Protector Briefing Pack
for Technical Support Telecon
(Between MoD/CAA and FAA/USAF/GA-ASI)

Prepared by:

[Redacted]
Introduction

- PROTECTOR to be based on
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- UK effort has been focussed on de-risking aspects of the certification programme plan
- Above all, UK Cert Programme driven by MRP Regulation
  - Including emerging MRP Requirements (RA 5800 series) based on EMAR 21 (derived from civil Pt 21)
  - Recent incorporation of UAS specific regulation under RA 1600 (and associated regulation)
Initial Assumptions for Certification

- MGTOW will not exceed **[redacted]**.
- Basic design performance assumptions include:
  - **[redacted]**
  - **[redacted]**
  - **[redacted]**
- Structure is predominantly of carbon composite design, and will incorporate lightning protection and de-icing systems sufficient for **all-weather operations**.
- The design will include an automatic take-off and landings system (ATLS) as the **only** means of control for those initial and terminal phases of flight.
- Airspace integration design requirements will be derived from the PROTECTOR SRD to meet flight in **Classes A-C airspace as the Threshold** system requirement, with an ultimate objective to expand to **Classes A-G in the future**.
Initial Assumptions for Certification

- Flight control and payload control computers will be physically separated.
- The engine will be controlled by a Digital Electronic Engine Control (DEEC) unit and the design will include a mechanical reversion.
- Engine installation will include fire protection, and the UA will have backup electrical power (batteries) with recovery or termination of flight in the event of engine failure/loss of power.
• Unmanned Aircraft
  – STANAG 4671 (Edition 2) - USARs
  – Def Stan 00-970 – UK Airworthiness Requirements
    • Pt 1, Issue 12, fixed wing aircraft requirements (where applicable and not covered in STANAG)
    • Pt 9, Issue 10, UAS specific UK requirements (eg reservations)
    • Pt 13, Issue 13, common aircraft requirements (eg armament systems and weapons integration)
  – Special Conditions
• Engine
  – FAR 33 Amdt 3, with later amdts (where evidence exists)
• Propeller
  – FAR 35 Amdt 8
Omissions from the STANAG

- Airspace integration and segregation of aircraft
- The type of operation. Eg en-route climb/descend, Manual Abort, and Lost link behaviour.
- Vehicle Management and Navigation requirements - Radio and radar installations
- Noise and emission certification requirements (Not in scope of Military Certification)
- Piloting from an external or internal control box (Expected to be satisfied primarily through DefStan 00-970 Requirements)
- The competence, training and licensing of UAV system crew, maintenance and other staff
- Approval of operating, maintenance and design organizations
- Frequency spectrum allocation (N/A to Certification)
- Launch/landing equipment that is not safety critical and which does not form part of the Type Certification Basis (Maybe N/A - PROTECTOR may not use LRE)
- (N/A to PROTECTOR Design)
- Sea-basing (N/A to PROTECTOR Design)
- Supersonic flight (N/A to PROTECTOR Design)
Relationship between Protector and Predator B Family

- NASA Altair
- Predator B
- USAF MQ-9 Block 1
- USAF MQ-9 Block 5
- Cert. Predator B
- Predator B ER
- DHS Predator B
- Guardian
- Protector

Approved for Public Release. This presentation does not contain technical data per ITAR 22 CFR parts 120-130.
Certifiable Predator B (CPB) RPA

- **Airworthiness Requirement**
  - Create a MALE UAS Weapon System that can be cleared to fly in civilian airspace
    - Certifiable to the UK DEFTSTAN 00-970/STANAG 4671
- **CDR held April 2015**
- **Preproduction aircraft first flight scheduled Q3 CY2016**
- **Certifiable aircraft first flight scheduled Q4 CY2017**

<table>
<thead>
<tr>
<th>Certification Driven Design Changes</th>
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<tbody>
<tr>
<td><strong>Structures</strong></td>
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<tr>
<td>- Hot/Wet Capable Composite Materials</td>
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<td>- Primary and Secondary Load Paths (i.e., Fasteners)</td>
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<td>- Durable and Damage Tolerant Airframe</td>
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<td><strong>DO-254 Avionics</strong></td>
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<tr>
<td>- Flight vs. Payload Separation</td>
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<td>- Thorough environmental testing (23 areas)</td>
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<td><strong>DO-178C Software</strong></td>
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<tr>
<td><strong>System-wide Hardening/Protections</strong></td>
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<td>- Lightning, Icing, Bird Strike and Fire Detection</td>
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<td><strong>Sense and Avoid System</strong></td>
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<td>- Fused sensor products: TCAS, ADS-B (growth to support DRR)</td>
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MQ-9A Predator B Aircraft Upgrade to "Certifiable" CPB Configuration
(DEFSTAN/NATO STANAG 4671 Compliant Aim)

**Powerplant**
- 4-Blade Certified Propeller
- Alcohol Water Injection (AWI)
- Fireproof Engine Bay

**Air Vehicle/Structural**
- Improved Landing Gear
- Hi-Cap Electrical Power System
- Damage Tolerant Airframe
- Lightning Protection
- Electro-Expulsive De-Ice System
- Redundant Flight Controls
- Redundant Smart Servos

**Communications**
- C-Band RLOS/Ku BLOS (Encrypted)
- UHF/VHF radios (dual)
- ATC Voice/Mode IV IFF

**Avionics Systems**
- Revised Avionics Bay
- Automatic Take-off & Landing
- Triplex Embedded GPS/INS
- Redundant Laser Altimeter
- Li-Ion Battery System
- Mission/Payload Control Separation
- Rover
- Flight Data/Voice Recorder

**Sensor Systems**
- MTS-B EO/IR/Laser Designator
- Lynx Blk 20A Synthetic Aperture Radar (SAR)
- Nose EO/IR Camera
- Sense and Avoid (ADS-B, TCAS, growth for DRR)

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Protector RPA

- UK MoD high-level airworthiness requirement:
  - Procure a MALE UAS Weapon System that can be **MAA-certified** to fly in civilian airspace

- Details
  - Areas of focus over and above **[redacted]**:
CPB Aircraft Upgrade to "Protector" Configuration

**Powerplant**
- 4-Blade Certified Propeller
- Alcohol Water Injection (AWI)
- Fire Protection System

**Air Vehicle/Structural**
- Improved Landing Gear
- Hi-Cap Electrical Power System
- Damage Tolerant Airframe
- Lightning Protection
- Electro-Expulsive De-Ice System
- Redundant Flight Controls
- Redundant Smart Servos

**Communications**
- C-Band RLOS (C2 only)
- UHF/VHF radios (dual)
- Mode S, ADS-B (IN, OUT, 1090 ES)

**Avionics Systems**
- Revised Avionics Bay
- Triplex Embedded GPS/INS
- Redundant Laser Altimeter
- Radar Altimeter
- Li-Ion Battery System
- Flight Data/Voice Recorder
- **Automatic Take-off & Landing Capability**

**Sensor Systems**
- MTS-B EO/IR/Laser Designator
- Lynx Blk 20A Synthetic Aperture Radar (SAR)
- Nose EO/IR Camera
- Sense and Avoid (TCAS, growth for DRR)

Date: 25 Apr 2016
Configuration History - Ground Control Station

Mobile GCS  Block 10  Advanced Cockpit

Block 15

Block 50

Certifiable-GCS

Block 30
Certifiable GCS Overview

Airworthy Flight Critical Displays

DO-254 Compliant Multi-core Computer

DO-254 Compliant Controls (Stick, Throttle, Pedals)

Secure Power Supplies and Connections

"Cockpit" Voice Recorder

DO-178 Compliant Flight Control Software

GA-ASI Advanced Cockpit Basis of Design
Certifiable-GCS Upgrade to "Protector" Configuration

- Lack of released/available technical familiarisation content to allow for further technical overview in this presentation.

- Cert Basis for GCS still to be concluded.
Top Certification Risks
(Cert Basis Work In Progress)

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- GCS Certification (Technical Risk)

- Engine Certification (Technical Risk)
  - FAR 33 Amdt 3 basis