Detect and Avoid Equipment and Systems

Company Name	
UA Make	
UA Model	

Introduction:

This document is a tool to help applicants document their Detect and Avoid strategy when requesting to operate beyond visual line of sight (BVLOS) without VOs. Filling out this form is entirely voluntary and is only provided to assist applicants in making a full and complete safety case.

Flying an unmanned aircraft system BVLOS is a unique situation and contains inherent conditions distinct from visual line of sight (VLOS). As such, this document can be used to document the technological mitigations used for a layered mitigation strategy to avoid cooperative and non-cooperative manned aircraft and reduce the overall risk of BVLOS operations. Information provided here will be considered when evaluating applications for waivers and exemptions, as appropriate, but may be submitted in other ways as well. Operations under this framework consider the following:

1. Aircraft Size
2. Aircraft Weight
3. Operating Speed
4. Operating Altitudes
5. Operating Timeframe: Day/Night
6. Right of Way Procedures
7. Emergency Procedures
8. The ability of the UAS to yield the right-of-way to all manned aircraft broadcasting ADS-B out
9. The avoidance maneuvers performed by the UAS and that they do not induce additional safety issues

Note: Operations will be reviewed on a case-by-case basis and the FAA may determine that an operational evaluation is necessary when considering the design, operational capability and other aspects of the proposed system.

Detect and Avoid (DAA) System Components:

Please submit Aircraft DAA systems, equipment and capabilities information and answer the following questions. If your company has multiple Makes or Models with different DAA equipment, please submit separate documents. Thank you.

Make	Model	Airborne / Ground	Description (Radar, Electro-Optical, ADS-B In, Acoustic, LiDAR, HD Surface or Terrain maps, SLAM Algorithm)

Detect and Avoid (DAA) System Description

General	
1	Describe the system components.
2	Describe the DAA telemetry elements provided to the RPIC. (examples include heading, altitude, speed, distance from UAS, system status, etc.)
3	Describe how the DAA system status and alerts are displayed to the RPIC or Electronic Observer? Are there visual as well as audible cues? (Visual warnings in telemetry use graphical elements and color-coding to alert operators to potential issues, system statuses, or anomalies. This may also include dashboard icons, pop-up warnings, or animated gauges and graphs)
4	What are the alerting criteria for non-cooperative intruders and ADS-B equipped intruders? (e.g., does the system have differing alert levels dependent on the distance, altitude and vector of the possible intruder)
5	What is the avoidance strategy? (Are the maneuvers automated, or do they require PIC action? What is the expected time from alert to mitigation? Etc.)

6	When is the avoidance strategy active. (For example, active during enroute but not landing or taking off)
7	Describe the RPIC role for monitoring and taking actions.
8	What safeguards are there to protect the system from undesired behavior? (If the avoidance maneuver is automated, is the RPIC able to monitor the avoidance maneuver and take manual control if necessary? If RPIC initiated, what happens in the event of a C2 loss?)
9	If automated, describe the procedures upon system failure. (e.g. return to home, hold in place, land now, Lost link procedures, etc.)
10	Is there adequate low-altitude DAA coverage to support the operation? (Describe the operational volume coverage.)

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11	What is the effective range of the system in detecting other aircraft? (This should describe the detection range with any classifier in place, just as the system would be intended to be operated.)
12	What is the minimum distance for detection so the avoidance strategy can be safely carried out? (How do you determine the time needed for detection of an intruder, alerting the RPIC/EO, and initiation and completion of the avoidance maneuver.)
13	What are the DAA systems equipment limitations? (e.g., night or lighting conditions, reduced visibility from fog or rain, attenuated signal from obstructions trees, rain, temperature, etc.)
14	Describe the command and control (C2) link to include the communications system from the GCS to the Dock (if used), Dock to the UA, or GCS to the UA. Include the operational frequency (e.g. 900 MHz, 2.4 or 5.8 GHz, LTE, 4G or 5G)
15	Is the system using any unlicensed frequency bands for C2? (If applicable, what frequency range is being used.)
16	Describe any FCC approvals obtained for the equipment.

17	Does the system incorporate the use of an Unmanned Traffic Management (UTM) system employed through an FAA Approved Unmanned Service Supplier (USS)? (If "Yes", provide identification of the Service Provider and the services they provide.)
ADS-B In	
18	Is the receiver airborne, ground based or both? (ADS-B out transmissions may be received or obtained through a sensor owned, operated, or controlled by the person responsible, onboard the UA itself, or an FAA approved third party ADSP)
19	Is the receiver TSO compliant and able to receive 1090 ES or 978 MHz UAT signals?
20	What is the receiver sensitivity expressed in dBm for the ADS-B in receiver element of the DAA system? (Note: A receiver sensitivity greater than -93dBm could indicate that the DAA system is not optimized for receiving ADS-B out broadcasts at a sufficient range to detect and avoid.)
Additional Sensors, i.e. Radar, Electro-Optical, Acoustic, Lidar	
21	Does the DAA system have obstacle avoidance equipment in place (Location of the obstacle avoidance sensors: [LIDAR on the UA, or relative to the GCS, as in map based])

22	If applicable, in what specific direction are the obstacle avoidance sensors orientated? Forward, rear, below, above? (Obstacle avoidance sensors with a directional view, such as those using LiDAR, radar, or vision-based cameras, detect obstacles in specific directions, providing a limited field of view rather than omnidirectional coverage. Directional capability offers high-resolution, focused detection ideal for path planning and safety in targeted areas.)
23	If ground-based, describe the mounting location. (Examples include mast mounted, directly on ground, on top of a building or structure such as an antenna or water tower.)
24	Has the DAA system been designed and/or tested using any published DAA Standards (DO-396, ASTM F3442-25)? (If yes, provide a compliance checklist, if available, and describe any areas of non-compliance.)
25	Have any of the DAA subsystems, such as a ground-based or airborne radar, been designed and/or tested using any published standards (DO-381A, etc.)? (If yes, provide a compliance checklist, if available, and describe any areas of non-compliance.)
26	What are the obstacle avoidance sensor equipment limitations? (e.g., night or lighting conditions, reduced visibility from fog or rain, attenuated signal from obstructions trees, rain, temperature, etc.)

27	If a risk ratio analysis was performed for the DAA system, what are the estimated NMAC and well clear (safe distance) Risk Ratios for the DAA system for both cooperative and non-cooperative traffic?

DETECT AND AVOID (DAA) POST TESTING REPORT DATA

Provide DAA system description and CONOPS/CONUSE

Provide Testing Methodology Descriptions

- Simulations
- With live aircraft
  - Provide type(s) of aircraft utilized during testing

Provide environmental conditions encountered during testing

Provide any anomalies (e.g. UAS or DAA system failures) that occur during testing

Provide the following Test Data Results

Detect Function:

- Detection Range
- Tracking Sensitivity (provide data on how well the system was able to acquire and maintain an intruder’s/multiple intruders’ track)
- Tracking Accuracy (provide data, reported by this function, on intruder’s/multiple intruders’ distance, altitude, speed, etc. when compared to intruder’s/intruders’ actual distance, altitude, speed, etc.)

Alert Function:

- Intruder distance, bearing, azimuth, altitude, heading, etc. relative to the ownship at the time of the alert
- Ownship altitude at time of encounter/alert

- Ownship heading at time of encounter/alert
- Accuracy (any false alerts, including alerts that initiated an avoidance maneuver)

Avoid Function (Can be RPIC generated or Autonomous):

- Intruder distance, bearing, azimuth, altitude, heading, etc. relative to the ownship when maneuver was initiated
- Ownship altitude at time of maneuver
- Ownship heading at time of maneuver
- Closest point of approach

System Latency and Timing:

- Data on system response times from detection to alert and avoidance maneuver execution. This includes individual component latencies and overall system timing.

Attestation:

a. The UAS will yield the right-of-way to all manned aircraft broadcasting ADS-B out, and when yielding right-of-way, the unmanned aircraft will not pass over, under, or ahead of the aircraft being yielded to unless at a safe distance. The operators “safe distance” is described as the following:

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b. The aircraft will detect AND avoid, or the operator must be able to detect AND perform an avoidance maneuver that does not induce potential safety issues though execution of emergency procedures such as a "land now" event.

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Signature Date

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Title of Individual Responsible