducted as VLOS or BVLOS
- Are subject to more stringent risk thresholds to comply with higher target levels of safety associated with manned aircraft
- Primary means of achieving required risk level is likely through a combination of robust/redundant and low-latency command-and-control links;
- Precise lateral/vertical positioning and onboard traffic avoidance should be considered as a last-resort conflict resolution tool. Coordination based on real-time manned aircraft arrival/departure corridors in use will be essential.

IATA Analysis on RPAS Events

Phase of flight: 93% (448) of reports indicated phase of flight and as expected the majority of incidents were reported during approach, descent, take-off and climb.



IATA Analysis on RPAS Events

Average distance of aircraft from Airport:

- 29% (139) of reports indicated numerical distance of the aircraft from airport at the time of the occurrence, the global average was 6NM.
- 15 additional reports indicated UAS encounters in short final / final.
- Not all reports contained the distance of UAS from airport.

Average Vertical Separation between UAS and Aircraft

- 53% (255) of reports indicated vertical separation between UAS and aircraft (as described by the reporter).

UAS TCAS Events

IATA data indicates TCAS events were reported in 10 of the incidents that occurred.

- In 4 out of the 10 cases, the TA was followed by an RA.
- Out of 10 of the events, 9 events did not report the size of the RPAS.

And,

- Regarding Altitude:
  - Out of 10 reports, 50% (5) of reports stated the altitude of UAS.
  - Out of which, 3 UAS incidents were below 7000ft.

Was ATC aware that a TCAS Event had Occurred?

- Out of 480 reports, 64% (305) of reports stated that ATC was aware of the UAS or was informed by Flight crew.
- In the majority of occurrences, the UAS did not paint on the ATC radar
- Given the size and variability in shapes, it will be difficult for ATC to recognize small UAS, without the benefit of transponders

What Actions were taken?

Out of 480 reports, a variety of the reports described the actions taken by flight crews or ATC.

Examples of actions:

- Some aircraft were diverted due to UAS event, ‘Airport closed’ was the main reason for diversion.
- Diversions often followed a period of holding.
- If flight crews were able to visually acquire the UAS with sufficient distance, aircraft were maneuvered to avoid the UAS.
- In order to maneuver, the UAS was an average distance of more than 2NM horizontally and 350ft vertically.

Report Outcome types

UAS incident report narratives were studied and the outcomes grouped into three categories. Categories were based on the vertical and horizontal proximity of the UAS to the aircraft.

98% of the reports indicated an outcome type, the majority of reports were categorized as near-collisions based on the proximity to the aircraft:

- *Collision* : When there was a collision between aircraft and UAS.
- *Near Collision* : When the separation between UAS and aircraft was less than 3NM horizontally and 1000ft vertically.
- *Encounter*: When the separation between UAS and aircraft was greater than 3NM horizontally and 1000ft vertically.

Types of Operations and Risks:

Package Delivery:

- Payload-carrying vehicles that fly between warehouses or pickup points and delivery locations.
- Flights that operate with varying levels of autonomy in scheduling, dispatch/flight operations.
- Operator may have a human pilot monitoring multiple operations at once, but with limited capability to manually control the vehicle.
- Operator may have a human on the ground with functionally limited roles for loading, preflight checks or maintenance.

Risk: Number of operations may overwhelm the system, creating a hazard to operators in and around these areas

Types of Operations and Risks:

Emergency Response, Search-and-Rescue:

- Vehicles requiring priority handling and authorization in conjunction with police, firefighting or other operations critical to life.
- Vehicles may be deployed by a pilot at the scene of an event and operate similarly to a VLOS mission, or autonomously launch from a storage and recharge depot to the location where needed
- The UAS may need broader and faster access to controlled airspace that wouldn't otherwise be permitted.
- Flights may need to operate at altitudes above 400' AGL, or follow paths such as search-and-rescue grid patterns.

Risk: Possibility exists that Operations may require all other traffic to deviate from normal patterns, resulting in increased complexities for ATM system.

Types of Operations and Risks:

Urban air mobility/air taxi:

- Large VTOL vehicles that can carry 1-4 passengers over distances of up to 100 nautical miles and at altitudes up to 4,000’ AGL.
- Vehicles takeoff and land at designated locations, but may use helipads, playing fields or other open spaces as emergency diversion locations.
- Vehicles may have an onboard safety pilot during initial deployment phases, and/or monitored by a human in a ground control center with limited override capabilities.
- Vehicles should be equipped with detect and avoid (DAA) sensors to ensure they may deviate for birds, non-cooperative aircraft or uncharted obstructions.

Risk: Given the expectation that these vehicles will plan to operate in and around airports, there must be an assessment done to mitigate any possible conflicts.

Air Traffic Control or Management:

- Assuming that the current vision of establishing an autonomous traffic management system UAS operations in controlled airspace is valid, the development of procedures, routes and separation rules to avoid conflicts with manned traffic is a must.
- In the event of failures of the communications link, a UAS Traffic Management Service Provider, will need to ensure those monitoring UAS flights are awareness not just of the impending unresolved conflict, but also of any follow-on conflicts that might emerge based on the first set of control instructions.
- Design and development of decision support tools, must provide controllers with suggested best courses of action so that the controller doesn’t have to gain full situational awareness of a dozen vehicles in their airspace that *may* pose conflicts?

Risk: The relationship between ATC and UTM will need to be clearly defined, as the concept develops. Unclear airspace boundaries and operating procedures will increase the potential for conflict or collision

Key findings

- Data suggests that UAS reports are under represented, which indicates there were far more UAS incidents during 2012 to 2016 than what is reported.
- IATA has compiled data indicating that there were 472 UAS reports which led to 91 encounters, 378 near-collisions and 3 collisions.
- 64% of the total UAS incidents occurred during approach or initial climb phase.
- The relationship between ATC and UTM will need to be clearly defined, as the concept develops.
- Airspace, equipment, and tools will all play a significant role in assisting the personnel that will manage these two similar, yet different, systems
- The costs associated with the introduction of UAS into the terminal area, must not adversely affect the primary objective of ensuring Safety and Efficiency.