Communications Department
External Information Services

[redacted]

22 December 2017
Reference: F0003412

Dear [redacted]

I am writing in respect of your request of 21 September 2017, for the release of information held by the Civil Aviation Authority (CAA). I am sorry for the significant delay in responding to your request.

Your request:

'I am writing to request, under the Freedom of Information Act, copies of documents relating to discussions between the CAA and the Ministry of Defence (MoD) and/or The Royal Air Force (RAF) regarding the Predator B ER unmanned aerial vehicle (UAV) (also known as 'Protector' or 'SkyGuardian').'

Our response:

Your request has been considered in line with the provisions of the Freedom of Information Act 2000 (FOIA).

Please find attached copies of communications that have taken place between the CAA and the Ministry of Defence (MOD) in relation to the Predator B ER unmanned aerial vehicle (UAV) (also known as 'Protector' or 'SkyGuardian').

As you will see, we have redacted some information within the attached communications on the basis that it is exempt from disclosure under FOIA and cannot be released. The reasons are set out below and a copy of the relevant exemptions can be found at the end of this letter.

Our response:

Your request has been considered in line with the provisions of the Freedom of Information Act 2000 (FOIA).

Please find attached copies of communications that have taken place between the CAA and the Ministry of Defence (MOD) in relation to the Predator B ER unmanned aerial vehicle (UAV) (also known as 'Protector' or 'SkyGuardian').

As you will see, we have redacted some information within the attached communications on the basis that it is exempt from disclosure under FOIA and cannot be released. The reasons are set out below and a copy of the relevant exemptions can be found at the end of this letter.

Section 43 – Commercial interests

Under Section 43(2), information is exempt if its disclosure would, or would be likely to, prejudice the commercial interests of any person (including the public authority holding it). The information contains some commercially sensitive material which, if disclosed, would be likely to prejudice the commercial relationship between the MOD and a third party.

As Section 43 is a qualified exemption, we have also considered whether, in all the circumstances of the case, the public interest in withholding the information outweighs the public interest in disclosure.

The public interest in disclosing the information include the general principle of transparency and open government, the public right of access to information held Disclosure may also give the public an increased understanding and trust in UK defence operations.

However, there is a strong public interest in allowing organisations to engage with contractors and gain the best outcome in procurement, free from outside pressures. Having considered the factors on both sides the CAA has concluded that, in all the circumstances of the case, the public interest in maintaining the exemption outweighs the public interest in disclosing the information.

Section 26 – Defence

Under Section 26(1)(b), information is exempt if its disclosure would, or would be likely to prejudice the capability, effectiveness or security of any relevant forces. The information contains operationally sensitive material which, if disclosed, would prejudice the general capabilities and effectiveness of the MOD's UAV operations. Certain decisions have not yet been finalised and therefore disclosure into the public domain could jeopardise the process of effective decision making, thus affecting present and future capabilities of the MOD's operations.

As Section 26 is a qualified exemption, we have also considered whether, in all the circumstances of the case, the public interest in withholding the information outweighs the public interest in disclosure.

The public interest in favour of disclosure is effectively the same as those set out above. However, there is a need to protect information that could be exploited by potential enemy forces which would have an adverse impact on defence operations.

Having considered the factors on both sides, the CAA has concluded that, in all the circumstances of the case, the public interest in maintaining the exemption outweighs the public interest in disclosing the information.

Section 22 – Information intended for future publication

Under Section 22(1)(a), information is exemption where it is held by the public authority with a view to its publication, by the authority or any other person, at some future date (whether determined or not).

The MOD has not formally decided where the Protector UAV will be based, which will be a decision that will be approved by Ministers. The CAA considers that it would not be reasonable or sensible to disclose information about the likely outcome at this stage until the decision has been finalised. The location of the Protector's base will be confirmed by the MOD in due course.

As this is a qualified exemption, we have also considered whether, in all the circumstances of the case, the public interest in withholding the information outweighs the public interest in disclosing the information.

The public interest in favour of disclosure is effectively the same as those set out above. However, it is important to allow effective decision making without external interference or distraction.

Having considered the factors on both sides, the CAA has concluded that, in all the circumstances of the case, the public interest in maintaining the exemption outweighs the public interest in disclosing the information.

Section 40 – Personal information

We have redacted all personal information in accordance with Section 40(2) of the FOIA as to release the information would be unfair to the individuals concerned and would therefore contravene the first data protection principle that personal data shall be processed fairly and lawfully.

If you are not satisfied with how we have dealt with your request in the first instance you should approach the CAA in writing at:-

Caroline Chalk
Head of External Information Services
Civil Aviation Authority
Aviation House
Gatwick Airport South
Gatwick
RH6 0YR

caroline.chalk@caa.co.uk

The CAA has a formal internal review process for dealing with appeals or complaints in connection with Freedom of Information requests. The key steps in this process are set in the attachment.

Should you remain dissatisfied with the outcome you have a right under Section 50 of the FOIA to appeal against the decision by contacting the Information Commissioner at:-

Information Commissioner's Office
FOI/EIR Complaints Resolution
Wycliffe House
Water Lane
Wilmslow
SK9 5AF
https://ico.org.uk/concerns/

If you wish to request further information from the CAA, please use the form on the CAA website at http://publicapps.caa.co.uk/modalapplication.aspx?appid=24.

Yours sincerely

Rihanne Stephen
Information Rights Officer

CAA INTERNAL REVIEW & COMPLAINTS PROCEDURE

- The original case to which the appeal or complaint relates is identified and the case file is made available;
- The appeal or complaint is allocated to an Appeal Manager, the appeal is acknowledged and the details of the Appeal Manager are provided to the applicant;
- The Appeal Manager reviews the case to understand the nature of the appeal or complaint, reviews the actions and decisions taken in connection with the original case and takes account of any new information that may have been received. This will typically require contact with those persons involved in the original case and consultation with the CAA Legal Department;
- The Appeal Manager concludes the review and, after consultation with those involved with the case, and with the CAA Legal Department, agrees on the course of action to be taken;
- The Appeal Manager prepares the necessary response and collates any information to be provided to the applicant;
- The response and any necessary information is sent to the applicant, together with information about further rights of appeal to the Information Commissioners Office, including full contact details.

Freedom of Information Act: Section 43

(1) Information is exempt information if it constitutes a trade secret.

(2) Information is exempt information if its disclosure under this Act would, or would be likely to, prejudice the commercial interests of any person (including the public authority holding it).

3) The duty to confirm or deny does not arise if, or to the extent that, compliance with section 1(1)(a) would, or would be likely to, prejudice the interests mentioned in subsection (2).

Freedom of Information Act: Section 26

(1) Information is exempt information if its disclosure under this Act would, or would be likely to, prejudice-

(a) the defence of the British Islands or of any colony, or
(b) the capability, effectiveness or security of any relevant forces.

(2) In subsection (1)(b) "relevant forces" means-

(a) the armed forces of the Crown, and
(b) any forces co-operating with those forces,

or any part of any of those forces.

(3) The duty to confirm or deny does not arise if, or to the extent that, compliance with section 1(1)(a) would, or would be likely to, prejudice any of the matters mentioned in subsection (1).

Freedom of Information Act : Section 22

(1) Information is exempt information if-

(a) the information is held by the public authority with a view to its publication, by the authority or any other person, at some future date (whether determined or not),
(b) the information was already held with a view to such publication at the time when the request for information was made, and
(c) it is reasonable in all the circumstances that the information should be withheld from disclosure until the date referred to in paragraph (a).

(2) The duty to confirm or deny does not arise if, or to the extent that, compliance with section 1(1)(a) would involve the disclosure of any information (whether or not already recorded) which falls within subsection (1).

Freedom of Information Act: Section 40

(1) Any information to which a request for information relates is exempt information if it constitutes personal data of which the applicant is the data subject.

(2) Any information to which a request for information relates is also exempt information if-

(a) it constitutes personal data which do not fall within subsection (1), and
(b) either the first or the second condition below is satisfied.

(3) The first condition is-

(a) in a case where the information falls within any of paragraphs (a) to (d) of the definition of "data" in section 1(1) of the Data Protection Act 1998, that the disclosure of the information to a member of the public otherwise than under this Act would contravene-

(i) any of the data protection principles, or

(ii) section 10 of that Act (right to prevent processing likely to cause damage or distress), and

(b) in any other case, that the disclosure of the information to a member of the public otherwise than under this Act would contravene any of the data protection principles if the exemptions in section 33A(1) of the Data Protection Act 1998 (which relate to manual data held by public authorities) were disregarded.

(4) The second condition is that by virtue of any provision of Part IV of the Data Protection Act 1998 the information is exempt from section 7(1)(c) of that Act (data subject's right of access to personal data).

(5) The duty to confirm or deny-

(a) does not arise in relation to information which is (or if it were held by the public authority would be) exempt information by virtue of subsection (1), and

(b) does not arise in relation to other information if or to the extent that either-

(i) the giving to a member of the public of the confirmation or denial that would have to be given to comply with section 1(1)(a) would (apart from this Act) contravene any of the data protection principles or section 10 of the Data Protection Act 1998 or would do so if the exemptions in section 33A(1) of that Act were disregarded, or

(ii) by virtue of any provision of Part IV of the Data Protection Act 1998 the information is exempt from section 7(1)(a) of that Act (data subject's right to be informed whether personal data being processed).

(6) In determining for the purposes of this section whether anything done before 24th October 2007 would contravene any of the data protection principles, the exemptions in Part III of Schedule 8 to the Data Protection Act 1998 shall be disregarded.

(7) In this section-

"the data protection principles" means the principles set out in Part I of Schedule 1 to the Data Protection Act 1998, as read subject to Part II of that Schedule and section 27(1) of that Act;

"data subject" has the same meaning as in section 1(1) of that Act;

"personal data" has the same meaning as in section 1(1) of that Act.

Stephen Rihanne

From: [redacted]
Sent: 07 September 2016 13:07
To: [redacted]
Subject: RE: Question about a protector Meeting tomorrow?

[redacted],

[redacted] was due to represent the CAA but this has now been cancelled.

Regards,

[redacted]

[redacted] | Defence Airspace and Air Traffic Management | K6 CAA House | 45 - 59 Kingsway London WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] |

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: 07 September 2016 12:18
To: [redacted] ([redacted])
Subject: Question about a protector Meeting tomorrow?

Hi [redacted],

I tried ringing you but no reply, hence this message.

Could you give me a ring this afternoon when you see this please? [redacted] has picked up something in passing regarding a PROTECTOR meeting that is taking place at CAA House tomorrow – is this a DAATM/Mil only meeting or is the CAA being represented as well (and if so, who is the CAA rep)?

Thanks,

[redacted]

[redacted]

[redacted]
Intelligence, Strategy and Policy
Safety and Airspace Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
W Sussex
RH6 0YR
Tel: [redacted]
E-mail: [redacted]@caa.co.uk

****

Before Printing consider the environment.

****

Stephen Rihanne

From: [redacted]) <[redacted]@mod.uk>
Sent: 12 January 2016 16:02
To: [redacted]
Cc: [redacted]
Subject: 20160112-PROTECTOR_Airspace_Integration_Workshop
Attachments: ASI-09537 Airspace Integration CONOPS Rev A-ForUK.PDF; 20160112-Protector_Airspace_Workshop.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Red Category

Dear all

There has been much discussion relating to the airspace integration requirements associated with future RPAS, and PROTECTOR in particular, operating in non-segregated airspace in the UK (and Europe). During the PROTECTOR Type Board Meeting at the end of last year, which some addresses (but not all) were involved with, it was identified that GA-ASI needed better to understand the UK requirements and intent for operating PROTECTOR, and the associated constraints in the UK; in order for them to be able to progress design, certification and qualification aspects of the Project. It was decided that an Airspace Integration Workshop, in the UK, would be the best vehicle to gather the broad range of subject experts from the stakeholder community to achieve this.

To this end, it is proposed to hold a PROTECTOR Airspace Integration Workshop during w/c 1 Feb, and current planning is for this to be at a suitable venue in London arranged by GA-ASI. The purpose of the WS will be to inform the solution for PROTECTOR airspace access: by developing the requirements, as expressed in the SRD, for initial operation through Class A-C and eventual access to A-G airspace in the UK; and by identifying the challenges of operating in non-segregated airspace in the UK and how that differs from GA-ASI's concept of operating in the US NAS.

The 1st to 3rd Feb have been identified as potential days for the WS. While the agenda and scope will be predicated on availability of key stakeholder attendees, I expect it to cover:

1. Understand requirements and constraints of UK Airspace and operating MALE RPAS/PROTECTOR
2. Explore issues, technical solutions and difficulties
3. Develop Strategy, policy and way forward to address the UK airspace integration challenge

(Attached is an issues and questions thinkpiece from GA-ASI and UAST, which articulates what the workshop discussion could cover; and a copy of the GA-ASI CONOPS for airspace integration in the US NAS for comparison).

Clearly, while 1 and 2 are lower-level discussions that will require SME involvement at the working level, it is envisaged that 3 will involve a higher-level discussion among the appropriate stakeholder organization representatives; ideally this strategic discussion is planned for OF5 attendance/chair on 3rd Feb, to be informed by the earlier working level meetings. However, detailed scheduling will be flexible to optimize availability.

At this stage we need to identify appropriate attendees and availability over the period 1-3 Feb, in order to make sure we can get the right SMEs for the workshop and leadership for the higher-level aspects, in order to structure a suitable agenda. Therefore, I would be grateful if addresses could confirm appropriate attendees from their stakeholder organizations, and their wish/intent and availability to attend on days between 1st and 3rd Feb inclusive – responses to the undersigned, copy [redacted] (cc'd) in the UAST.

From responses, I hope to determine:

- Feasibility (and value) of holding the workshop during the proposed week 1-3 Feb, depending on availability of key stakeholders; and
- Suitable detailed agenda for 2-3 days (depending on scope/requirements and SME attendance).

Finally, I have aimed distribution to accommodate a broad range of stakeholders from Requirements, Ops, Airspace management, Regulatory and Eng organizations; my apologies if I have missed the target or left out someone that you think should be involved. Please let me know, and feel free to extend the invitation as necessary.

Regards

[redacted]

[redacted]
Unmanned Air Systems' Type Airworthiness Authority
DE&S, UAS PT
Yew 2c, Mail Point #1251

Ministry of Defence
Abbeywood
Bristol BS34 8JH

E-mail: [redacted]@mod.uk
Personal: [redacted]@mod.uk
Telephone: Office: [redacted] Mil: [redacted] Mobile: [redacted]

Proposed Meeting Arrangements

Location:

London

Timing:

Preferred date: Week beginning 1st Feb 2016

Back-up dates: Week beginning 25th Jan 2016 or Week beginning 8th Feb 2016

Meeting Participants:

Organisation	Function / Role	Name
JFC	[redacted]	[redacted]
Air	[redacted]	[redacted]
MAA	Reg/ATM Cert	[redacted]
MoD DAATM	MoD Airspace Policy	[redacted]
Dstl	[redacted]	[redacted]
CAA	RPAS Policy	[redacted]
CAA/NATS	[redacted]	[redacted])
GA-ASI	[redacted]	[redacted]
GA-ASI	[redacted]	[redacted]
GA-ASI	C3 (Command, Control and Communications)	[redacted]
GA-ASI	Office of Airworthiness	[redacted]

(Suggested) Agenda for UK Protector Airspace Access Workshop

Day 1 (8:30am Start):

"Understanding the Challenge" (UAST (with appropriate DH/Cap support) and DAATM to lead 2/3 of day, [redacted])

- **Understanding applicable user requirements, i.e. where would Protector be expected to operate in UK (and European?) airspace?**

(0.5hr) Introduction, Agenda and Anticipated Outcomes
(1 hr) Protector Airspace Access Requirements (Led by UAST and Duty Holder)

- Flight in Class A-C Airspace
- What (in general terms) does RAF want to do with Protector in UK Airspace? (Duty Holder supported)
- (1 hr) CAA/NATS UK Airspace Overview (MoD DAATM-led)What is UK Airspace?
- Address comments along the lines of UK airspace being "different"

(1 hr) CAA/NATS UAS Airspace Integration Context/Background/ CAP722 (CAA led)

- How has CAA/NATS been working to integrate UAS so far?
- How do they envision it working in the near, medium, and long terms?
- What are FAR-91 equivalent regulations?
  - What are the differences between 14 CFR 91 and equivalent reqts (ANO)?
  - What requirements would present greatest integration challenge?

Lunch (1 hr) (Working Lunch?)
(1 hr) UK MOD UAS Airspace Integration Context/Background

- How does the MOD integrate other military aircraft into UK airspace?
- What exceptions or accommodations are made today for other military aircraft?

(3 hrs) GA-ASI CPB Concept of Operations Overview

- By Feb meeting, some work will have been done to update/revise CONOPS based on UK MOD feedback
- Discussion on sense and avoid approach

Outcome:

- Identify particular areas that need further clarification or issues that need resolution

(5pm End)
Total: 8.5 Hours

Day 2: (8:30am Start):

"Agreeing on an Approach"

- **Understand viable approaches including use of Ground-based Sense and Avoid equipment.**
- **Learning from [redacted] activities.**
- **Opportunity to influence ConOps.**

(0.5hr) Review Day 1, Agenda for Day 2
(1 hr) Operations in the Terminal Environment

- Take-off/Landing
- Departure and Arrival
- Pattern Operations
- Controlled/Uncontrolled and Military/Civilian

(1 hr) Operations in Transit to Mission/Training Area

- Vertical Transit
- Lateral Transit
- Controlled/Uncontrolled

(1 hr) Operations in Mission/Training Area
- Are there any ATC considerations (beyond contingency) in mission/training areas?

Lunch (1 hr) (Working Lunch?)
(1 hr) Contingency Operations: General Approach
- Frequency and severity
- What are the options available to manned aviation today?
- Capabilities that are needed in RPAS and within ATC

(1 hr) Contingency Operations: Loss of Datalink
- Agree on an approach on how to handle it, not detailed implementation

(1 hr) Contingency Operations: Loss of DAA
- Agree on an approach on how to handle it, not detailed implementation

(1 hr) Contingency Operations: Loss of Communications
- Agree on an approach on how to handle it, not detailed implementation

Outcome:
- Come to general agreement on approach for operations over the Phases of Flight (Defined on Day One)
- Come to general agreement on approach to handling contingencies (Defined on Day One)

(5pm End)
Total: 8.5 Hours

Day 3: (8:30am Start):

"Agreeing on a Certification / Approval Path"

(0.5hr) Review Day 2, Agenda for Day 3
(1 hr) Flowdown of CNS/ATM Requirements
- Given operations (Defined on Day Two), what equipment or capabilities are needed on Protector
- Equippage requirements (Navigation, Communication, Surveillance, Command and Control)
- Reliability, Integrity, Continuity, Availability
- Given operations (Defined on Day Two), what equipment or capabilities are needed by ATC

(2 hr) CNS/ATM Certification / Approval Path
- Given equipment or capabilities needed on Protector, what is agreed certification or approval path for each
    - Applicability of CS-ACNS and other relevant Certification Specifications

Lunch (1 hr) (Working Lunch?)
(1 hr) CONOPS Approval Plan
- How do we get to a final CONOPS document that everyone can agree on and that the program can "sign up" for?

(1 hr) CONEMP Approval Plan
- What is the process for deriving a Concept of Employment in UK for Protector?

(1 hr) Open Issues/Items for Discussion
- Anticipate that with so many topics, there will be a need for some extra time

(1 hr) Wrap up and Action Items
Outcome:

- Broad agreement on a certification and approval plan related to Airspace Access, not all of the answers, but at least a path to get there
- Action Items for Protector MOD Team
- Action Items for GA-ASI

(5pm End)
Total: 8.5 Hours

Day 4:

Suggest that GA-ASI (and NLR) be given a day on the back end to work as a team on the outcomes of the workshop.
Total: 8 Hours

Stephen Rihanne

From: [redacted]
Sent: 01 February 2016 12:54
To: [redacted] ([redacted])
Cc: [redacted]
Subject: 20160127-PROTECTOR_Presentation.pptx
Attachments: 20160127-PROTECTOR_Presentation.pptx

[redacted]

Please see attached for discussions on Wednesday. [redacted] may have his own slides; however, regrettably his email to me was blocked by the MOD firewall and I have not been able to contact him. [redacted] should see [redacted] tomorrow and will try to sort things out then.

Yours

[redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted]) | [redacted]@mod.uk | Personal: [redacted]@mod.uk

UK PROTECTOR AIRSPACE INTEGRATION WORKSHOP

[redacted]

[redacted]

AGENDA

- **Introduction/User Requirements** (UAST Lead).
- **UK Airspace Requirements** (DAATM / CAA lead)
  - **UK UAS Operating Principles**
    - CAP 722
    - Current Operating Constraints
    - Future Focus
  - **Airspace Integration**
    - Rules of the Air – Manned vs Unmanned
    - Class G vs Controlled Airspace
    - Flight Rules
    - Detect & Avoid – Collision Avoidance/Separation
    - ATS Provision – Separation vs Segregation
- **UAS Pilot Qualifications** (All).
- **Basing**
  - Airspace Requirements for Operations/Training.
- **AOB**

UAST
Introduction/User Requirements

AIRSPACE INTEGRATION

- UK UAS Operating Principles
  - CAP 722
  - Current Operating Constraints
  - Future Focus

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AIRSPACE INTEGRATION

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AIRSPACE INTEGRATION

- Rules of the Air – Manned vs Unmanned
- Airspace Classification - Class G vs Controlled Airspace
- Detect & Avoid – Collision Avoidance/Separation
- ATS Provision – Separation vs Segregation

AIRSPACE INTEGRATION

UAS Pilot Qualifications

- The requirements for the licensing and training of United Kingdom civil Remote Pilots have not yet been fully developed. It is expected that United Kingdom requirements will ultimately be determined by ICAO Standards and Recommended Practices (SARPs) and EASA regulations. (CAP 722)
- The qualification required, should be equivalent to that required for a manned aircraft for the airspace classification and flight rules under which the RPAS will be operated.

AIRSPACE INTEGRATION

- Basing
  - Airspace Requirements for Operations/Training.

AIRSPACE INTEGRATION

[redacted]

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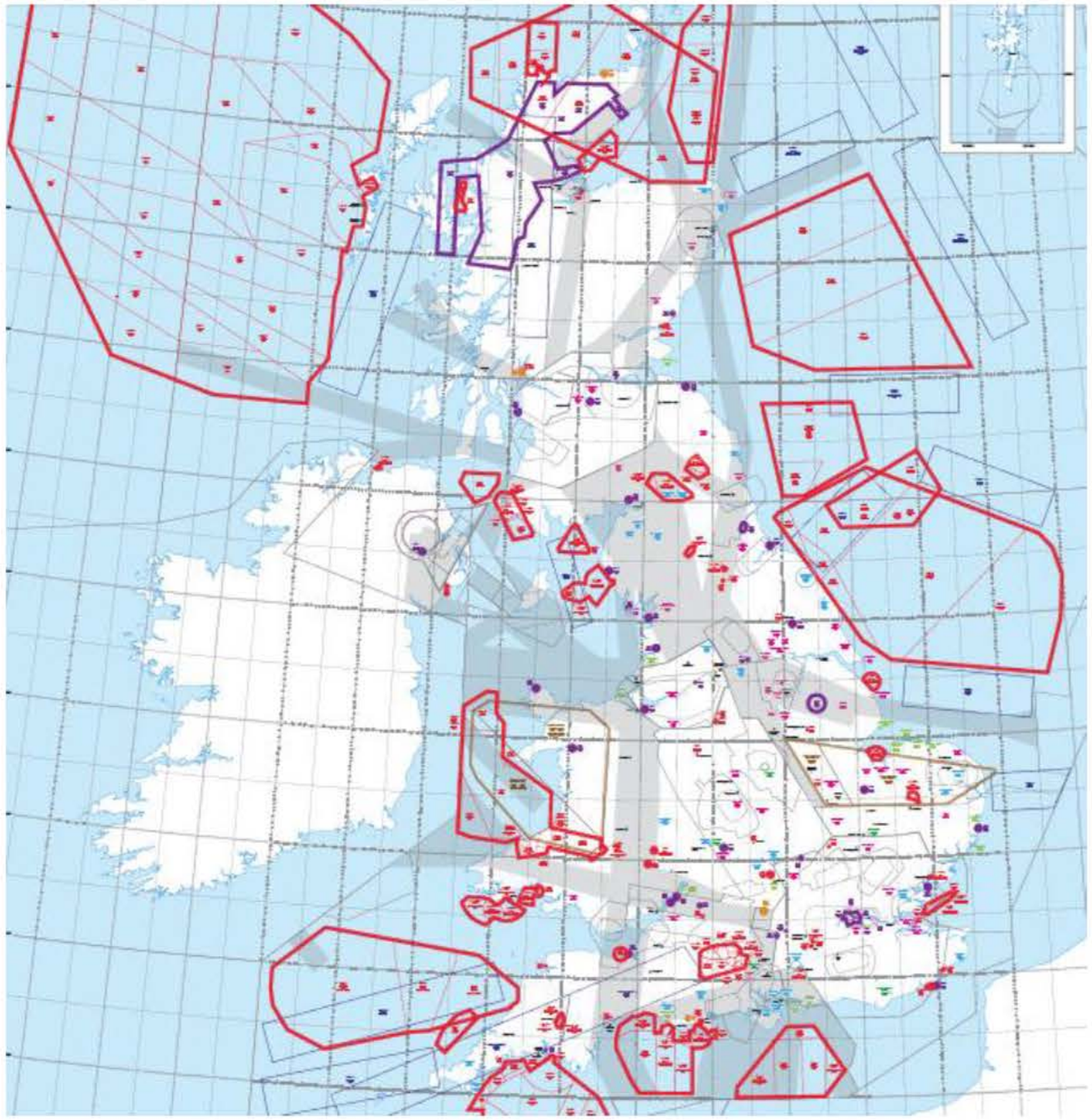
AIRSPACE INTEGRATION



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AIRSPACE INTEGRATION

QUESTIONS

Ministry of Defence

AIRSPACE INTEGRATION

[redacted]

Ministry of Defence

AIRSPACE INTEGRATION

[redacted]

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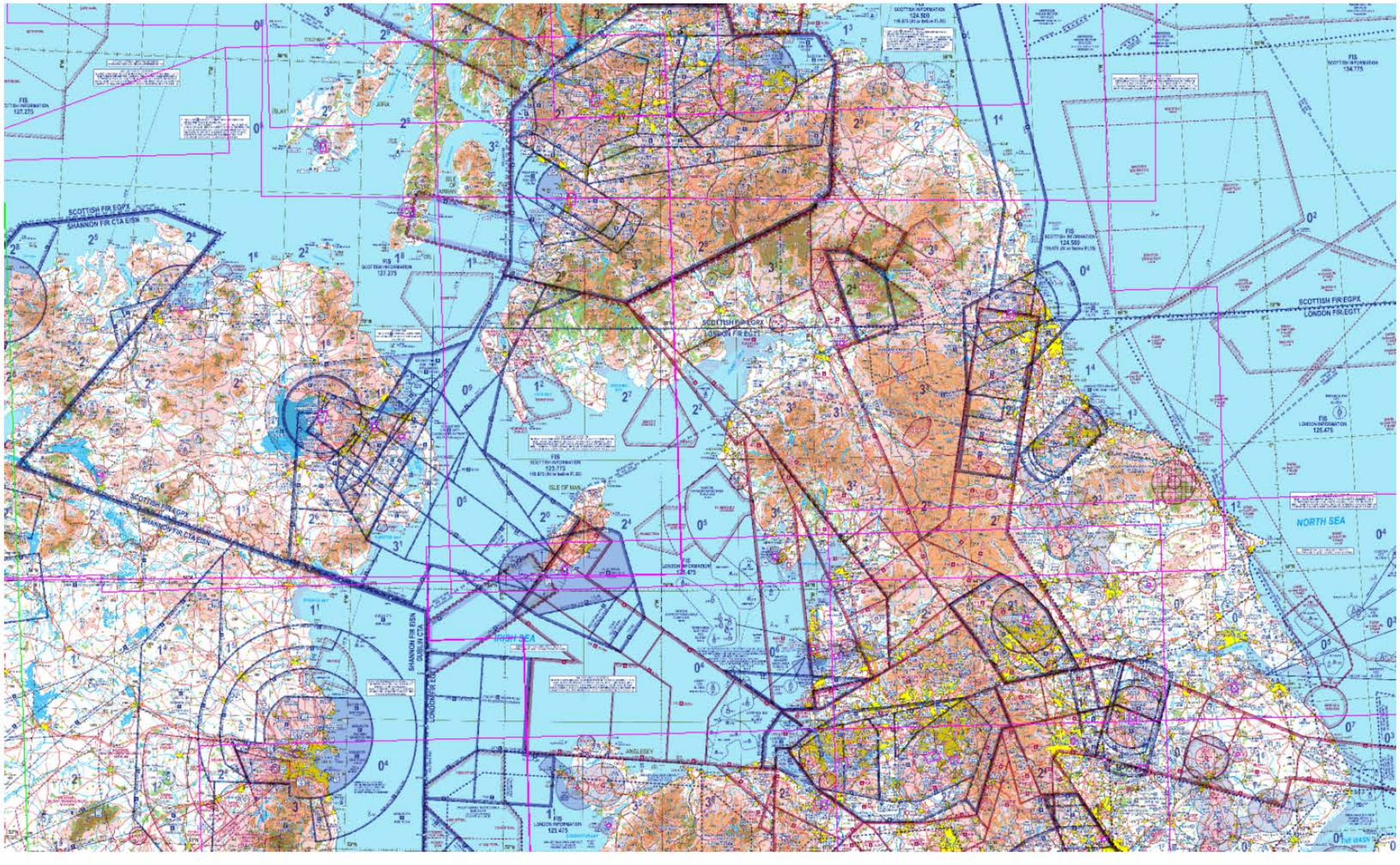
AIRSPACE INTEGRATION



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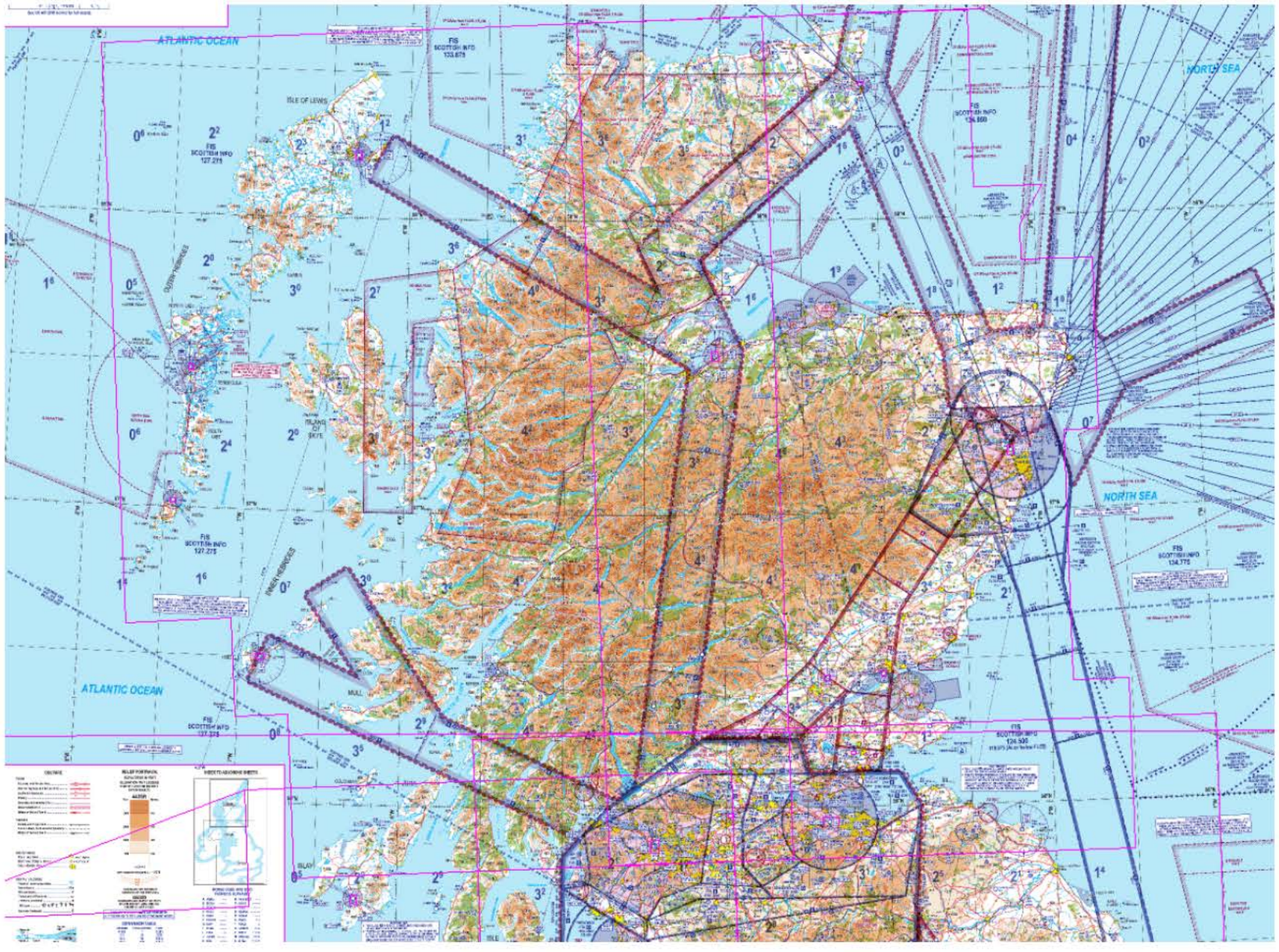
AIRSPACE INTEGRATION



Ministry of Defence

Stephen Rihanne

From: [redacted]
Sent: 29 January 2016 14:28
To: [redacted]
Cc: [redacted]
Subject: PROTECTOR MEETING 3 FEB 16
Attachments: PROTECTOR MEETING 3 FEB 16.docx

Categories: Red Category

[redacted]

Some thoughts on discussion notes. Clearly for Slide 4 you will have your own thoughts but these were some points that sprang to mind. [redacted] will tidy up while I am in Brussels but input appreciated.

Yours

[redacted]

[redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DI [redacted]) | [redacted]@mod.uk | Personal: [redacted]@mod.uk

PROTECTOR MEETING 3 FEB 16

1. **SLIDE 1 – INTRODUCTION**

2. **SLIDE 2 - AGENDA**

3. **SLIDE 3 - INTRODUCTION/USER REQUIREMENTS (UAST Lead)**.

4. **SLIDE 4 - UK UAS OPERATING PRINCIPLES (CAA Lead)**.

- **CAP 722 - Sixth Edition, 31 March 2015**
  - CAP 722 is intended to assist those who are involved in the development of UAS to identify the route to certification, outline the methods by which permission for aerial work may be obtained and ensure that the required standards and practices are met by all UAS operators.

  - The document highlights the safety requirements that have to be met, in terms of airworthiness and operational standards, before a UAS is allowed to operate in the UK.

  - 'UAS must meet at least the same safety and operational standards as manned aircraft.'

  - Military regulation - MAA is the lead agency for the military. Effectively adhere to the principles set out in CAP 722 and in RA 2320.

- **Current Operating Constraints**
  - **Detect and Avoid** - The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action. Key enabler for flight in unsegregated airspace.

  - **BVLOS**. RPAS intended for operation beyond visual range of the pilot will require an approved method of aerial separation and collision avoidance that ensures compliance with Rule 8 of the Rules of the Air Regulations 2007 (Rules for avoiding aerial collisions), or will be restricted to operations within segregated airspace.

    - **EVLOS**. EVLOS operations are operations, where the Remote Pilot is still able to comply with his collision avoidance responsibilities, but the requirement for the Remote Pilot to maintain direct visual contact with the UA is addressed via other methods or procedures. It is important to

note, however, that collision avoidance is still achieved through 'visual observation' (by the Remote Pilot and/or RPA Observers).
        - Could be explored for Circuit work.

    - **Segregated Airspace**. Lack of suitable airspace to operate and train.
        - In order to integrate with other airspace users - must ensure that RPAS can demonstrate an equivalent level of compliance with the rules and procedures that apply to manned aircraft.

        - Routine flight of any UAS outside UK Danger Areas or non-segregated airspace cannot be permitted as it would increase the risk to existing users.

- **Future Focus**.
    - CAA vision for the future.
    - Roadmap to full integration – How will this be achieved.

5. **SLIDE 5 - AIRSPACE INTEGRATION (DAATM Lead)**. Chart.

6. **SLIDE 6 - AIRSPACE INTEGRATION.**

- **Meeting Agenda** – Asked Question 'How does the MOD integrate other military aircraft into UK Airspace. Simple Answer:
    - Manned.
    - Unmanned such as Watchkeeper – Segregated Airspace was established.

- **Rules of the Air – Manned vs Unmanned**
    - From a Mil perspective - ROTA are detailed in RA 2307. Based on principles of 'see and avoid', whereby pilot can see hazards (objects, weather, terrain) and therefore can take appropriate action to resolve.

    - Current operating constraints are inextricably tied to these Rules, hence the drive to identify a solution for Detect and Avoid.

- **Class G vs Controlled Airspace**.
- **Class G**.
    - As outlined in response regarding the CONOPS - The UK has a significantly different structure of airspace than that used within the US or indeed other European States.

    - The UK construct has developed over time but its guiding principle is focussed on the concept that Class G (uncontrolled airspace) should be the default used.

    - Class G allows for the least restrictions or requirements to be placed on pilots, or aircraft equipment fits and thus ensures the greatest level of freedom for airspace users. However, it also works on the principle that

the pilot will use 'See and Avoid' as the primary method of achieving separation from other aircraft irrespective of the flight rules under which the pilot has elected to operate.

  - [redacted]

- CAS
  - Whilst the UK does have classifications of Controlled Airspace (CAS) they are primarily designed to support Commercial Aircraft (CA) operations into an out of commercial airfields.

  - The network of CAS structures does not provide connection to all airfields and in general CAS structures within the UK are densely packed with Commercial traffic.

  - The concept of utilising CAS structures that require ATC to separate aircraft flying under IFR from one another (all CAS) and indeed between aircraft flying IFR and VFR (Class C & B) has merit; the reality is that such airspace within the UK has commercial value, therefore separation concepts are not the only factor that require consideration to facilitate entry into such UK CAS structures.

- **Detect & Avoid – Collision Avoidance/Separation**
  - RA 2320 states that 'because of the absence of an approved sense and avoid means for complying with the Rules of the Air (RA 2307)….RPAS should only be flown in segregated airsapce in the UK FIR (airspace specifically designated for RPAS operation). This includes transit areas.

  - The use of 'First Person View' R/C Equipment (see CAP 658) is not considered to be acceptable for use as a Detect and Avoid solution.

- **ATS Provision – Separation vs Segregation**
  - **Ground Based D&A**. Explore what is being proposed?
  - ATS Separation vs Segregation.

  - Recognised that the provision of segregated airspace cannot be met by CAS; however, the fact that in Classes A-D airspace aircraft are operating in a known traffic environment presents the opportunity for the RPAS to be safely controlled by an en-route service provider, to ensure that the air vehicle is separated from other conflicting traffic.

  - [redacted]

- If an approved Detect system was not available, would the provision of ATS within a known traffic environment provide the required mitigation for RPAS operations with the service provider issuing instructions for separation from other traffic upon its detection? This could for example be caveated with the need for a Collision Avoidance system.

7. **SLIDE 7 - UAS PILOT QUALIFICATIONS (ALL)**.

- The requirements for the licensing and training of United Kingdom civil Remote Pilots have not yet been fully developed. It is expected that United Kingdom requirements will ultimately be determined by ICAO Standards and Recommended Practices (SARPs) and EASA regulations. (CAP 722)
- The qualification required, should be equivalent to that required for a manned aircraft for the airspace classification and flight rules under which the RPAS will be operated.
- RA – NPA?

8. **SLIDE 8-15 - BASING**.

- Airspace Requirements for Operations/Training.
  - **Training**.
    - In order to minimise the impact on other airspace users, access to existing segregated airspace should be considered.
    - Segregated airspace would need to be established around the operating base, with links to training areas.
    - [redacted]
    - Immediate access to suitable Danger Areas to conduct Air-to-Ground training is extremely limited and would therefore require suitable segregated airspace connectivity.

  - **Operations**. [redacted] temporary segregation could be utilised under existing protocols. Such arrangements, as today, could have a considerable impact on commercial operations. However, as the volume of airspace required to meet the CAA regulatory requirements for RPAS operations would be greater than that currently required for manned aircraft the impact on commercial operators would be greater.
- **ACP**
  - [redacted]
    - [redacted]

- **Process detailed in CAP 725**. Currently a 7 stage process from initial presentation to the CAA, through to public consultation (eg. focus groups), amendments and final presentation to the CAA.

- Depending on complexity and the impact on other airspace users, the ACP process can take up to 2 years to complete and there are no guarantees that the MOD requirement will be met; this must be factored into RPAS project plans.

- **TDA**. Until UAS can comply wth the requirements of the ANO and the Rules of the Air Regulations, one-off or occasional UAS flights outside DAs may be accommodted through the establishment of Temporary Danger Areas (TDAs). TDAs must not be considered as a convenient 'catch all' for short notice UAS activities that can simply be requested, and implemented, without due consideration for other airspace users. RPAS activities up to a maximum period of 90 days.

9. **SLIDE 16 - QUESTIONS**

Stephen Rihanne

From: [redacted]
Sent: 31 January 2016 11:49
To: [redacted]
Cc: [redacted]; [redacted]
Subject: RE: 20160127-PROTECTOR_Presentation.pptx
Attachments: 20160203-Protector Airspace Access workshop-CAA aspects.pptx

[redacted],

Thanks – I've attached a set of initial slides that I'd look to use for my section as a starter. I've not had a chance to think through them all properly as yet (I'm on a plane at the moment and things are a bit squashed) but I'll get things sorted out properly, along with some adjustments to the briefing doc you sent me on Monday.

[redacted]

[redacted]

[redacted]
Intelligence, Strategy and Policy
Safety and Airspace Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
W Sussex
RH6 0YR
Tel: [redacted]
E-mail: [redacted]@caa.co.uk

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 29 January 2016 14:29
To: [redacted]
Subject: 20160127-PROTECTOR_Presentation.pptx

UAS Context – Vision and Scale

CAA Vision is “to enable full and safe integration of all UAS operations into the total aviation system”

UAS must be….

- ***Safe to be flown***
- ***Flown safely***

UAS Ops Within UK Airspace

- **How do you avoid collisions?** (with anything?)

- **Visual Line of Sight (VLOS)**
  - 'See and Avoid' responsibilities through direct visual observation (visually managed – ie. you have to be able to see it)
  - Limited range- Size/Colour, weather conditions
  - 400ft vertical, 500m horizontal – generally accepted limits

- **Beyond Visual Line of Sight (BVLOS)**
  - Detect and Avoid capability – technical solution
  - Segregated Airspace (if no DAA system fitted)
  - Clear evidence of 'no aviation threat'

Large/BVLOS challenges

- Airworthiness – '*safe to be flown*'
  - What are the differences/additions required for unmanned flight ?
  - Complex systems – especially compared to size of aircraft
  - **wider and more involved process**

- Operations – '*flown safely*'
  - Avoidance of collisions? – DAA or Segregated?

- C2 datalink
  - Integrity of link?
  - Direct or satellite relay? Oversight of Comms Service Provider
  - Spectrum availability?
  - C2 link loss and subsequent actions

equivalence…….

Detect and Avoid

- **Generic expression - technical capability commensurate to 'see and avoid' in manned aviation**

Must enable the Remote Pilot to:

- **Separation/Traffic avoidance**
  - Perform the same 'give way'/'maintain sufficient distance so as not to cause a hazard' roles undertaken by the pilot of a manned a/c iaw the Rules of the Air
- **Collision Avoidance**
  - Undertake collision avoidance manoeuvres (ie. 'last ditch' avoidance) if the normal separation provision fails
  - What happens of C2 link is lost? - 'Automatic' capability?

Minimum Requirements for routine Ops in 'non segregated' airspace?

- **IFR in Controlled Airspace**
  - Collision Avoidance (CA)
    - ATC is the 'separator'
    - CA required if ATC separation 'fails' – same as for manned
    - CA required if aircraft has to leave CAS (eg. Engine failure) – same as for manned

- **VFR in Controlled Airspace/any flight in Class G**
  - Separation/Traffic Avoidance and Collision Avoidance
    - Remote Pilot is the 'separator' – same as for manned

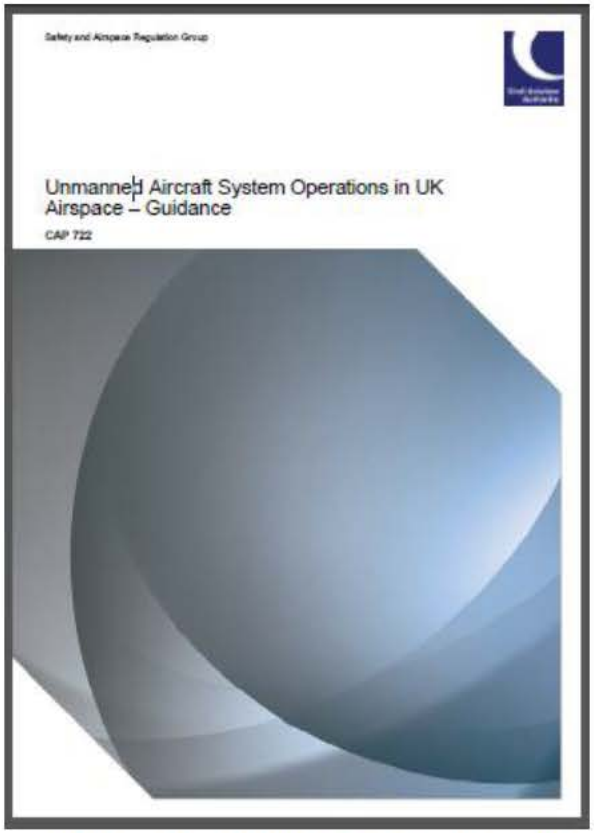
Possible Exceptions/Variations?

- **Operations where other aviation obstruction hazards already exist**
  - Eg. Power Cables/Pylons
    - Airborne collision risk reduced/removed?
    - Collision with pylons/cables – infrastructure risk?

- **'One off' flights/trials in Controlled Airspace**
  - Accompanied by appropriate safety case
    - [redacted]
    - [redacted]

Segregated Airspace

- Used if DAA not fitted – interim measure, not the final solution as it denies airspace to others
  - Permanent Danger Areas
  - Facility exists for Temporary Danger Areas (short term requirements)



Civil Aviation Authority

CAP 722

"Unmanned Aircraft System Operations in UK Airspace – Guidance"

Edition 6, 31 March 2015

- UK Civil UAS Policy/Regulation developed and published through CAP 722 (note this includes airspace use for all though)
- Takes CONOPS/safety case approach for UAS (150kg or less – CAA 'competence')
- What your system is? How it is planned to be used? Where it is intended to be used? What happens when things go wrong?

Demonstrate that it is 'safe enough'

International Regulatory Development/Cooperation

- ICAO
  - RPAS Panel
  - RPAS Manual Mar 15
  - Annex Development – 2018 onwards

- Europe
  - EC RPAS Roadmap
  - EASA
    - CONOPS – Mar 15, A-NPA Jul 15, Technical Opinion Dec 15
    - Competence (currently 150kg) – Based on EASA BR (changes coming)
  - JARUS / EUROCAE

- UK
  - CAP 722
  - Small UAS regulations
  - 20kg-150kg – Operational safety case

Civil Aviation Authority

Civil Aviation Authority

Stephen Rihanne

From: [redacted]
Sent: 05 February 2016 08:33
To: [redacted]; [redacted]
Cc: [redacted]; [redacted]
Subject: FW: UK Protector UAV brief

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Red Category

[redacted] and [redacted],

The start of a new issue - for the life of me I can't see how MOD will be able to operate [redacted] through domestic Class G airspace etc but perhaps I am too set in my thinking. One to watch carefully I think.

I have also picked up that MOD is considering relocating [redacted] - not sure how [redacted] either.

[redacted]

From: [redacted]
Sent: 05 February 2016 06:36
To: [redacted]
Cc: [redacted]
Subject: UK Protector Uav brief

Good Morning [redacted],

Salient points from the Protector UAV project briefing,

[redacted]

[redacted]

[redacted]

The MAA are to provide safety assurance in the form of a safety case.

The CAA advised that the proposed [redacted] detect and avoid solution would need to fully mitigate the requirements of current regulation for class G operation with regards to adherence to the rules of the air, see and avoid etc, utilizing extant service provision responsibilities or segregated airspace would be required.

The CAA advised the anticipated time frames required for ACP activity related to any new segregated volumes.

The MAA do not view segregated airspace as a desirable outcome.

Fundamental Issue- : The project team argue that delivery of [redacted] can be viewed as an acceptable means of mitigating the see and avoid principle, this would effectively [redacted]

Next meeting planned for April TBN.

Cheers

[redacted]

[redacted]
Civil Aviation Authority
Safety and Airspace Regulation Group (SARG)
AAA Air Traffic Management (ATM)

Tel-: [redacted]
Mobile-: [redacted]
Email-: [redacted]@caa.co.uk

Stephen Rihanne

From: [redacted]
Sent: 16 March 2016 07:28
To: [redacted]
Subject: PROTECTOR airspace integration mtg

Follow Up Flag: Follow up
Flag Status: Completed

Dear All,

For information and awareness. I will be attending a 1* meeting on 18 Apr to discuss org responsibilities for PROTECTOR airspace integration. Calling notice below:

Sir, Ma'am, [redacted]

Please see the below calling notice from ACAS for a Protector airspace integration meeting. [redacted] will update this invitation with room details when booked.

I have been discussing with [redacted] (the current [redacted] for PROTECTOR) the approach we should take to Airspace integration for PROTECTOR. By way of background, the SDSR15 announced that the PROTECTOR Programme will deliver UK armed ISTAR collect capability out to 2035 with an IOC delivery from Jul 2021 and FOC in May 2023. The down-selection of a certifiable platform to fulfil the PROTECTOR requirement provides an opportunity for the UK to be the leading European nation for the integration of RPAS into national , non-segregated, airspace. [redacted], and will pave the way for further development in the pan-government and commercial RPAS sectors. The challenge is how to deliver this 'clearance'. The attached from [redacted] gives a flavour for the complexity. The [redacted] is struggling to define the process for approval and who should own the various aspects of the work. I offered to pull the key players together to debate the issue, establish an outline plan and define responsibilities for delivery.

As outlined on the distribution list, proposed invitees include JFC Cap, AIR Cap, MAA, CAA, ACP, DE&S and DSTL. Please let me know if you think I have missed anybody essential off the list. My office will be in touch to arrange the meeting.

I will restate that AW responsibilities would fall to the MAA as a mil registered platform. Our responsibility will be for the airspace aspects i.e. defining the requirements to operate in the various classifications of airspace that this platform wishes to operate in, in order to ensure that no additional risk is presented to other airspace users (but crucially not specifying how those capabilities are delivered by MOD – that is for DE&S to determine).

To my mind the principles that applied for [redacted] (as regards responsibilities and sequencing) equally apply here, albeit the scope here is much broader.

It would be useful if we could work up a clear position (via a short paper) in advance of the meeting – defining CAA responsibilities (and crucially those areas which we are not responsible for) and where we would envisage we would input into the process and who/how we would interface with other organisations. I think this would be a rehearsal of our previously articulated position but having it in writing will be useful for the audit trail. I would want to share this with DAATM and MAA in advance so that we 3 are all on the same page and have a clear understanding between ourselves as we walk into this meeting. Given we only have an hour this prep will be essential if we are to walk out with agreements and a clear understanding of the way forward.

[redacted] – would you be able to lead on this paper and make a start in drafting something up? Aiming at having something by 30 Mar. Happy to chat to discuss in more detail.

Regards,

[redacted]

[redacted] | [redacted]
Aviation House, Gatwick Airport South, West Sussex, RH6 0YR
Telephone: [redacted]
Mobile: [redacted]

From: [redacted]
To: [redacted]
Subject: FW: PROTECTOR_Airspace_Integration_Meeting
Date: 21 March 2016 18:37:38

From: [redacted]
Sent: 21 March 2016 18:36
To: [redacted]
Cc: [redacted]
Subject: PROTECTOR_Airspace_Integration_Meeting

[redacted]

Meeting rooms are difficult to come by at CAA House; however, I have secured one from 1130 on 12 May 16 for up to 20 people, if you wish to proceed with a meeting. I have CC'd those in your email for information and would appreciate confirmation that you wish to go ahead with the meeting. Once that is confirmed, we can discuss the attendance list to ensure that we get the right people in the room and thereafter I will send out a calling notice.

Yours

[redacted]
[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: DAATM-Airspace SO1 [redacted]) | [redacted]@mod.uk | Personal: [redacted]@mod.uk

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From: [redacted]
Sent: 16 March 2016 19:48
To: [redacted]
Cc: [redacted]
Subject: 20160316-PROTECTOR_Airspace_Integration_Meeting_ScavRASM

Thanks for the update.

I think it is important that we keep up the momentum following on from the initial Protector Airspace Integration meeting, and the opportunity for a working level discussion among the "tight group" of SMEs is definitely worthwhile, so I agree we should push for an early May timescale – provided that works for the CAA representatives. From a UAST RASM perspective we should be able to support any time (although w/c 9 May works best for me personally). We are [redacted], to produce an outline in advance of the WG for stakeholders to review. Looking at the outcomes list from the previous meeting, I propose the following discussions for the Agenda:

- CONOPS/Use Cases/Scenarios (Produced by Air Cmd?)
  - Identify Airspace Integration issues/requirements

- Consider initial airspace "accommodation" limitations (IOC without full on-board SAA)
- [redacted]
  - Need for segregation to achieve initial "accommodation" in the airspace – ACP
- [redacted]
- Review GA Lost Link Logic white paper
  - Consider how to staff for "agreement"

The above is a strawman proposal for discussion, please feel free to comment/add/remove. I've also included other stakeholders/actors/potential WG attendees for SA and diary alignment.

Regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA **92064**, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk

---

From: [redacted] **On Behalf Of** [redacted] ([redacted])
Sent: 16 March 2016 06:11
To: [redacted] ([redacted]); [redacted] [[redacted]@caa.co.uk]'; [redacted]@caa.co.uk'; CAS-AS Strat 3 ([redacted]); [redacted]@caa.co.uk
Cc: [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted])
Subject: FW: PROTECTOR Airspace Integration Meeting

Sirs et al

Please be advised that the Protector Airspace Integration meeting/workshop to be held at CAA House and scheduled for Tuesday 19th Apr 16 is regrettably cancelled.

It is hoped that an alternative date can be arranged in early May. DAATM will advise.

[redacted]

[redacted] has asked if you can provide a date within the first two weeks of May that you will be available and we will try and work around this.

Regards

[redacted]

[redacted] | [redacted] | [redacted] | Defence Airspace and Air Traffic

Management | K6 CAA House | 45 - 59 Kingsway London WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] | E-Mail: [redacted] @mod.uk | Mobile: [redacted]

From: [redacted] ([redacted])
Sent: 11 March 2016 10:26
To: [redacted] ([redacted])
Subject: FW: PROTECTOR Airspace Integration Meeting

[redacted]

Could you please cancel the room and advise those in the email below.

Yours

[redacted]
[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] ([redacted]) | [redacted] @mod.uk | Personal: [redacted] @mod.uk

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From: DAATM-Airspace SO1 ([redacted])
Sent: 05 February 2016 08:57
To: [redacted] ([redacted])
Cc: Subject: PROTECTOR Airspace Integration Meeting

[redacted]

As a follow on from Wednesday's discussions on the next Airspace Integration meeting, I believe that a focussed one day workshop would suffice to draw out and discuss the key issues that need to be understood and addressed. To that end I have tentatively booked a meeting room at CAA House in London on Tuesday 19 Apr 16, if that is of use to you. I am not sure who you would like to attend; however the room holds up to 20. That said, a tight group of UK operators and Airspace/ATC SME's would perhaps be better placed to focus discussions in the right direction, in particular in areas such as [redacted], Class G and Controlled Airspace operations and potential segregated airspace requirements.

I have CCd the key players from the CAA as a diary marker.

If you are content with the above please let me know who is taking the lead to coordinate and run the workshop. DAATM can then facilitate access to CAA House.

Yours

[redacted]
[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] ([redacted]) | [redacted] @mod.uk | Personal: [redacted] @mod.uk

From: [redacted]
To: [redacted]
Cc: [redacted] ; [redacted]
Subject: RE: 20160323-RE: 20141008-DAATM_RPAS_NDS_Concept
Date: 24 March 2016 08:22:03

Thanks [redacted]

We will consider the points raised below.
Yours

[redacted]

[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] [redacted]) | [redacted]@mod.uk | Personal: [redacted]@mod.uk

---

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: 23 March 2016 12:30
To: [redacted] ([redacted])
Cc: [redacted]
Subject: 20160323-RE: 20141008-DAATM_RPAS_NDS_Concept

Hi [redacted],

I'm sorry I completely missed your previous message (the one sent on 26 Jan), so I've not given any further thought to this I'm afraid.

However, from what you've mentioned below, I'm pretty sure that the position that I set out with you at the Protector meeting on 3 Feb fits the bill with regard to what you are talking about actually.

The key question revolves around identifying the person that has the responsibility for separation in any confliction (ie. who is *the separator ?*) as collision avoidance is always a pilot/remote pilot responsibility. In simple terms, the minimum starting requirements for 'routine UAS ops' (ie. day to day, 'file and fly' type sorties rather than longer term pre-planned 'trials' or 'one offs') in non-segregated airspace would be:

a. For **IFR flights in Controlled Airspace**, a *collision avoidance capability* will be required
   - ATC *separates* from other traffic (although in Class D and E, the pilot of a conflicting VFR flight holds the separation responsibility) – ATC is the *separator* for Class A, C and IFR/SVFR conflicts in Class D. The VFR pilot in Class D and E is the *separator* for all conflicts with his/her aircraft.
   - As for manned aviation, a collision avoidance capability is required in case the 'normal' separation provision fails
   - If the flight is conducted wholly within controlled airspace where the operation of a transponder is mandatory, then a collision avoidance capability that is cooperative would be acceptable
   - If there is any possibility that the UAS will/might leave controlled airspace and enter non-segregated Class G, then I would see there being a requirement for the collision avoidance capability to be a non-cooperative one (unless there are other airspace measures in place that would mitigate this, such as a TMZ, above FL100 (transponder required) etc, which would allow a non-cooperative system to be used)

b. For **VFR flights in controlled airspace, or any flight in Class G**, then a *separation/traffic avoidance capability* **and** a *collision avoidance capability* will be required
   - This is because the remote pilot of the UAS is the *separator* for all conflicts – this is the same as for manned aviation

c. For 'one off' flights or trials (such as [redacted] then these could be accommodated separately with an appropriate safety case.

Hope that helps? I think it verifies what you have mentioned below.

[redacted]
Intelligence, Strategy and Policy
Safety and Airspace Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
W Sussex
RH6 0YR
Tel: [redacted]
E-mail: [redacted]@caa.co.uk

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 22 March 2016 21:44
To: [redacted]
Subject: FW: 20141008-DAATM_RPAS_NDS_Concept

[redacted]

Could you confirm if any further thought has been given to this. With The PROTECTOR meeting now scheduled for May, it would be useful if this subject could form part of the discussion.

Yours

[redacted]
[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] [redacted]) | [redacted]@mod.uk | Personal: [redacted]@mod.uk

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From: [redacted] ([redacted])
Sent: 26 January 2016 16:52
To: [redacted]'
Cc: [redacted]'; [redacted]; [redacted] ([redacted])'
Subject: FW: 20141008-DAATM_RPAS_NDS_Concept

[redacted]

Having discussed with [redacted] the issues raised in the response below, it was agreed that there may be scope for further discussions, in particular, based on the conversation that we had with regard to [redacted] and the ability to operate

RPAS within Controlled Airspace (CAS). In effect, rather than segregation, the MOD was looking at the use of [redacted] to separate the RPAS from other traffic within a known traffic environment. While it is recognised that [redacted] may not have been used in its true context, hence the MOD may not have presented a valid argument for 'replacing' segregation with separation, it is considered that the potential to utilise the benefits of a known traffic environment may as a consequence have been discounted on a technicality, based on a definition rather than the concept that was being proposed. As such, I would appreciate your views on the following;

> While it is recognised that the provision of segregated airspace cannot be met by CAS, the fact that in Classes A-D airspace aircraft are operating in a known traffic environment presents the opportunity for the RPAS to be safely controlled by an en-route service provider, to ensure that the air vehicle is separated from other conflicting traffic. The control element would be exactly the same as that of a traditional manned aircraft. As you are aware, these principles were applied during [redacted]
>
> [redacted]

With discussions within the PROTECTOR project regarding airspace integration, it would be useful to explore the boundaries of current regulation to establish if there is scope to apply the principles [redacted] This would help the project team to gain a greater understanding of how operations and training could be conducted and the airspace changes required to achieve it. This could be addressed at the PROTECTOR meeting on 3 Feb 16.

Yours

[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] ([redacted]) | [redacted]@mod.uk | Personal: [redacted]@mod.uk

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: 19 January 2016 14:20
To: [redacted] ([redacted])
Cc: [redacted] ([redacted]); [redacted]; [redacted]; [redacted]
Subject: RE: 20141008-DAATM_RPAS_NDS_Concept

[redacted],

I have had a discussion with [redacted], [redacted] and [redacted]. [redacted] believed we had responded to this but if not we apologise.

The [redacted], [redacted] and [redacted] sat down and discussed the proposal and I have attached the summary of their thoughts.

The CAA acknowledges that any proposal to further integrate RPAS operations into UK airspace whilst removing the requirement to segregate large areas of CAS has significant merit and is certainly a CAA aspiration for the future; however, RPAS operators must work within the same regulatory framework as that designed to enable the safe and efficient operation of manned aircraft in all classes of airspace. Current UK aviation legislation directs that an approved method of aerial collision avoidance is required; therefore RPAS operations will not be permitted in non-segregated airspace without an acceptable and approved Detect and Avoid system.

Whilst on the face of it this proposes a more flexible use of airspace, [redacted]) actually affords priority to a flight (and then only between parties to, or alerted to, the fact), it does not provide safety and segregation; in the context of UAS segregation we are in essence talking here about 'apples and pears' with regard to [redacted] and segregation.

Unless able to comply with the current requirements of the ANO, including the Rules of the Air, RPAS flights which are operated beyond the visual line of sight of the pilot are required to be contained within segregated airspace. Until an approved Detect and Avoid system is installed SARG does not believe that [redacted] provides satisfactory segregation between RPAS flights and other airspace users, nor compliance with UK aviation legislation.

Regards,

[redacted].

[redacted]
[redacted]
Safety and Airspace Regulation Group
Civil Aviation Authority

Tel: [redacted]
Mob: [redacted]

www.caa.co.uk
Follow us on Twitter: @UK_CAA

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Before Printing consider the environment.

****

From: [redacted]
To: [redacted]; [redacted] [redacted]
Cc: [redacted]; [redacted]
Subject: 20160419-PROTECTOR meeting update and for awarenes for Board meeting with ACAS tmw
Date: 19 April 2016 13:12:48
Attachments: 20160318-CAA Position Protector Airspace-V3.docx
Importance: High

Dear All,

I attended the PROTECTOR airspace integration meeting yesterday.

I outlined the CAA position in line with the note that we had preapred in advance.

MOD confirmed that [redacted].

I expressed my lack of confidence in MOD's [redacted] and the novel and ground breaking nature of what they are aiming to achieve with a DAA capability.

I espoused a crawl, walk, run methodology and advised that we should be looking at conplans (i.e. segregated airspace/TMZ requirements *et al*) while the other work progresses in parallel. This was taken on board by ACAS. I also advised that it would be useful to concentrate on the easier wins first e.g. operations in Class A, as opposed to Class G which will be the most difficult to address. I stressed that the CAA would assist with those aspect pertinent to our responsibilties.

HIghlight: Only one potentially awkward moment when the subject of 'equivalence' came up. There was some discussion about the difficulties of demonstrating equivalence with rules of the air which rely on see and avoid and the falibility of pilot scan. [redacted]

[redacted]

Please let me know if there are any queries. I have not included all content in this update as not necessarily relevant.

Regards,

[redacted] | [redacted]
Aviation House, Gatwick Airport South, West Sussex, RH6 0YR
Telephone: [redacted]
Mobile: [redacted]

5 Apr 16

CAA POSITION ON ROLES AND RESPONSIBILITIES FOR PROTECTOR AIRSPACE INTEGRATION

Paper for Information – Authors [redacted] (AAA) and [redacted] (ISP)

Issue

1. A clear position on CAA roles and responsibilities with regards to integration of Protector into UK airspace is required in advance of a high level Ministry of Defence (MOD) meeting on 18 Apr 16.

Timing

2. Routine. An agreed position is required in advance of the meeting on 18 Apr to ensure the CAA position is endorsed by key internal stakeholders and fully understood by external stakeholders.

Recommendation

3. It is recommended that GDSAR **notes** the contents of this paper and **endorses** the position articulated.

Background

4. PROTECTOR. SDSR15 announced that the PROTECTOR Programme will deliver a UK Information, Surveillance, Target Acquisition, and Reconnaissance (ISTAR) capability [redacted] The down-selection of a certifiable platform to fulfil the PROTECTOR requirement provides an opportunity for the UK to be the leading European nation for the integration of RPAS into non-segregated airspace. Integration will enable routine training and the conduct of [redacted] for PROTECTOR, and will pave the way for further development of pan-government and commercial RPAS sectors.

5. The Immediate Challenge. The MOD is defining the process for approval and who should own the various aspects of the work. A meeting has been set up with the key players to debate the issue, establish an outline plan and define responsibilities for delivery. Proposed invitees include relevant MOD stakeholders as well as the CAA. This paper outlines the CAA position in advance of this meeting.

[redacted]

Division of Responsibilities

7. The CAA needs to be clear on its high level responsibilities and, crucially, what *does not* fall under the CAA's regulatory remit, to ensure clarity with external stakeholders at the outset of discussions.

a. CAA Responsibilities. *Regulating airspace* provision is the responsibility of the CAA, where it acts in response to proposals from external change sponsors. Accordingly, any Airspace Change Proposal (ACP) to accommodate PROTECTOR would be sponsored by the MoD customer.

b. MAA Responsibilities. As a military or 'State' aircraft, all aspects of PROTECTOR's airworthiness and technical capability would be regulated by the MAA on behalf of the MOD. RA 2320 details that "*RPAS shall be operated with due consideration for the safety of persons, aircraft, vessels and infrastructure*."[1]

c. DAATM Responsibilities. In order to meet the UK strategic aspiration to enable full and safe integration of RPAS operations into the existing airspace structure, Hd DAATM has been nominated as the Airspace lead, responsible for RPAS airspace integration. To achieve this, PROTECTOR would be required to demonstrate that it is both safe to be flown, and flown safely, while abiding by the Rules of the Air.

8. Airspace Considerations

a. Overarching position. There are no regulatory restrictions applicable to UAS that prevent their flight within any airspace classification or structure within UK airspace. Access is dependent on compliance with requirements applicable to all aircraft. The CAA's guidance on the use of UAS is detailed in CAP722 – Unmanned Aircraft System Operations in UK Airspace.

b. Safety Equivalence. To operate BVLOS, UAS require an approved method of Detect and Avoid capability to meet *at least the equivalent safety and operational standards* as manned aircraft. The CAA is agnostic about how that capability is delivered, this is for the MOD to define and assure.

9. Detect and Avoid (DAA)[2]**.** A detect and avoid capability is fundamental to facilitating airspace integration. The essential requirements are:

a. *Within Controlled Airspace*. The requirements to detect other traffic and avoid collisions are achieved through a combination of electronic conspicuity measures, airborne collision avoidance systems and compliance with ATS instructions.

b. *Outside Controlled Airspace*. The avoidance of all airborne objects must be achieved sufficient to comply with the Rules of the Air (RoTA Regulations 2015 where they apply as well as Military Flying Regulations RA 2307).

c. A DAA system does not exist currently which will allow adherence to the Rules of the Air. MAA RPAS regulations (RA2320) specify that, "*Because of the absence of an approved 'sense and avoid' means for complying with the Rules of the Air (RA2307) appropriate to the class of airspace, RPAS should only be flown in segregated airspace in the UK Flight Information Region (FIR)".*

d. Challenge. The presence of Class G airspace below FL195 within UK airspace poses the greatest challenge to PROTECTOR integration. Prolonged access to this airspace is likely (but has not, as yet, been defined as a requirement by MOD).

[1] RA2320 refers.
[2] Also referred to as 'Sense and Avoid'.

10. Airspace 'Accommodation' Options. In the absence of DAA or a safety case that shows equivalent or better safety outcomes, a mix of permanent and temporary segregated airspace may be required for arrivals, departures, transits and 'on task' to allow PROTECTOR to operate in accordance with the CONOPS.

a. The introduction of any new permanent airspace structure, or significant change to an existing one, will be subject to an Airspace Change Proposal (ACP). This process is currently under review and open to external consultation, but under the existing arrangements an ACP would normally require at least 18 months to complete. This is greatly dependent on the size and nature of the proposed change.

b. Any ACP to accommodate the introduction of PROTECTOR would be sponsored by the MOD (specific sponsor is to be determined by MOD.

c. Accommodation of temporary airspace requirements for UAS/RPAS in the UK is achieved through establishment of Temporary Danger Areas (TDA). TDAs are limited to 90 days' duration and are therefore unsuitable for PROTECTOR's long-term integration. However, their use for precisely defined short-term requirements or contingencies may be appropriate. TDAs must be requested by a sponsor and sent to SARG for consideration. CAP 722 provides guidance on the requirements and timescales. Notification of TDAs is via Aeronautical Information Circular (AIC) which are published as part of the AIRAC cycle; as a guide 90 days' notice is required.

11. Spectrum. Beyond specific airspace integration considerations, the CAA are responsible for ensuring that aeronautical systems have access to sufficient, suitably protected spectrum in order that they can achieve their operational objectives whilst ensuring the safety of the overall air traffic system. Separate discussions are required between the MOD and CAA regarding spectrum usage.

Summary

12. This brief outlines the CAA roles and responsibilities with regards to integration of PROTECTOR into UK airspace. In essence CAA responsibilities extend to *airspace* considerations, where it acts in response to proposals from external change sponsors.

[redacted] [redacted]
AAA ISP

From: [redacted]
To: [redacted]
Subject: FW: 20160419-PROTECTOR_Airspace_Integration_WG_Postponement-O
Date: 19 April 2016 10:36:00
Importance: High

[redacted],

Passed on for information.

There was a protector airspace integration meeting planned for 12 May (originally it was going to be mid April) – [redacted] was wanting me to attend (I am away on leave at that time, and had actually suggested that he approached you instead) but he had also approached [redacted] to be there as well..

It appears that, as a result of the meeting you attended yesterday, the airspace discussions have been postponed too.

Please note that I have consistently made it quite clear to [redacted] that the CAA cannot start getting deeply involved in matters regarding what equipment fits/requirements/capabilities/standards that Protector needs as it is not our call to make – we can outline the principles, in that our basic question will always be 'How are you going to mitigate for the potential of a collision (with anything) ?' hence we would expect an unmanned aircraft to display the equivalent capabilities for safe operation in the same airspace structure, but we are not going to define how this must be done; it is up to the Military, as a self-regulating organisation, to be able to satisfy itself that the operation is safe enough.

[redacted]
[redacted]
[redacted]
Intelligence, Strategy and Policy
Safety and Airspace Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
W Sussex
RH6 0YR
Tel: [redacted]
E-mail: [redacted]@caa.co.uk

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 19 April 2016 09:57
To: [redacted]
Cc: [redacted]
Subject: 20160419-PROTECTOR_Airspace_Integration_WG_Postponement-O
Importance: High

[redacted]

Many thanks for your offer of support this morning; however, as you can see below, the meeting has been postponed once again. I will keep you informed of any future requests.

Yours

[redacted] | [redacted] | [redacted] | DAATM | 6th Floor | CAA House | 45-59 Kingsway | London | WC2B 6TE | Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] | [redacted]@mod.uk | Personal: [redacted]@mod.uk

---

From: [redacted] ([redacted])
Sent: 19 April 2016 09:14
To: [redacted]
Subject: 20160419-PROTECTOR_Airspace_Integration_WG_Postponement-O
Importance: High

Sirs, all,

Please accept this email as postponement of the next PROTECTOR Airspace Integration WG, nominally scheduled for w/c 9 May 16.

Background:

ACAS' mtg yesterday assigned [redacted], [redacted], as the lead on PROTECTOR UK Airspace Integration. Initial scoping will report back to ACAS by end of May 16 (date to be coordinated through [redacted]). Dates for subsequent WGs will then be decided upon.

Please cascade as required.

Please contact me directly with any questions/issues.

Yours aye,

[redacted]

[redacted] | [redacted] | [redacted] | [redacted] | RAF Waddington, Lincoln, LN5 9NB | Mil: [redacted] | Civ: [redacted] | Secure: [redacted] | Work Mobile: [redacted] | DII(F) [redacted]@mod.uk

From: [redacted]
To: [redacted]
Cc: [redacted]
Subject: FW: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]
Date: 27 April 2016 16:15:25
Attachments: 20160421-PROTECTOR_AIRSPACE_INTEGRATION-Minutes-[redacted].docx

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[redacted],

Many thanks for shuffling your diary to represent the CAA at the next Protector airspace integration meeting.

PSA official record of the meeting to complement my after meeting note. Please let me know if the military speak needs translation!

No input has, as yet, been requested with regards to the action to develop an airspace integration plan. We are standing by and will prioritise support, alongside other activities, accordingly as and when we are approached ([redacted]/[redacted] copied in in case the request comes in at a working level via the Working Group).

[redacted]/[redacted],

To be aware. I have a prior commitment which clashes with the next meeting. [redacted] ([redacted]) has kindly agreed to step in to replace me given the level (OF5 and above) of attendance.

Regards,

[redacted] | [redacted]
Aviation House, Gatwick Airport South, West Sussex, RH6 0YR
Telephone: [redacted]
Mobile: [redacted]

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 22 April 2016 09:38
To: [redacted]
Subject: FW: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]

Morning,

For you…

[redacted]

[redacted] | [redacted] | [redacted] | Defence Airspace Air Traffic Management| K6 CAA House | 45-59 Kingsway | London | WC2B 6TE
Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] | [redacted]@mod.uk | Personal: [redacted]@mod.uk

From: [redacted]
Sent: 21 April 2016 15:30
To: [redacted]
Cc: [redacted]
Subject: 20160421_PROTECTOR_Airspace_Integration_Meeting_OS

Sirs/Ma'am/All,

Please find attached minutes from **PROTECTOR AIRSPACE INTEGRATION MEETING HELD IN MOD MAIN BUILDING ON MON 18 APR 16**.

[redacted] - Pse pass to [redacted].

Regards

[redacted]
[redacted] | [redacted]
Ministry of Defence | Level 5, Zone I, Desk 20 | Horseguards Avenue | Whitehall | London | SW1A 2HB | [redacted] / [redacted] | [redacted] / [redacted]@mod.uk

[redacted]

MINUTES OF A MEETING TO DISCUSS PROTECTOR AIRSPACE INTEGRATION HELD IN MOD MAIN BUILDING IN MEETING ROOM 04-2-MR13 AT 1300 ON MON 18 APR 16

Present	AVM Richard Knighton [redacted]	ACAS [redacted]	Chair Sec
In Attendance	[redacted]	[redacted]	
Apologies	[redacted]	[redacted]	

Item 1 – Introduction

1. ACAS opened the meeting summarising that the [redacted] was seeking to define the pathway to establish an outline plan, and define responsibilities, to enable the operation of PROTECTOR (PROT) within non-segregated airspace in the UK.

Item 2 – PROTECTOR Programme Update

2. The [redacted][1] opened by confirming that PROT was just one aircraft requiring access to UK airspace and this should not be considered in isolation by the pan-MOD and x-govt WGs. However, it was recognised that PROT was likely to be the pioneer programme in this regard. The [redacted] further outlined the core programme timelines and the need for [redacted]. This would require PROT to transit through G Class airspace and should be the challenge to be overcome by the assembled body. It was also recognised that technological advances would need to occur in parallel with regulatory developments to enable PROT to operate in UK airspace and that [redacted]

Item 3 – Regulation (CAA/MAA/TAA) Outline

3. CAA reminded all that, at present, there were no standing regulatory restrictions to prevent RPAS operating in UK airspace; however, the requirement to comply with the rules of the air (including the possible requirement for sense and avoid technology) was reiterated. The regulatory framework to be applied to PROT (and future UAS programmes) was stated as being that which is routinely applied to

[1] SRO is planned to transition to HQ AIR from receipt of MG approval.

[redacted]

[redacted]

manned aircraft. It was confirmed that certification of PROT, as a military aircraft, would be the responsibility of the MAA. It was noted that, as is common practice, the development of the detail of this safety case sits with the TAA, but some of the required standards are currently undefined. More broadly, it was noted that the safety standards for the PROT may not apply to the wider UAS enterprise. It was acknowledged that tolerance of operating risk rests with the Duty Holder chain.

Item 4 – Research and Development Update

4. Concern was expressed that unless MAA/CAA articulated a target equivalent standard for PROT, [redacted] MAA standards, and sign off, will have to be based on a body of research and trials evidence to support a safety case. MAA (which has primacy for certification of PROT to operate in UK airspace) and CAA agreed to be proactive in working alongside DE&S, and ISTAR FHQ, in developing the parameters of a research baseline. As part of this, the need for further dialogue between CAA and MAA was necessary to ensure a mutually agreeable pathway to RPAS airspace integration.

5. DSTL remarked that [redacted]

Action: DSTL to assess previous research efforts that would underpin a definition of manned/unmanned 'equivalence.' **DSTL**

Item 5 – Further Work

6. [redacted] It would be necessary to agree a set safety standard, underpinned by a suitable research basis, upon which TAA could make a robust case to regulatory authorities for safe RPAS integration into UK airspace. DAATM outlined that while they could prove an effective liaison with MAA and CAA, and advise on airspace restrictions, they were not in a position to lead the work on integrated PROT in to UK airspace. RPAS x-govt WG reasoned that while they exist to 'enable full and safe integration of all RPAS/UAS operation into the total aviation system', their policy/coherence function should not interfere with MOD/other departmental activity.

7. It was agreed that there is a requirement to 1) gather evidence that articulates/adds credence to the manned/unmanned equivalency argument, 2) create an appropriate standard for MAA to judge safety against without compromising the success of wider UAS projects, and 3) produce a coherent plan based on a 'crawl, walk, run' approach to airspace access with the ultimate aim of being able to operate PROT in Class G airspace as soon as possible.

8. The [redacted] agreed to lead the work to develop a plan to integrate the PROT in to UK airspace. This work would be based on the on-going development of the CONOPS, CONEMP and CONPLAN work. It would identify more clearly the requirements for operating in UK airspace and would provide a staged approach to the operation of PROT in UK airspace.

Action: It was agreed that the [redacted] would present his plan back to the group before the end of May 16. **ISTAR FC**

CAS AS Strat 3
Sec

[redacted]

From: [redacted]
To: [redacted]; [redacted]; [redacted]
Subject: RE: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]
Date: 29 April 2016 10:28:48

Dear all,

Initial high level update:

I was asked to join a telecom that the TAA was having with Gen Atomics, US DoD and the FAA on Monday 25th which was then followed up a further telecom with the TAA team. Yesterday afternoon I took the opportunity of being in Bristol for a different subject to go over to Abbey Wood and meet F-2-F with [redacted] and [redacted] from the TAA.

The discussions can be summarised as:

Initial reach out from the TAA on how / what they will need to know/put in place for the platform to be able to:

a) access/operate in UK (and subsequently international) airspace
b) establish/define the necessary requirements within the type certification basis
c) how and where they could gain appropriate expertise support – as this is the first whole platform type certification exercise that has been undertaken to this degree of operational intent.

I have provided very high level advise on the ICAO/Chicago convention for civil aviation – and the lack of any known global equivalent for state/military aircraft, and the intent / principles being developed within ICAO and to an extent in JARUS with EU/EASA that could at least aid the national operational intent.

[redacted]

b) From a UK PLC viewpoint the only experience on undertaking Type Certification as a regulatory task lies in CAA and respective individuals therein. Thus whilst the TAA could place (or extend) CAAi contract request they are not clear on if/would CAA be in a position to do this, from their understanding of the current organisation changes. Also, would need to resolve any concerns with potentially similar activity from/with MAA. The main areas of interest discussed area in the overall process management (Project Cert Manager type role, and System Safety Assessment application, safety target setting and then compliance material review methods).

TAA are to look into these further, with potential requests for assistance thereafter.

Regards,

[redacted]

From: [redacted]
Sent: 27 April 2016 17:41
To: [redacted]; [redacted]; [redacted]
Subject: RE: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]

[redacted],

Thanks - got it. Useful addition. Useful to see if there were MOD 'reattacks' post the meeting…

[redacted] | [redacted]
Aviation House, Gatwick Airport South, West Sussex, RH6 0YR
Telephone: [redacted]
Mobile: [redacted]

From: [redacted]
Sent: 27 April 2016 17:37
To: [redacted]; [redacted]; [redacted]
Subject: RE: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]

[redacted], [redacted],

Please note that [redacted] had a telecon with some members of the UAS Project Team ([redacted], [redacted] plus some others I think) late on Monday 25th afternoon – it was on airworthiness aspects but apparently had some 'enlightening' points to note. [redacted] is doing some notes, but if this next meeting is quite soon, I'd suggest you check in with [redacted] beforehand to get his feedback.

[redacted] – debrief note attached

[redacted]
[redacted]
[redacted]
Intelligence, Strategy and Policy
Safety and Airspace Regulation Group
Civil Aviation Authority
Aviation House
Gatwick Airport South
W Sussex
RH6 0YR
Tel: [redacted]
E-mail: [redacted]@caa.co.uk

From: [redacted]
Sent: 27 April 2016 16:15
To: [redacted]
Cc: [redacted]; [redacted]; [redacted] ([redacted]); [redacted] ([redacted]); [redacted]; [redacted]; [redacted]
Subject: FW: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]

[redacted],

Many thanks for shuffling your diary to represent the CAA at the next Protector airspace integration meeting.

PSA official record of the meeting to complement my after meeting note. Please let me know if the military speak needs translation!

No input has, as yet, been requested with regards to the action to develop an airspace integration plan. We are standing by and will prioritise support, alongside other activities, accordingly as and when we are approached ([redacted]/[redacted] copied in case the request comes in at a working level via the Working Group).

[redacted],

To be aware. I have a prior commitment which clashes with the next meeting. [redacted] ([redacted]) has kindly agreed to step in to replace me given the level (OF5 and above) of attendance.

Regards,

[redacted] | [redacted]
Aviation House, Gatwick Airport South, West Sussex, RH6 0YR
Telephone: [redacted]
Mobile: [redacted]

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 22 April 2016 09:38
To: [redacted]
Subject: FW: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]

Morning,

For you…

[redacted]

[redacted] | [redacted] | [redacted] | Defence Airspace Air Traffic Management| K6 CAA House | 45-59 Kingsway | London | WC2B 6TE
Military Network: [redacted] | Civilian Telephone: [redacted] | DII: [redacted] | [redacted]@mod.uk | Personal: [redacted]@mod.uk

---

From: [redacted] [redacted])
Sent: 21 April 2016 15:30
To: [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted]

[redacted]; [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted]; [redacted] ([redacted])
Cc: [redacted] ([redacted]); [redacted] ([redacted])
Subject: 20160421_PROTECTOR_Airspace_Integration_Meeting_[redacted]

Sirs/Ma'am/All,

Please find attached minutes from **PROTECTOR AIRSPACE INTEGRATION MEETING HELD IN MOD MAIN BUILDING ON MON 18 APR 16**.

[redacted] - Pse pass to [redacted].

Regards

[redacted]
[redacted] | [redacted]
Ministry of Defence | Level 5, Zone I, Desk 20 | Horseguards Avenue | Whitehall | London | SW1A 2HB | [redacted] / ([redacted]) [redacted] | [redacted] / [redacted]@mod.uk

From: [redacted]
To: [redacted]; [redacted]; [redacted]
Cc: [redacted]; [redacted]
Subject: FW: 20160523-Protector_Airspace_Integration_Meeting_Read-Ahead-[redacted]
Date: 07 June 2016 19:47:45
Attachments: 20160520-Protector_Airpspace_Integration_ACAS_Final-[redacted].doc
20160520-Annex_A_Airspace_Integration-[redacted].doc
20160520-Annex_B_to_Protector_Airspace_Integration_CONOP-[redacted].ppt
20160520-Annex_C_to_Protector_Airspace_Integration-[redacted].docx
20160516-ICAO_RPAS_Trip_Report-[redacted].doc
Importance: High

PLEASE NOTE THE DOCUMENT CAVEATS AND PLEASE DO NOT DISTRIBUTE FURTHER WITHOUT PERMISSION FROM ME

Dear All,

PSA papers which the MAA kindly sent to me today (I will ask to receive via formal channels this week as CAA did not receive a copy).

These papers were sent out prior to the high level PROTECTOR meeting on 26 May. At the meeting a hard copy bow tie was given to attendees to accompany these briefing notes (currently [redacted] has the bow tie hard copy I received).

I wanted you to have sight of these as you have been involved at a working level with the PROTECTOR project and I understand that there are meetings coming up in the near future.

I would like to form a CAA position on what is being proposed in this paper, building on the high level general position that we wrote prior to the first of these meetings.

I was the only voice of caution in the meeting as I was not convinced that the bow tie 'solved' the exam question; however, as I had not had the opportunity to see the papers beforehand I could not comment on the detail, only on the high level principles.

My logic/question I posed in the meeting: if equivalence is being demonstrated then why the need for the layered safety approach (i.e. depart in quiet hours etc); if equivalence is achieved there is no need for any layered mitigations? Happy to be put in my place and challenged.

In sum, ACAS agreed with the recommendations in the paper, so he is of the opinion that what is being proposed has merit.

I would value your thoughts on the proposals. I think it would be helpful to form this collective view prior to the next working group so those attending have a clear steer. If we have issues/questions we should flag early before the idea grows (more legs) **Can someone confirm the exact date?**

Regards,

[redacted] | [redacted]
Aviation House, Gatwick Airport South, West Sussex, RH6 0YR
Telephone: [redacted]
Mobile: [redacted]

[redacted]

20160520-Protector_UK_Airspace_Integration

20 May 16

PSO ACAS

PROTECTOR UK AIRSPACE INTEGRATION

1. **Issue.** An appropriate strategy is required to enable integrated Protector operations within UK airspace. These should be aligned to CAA and MAA policy and VCDS' aspiration to normalise RPAS access to UK airspace.

2. **Recommendations.** ACAS is **invited to note**:

a. While extant ICAO and CAA regulations do not explicitly prohibit RPAS[1] ops outside segregated airspace, 'equivalence' with manned platforms is required when measured against the most testing scenario[2]. However, there are currently no universally accepted performance standards for RPAS Sense and Avoid (SAA).

b. As a minimum, Protector is required[3] to be capable of transiting through all classes of UK airspace by [redacted]. This is aligned to emerging cross-government aspirations for the integration and normalisation of RPAS operations.

c. If required, segregated airspace will be enabled via the Airspace Change Process (ACP). However, this would incur additional cost, delay and impact other UK airspace users.

d. Public acceptance will be an important factor in normalising domestic RPAS ops.

and **agree that**:

e. DSTL [redacted] and tasked to quantify human performance and define the technical equivalencies required for non-segregated operations in the most testing scenario.

f. The proposal at Annex A is endorsed and submitted to the TAA.

g. DAATM is tasked to define the ACP timeline and potential cost at Annex B.

h. DDC is tasked to establish a supporting RPAS engagement strategy.

Background.

3. The most testing RPAS regulatory scenario is considered to be operations in non-segregated airspace where visual lookout remains the last safeguard for separation from non-coordinated traffic[4]. However, there is no defined technical standard offering equivalence to the human eye or regarding RPAS SAA[5] technology. Although SAA capabilities are being developed, these will not be available in Protector IOC criteria at Annex C[6]. Moreover, these capabilities may set unrealistic regulatory standards beyond the financial and technical resources of other potential airspace

---

[1] Specifically, RPAS operated in the Certified category as defined in EASA regulatory 'Concept of Operations for Drones' (May 2015).

[2] 20160405-CAA_Position_On_Roles_And_Responsibilites_For_Protector_Airspace_Integration.

[redacted]

[4] ICAO defined Class G airspace permits non-participating traffic to operate under VFR. Individual states are permitted to impose more stringent criteria if they so wish; in the UK, the CAA currently chooses not to.

[5] DSTL cite numerous industry approaches to SAA development but highlight the lack of universally accepted methodology or regulated performance standard.

[6] [redacted]

[redacted]

users. RPAS integration into non-segregated airspace can therefore be distilled into the following work-strands:

a. **SAA Equivalence.** Human performance in the most testing scenarios requires definition for a comparable and acceptable RPAS SAA capability to be certified.

b. **C2 Link Fidelity.** RPAS C2 links must have a likelihood of failure below $1x10^{-6}$ per flying hour. If this cannot be achieved, SAA capability must have the ability to act autonomously outside of segregated airspace.

4. **Proposed PROTECTOR Approach.** Assessment of PROTECTOR regulatory compliance will be undertaken by the TAA, with MAA agreement, and will support the Safety Assessment Report (SAR). Should airworthiness standards not be achieved or not exist, then a safety-based argument will be generated within the SAR, with an associated risk transfer note to the DH chain. The following approaches are recommended:

a. **Preferred Hybrid Approach.** Annex A is a methodology similar to that already considered by some to be best practice[7]. This graduated risk assessment will seek near-term integration by proving equivalence with manned aircraft under extant Rules of the Air. This analysis, based on the Protector equipment fit detailed at Annex B, will inform the TAA assessment.

b. **Fallback Segregated Approach.** If RPAS integration cannot be achieved, then segregation via ACP will be necessary. This will incur additional cost and delay, and could impose restrictions on other UK airspace users[8]. Nevertheless, the ACP at Annex B, should be progressed in parallel to de-risk the preferred CoA at IOC.

c. **Communication Strategy.** Public perception will be central to normalising RPAS use in UK airspace, especially for military purposes. An internal and external communication strategy will therefore be essential to support Protector DLoDs.

Summary

5. DSTL research based on defined Protector capabilities is required to define the technical standards required to establish CAA regulation enabling routine Protector use in UK airspace. This in turn will secure TAA approval and potentially allow the UK to become a recognised leader amongst ICAO member states in the integration of RPAS. While regulatory implications may result, the broader economic and reputational benefits for the MoD and Prosperity Agenda may be compelling. However, the perception of RPAS - both by the public and ATM community - will be central to integration and require a coherent cross-government communications strategy.

ISTAR FC

Annexes:

A: Proposed Protector Integration CoAs.
B: Proposed DAATM ACP fallback measures.
C. Protector IOC equipment and criteria.

Attachment:

1. 'ICAO RPAS and Remote ATS Symposium': ISTAR FHQ Trip Report.

---

[7] CANSO "ANSP Considerations for RPAS Operations" Para 7 – "Best practice Switzerland: operation procedures ADS-95".
[8] BZN ACP started in 2011, had to be changed to accommodate Oxford airport, is still not ratified, and has cost over £248 000 so far.

[redacted]

Annex A to
Protector UK Airspace
Integration-[redacted]
Dated 20 May 16

PROTECTOR PREFERRED INTEGRATION APPROACH

1. **Background.** The following bowtie analysis considers potential Risks and mitigations for operating Protector with IOC equipment fit (at Annex C). This preferred approach has been designed to prove equivalence with a participating manned platform on a typical UK flight profile.

2. **Assumptions.** Although not exhaustive, the following assumptions were made:

   a. All pilots are fully qualified with appropriate Instrument Rating.

   b. [redacted]

[redacted]

Annex A to
Protector UK Airspace
Integration-[redacted]
Dated 20 May 16

Hazard: FRPAS operation in UK controlled airspace (MAC)

Hazard name:	FRPAS operation in UK controlled airspace (MAC)
Top event:	RPAS aircraft in close proximity with another aircraft so that their safety is or may be compromised
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat		
	Barrier	
		Escalation Factor
		Barriers (...)
• Participating aircraft in conflict		
	• Flightplan submitted and accepted by ATC	
	• ATC Service Provided	
		• Esc. Lost radio comms with ATC
		• Br. Standard international lost comms procedure
		• Br. Telephone communications between GCS and ATC agency
	• Situational Awareness provided by Collision Warning System (CWS)	
	• ADS-B	
		• Esc. Limited carriage by participating aircraft
	• [redacted]	
		• [redacted]
		• [redacted]
		• [redacted]
		• [redacted]
	• [redacted]	
	• [redacted]	

[redacted]

[redacted]

• Other aircraft airmanship - prompted by ATC to keep good lookout
• Loss of command and control link while another aircraft is in conflict
• Robustness of BLOS Primary link
• Esc. Manoeuvre impact on link
• Br. Manoeuvre Limited
• Esc. Satellite geographic footprint limitation
• Br. Operations conducted within usable satellite footprint
• Esc. BLOS hardware failure
• Br. Robustness of primary SATCOM physical infrastructure
• Esc. Interruption in services and connectivity
• Br. GCS
• Esc. Primary power failure
• Br. System includes a UPS which provides backup power
• Esc. CIS Failure
• Br. TTPS and reversionary procedures
• Esc. Environmental Control System failure
• Br. Redundant Environmental Control Systems
• Br. Load shed the system
• Br. SOPs
• Br. C2 Circuitry
• Esc. Failure of C2 link between GCS and relay site
• Br. Redundant links at ground sites
• Br. Physical protection of C2 link hardware
• [redacted]
[redacted]
• Br. Satellite
• Esc. Satellite fails
• Br. Satellite is manufactured to military specs
• Br. Redundant satellite equipment
• Br. Redundant satellites within constellation
• Br. Redundancy within BLOS system
• Pilot will be given prior indication of degradation and loss of link
• Secondary BLOS link
• Predictable lost-link profile agreed with ATC
• Departure from controlled airspace due to technical failure
• FRPAS Declares in-flight emergency
• Control of aircraft is retained
• Esc. Control system integrity is compromised
• Br. Certified air vehicle
• Esc. Air vehicle integrity is compromised
• Br. Certified air vehicle
• Pre-planned emergency landing zones

[redacted]

Consequences

Consequence		
	Barrier	
		Escalation Factor
		Barriers (...)
• Mid air collision resulting in fatalities		
	• TA/RA from CWS	
		• Esc. May not be able to comply with CWS RA due to performance limitations
		• Br. CWS logic
	• FRPAS Pilot instigates avoiding action (if they are able)	
	• Other aircraft pilot instigates avoiding action (if they are able)	
• Third party fatalities on the ground (see separate tech failure bowtie)		

[redacted]

[redacted]

Hazard: FRPAS Terminal Operation (Take off and landing)

Hazard name:	FRPAS Terminal Operation (Take off and landing)
Top event:	Unplanned deviation from normal launch and recovery profile
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat			
	Barrier		
		Escalation Factor	
			Barriers (...)
• Aircraft in conflict			
	• FRPAS operating in controlled airspace		
	• ATC service		
• Failure to maintain separation with terrain or obstacle			
	• FRPAS flies approved arrival and departure procedures		
	• FRPAS is fitted with CNS - ATM approved navigation system		
	• FRPAS scheduled performance is defined		
• Engine Failure			
	• Engine is envisaged to be certified in accordance with appropriate standards		
• Loss of BLOS link			
	• Alternate Line of Sight (LOS) control link		
		• Esc. Loss of LOS control	
			• Br. Pre-programmed loiter profile
• Runway becomes unavailable			
	• Contingency Fuel		
	• Executes diversion procedure		

	• Commanded forced landing

Consequences

Consequence	
	Barrier
• Results in loss of life	
	• Abort/go around procedures
	• Pre programmed loiter profile
	• Pre-agreed surveyed forced landing sites within the ATZ

[redacted]

Hazard: FRPAS operation in UK class G (uncontrolled) airspace (MAC)

Hazard name:	FRPAS operation in UK class G (uncontrolled) airspace (MAC)
Top event:	RPAS aircraft in close proximity with another aircraft so that their safety is or may be compromised
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat			
	Barrier		
		Escalation Factor	
			Barriers (...)
• Participating aircraft in conflict			
	• Minimise time in Class G airspace		
	• NOTAMS		
	• ATC Service Provided		
	• Local agreements achieved between ATC units		
	• Situational Awareness provided by Collision Warning System (CWS)		
	• ADS-B		
		• Esc. Limited carriage by participating aircraft	
	• [redacted]		
		[redacted]	
			[redacted]
			[redacted]
			[redacted]
	• FRPAS controlled by qualified pilots		
	• FRPAS Crew Fatigue Management		
	• Other aircraft airmanship - prompted by ATC to keep good lookout		

[redacted]

	• FRPAS Conspicuity	
• Non-participating aircraft in conflict		
	• RPAS to Minimise time in Class G airspace	
	• NOTAMS	
	• ATC Service Provided	
	• De-confliction by time of day for reduced traffic density (take-off and recover by night)	
		• Esc. FRPAS does not have sufficient fuel to wait until night time to be recovered
		• Br. Maintain sufficient fuel reserve for recovery at night
		• Esc. FRPAS undergoes critical failure during daylight hours
		• Br. FRPAS declares emergency as per procedures used by manned aircraft
	• SA provided by CWS	
		• Esc. Other aircraft not fitted with CWS
	• [redacted]	
	• FRPAS controlled by qualified pilots	
	• FRPAS Crew Fatigue Management	
	• Other aircraft airmanship - required to keep good lookout	
	• FRPAS Conspicuity	
• Loss of command and control link while another aircraft is in conflict		
	• Robustness of BLOS Primary link	
		• Esc. Manoeuvre impacts on link
		• Br. Manoeuvre Limited
		• Esc. Satellite geographic footprint limitation
		• Br. Operations conducted within usable satellite footprint
		• Esc. BLOS hardware failure
		• Br. Robustness of primary SATCOM physical infrastructure
		• Esc. Interruption in services and connectivity
		• Br. GCS
		• Esc. Primary power failure
		• Br. System includes a UPS which provides backup power
		• Esc. CIS Failure
		• Br. TTPS and reversionary procedures
		• Esc. Environmental Control System failure
		• Br. Redundant Environmental Control Systems
		• Br. Load shed the system
		• Br. C2 Circuitry
		• Esc. Failure of C2 link between GCS and relay site
		• Br. Redundant links at ground sites
		• Br. Physical protection of C2 link hardware
		• [redacted]

[redacted]

		• [redacted]
		• Br. Satellite
		• Esc. Satellite fails
		• Br. Satellite is manufactured to military specifications
		• Br. Redundant satellite equipment
		• Br. Redundant Satellites within constellation
		• Br. Redundancy within BLOS system
	• Pilot will be given prior indication of degradation and loss of link	
	• Secondary BLOS link	
	• Line Of Sight control system	
	• Predictable lost-link profile agreed with ATC	

Consequences

Consequence		
	Barrier	
		Escalation Factor
		Barriers (...)
• Mid air collision resulting in fatalities		
	• TA/RA from CWS	
		• Esc. May not be able to comply with CWS RA due to performance limitations
		• Br. CWS logic
		• Esc. TA/RA only generated for participating aircraft
	• FRPAS Pilot instigates avoiding action (if they are able)	
	• Other aircraft pilot instigates avoiding action (if they are able)	

[redacted]

Hazard: FRPAS Technical Failure in Controlled Airspace/with Engine Failure

Hazard name:	FRPAS Technical Failure in Controlled Airspace/with Engine Failure
BowTie Group:	New Location
Top event:	RPAS aircraft inability to remain airborne
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat			
	Barrier		
		Escalation Factor	
			Barriers (...)
• Departure from controlled airspace due to technical failure			
	• FRPAS Declares in-flight emergency		
	• Control of aircraft is retained		
		• Esc. Control system integrity is compromised	
			• Br. Certified air vehicle
		• Esc. Air vehicle integrity is compromised	
			• Br. Certified air vehicle
	• Pre-planned emergency landing zones		

Consequences

Consequence	
	Barrier
• Third party fatalities on the ground	
	• Emergency procedures
	• Pilot lands aircraft at Pre-planned emergency landing zones

[redacted]

[redacted]

CLASS G AIRSPACE SEGREGATION OPTION

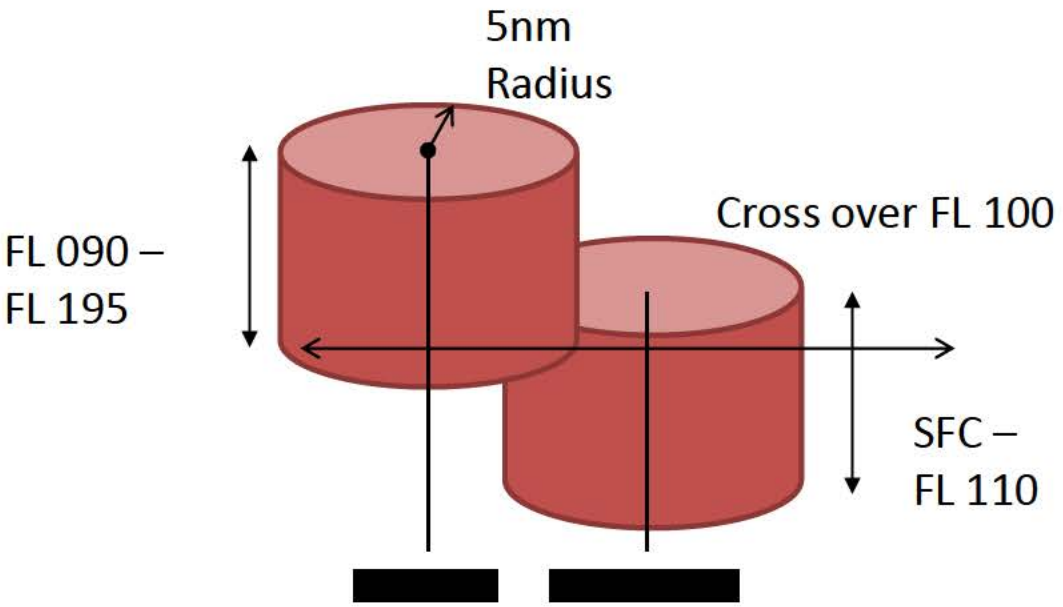

[redacted]

[redacted]

- **This would require an ACP; Approx 2 years with consultation.**

[redacted]

CLASS G AIRSPACE SEGREGATION OPTION

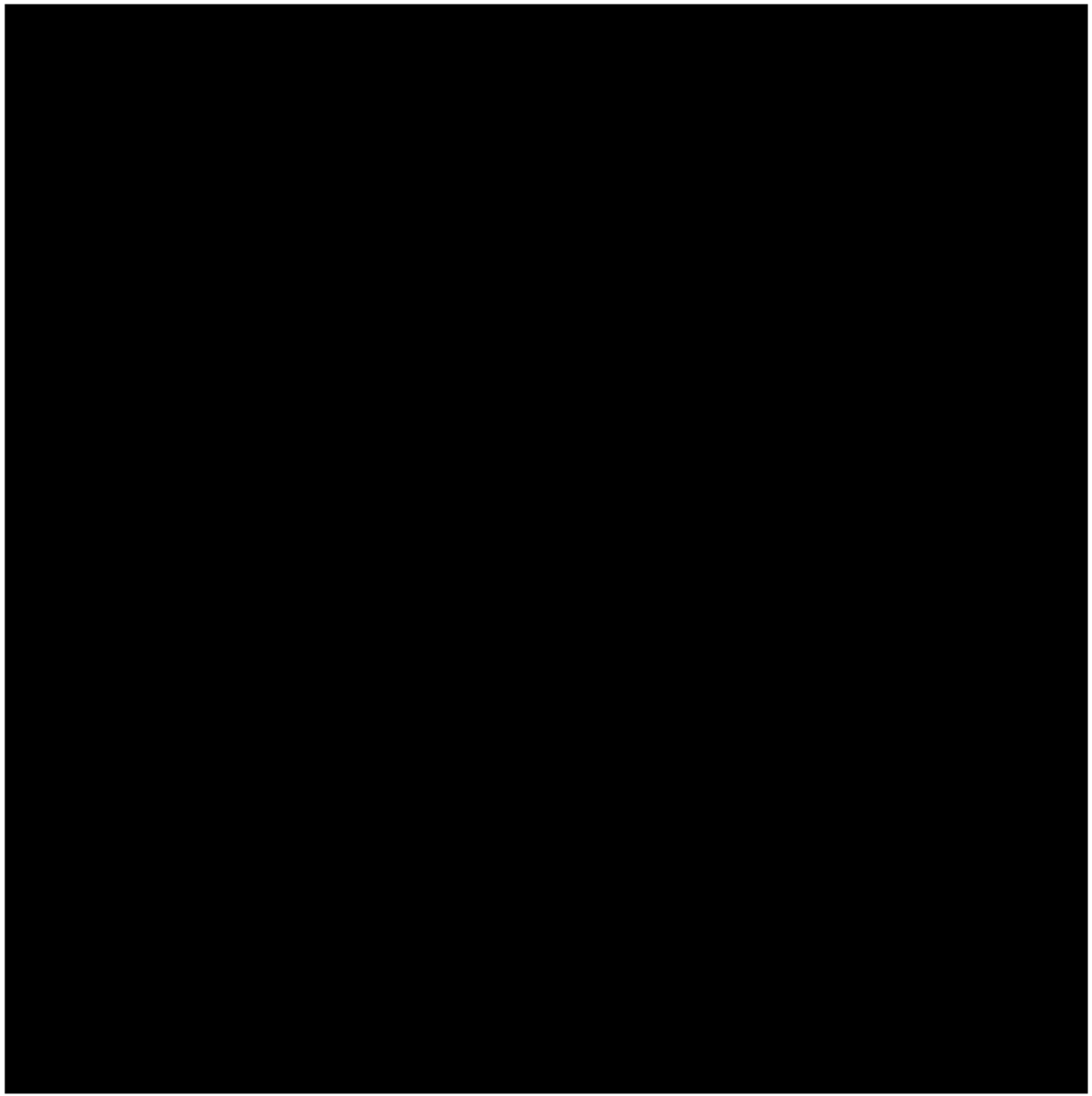


- **Cross section view depicting spiral climb and crossover requirement.**
- **Once Protector reaches FL200 will route in CAS as OAT.**
- **Integration within CAS still requires acceptance by the CAA.**

[redacted]

Annex B to
PROTECTOR UK
Airspace Integration
Dated 20 May 16

CLASS C AIRSPACE ROUTINGS



[redacted]

CLASS C AIRSPACE ROUTINGS

[redacted]

[redacted]

- [redacted]
- TRAs already Established between FL195 and FL245.
- TRAs designed to allow autonomous VFR access for Mil ac.
- Use of TRAs minimises interaction with Civil ac.
- Changes to ATC rules required to accommodate mandatory Separation between Civil ac and Protector.

[redacted]

Annex C to
Protector UK Airspace
Integration-[redacted]
Dated 20 May 16

PROTECTOR IOC EQUIPMENT FIT

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

20160516-ICAO RPAS Trip Report-[redacted]

16 May 16

ISTAR FC
DFC
AS Strat 3
AS International 1

ICAO RPAS AND REMOTE ATS SYMPOSIUM TRIP REPORT

1. **Issue.** SO1 RPAS and Shadow attended the ICAO 'RPAS and Remote Air Traffic Service (RATS)' Symposium in Stockholm, 10-11 May 16.

2. **Timing.** Routine.

3. **Recommendations.** The FC and DFC are invited to **note** that:

   a. **The international civilian air traffic community is overwhelmed by the expansion of unregulated small (<150 kg) UAS use.**

   b. **RPAS are viewed as a 'disruptive technology' requiring a fundamental change to Air Traffic Management (ATM) regulation and methodology.**

   c. **ICAO and CAA representatives opined that industry should drive 'regulatory answers' to RPAS integration challenges including 'Detect and Avoid'.**

   d. **RATS sensor technology is already considered to exceed the acuity of the human eye.**

Background

4. The Symposium was attended primarily by ICAO member state and industry representatives. It therefore provided an excellent insight into the civilian ATM regulatory community's thinking regarding RPAS integration and RATS. It is evident that they are overwhelmed by the rapid proliferation of unregulated small UAS (SUAS).[1] The overall ICAO mindset was illustrated by RPAS/UAS and RATS being described as 'disruptive' and 'sustaining' technologies respectively despite arguably presenting similar cultural challenges.

5. Although ICAO focus remains on SUAS, this may increasingly be offset by the introduction of large commercial RPAS in the next decade. Indeed, the Facebook Director of Aeronautical Platforms stated an intention to deploy up to 10 000 solar powered High Altitude Long Endurance RPAS by 2025 globally.[2] This presents an opportunity for Defence to share the lessons of over 20 years of military MALE operations. Equally, emerging 'Unmanned Traffic Management' (UTM) concepts using 'self organised air network' wifi Cloud technology to deconflict SUAS with General Air Traffic may prove relevant to military RPAS and swarming weapons.

6. There was considerable discussion regarding how ATM policy bodies should adapt to the 'Drone Age.' It was widely accepted that the current 3-7 year period required for new civilian aviation regulation was unsuited to the rapid evolution of drone technology. Therefore, both the ICAO and CAA advocated a more agile block upgrade strategy for global regulation; this would also consider upper airspace and commercial space activity. Moreover, there was likely to be a

[1] Although definitions differed between nations, SUAS were generally considered to fall below 150 kg in weight. The US FAA stated that there were now some 400 000 registered SUAS and an unknown number of unregistered systems. This compared with a total of 300 000 registered civilian manned aircraft in the US.
[2] These appear to be in a similar class to Zephyr T.

[redacted]

[redacted]

requirement to introduce new rules of the air including ‘non-direct’ or ‘synthetic VFR’ and Accident Data Recorder equivalency for remote data storage. Addressing the question of who defined standards, both ICAO and the CAA tacitly acknowledged the need for industry to offer the technological solutions upon which ICAO would base policy. This may present an opportunity for the RAF to gain disproportionate influence as Protector paves the way with RPAS airspace integration. If appropriately highlighted by Centre, the associated technological and commercial benefits to be derived from integrating military and commercial RPAS into airspace may also prove a powerful lever to assure Protector timescales and funding.

7. Perhaps unsurprisingly, the audience was far more positive concerning RATS. Increasing numbers of these remotely manned and operated towers are now operational at isolated airfields in Scandinavia and North America; such technology also has clear relevance to expeditionary military ATC. Of particular note, it is already widely accepted that visual sensors used in RATS architecture exceed the visual acuity of the human eye; this precedence should be exploited to erode resistance regarding RPAS ‘detect and warn’ technology. Interestingly, parallels to military Ku-Ku RPAS ops are already emerging regarding the implications for sustained 24/7 workload and ‘follow the sun’ handovers of airfield control. There is also potential for the visual presentations inherent in RATS to be used for the remote supervision of RPA taxiing and ATOL. This may reduce the need for Protector engineers to be SQEP in this role.

Summary

8. This symposium offered a valuable insight into the mindset of the ATM community and industry regarding remote technology. While ICAO remains overwhelmed by the explosion in unregulated SUAS, there is emerging commercial interest in larger RPAS. This may dictate fundamental changes to aviation law and regulatory tempo. However, continued ICAO focus on SUAS also presents an opportunity for the military to assume a degree of leadership in RPAS regulatory standards via industry. Moreover, the commercial and economic benefits of the UK becoming a recognised leader in RPAS integration may prove compelling for UK ministers. This could in turn act as a positive lever for Protector and Zephyr development. Similarly, the acceptance of RATS synthetic visual technology sets a valuable precedence for RPA ‘detect and avoid’ certification.

SO1 RPAS and Shadow

Stephen Rihanne

Subject: Updated: PROTECTOR Airspace Integration WG
Location: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Start: Wed 15/06/2016 00:00
End: Thu 16/06/2016 00:00
Show Time As: Tentative

Recurrence: (none)

Organizer: [redacted])

Importance: High

When: 15 June 2016 00:00 to 16 June 2016 00:00 (GMT) Greenwich Mean Time : Dublin, Edinburgh, Lisbon, London.
Where: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*~*

****AGENDA** Mtg will only be one day because of numerous cancellations.**

ITEM 1. Introduction and update by SO2 PROTECTOR
ITEM 2. Work through ISTAR FHQ preferred Airspace Integration proposal
ITEM 3. Discuss Segregated Airspace Option and timeline for ACP process
ITEM 4. RFIs/AOB

All - FURTHER UPDATE - apologies - an Outlook glitch - this mtg will still be taking place at the RAF Benevolent Fund building on 15 & 16 Jun 16.

UPDATE This WG will now be used to discuss the specifics of the proposals that will be put to ACAS on 26 May 16. GA-ASI will not be required to attend as they will be centred on IOC timeline aspirations for PROTECTOR operation in UK Airspace.

Subsequent mtgs to discuss broader Airspace Integration issues (specifically equipage regulation etc) will be scheduled in due course.

Please come back directly with any points/issues.

Agenda will follow shortly.

Sirs, all,

Invitation to the next PROTECTOR Airspace Integration WG to be held at the RAF Benevolent Fund from 0900-1700 BST each day.

Please do not expand invite without prior consultation.

Agenda to follow shortly.

Light refreshments will be provided throughout the 2 days.

Yours aye,

[redacted]

[redacted] | [redacted] | **1Gp ISTAR FHQ** | **SO2 Protector** | RAF Waddington, Lincoln, LN5 9NB | Mil: [redacted] | Civ: [redacted] | Secure: [redacted] | Work Mobile: [redacted] | DII(F) [redacted]@mod.uk

Stephen Rihanne

From: [redacted] ([redacted]) <[redacted]@mod.uk>
Sent: 06 September 2016 23:09
To: [redacted];
Cc: [redacted])
Subject: 20160906-Protector Airspace Accommodation Approach and Development of an RPAS CS-ACNS
Attachments: FW: 20160829-Airpace Integration Telecom Notes-[redacted]

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Red Category

[redacted], [redacted],

I hope you are both well. I'm conscious that either or both of you maybe in Washington DC this week with the RPASP airworthiness WG, so you may be able to further discuss the matters below with [redacted].

First off, I wanted to check whether you were aware of the recent developments in the UK relating Protector's airspace accommodation planning? The airspace accommodation planning is picking up speed, and it appears the CAA have agreed an approach, which aims to exclude the need for airspace segregation and airspace change process. Reading the attached email (please limit distribution), I'm guessing, based on DSTL/[redacted] involvement, that the safety analysis may be developed through assumptions and approaches previously [redacted]. As an outsider to European/UK RPAS integration R&D politics, policy development appears fragmented across European nations.

[redacted]

My question to you both (in addition to the awareness of the accommodation approach) is: Are you aware of the level of coordination between EuroControl and CAA (Airspace Directorate), and between MIDCAS and independent SESAR research programmes, such as [redacted] and if so, how co-ordinated is it? I'm trying to get a feel for whether policies are joined up and coherent, or fragmented/segregated, in order to take the necessary action to ensure Protector benefits from developed/developing policies which have had regulator involvement and high levels of standardisation.

So far, we've received very little information down the military communications (EDA to MAA/CAA-DAATM to DE&S PT) chain, and hopefully this will be rectified in the near term. I assume EASA are developing CS-ACNS for RPAS (expected mid 2017) based on some of the learned outputs from MIDCAS. I'd be grateful for any advance direction you can share regarding potential equipage requirements. [redacted]

Best regards,

[redacted]

[redacted] | [redacted] | UAS Project Team
GA-ASI International Office, Rm 1130 (Mail Point 5) | Bldg A27 | Poway | 92064
CIV: [redacted] | MOB: [redacted]

Ministry of Defence de&s

Chartered Engineer

Defence Equipment & Support

Stephen Rihanne

From: [redacted] ([redacted]) <[redacted]@mod.uk>
Sent: 30 August 2016 17:07
To: [redacted]; [redacted]; [redacted] ([redacted])
Subject: FW: 20160829-Airpace Integration Telecom Notes-[redacted]

Sir, [redacted],

There are a couple of minor amendments (below in red) to the notes I made for the Airspace Integration Meeting that took place last week following a check with [redacted].

Regards,

[redacted]

[redacted] | [redacted] | Unmanned Air Systems Team | Defence Equipment & Support | International Office - Bldg A27 Rm 1130 | General Atomics Aeronautical Systems Inc | 14200 Kirkham Way | Poway | CA [redacted] | USA [redacted] (USA Mob) or [redacted]

ALL EMAILS ARE SENT WITHOUT PREJUDICE OR COMMITMENT.

From: [redacted] ([redacted])
Sent: 30 August 2016 03:23
To: [redacted] ([redacted])
Subject: RE: 20160829-Airpace Integration Telecom Notes-[redacted]

Pretty close [redacted], made a couple of tweaks…….(in red so you can see them.)

Airspace Integration Approach from UK Telecon on 22 Aug 16

Attended by – [redacted] *(on telecom),* [redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted].

Following a meeting between the PT, DAATM and CAA ([redacted]*) There was an agreed approach to the initial Airspace Integration approach.* [redacted] *proposed that the approach will be driven by the analysis of likely scenarios that the platform could be exposed to, within a limited scope (read IOC operating environment), whilst taking account of cross-domain failure such as Ops, reliability, ATC etc. The failure numbers would have to be accurate and qualified to support this approach. This analysis will produce event trees with appropriate mitigations to support an acceptable catastrophic failure rate but may also highlight non-compliances against standards, and evidence gaps that will need to be rectified for full airspace integration rather than accommodation. It is understood that for IOC this would be a safety based approach. Full Airspace Integration and associated certification would be phase 2 of the plan that would include the Sense and Avoid system within the event trees and the certification requirements (ICAO 2023?).*

[redacted]

The next step is for the PT to formalise the Strategy and Plan to support this approach and effort with a target of before the end of 2016. The CAA agreed that if they found the Strategy and Plan acceptable they would agree it and probably not get in to contesting the detail (numbers and actions within assessments).

[redacted]

[redacted]

[redacted]

[redacted]

DE&S, UAS PT, Yew 2b, Mail Point #1251
Ministry of Defence
Abbeywood
Bristol
BS34 8JH

E-mail: [redacted]@mod.uk
Personal: [redacted]@mod.uk

☎ Mil: [redacted]
☎ Civ: [redacted]
☎ Mob: [redacted]

From: [redacted] ([redacted])
Sent: 30 August 2016 00:16
To: [redacted] ([redacted])
Subject: 20160829-Airpace Integration Telecom Notes-[redacted]

Sir,

Does the below accurately reflect what you stated during last week's telecom? I haven't written this as an official record just as a reminder of what was discussed on the day.

Airspace Integration Approach from UK Telecon on 22 Aug 16

Attended by – [redacted] (on telecom), [redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted].

Following a meeting between the PT, MAA and CAA – [redacted] (not sure if other stakeholder) there was an agreed approach to the initial Airspace Integration approach. [redacted] proposed that the approach will be driven by the analysis of likely scenarios that the platform could be exposed to, within a limited scope (read IOC operating environment), whilst taking account of cross-domain failure such as Ops, reliability, ATC etc. The failure numbers would have to be accurate and qualified to support this approach. This analysis will produce event trees

with appropriate mitigations to support an acceptable catastrophic failure rate but may also highlight non-compliances against standards, and evidence gaps that will need to be rectified for full airspace integration rather than accommodation. It is understood that for IOC this would be a safety based approach. Full Airspace Integration and associated certification would be phase 2 of the plan that would include the Sense and Avoid system within the event trees and the certification requirements (ICAO 2023?).

[redacted]

The next step is for the PT to formalise the Strategy and Plan to support this approach and effort with a target of before the end of 2016. The CAA agreed that if they found the Strategy and Plan acceptable they would agree it and not get in to contesting the detail (numbers and actions within assessments).

[redacted]

[redacted]

Regards,

[redacted]

[redacted] | [redacted] | Unmanned Air Systems Team | Defence Equipment & Support | International Office - Bldg A27 Rm 1130 | General Atomics Aeronautical Systems Inc | 14200 Kirkham Way | Poway | CA **92064** | USA [redacted] (USA Mob) or [redacted]

Stephen Rihanne

Subject: FW: 20160920-PROTECTOR_Airspace_Integration_WG-O
Location: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Start: Fri 07/10/2016 09:00
End: Fri 07/10/2016 17:00
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: [redacted] ([redacted])

Hi All,

I will be able to attend as I had a WAH day scheduled. However, I think that the standard for the PROTECTOR meetings should be that 2 x CAA people should attend. [redacted] / [redacted] - are either of you able to attend?

Noting that the CAA are meant to be giving an update, I will see if [redacted] from DAATM has any relevant paperwork. I am not sure where this has been left since the high level meeting I attended.

Thanks

[redacted]

-----Original Appointment-----
From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 23 September 2016 13:20
To: [redacted] ([redacted]); [redacted]
Subject: FW: 20160920-PROTECTOR_Airspace_Integration_WG-O
When: 07 October 2016 09:00-17:00 (UTC) Dublin, Edinburgh, Lisbon, London.
Where: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Ma'am,

Hope all is well. PSB – Concern here that CAA may not be attending. Are you available to attend.

Regards

[redacted]
[redacted] | [redacted]
Ministry of Defence | Level 5, Zone I, Desk 20 | Horseguards Avenue | Whitehall | London | SW1A 2HB | [redacted] / [redacted] | [redacted] / [redacted]@mod.uk

-----Original Appointment-----
From: [redacted] ([redacted])
Sent: 20 September 2016 17:17
To: A[redacted] ([redacted]); [redacted] ([redacted]);

[redacted]
Subject: 20160920-PROTECTOR_Airspace_Integration_WG-O
When: 07 October 2016 09:00-17:00 (UTC) Dublin, Edinburgh, Lisbon, London.
Where: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Sirs, all,

Mtg request for the next PROTECTOR Airspace Integration WG.

Morning:

Update on Interim PROTECTOR Airspace Integration progress.

- Updates from TAA, CAA, MAA
- Update from WECA about broader integration work
- Update from Dstl on research work

Afternoon:

PROTECTOR Enhance WG – discussion with GA and CAA about longer-term airspace integration aspirations [redacted].

- Decide next steps required to support [redacted]

Detailed agenda to follow.

Tea and coffee will be provided but lunch will not.

Please contact me directly if more information is required.

Yours aye,

[redacted]

Stephen Rihanne

Subject: UK Protector Airspace Access Workshop
Location: 107-111 Fleet Street, EC4A2AB

Start: Tue 02/02/2016 08:30
End: Wed 03/02/2016 17:00
Show Time As: Tentative

Recurrence: (none)

Organizer: [redacted] ([redacted])

Ladies & Gentlemen,

OF5 Ranks are requested to attend Day 2 - 'Agreeing on a Certification / Approval Path'.

Please use this meeting calling note as a placeholder for the upcoming 2 day workshop as identified in emails posted on 11 Jan 16 ([redacted]) and early Jan 16 ([redacted]).

The Agenda is attached below with associated requests for SMEs to deliver presentations in their respective areas of expertise. Identified by (### Lead) next to the presented topic. Any problems – please contact me soonest.

Numbers are extremely tight for the identified location which unfortunately constrains the number of addressees to those above (not including GA-ASI). If a 'higher capacity' location can be identified in the interim – I will update you all soonest.

Location is confirmed as:

POC: [redacted]

107-111 Fleet Street
London
Greater London
EC4A 2AB
United Kingdom

Regards

[redacted]
[redacted] | DES UAS SAW3b | Unmanned Air Systems Team | Defence Equipment & Support | Yew 2c, #1251, MOD Abbey Wood | Bristol | BS34 8JH |
GPTN: [redacted] | PSTN: [redacted] | Mobile: [redacted] | DII: [redacted]@mod.uk

Proposed Meeting Arrangements

Location:

London (venue tbd)

Timing:

2–3 February 2016

Meeting Participants:

Organisation	Function / Role	Name
JFC	Capability Requirements	[redacted]
Air Command	Strategy	[redacted]
UAS Team	Type Airworthiness Authority	[redacted]
MAA	Reg/ATM Cert	[redacted] [redacted] (RN)
MoD DAATM	MoD Airspace Policy	[redacted]
Dstl	MoD Support	[redacted]
CAA	RPAS Policy/ Airspace / ATM	[redacted] +2 tbd
GA-ASI	Airspace Integration Mgt.	[redacted]
GA-ASI	Detect and Avoid Specialist	[redacted]
GA-ASI	C3 (Command, Control and Communications)	[redacted]
GA-ASI	Office of Airworthiness	[redacted]

Agenda for UK Protector Airspace Integration Workshop

Day 1 –

Morning Session (08:30pm Start):

"Understanding the Challenge"

- **Understanding applicable user requirements, i.e. where would Protector be expected to operate in UK (and European?) airspace?**

(0.5hr) Introduction, Agenda and Anticipated Outcomes (UAS Lead)

(1.5 hrs) Route to AI Requirements (DSTL Lead)

- Future Focus

[redacted]

(0.5 hr) Lunch

PM Session (following lunch)

"Identifying Gaps / Risks / Issues"

(1 hr) Concept of Operations/ Employment (JFC Lead)

- How Force Elements are generated and Sustained incl. deployment / basing / readiness
- [redacted]

(0.5 hr) TAA Certification (UAS Lead)

- Brief on Certification requirements
- Identify Gaps in Certification requirement

(0.5hr) Equipment Gaps (GA-ASI Lead)

- Brief on Technology Readiness Levels of Gaps identified

(1hr) Priority based on Gaps identified (JFC Lead)

- Understand out of scope requirements
- Set priority against equipment gaps

(0.5 hr) Wrap up Day 1

Agenda for UK Protector Airspace Integration Workshop

Day 2 –

Morning Session (08:30pm Start):

"Consolidation of Airspace Requirements"

(0.5hr) Agenda for Day 2 – Welcome DAATM / CAA attendees

(3 hrs) UK Airspace Requirements (DAATM / CAA lead)

- Airspace requirements including Military deltas (How does the MOD integrate other military aircraft into UK airspace? What exceptions or accommodations are made today for other military aircraft?)

- Flight in Class A-C Airspace

(1hr) Lunch

PM Session (following lunch)

"OF5 Presentation of Gaps / Risks / Issues"

(0.5hr) Welcome OF5s (UAS Team)

- Brief on Workshop Aims
- Identify issues (gaps / risks) from each stakeholder community

(0.5hr) Airspace Requirements Gaps (DAATM / CAA)

(0.5hr) Technology Risks Identified with associated TRLs (GA-ASI)

(0.5hr) Certification Risks Identified (TAA)

(1hr) Customer Risks Identified and Prioritisation (JFC)

(1 hr) Wrap up and Action Items (UAST)

- Broad agreement on a certification and approval plan related to Airspace Access, not all of the answers, but at least a path to get there
- Action Items for Protector MOD Team
- Action Items for GA-ASI

Stephen Rihanne

From: [redacted]
Sent: 04 April 2017 09:54
To: [redacted]
Cc:
Subject: FW: 20170330-PROTECTOR_Airspace_[redacted]-FOR REVIEW AND COMMENT
Attachments: UASCDC-Conflict_analysis_Protector_V1_0.pdf

Importance: High

Categories: Red Category

PLEASE DO NOT DISTRIBUTE FURTHER WITHOUT PERMISSION

Dear All,

Please see attached. This is the first piece of research to support PROTECTOR [redacted]. I have not reviewed yet so have a neutral view on the content.

The 'Ask'

Please could you review this document to examine the research and data and provide comments (and any questions). (Timeline TBC - please see below).

- I have phoned the MAA and have posed the question 'do we want to look at this together or work on it separately'. I am awaiting their feedback.
- I have also asked [redacted] what his deadline is for comments to come back - I am waiting for his response.
- Wrt Metrics I would propose this is treated as an OSC and recorded as such (open to any alternative/better suggestions!)
- I will signal to the Execs that we have received this. [redacted] may need to be read into this work as I am not sure how sighted he will be on it or how much [redacted] may have handed over.

Please let me know if there are any queries.

Regards,

[redacted]
Intelligence, Strategy and Policy
Civil Aviation Authority

Tel: [redacted]
Mob: [redacted]

Follow us on Twitter: @UK_CAA

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 30 March 2017 18:56
To: [redacted]
Cc: [redacted]
Subject: RE: 20170330-PROTECTOR_Airspace_[redacted]

Brilliant – with now with the report.

Long day. Apologies.

[redacted]

From: [redacted] ([redacted])
Sent: 30 March 2017 18:36
To: [redacted]
Cc: [redacted]
Subject: 20170330-PROTECTOR_Airpspace_A[redacted]

Ma'am, Sirs, all,

As key stakeholders, PSA the first strand of research required to support [redacted]'s PROTECTOR [redacted]. In line with CDS' and ACAS' strategic direction, the [redacted] is specifically looking to fly PROTECTOR [redacted] It should be noted that overall risk calculation will use this research as one layer of a multi-layered, qualitative, Safety Case argument. [redacted] will be presented to the MAA for their consideration in due course. With reference to the paper, please note the following:

1.1.1 [redacted]

1.4.11 The overall risk calculation includes a 'do nothing' model. [redacted]

[redacted]

Finally, it is also worthy of note that the risk modelling which does include predict traffic density growth, [redacted]

[redacted]

Appreciating that there is still significant distance to go, it would now seem that we have a real indication that our shared (Airspace LoD owner and TAA) aspiration is viable. Given [redacted]'s kind offer of a Project Manager (kick-off mtg scheduled for 5 Apr 17 in ISTAR FHQ) does this report represent the [redacted]

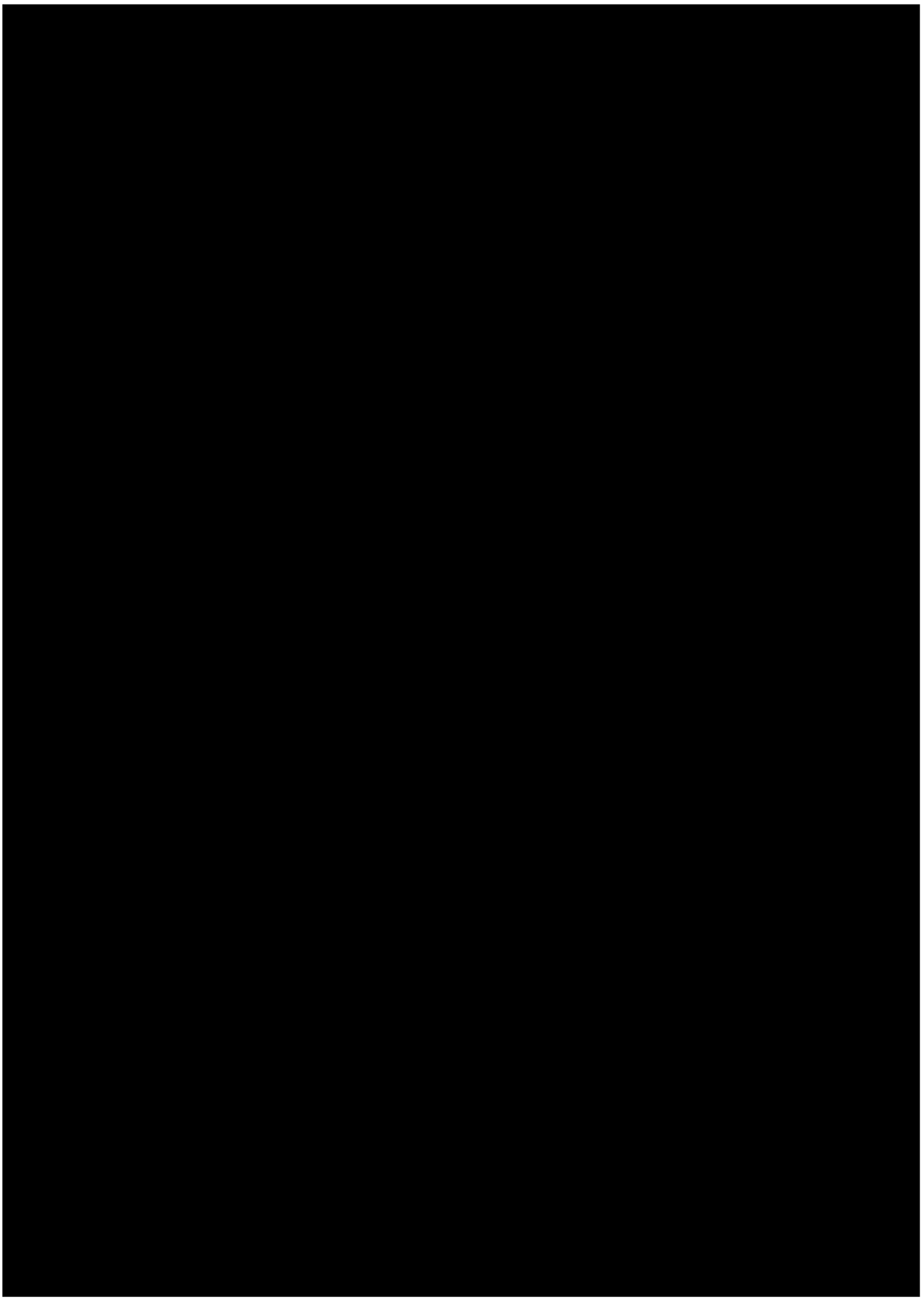
Yours aye,

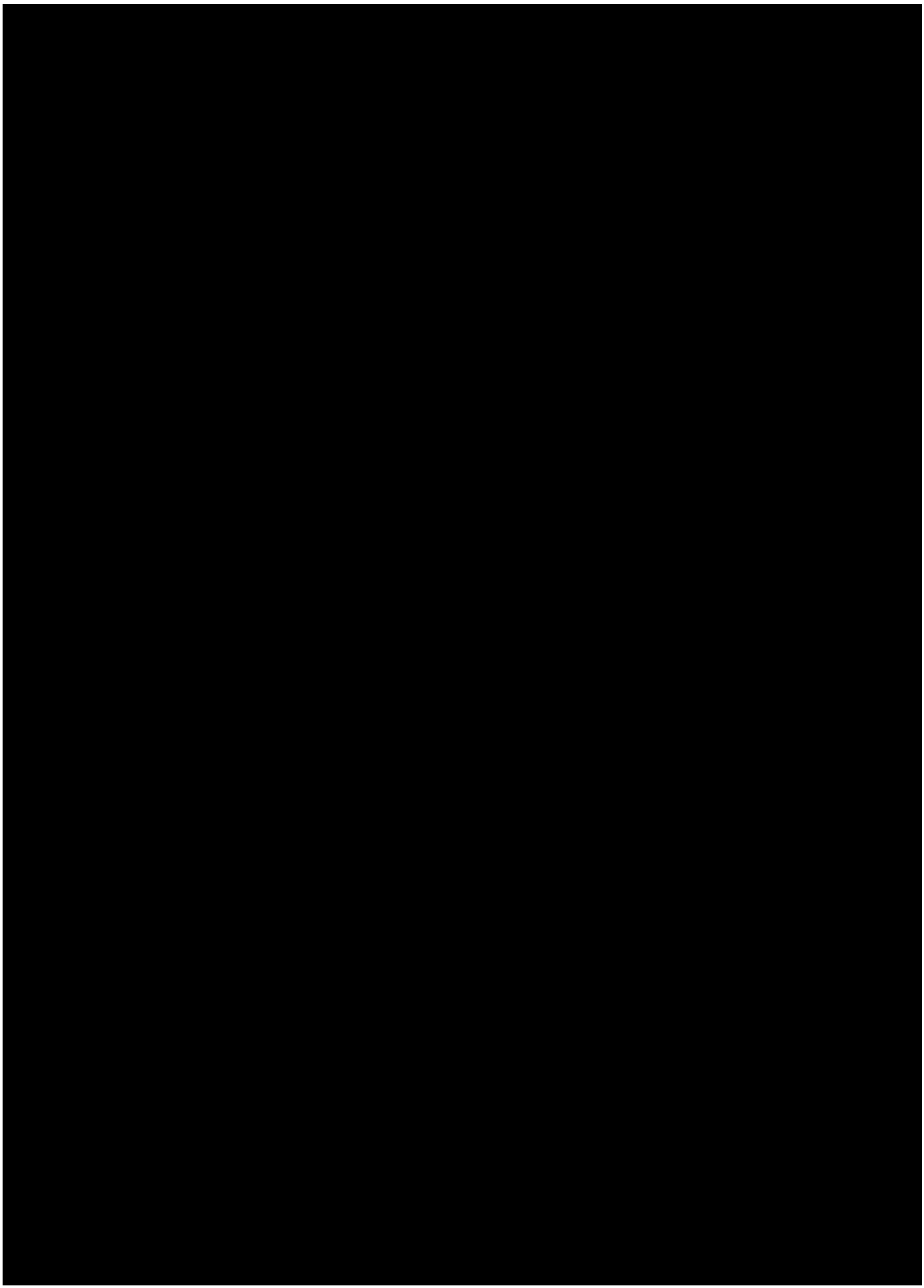
[redacted]

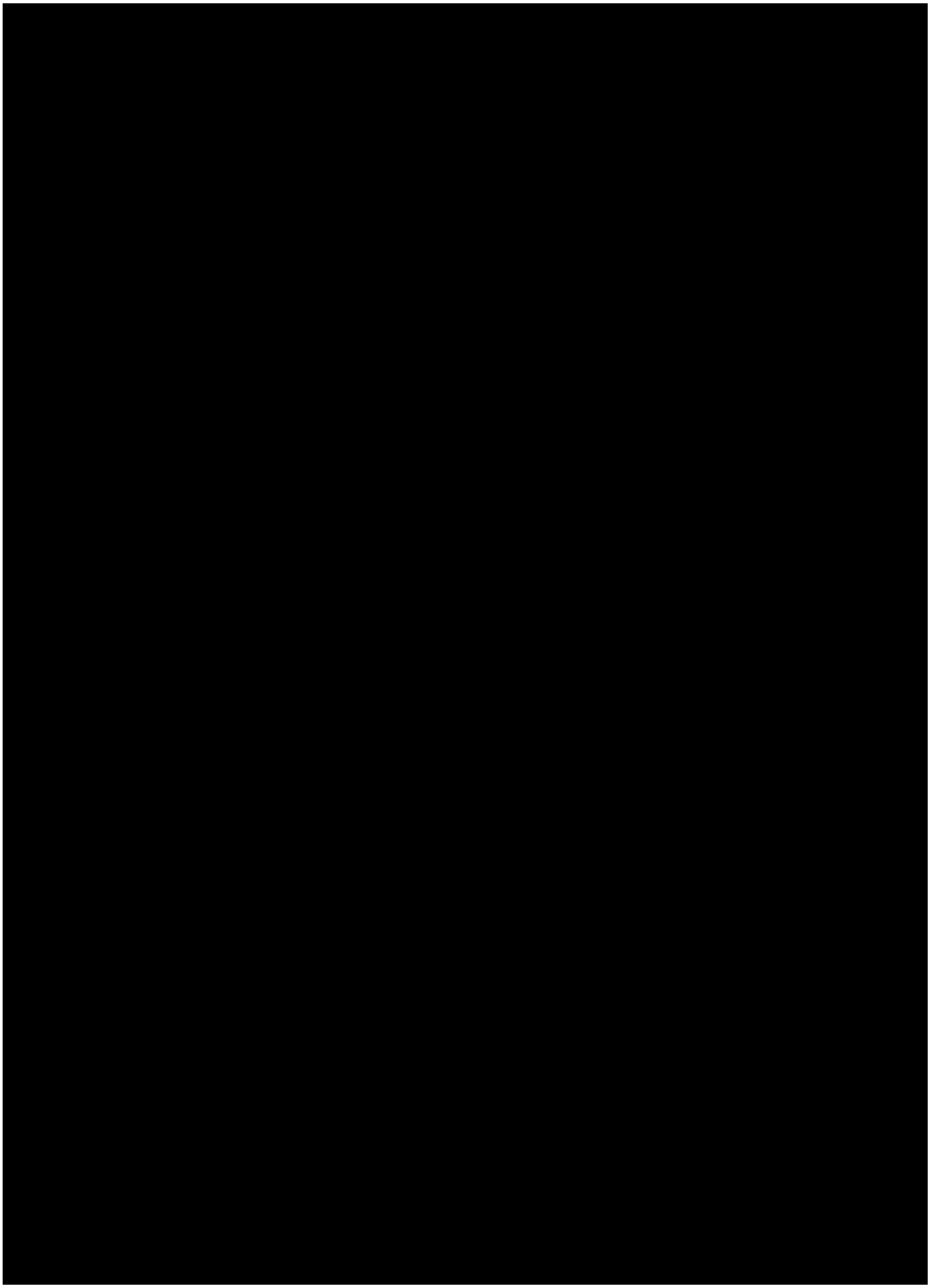
[redacted] | [redacted] | [redacted] | **SO2 Protector** | RAF Waddington, Lincoln, LN5 9NB | Mil: [redacted] | Civ: [redacted] | Secure: [redacted] | DII(F) [redacted]@mod.uk

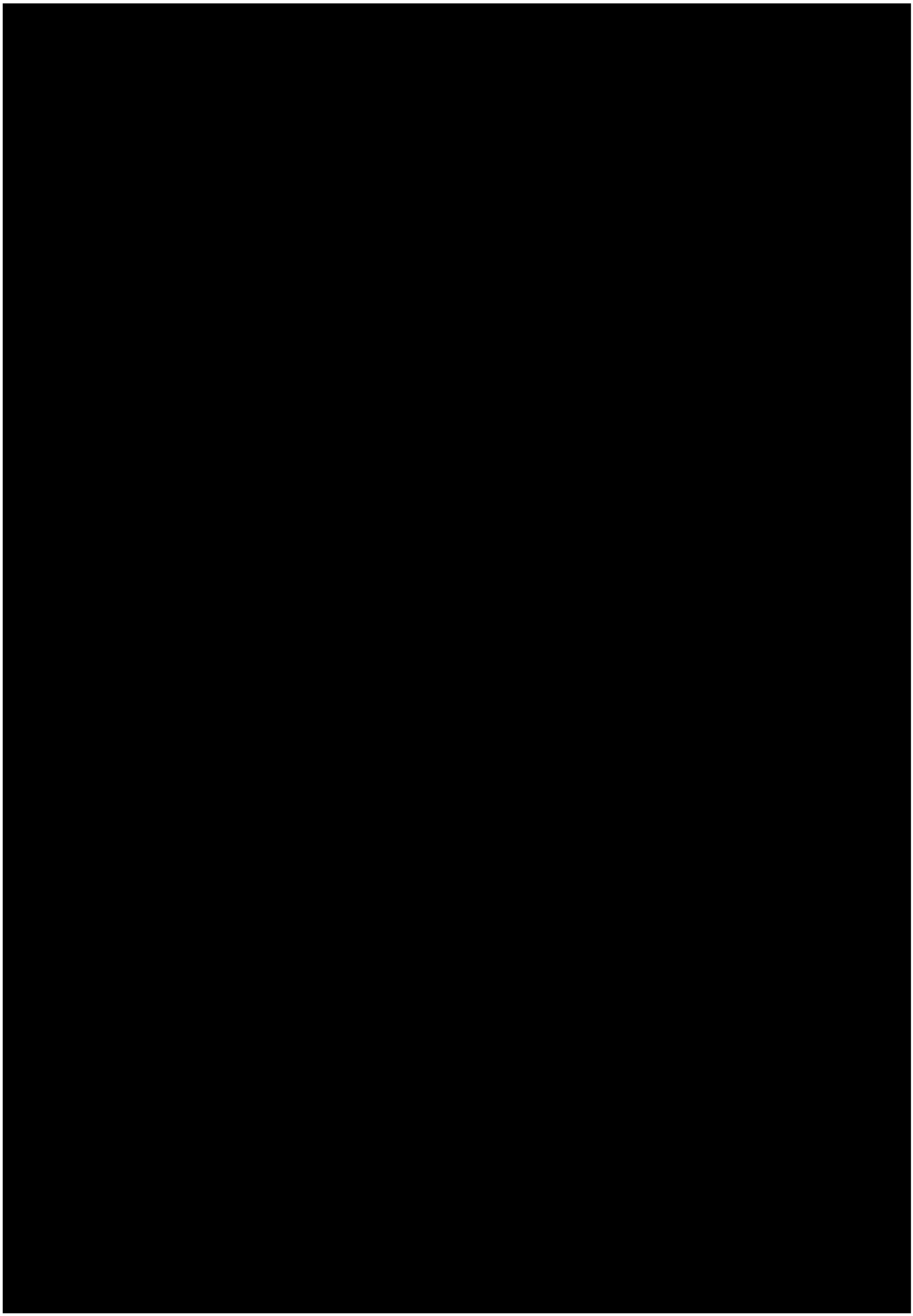
[redacted]

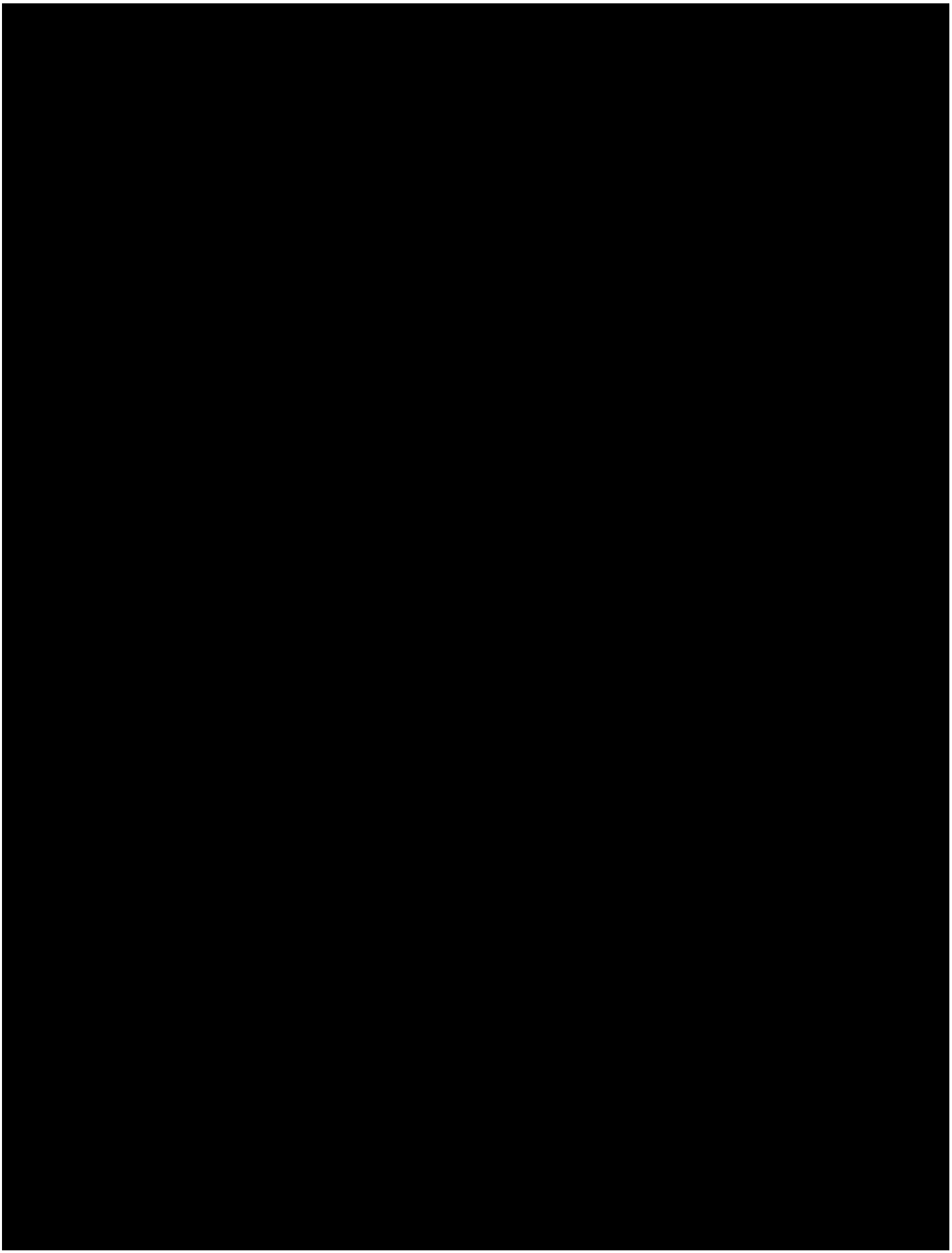
UAS CDC

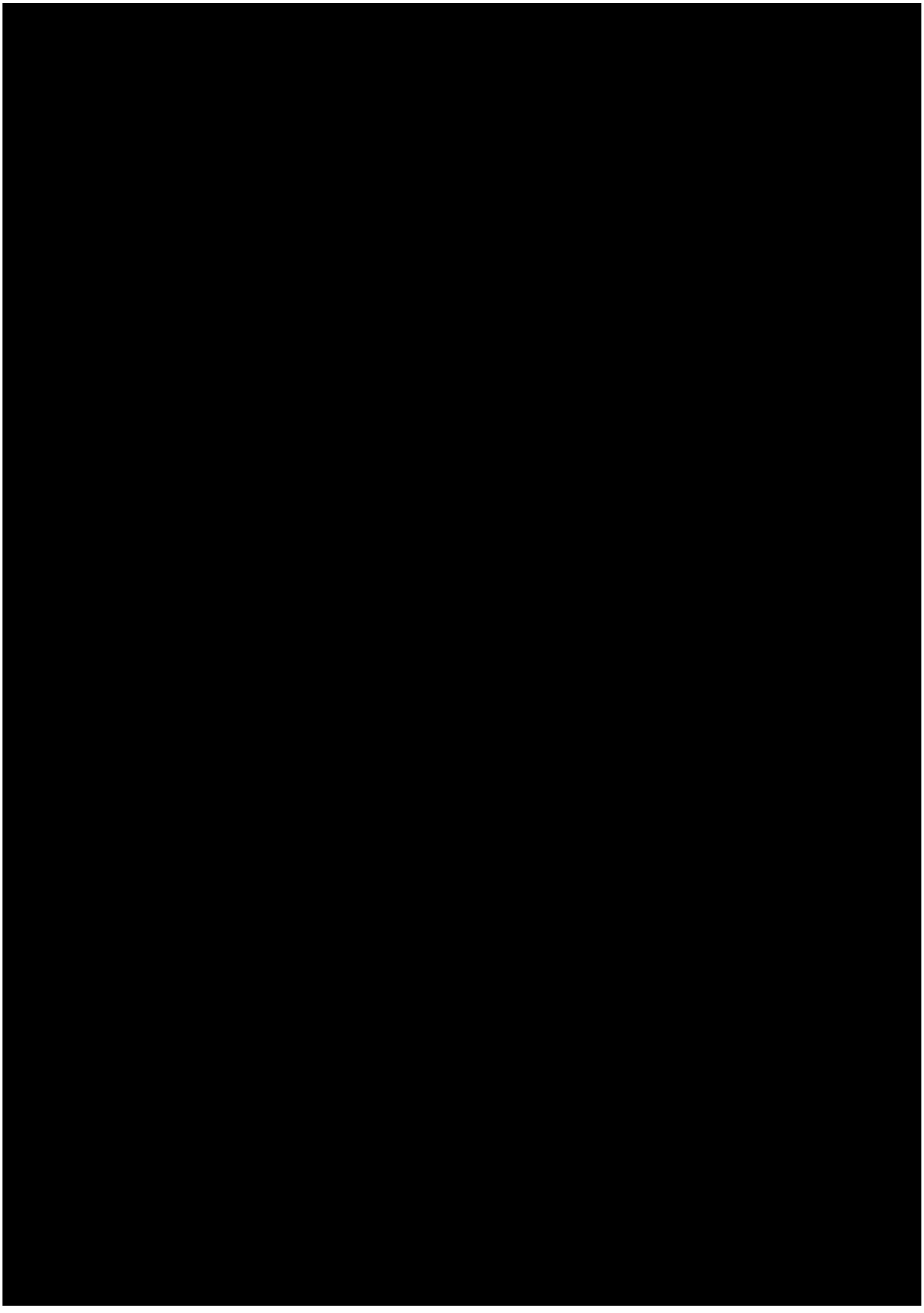


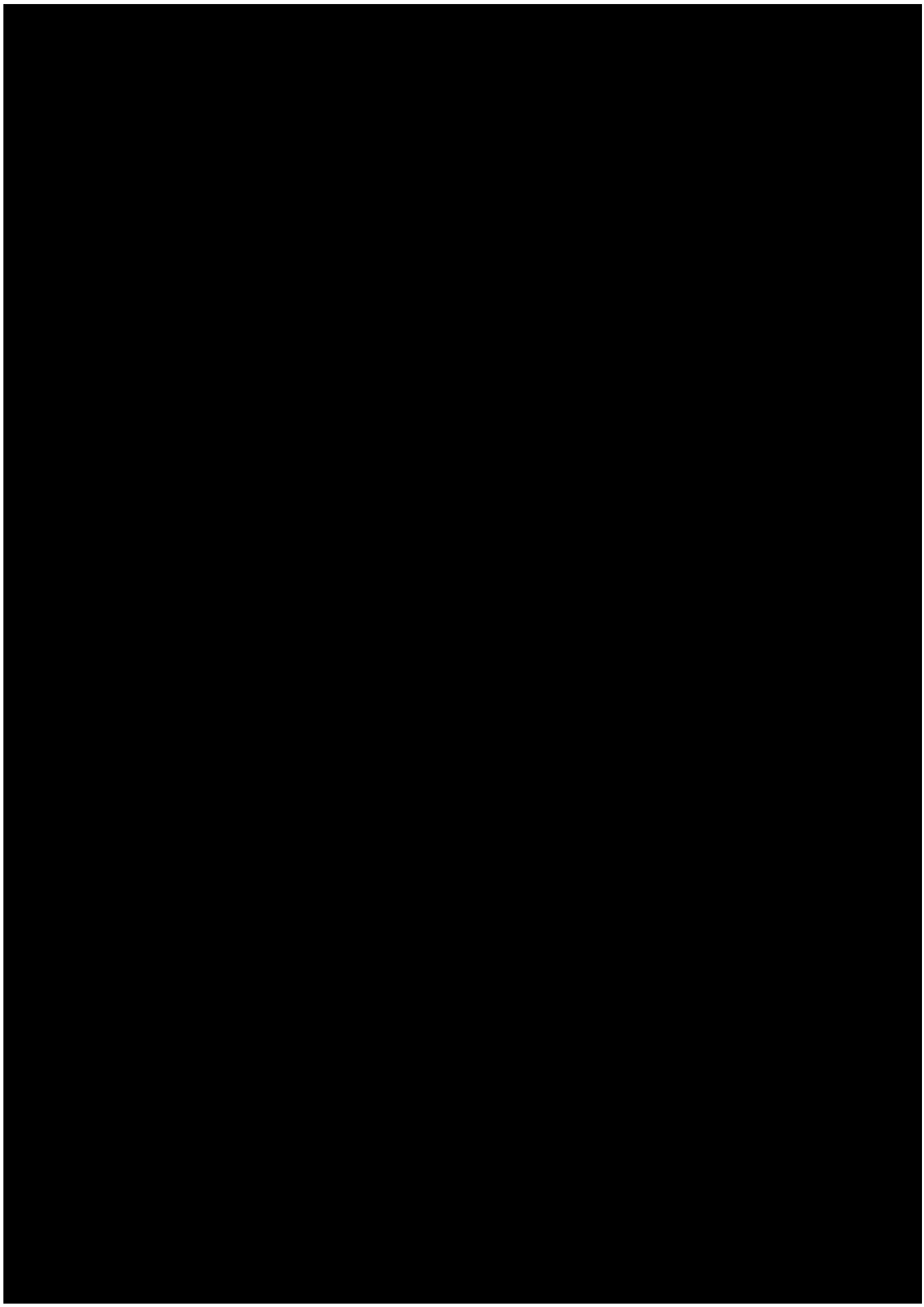


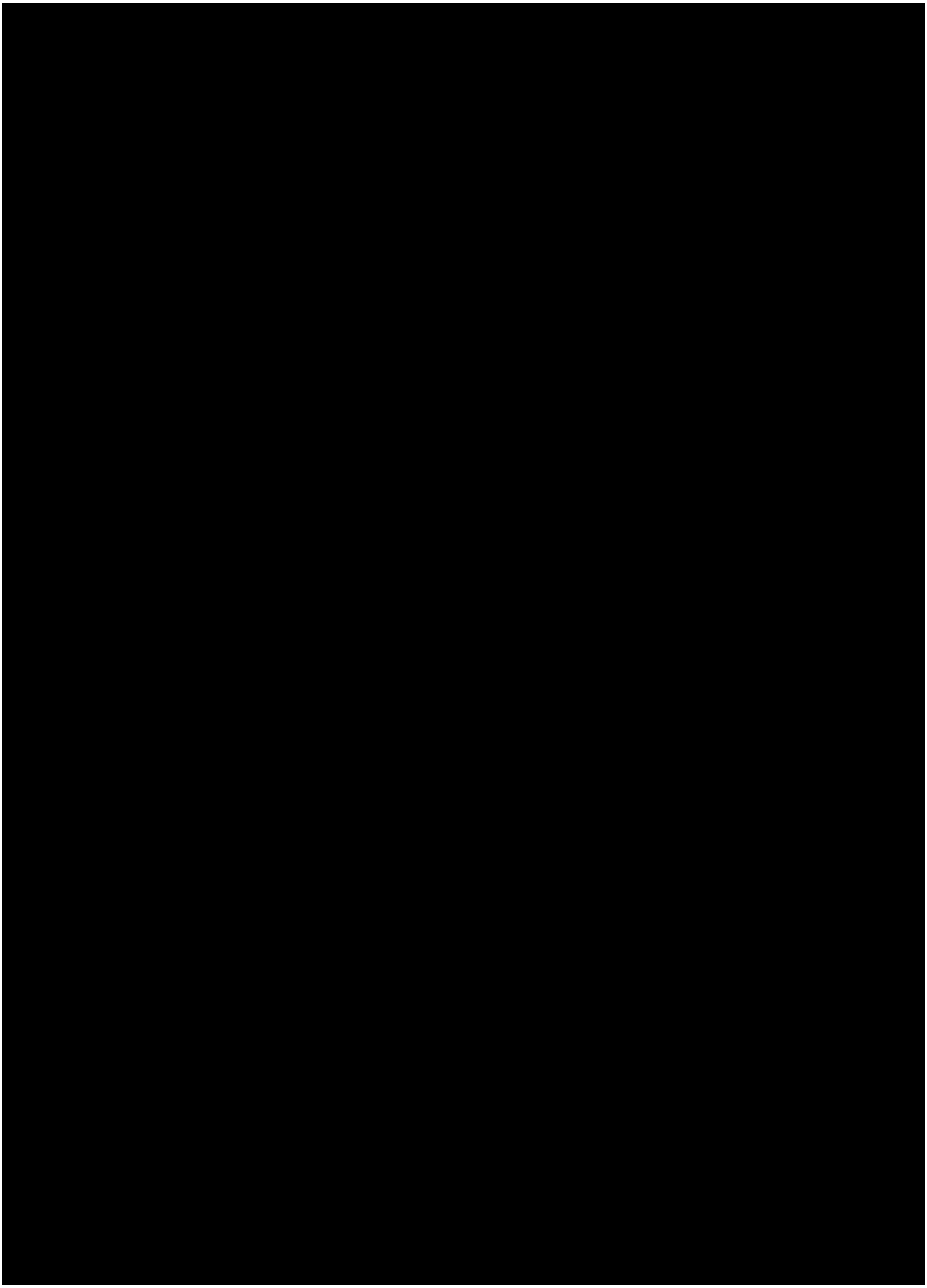


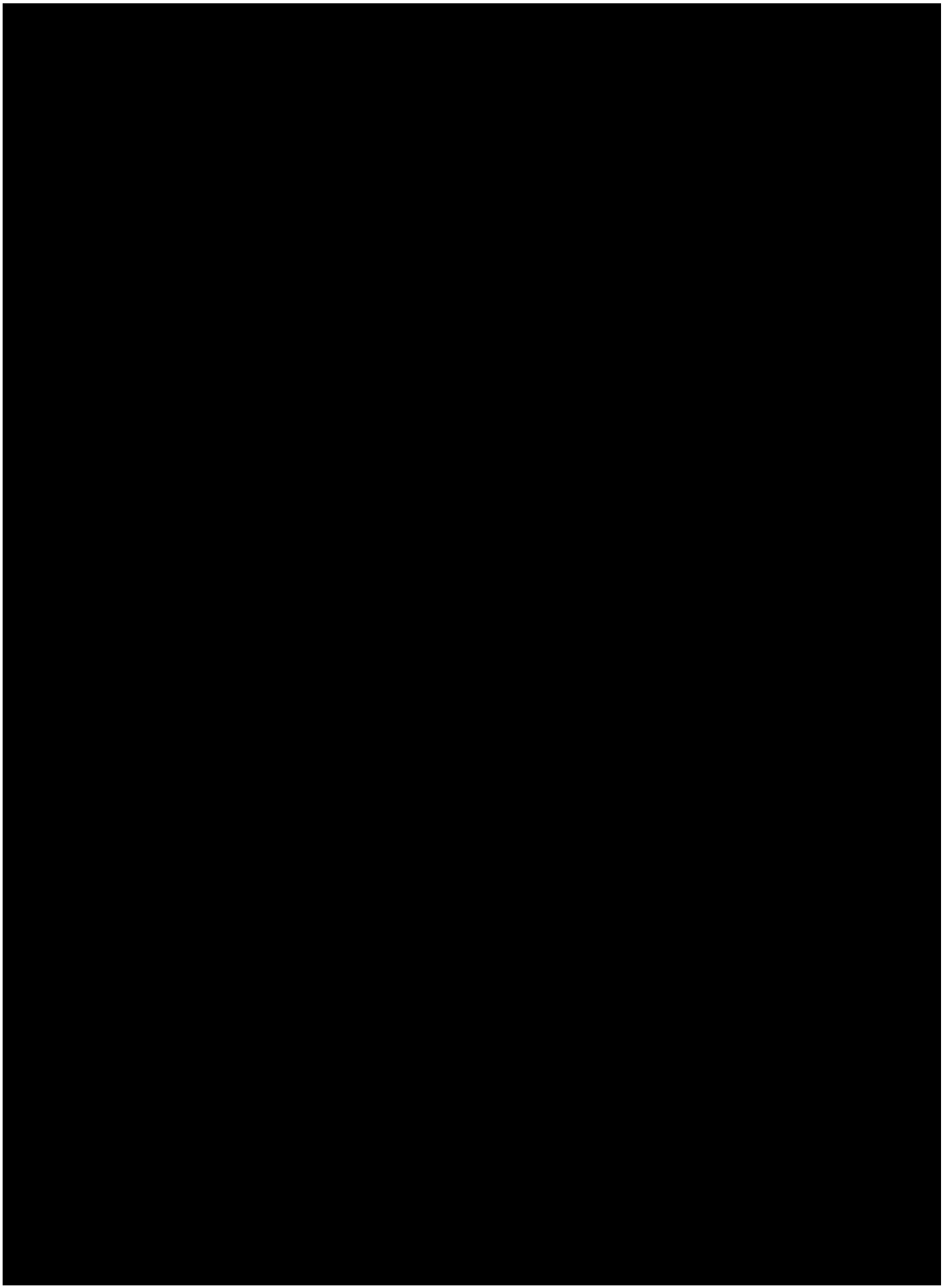


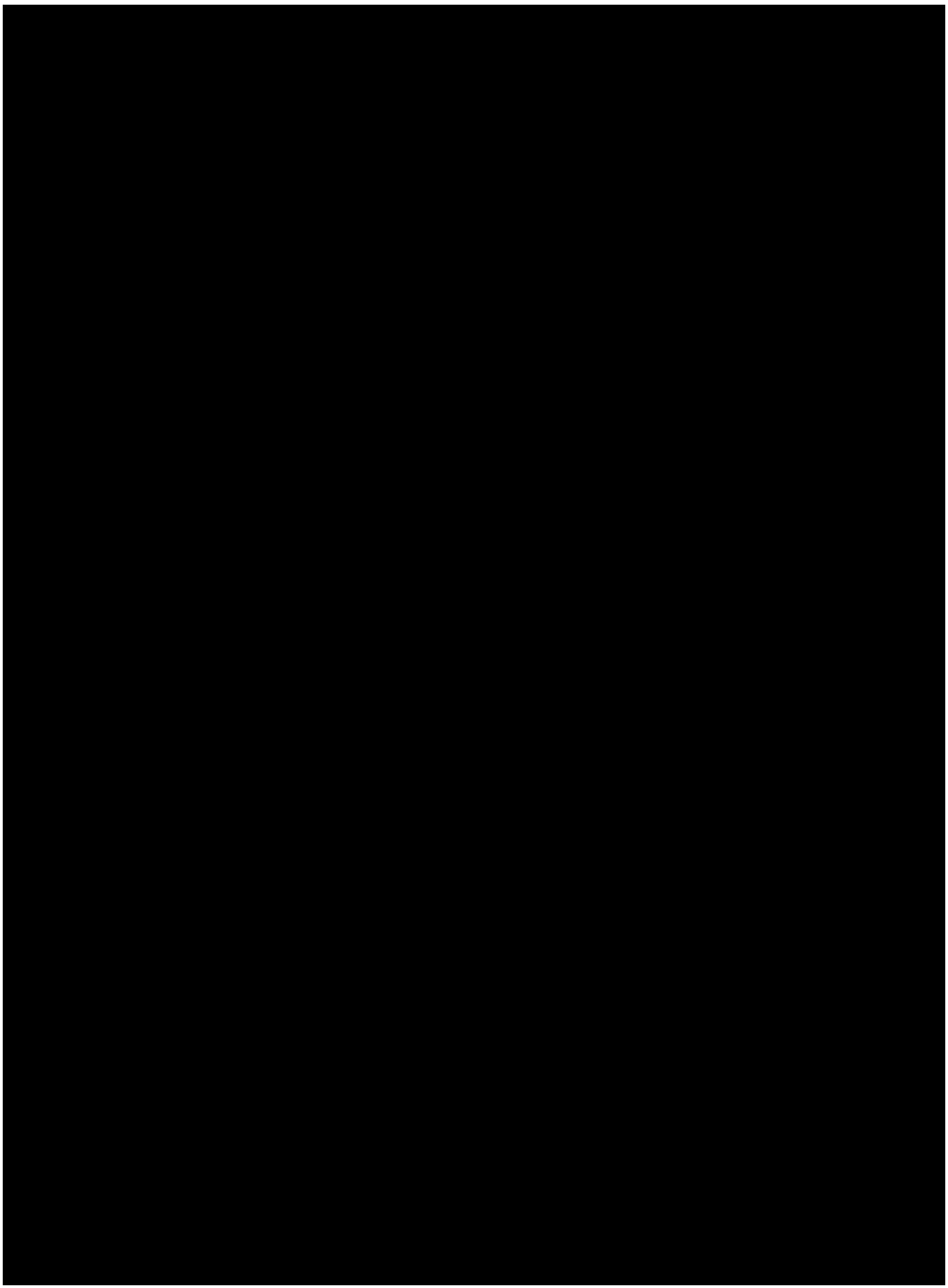


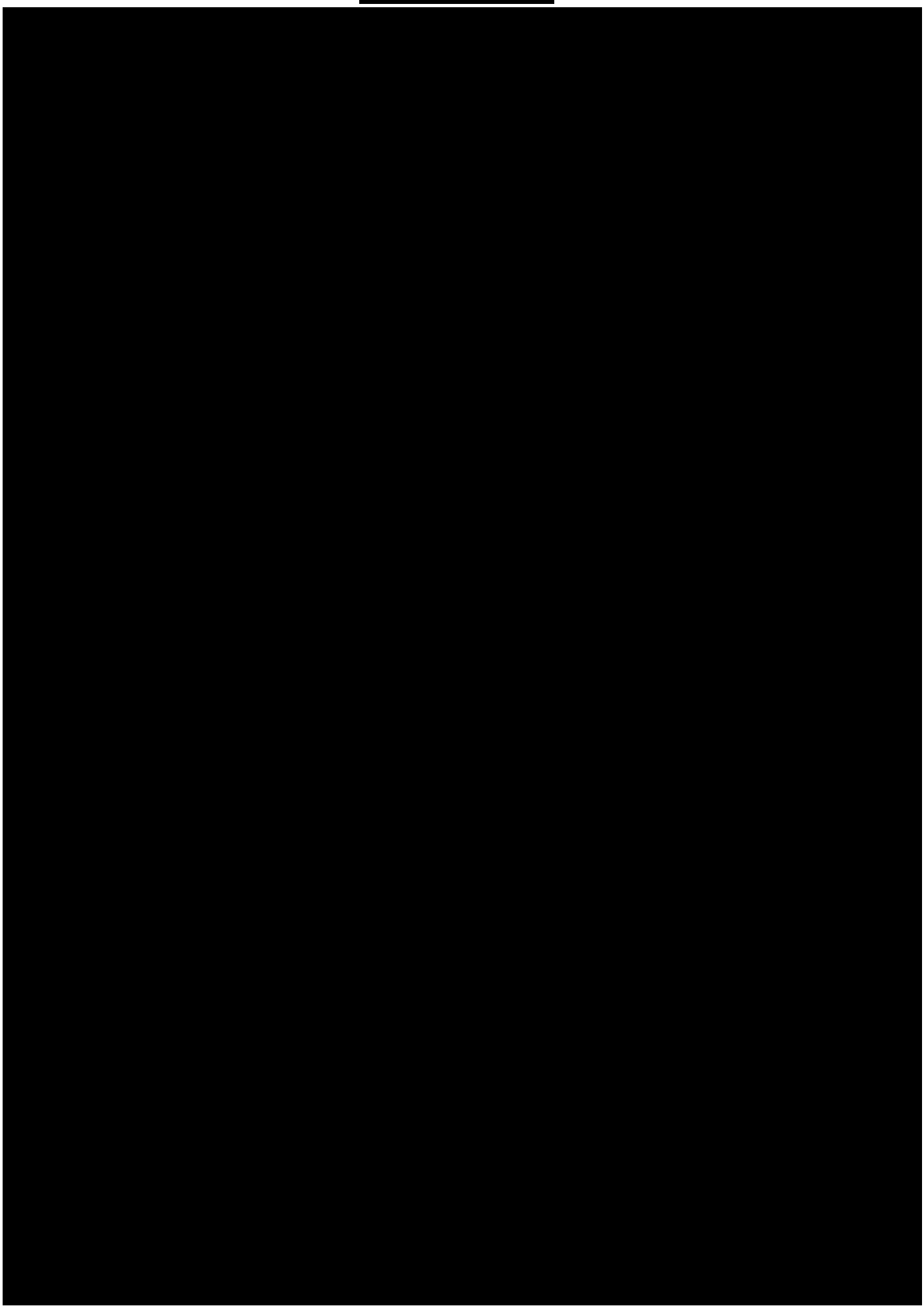


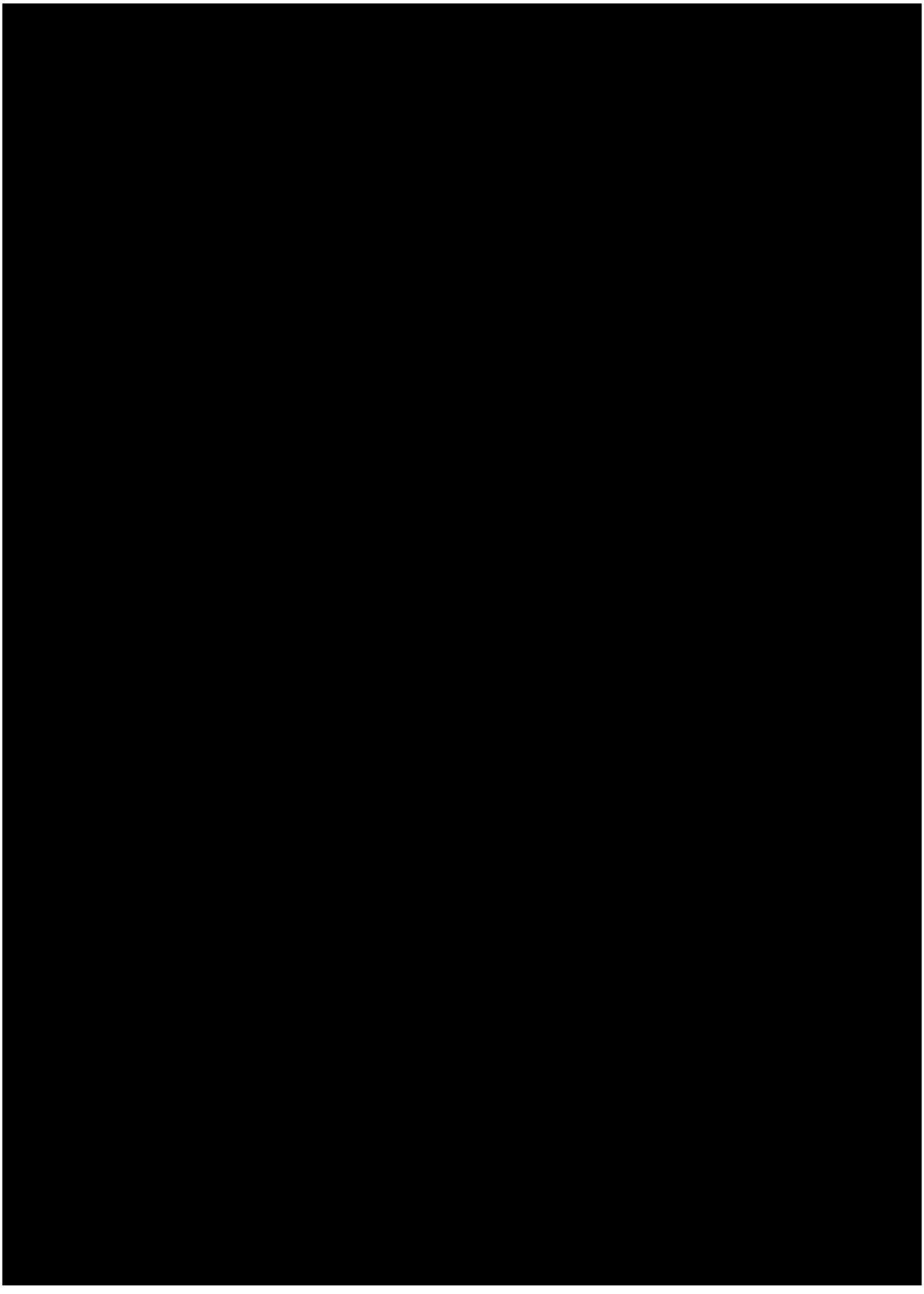












Stephen Rihanne

From: [redacted] ([redacted]) <[redacted]@mod.uk>
Sent: 12 January 2016 01:05
To: [redacted]
Subject: 20160111-Proposed_PROTECTOR_Airspace_Integration_Workshop_ScavRASM
Attachments: 20160111-PROTECTOR_Airspace_Workshop_Thinkpiece.docx

[redacted]

Happy New Year. You will recall [redacted] story at the RAeS President's Conference about the re-naming of our MALE RPAS project from SCAVENGER to PROTECTOR – so we're using the new name (still a solution based on a Certifiable Predator B) and trying to understand future airspace access for PROTECTOR in the UK.

There has been much discussion relating to the airspace integration requirements associated with future (larger) RPAS, and PROTECTOR in particular, operating in non-segregated airspace in the UK (and Europe). During the PROTECTOR Type Board Meeting at the end of last year, it was identified that [redacted] It was decided that an Airspace Integration Workshop, in the UK, would be the best vehicle to gather the broad range of subject experts from the stakeholder community to achieve this.

Attached is a thinkpiece we have put together simply describing the issues and questions that have arisen in discussion with GA-ASI. I would like to have appropriate representation from the CAA (and potentially NATS), from yourself, [redacted] and/or appropriate SMEs to support the discussion and [redacted]. You'll note I have included some names under potential representation, but grateful if you could perhaps point me in the right direction regarding who else in CAA/NATS I should try to engage.

Formal information/invitation to the workshop will follow, but grateful if you could let me know if you'd be interested in the discussions, and whether you have any availability over the period 1st to 3rd Feb to attend. Although arrangements are still in planning, venue is expected to be London, I already anticipate separate working-level and strategic/policy discussions so don't anticipate people needing to be there for the whole thing. I expect you would wish to attend the more strategic elements, so we will try to make the agenda suit people's availability; and dates could change – so if you can't make the Mon, Tue or Wed first week in Feb, please let me know any good alternatives, as I would very much value your contribution if at all possible.

Many thanks

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA **92064**, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk

Thinkpiece – PROTECTOR Airspace Integration Workshop

Proposed Meeting Arrangements

Location:

London, depending on participant availability

Timing:

Preferred date: Week beginning 1st Feb 2016 (2-3 days)

Back-up dates: Week beginning 25th Jan 2016 or Week beginning 8th Feb 2016

Meeting Participants:

Organisation	Function / Role	Name
JFC	[redacted]	[redacted]
Air	[redacted]	[redacted]
MAA	[redacted]	[redacted]
MoD DAATM	[redacted]	[redacted]
Dstl	[redacted]	[redacted]
CAA	[redacted]	[redacted]
CAA/NATS	[redacted]	?
GA-ASI	[redacted]	[redacted]
GA-ASI	[redacted]	[redacted]
GA-ASI	[redacted]	[redacted]
GA-ASI	[redacted]	[redacted]
NLR	[redacted]	?

Topics for Discussion

1 – Understand the Challenge (~~Duty Holders~~Informing and [redacted] and MOD Stakeholder Community)

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- **Understanding applicable user requirements, i.e. where/how would Protector be expected to operate in UK (and European?) airspace?**

  - Protector Airspace Access Requirements (UAST and Duty Holder)
    - Flight in Class A-C Airspace.
    - What (in general terms) does RAF want to do with Protector in UK Airspace? (Operator/Cap perspective).
  - UAS Airspace Integration Context/Background/ CAP722 (CAA/NATS perspective)
    - CAA/NATS UK Airspace Overview.
    - What is UK Airspace?
    - Address comments along the lines of UK airspace being "different" (to US NAS)
    - How has CAA/NATS been working to integrate UAS so far?
    - How will it work in the near, medium, and long terms?
    - What are FAR-91 equivalent regulations?
      - What are the differences between 14 CFR 91 and equivalent reqts (ANO)?
      - What requirements would present greatest integration challenge?
  - UK MOD UAS Airspace Integration Context/Background
    - How does the MOD integrate other military aircraft into UK airspace?
    - What exceptions or accommodations are made today for other military aircraft?
  - [redacted]
    - [redacted]
    - Discussion on sense and avoid approach
  - Outcome:
    - Identify particular areas that need further clarification or issues that need resolution

2 – Investigate possible solutions, feasibility and challenges

- **Understand viable approaches including use of Ground-based Sense and Avoid equipment.**

- **Learning from [redacted] activities.**

- **Opportunity to influence ConOps.**

  - Operations in the Terminal Environment
    - Take-off/Landing
    - Departure and Arrival
    - Pattern Operations
    - Controlled/Uncontrolled and Military/Civilian
  - Operations in Transit to Mission/Training Area
    - Vertical Transit
    - Lateral Transit
    - Controlled/Uncontrolled
  - Operations in Mission/Training Area
    - Are there any ATC considerations (beyond contingency) in mission/training areas?
  - Contingency Operations:
    - General Approach
      - Frequency and severity

        - What are the options available to manned aviation today?
        - Capabilities that are needed in RPAS and within ATC
    - Loss of Datalink
        - Agree on an approach on how to handle it, not detailed implementation
    - Loss of DAA
        - Agree on an approach on how to handle it, not detailed implementation
    - Loss of Communications
        - Agree on an approach on how to handle it, not detailed implementation
- Outcome:
    - Come to general agreement on approach for operations over the Phases of Flight (Defined on Day One)
    - Come to general agreement on approach to handling contingencies (Defined on Day One)

3 – Agree Strategy, Policy, and a Way Forward

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- Flowdown of CNS/ATM Requirements
    - Given operations what equipment or capabilities are needed on Protector
    - Equippage requirements (Navigation, Communication, Surveillance, Command and Control)
    - Reliability, Integrity, Continuity, Availability
    - Given operations what equipment or capabilities are needed by ATC
- CNS/ATM Certification / Approval Path
    - Given equipment or capabilities needed on Protector, what is agreed certification or approval path for each, and who should lead
        - Applicability of CS-ACNS and other relevant Certification Specifications
- CONOPS Approval Plan
    - How do we get to a final CONOPS document that everyone can agree on and that the program can "sign up" for?
- CONEMP Approval Plan
    - What is the process for deriving a Concept of Employment in UK for Protector?
- Outcome:
    - Broad agreement on Strategy and Responsibilities related to Airspace Access, not all of the answers, but at least a path to get there
    - Understand a certification, qualification and approval path
    - Action Items for Protector MOD Team
    - Action Items for GA-ASI

Stephen Rihanne

From: [redacted]) <[redacted]
[redacted]@mod.uk>
Sent: 22 April 2016 00:54
To: [redacted]@faa.gov'; [redacted]@mail.mil'
Cc: [redacted]); [redacted]); [redacted]@us.af.mil'; [redacted]@faa.gov'; [redacted]@faa.gov'; [redacted]'; [redacted]@ga-asi.com'; [redacted]); [redacted]
Subject: 20160421-PROTECTOR_RPAS_Certification_Telecon_25_Apr_ProtectorRASM

[redacted],

In advance of Monday's meeting, Tim asked me to outline a framework for discussion topics/agenda items/questions. I'm happy that the UK lead on discussion initially, and have included below an outline to frame the time available. As this is a baslining/scoping telecon, I did not feel it appropriate to try to run a detailed "presentation" style forum, but rather to leave that for any follow on formal meeting(s).

Purpose: Overview baseline understanding of the UK PROTECTOR (ex Scavenger) project, and explore technical/certification challenges and opportunities for international collaboration.

Aim: Future engagement and level of involvement of organizations as PROTECTOR certification progresses.

Agenda/Topics for discussion:

1. Introductions – [redacted], UK Type Airworthiness Authority
2. Basic outline of the PROTECTOR UAS – [redacted]
   -- Organizations & Timelines
   -- Baseline CPB design to address certification
   -- UK Mods - focus on Safety/Redundancy (C2 link, ATLC, etc...)
3. UK Certification – [redacted]
   -- UK MAA and other regulation and airworthiness standards
   -- Unrestricted Ops (routine access to non-segregated national airspace)
   -- Full Type Certification (compliance with a code...not risk-based approach)
   -- Current status of work
4. Technical Issue seeking support – [redacted]
   -- Developing the Cert Basis; especially beyond STANAG 4671 (eg for airspace access/equipage)
   -- System Safety Assessment assurance wrt USAR.1309
   -- Software assurance (DERs?)
   -- Detail issues/interpretation of airworthiness requirements (eg HIRF/Lightning)
5. [redacted]

Hope this helps guide thinking in preparation for the meeting, and discussion on Monday AM/PM (depending on Continent).

Regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA **92064**, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk

---

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: 15 April 2016 12:44
To: [redacted] ([redacted]); [redacted]@faa.gov'; [redacted]@mail.mil'
Cc: [redacted] ([redacted]); [redacted] ([redacted]); [redacted]@us.af.mil'; [redacted]@faa.gov'; [redacted]@faa.gov'; [redacted]'; [redacted]@ga-asi.com'; [redacted] ([redacted])
Subject: RE: 20160415-Support_to_PROTECTOR_RPAS_Certification_Telecon_25_or_27_Apr_ProtectorRASM

[redacted],

I can support proposed time on 25th.
On the 27th I'm presenting/panel member at a workshop in Geneva, Switzerland. The timing is between the workshop and a follow on evening discussion - so possible if necessary, but I might be a little late to join if things overrun.

Regards,

[redacted]

[redacted]
Tel. [redacted]
Mob. [redacted]

Sent with Good (www.good.com)

-----Original Message-----
From: [redacted] ([redacted]) [[redacted]@mod.uk]
Sent: Friday, April 15, 2016 08:19 PM GMT Standard Time
To: [redacted]@faa.gov; [redacted]@mail.mil
Cc: [redacted]; [redacted] ([redacted]); [redacted] ([redacted]); [redacted]@us.af.mil; [redacted]@faa.gov; [redacted]@faa.gov; [redacted]; [redacted]@ga-asi.com; [redacted] ([redacted])
Subject: 20160415-Support_to_PROTECTOR_RPAS_Certification_Telecon_25_or_27_Apr_ProtectorRASM

[redacted]

Thanks also, I think [redacted] and myself are trying to link up all the various strands between stakeholders, so not surprised the e-mail trail went full circle.

Regarding the proposed telecon dates, I think both would work from the UK MoD Project Team end, though preference is for the Weds Apr 27 date; 1100-1200 hrs EDT is good.

In terms of invitees, I think it would be really useful to have CAA involvement, hence including [redacted] in the list to help identify suitable representation. From GA-ASI I have cc'd [redacted] on the Programs side and [redacted] from Office of Airworthiness as stakeholders. My initial POC from the Embassy would be [redacted] (also cc'd).

Suggest we send dial-in details to all above, and let addressees determine appropriate representation and their desire/need to be involved in the telecon.

(PLEASE Note - New e-mail Address)
[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA 92064, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk

-----Original Message-----
From: [redacted]@faa.gov [mailto:[redacted]@faa.gov]
Sent: 15 April 2016 10:52
To: [redacted]@mail.mil; [redacted] ([redacted])
Cc: [redacted]@caa.co.uk; [redacted] ([redacted]); [redacted] ([redacted]); [redacted]@us.af.mil; [redacted]@faa.gov; [redacted]@faa.gov
Subject: RE: Telecon - 25 or 27 Apr?

[redacted],
Thanks. I will look at that week and see which date works.

[redacted], Small Airplane Directorate

A successful man is one who can lay a firm foundation with the bricks others have thrown at him. - David Brinkley

-----Original Message-----
From: [redacted] ([redacted]) [redacted] (US) [mailto:[redacted]@mail.mil]
Sent: Friday, April 15, 2016 10:56 AM
To: [redacted] ([redacted])
Cc: [redacted] (FAA); [redacted]@caa.co.uk; [redacted] ([redacted]); [redacted] ([redacted]); [redacted] (US)
Subject: Telecon - 25 or 27 Apr?

Almost funny - this is the same strand that initiated my involvement. It wound through some USAF agencies, before they added me, which led to me contacting [redacted] and [redacted] ([redacted]) in the FAA.

Rather than commit to a face-face at this time, with incumbent travel time and cost, I propose a telecon to determine what can be achieved. I cannot eloquently explain the FAA-CAA connections, or bilateral agreements, nor mesh them with the Protector program requirements.

I initially propose two options for a telecon. Mon 25 Apr, or Weds 27 Apr, 1100-1200 DC time, one of those days. Let me know if either is acceptable and I can arrange the dial-in instructions. Please share with other relevant stakeholders now so that I can arrange the proper number of dial in lines. GA should probably be added, due to their ongoing work with the LA Air Cert Office (I think).

Who is your embassy POC?

[redacted]

-----Original Message-----
From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: Thursday, April 14, 2016 8:04 PM
To: [redacted] ([redacted]) [redacted] (US) <[redacted]@mail.mil>
Cc: [redacted]@faa.gov; [redacted]@caa.co.uk; [redacted] ([redacted]) <[redacted]@mod.uk>; [redacted] ([redacted]) <[redacted]@mod.uk>

Subject: [Non-DoD Source] 20160318-
Developing_the_Mechanism_for_a_Technical_Support_Arrangement_to_Protector_UK_Mil_ProtectorRASM

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

[redacted]

It was good to meet earlier in the week in Dayton, and particularly to link up regarding FAA engagement with the PROTECTOR programme. To follow on from our brief discussion, I have included below background correspondence, where I have tried to outline our intent in meeting with the FAA to discuss potential levels of involvement.

As expressed, we see this could range from direct support in some form, to simply oversight of the key Project activities in order to maintain visibility, provide advice, and potentially to facilitate the Authority's consideration of GA-ASI's applications for operating approval and type certification of CPB. I see this also as a mutual benefit when we come to discuss Airspace [redacted]

Having discussed this in the round during our technical interchange teleconference with the FAA representatives at the end of last year, our preference now to move forward would be to arrange a physical meeting here in the US, to include stakeholders from the UK MOD Project Team (Type Airworthiness Authority), CAA, and MAA with the FAA, SAF/IA and British Embassy from this side of the Atlantic. I've outlined details of what we would seek to achieve below, and I think this could best be achieved successfully with a face-to-face meeting, which I'm proposing we arrange for end of Apr.

You asked if I could identify a suitable representative from the CAA, with whom we have engaged. My initial PoC would be [redacted], who I know has visibility of what we're doing on PROTECTOR, and can bring his valuable expertise from the ICAO RPAS Panel as well as the CAA; I've included him as cc above.

I know you're planning to follow-up with [redacted] from the FAA following your engagement with him, and I'd be grateful if we could look to link up the various strands and perhaps align on the most effective way forward to get all the stakeholders together and discuss "the art of the possible".

Regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA92064, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk < Caution-mailto: [redacted]@mod.uk >

From: [redacted]@faa.gov [Caution-mailto: [redacted]@faa.gov]
Sent: 19 March 2016 13:33

To: [redacted] ([redacted])
Cc: [redacted] @faa.gov; [redacted] @faa.gov; [redacted] @faa.gov; [redacted] @faa.gov; [redacted] @faa.gov
Subject: RE: 20160318-
Developing_the_Mechanism_for_a_Technical_Support_Arrangement_to_Protector_UK_Mil_ScavRASM

[redacted],

Thanks for the clarification. Big help. Let me do some checking around next week and see if the end of April would be a good target to shoot for.

[redacted], Small Airplane Directorate

A successful man is one who can lay a firm foundation

with the bricks others have thrown at him. - David Brinkley

From: [redacted] ([redacted]) [Caution-mailto [redacted] @mod.uk < Caution-mailto: [redacted] @mod.uk >]
Sent: Friday, March 18, 2016 6:03 PM
To: [redacted] (FAA)
Cc: [redacted] (FAA); [redacted] (FAA); [redacted] (FAA); [redacted] (FAA)
Subject: 20160318-Developing_the_Mechanism_for_a_Technical_Support_Arrangement_to_Protector_UK_Mil_ScavRASM

[redacted]

Just to follow-up on [redacted]'s comments below; I recall from the Telephone Conference we had back in Nov (I was on the line from London) that we discussed potential ways to engage some technical support/advice/level of [redacted] as our MALE RPAS solution under the PROTECTOR Project.

I'm not sure, however, that this was formal enough at this stage to describe as a "contracting/funding mechanism" as alluded to by [redacted] below.

[redacted]

Safety Assessment in accordance with the ARPs as AMC to RPAS.1309 certification - this is an area where the [redacted] the processes for an unmanned system; and similarly we would seek a Regulator's perspective on the output (how good or bad it is?) to support how the UK MAA assure it.

Software Assurance. [redacted]

[redacted]

[redacted]

- What is PROTECTOR? Outline the Project, what it is, and why we need to go for full [redacted]

- What that Means? Outline UK MAA Regulatory process and Certification in particular - how we demonstrate competence to assure GA's certification plan, and hence the value of [redacted].

- How can we get the [redacted]? Explore the "art of the possible":

o Technical Assistance Agreements

o Export controls aspects (ITAR)

[redacted]

Knowing that diaries fill quickly, I know that the UK Type Airworthiness Authority ([redacted], my Boss) has time allocated at the end-Apr to support a meeting in the US (could be DC, LA, San Diego or Kansas, whichever is most convenient to meet with appropriate FAA officers) to try to progress how we might be able to [redacted]. I don't envision this would be more than ½ day, with presentation from us on the above bullet points for about 1 - 1½ hr, followed by discussion of Options and (hopefully) a plan for way forward.

I'd be grateful, therefore, if you could engage with the relevant folks on your side to see if we can set something up for the last week in Apr (w/c 04/25)? Or if there is a more convenient time.

It might be useful to discuss further by telecon if there is a convenient time, please feel free to contact me or [redacted] on any of the numbers below - or let me know a good time and we can arrange to call next week if that works.

Many thanks for your help, regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA92064, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk <
Caution-mailto: [redacted]@mod.uk >

From: [redacted] ([redacted])
Sent: 18 March 2016 14:47
To: [redacted]

Cc: [redacted]; [redacted]@faa.gov < Caution-mailto[redacted]@faa.gov > [redacted]@faa.gov < Caution-mailto:[redacted]@faa.gov > ; [redacted]; [redacted] ([redacted])
Subject: 20160318-Developing the Mechanism for a Technical Support Arrangement to Protector UK Military Certification

[redacted],

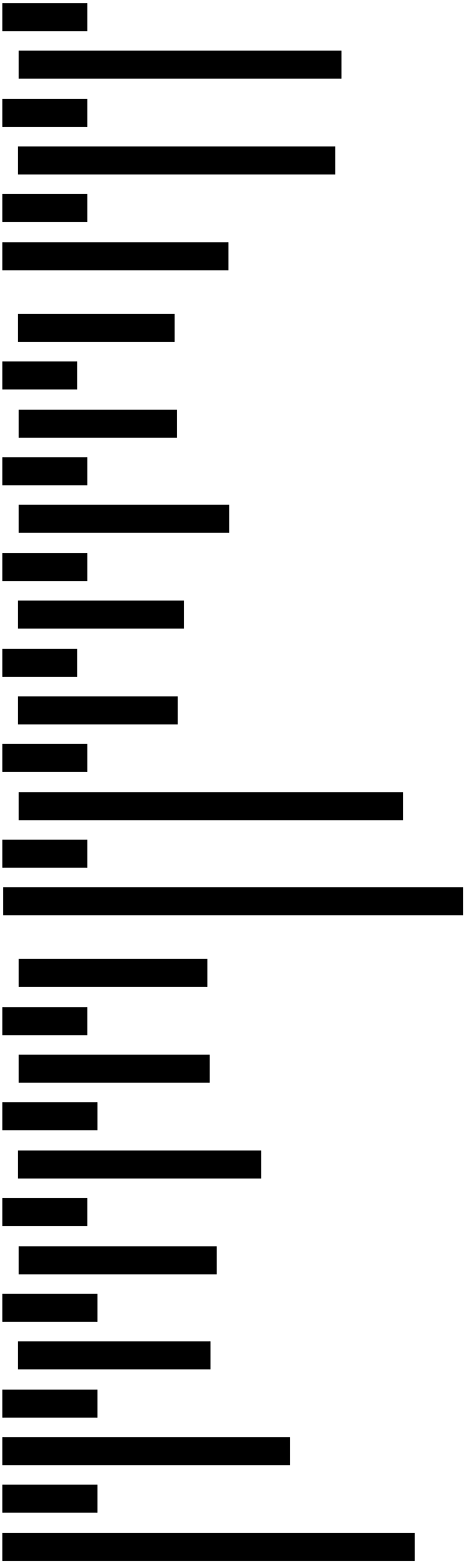
[redacted]

[redacted]

[redacted]

[redacted]

[redacted]



[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

SCAVENGER Resident Team (UAS PT)

International Office (Rm 1130), Mail Point #5, Bldg A27,

General Atomics Aeronautical Systems Inc,

12395 First American Way, Poway, CA 92064, USA

Office: [redacted] / BB: [redacted]

****

Before Printing consider the environment.

****

Stephen Rihanne

From: [redacted] ([redacted]) <[redacted]@mod.uk>
Sent: 25 April 2016 07:38
To: [redacted] (US); [redacted]; [redacted] (US)'; [redacted]@faa.gov'; [redacted]@faa.gov'; [redacted]
Cc: [redacted]
Subject: 20160425-Briefing Pack to Support FAA Protector Certification Support Telecon
Attachments: 20160425-FAA Brief on Protector-[redacted].ppt

All,

Please find attached a brief slide pack which I hope can serve as reference information for today's telecon. It's intended to give a general overview of where Protector is to date, how Protector relates to CPB, and list the identified UK certification issues (last two slides) for which external certification support is likely to be beneficial.

Best regards,

[redacted]

[redacted]

PROTECTOR Resident Team (UAS PT)
International Office (Rm 1130), Mail Point #5, Bldg A27,
General Atomics Aeronautical Systems Inc,
12395 First American Way, Poway, CA 92064, USA

Office: [redacted] / BB: [redacted]
Defence Equipment & Support

Protector Briefing Pack for Technical Support Telecon

(Between MoD/CAA and FAA/USAF/GA-ASI)

Prepared by:

[redacted]

[redacted]

Introduction

- PROTECTOR to be based on [redacted]
  - [redacted]
  - [redacted]
- 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)

[redacted]

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** .

[redacted]

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 [redacted] recovery or termination of flight in the event of engine failure/loss of power.
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

- 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

[redacted]

Omissions from the STANAG

- Airspace integration and segregation of aircraft [redacted]
- 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)
- [redacted]
- Piloting from an external or internal control box (Expected to be satisfied primarily through DefStan 00-970 Requirements)
- [redacted]
- [redacted]
- 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)
- [redacted]
- [redacted] (N/A to PROTECTOR Design)
- Sea-basing (N/A to PROTECTOR Design)
- Supersonic flight (N/A to PROTECTOR Design)

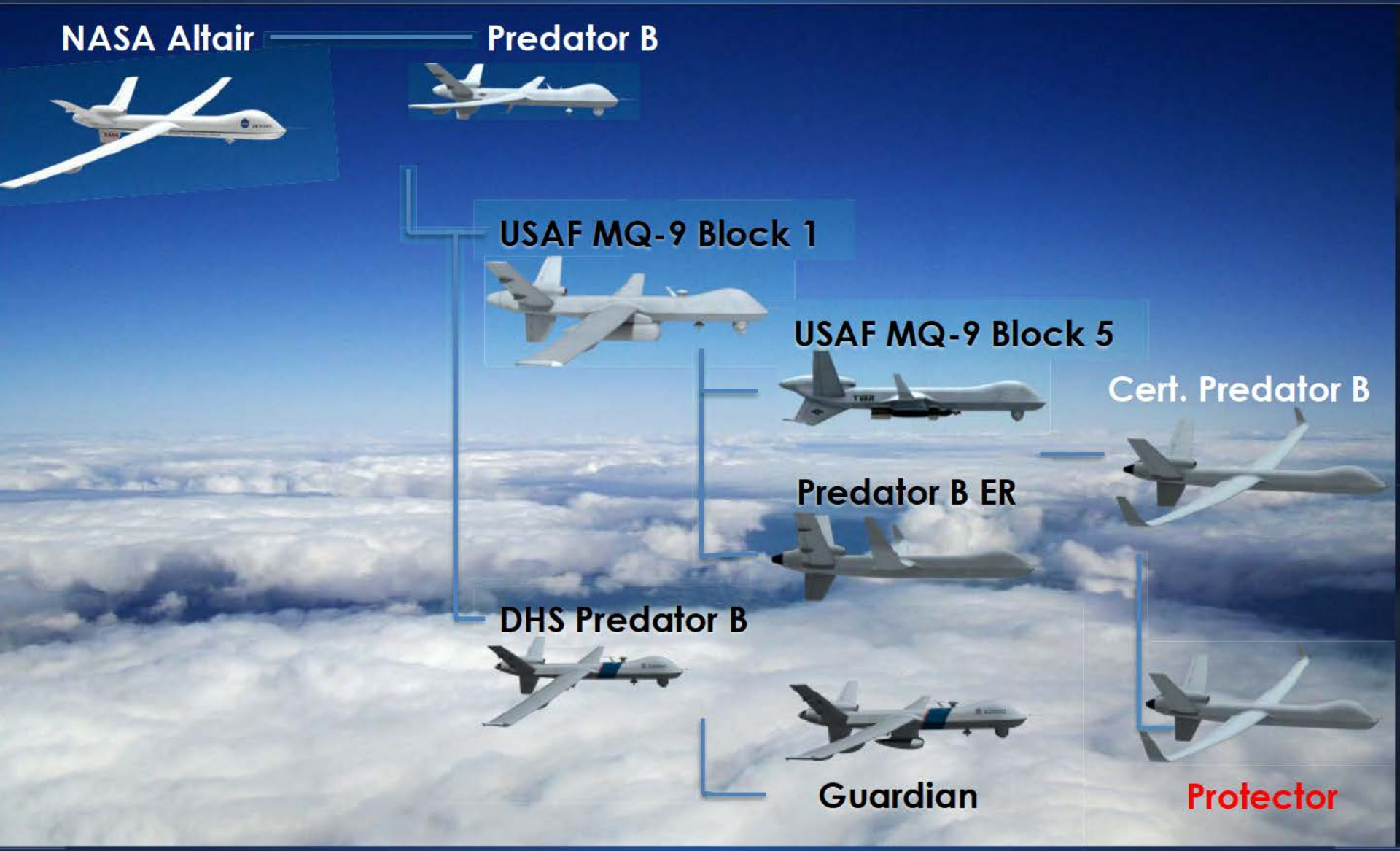
[redacted]

[redacted]

[redacted]

[redacted]

Relationship between Protector and Predator B Family



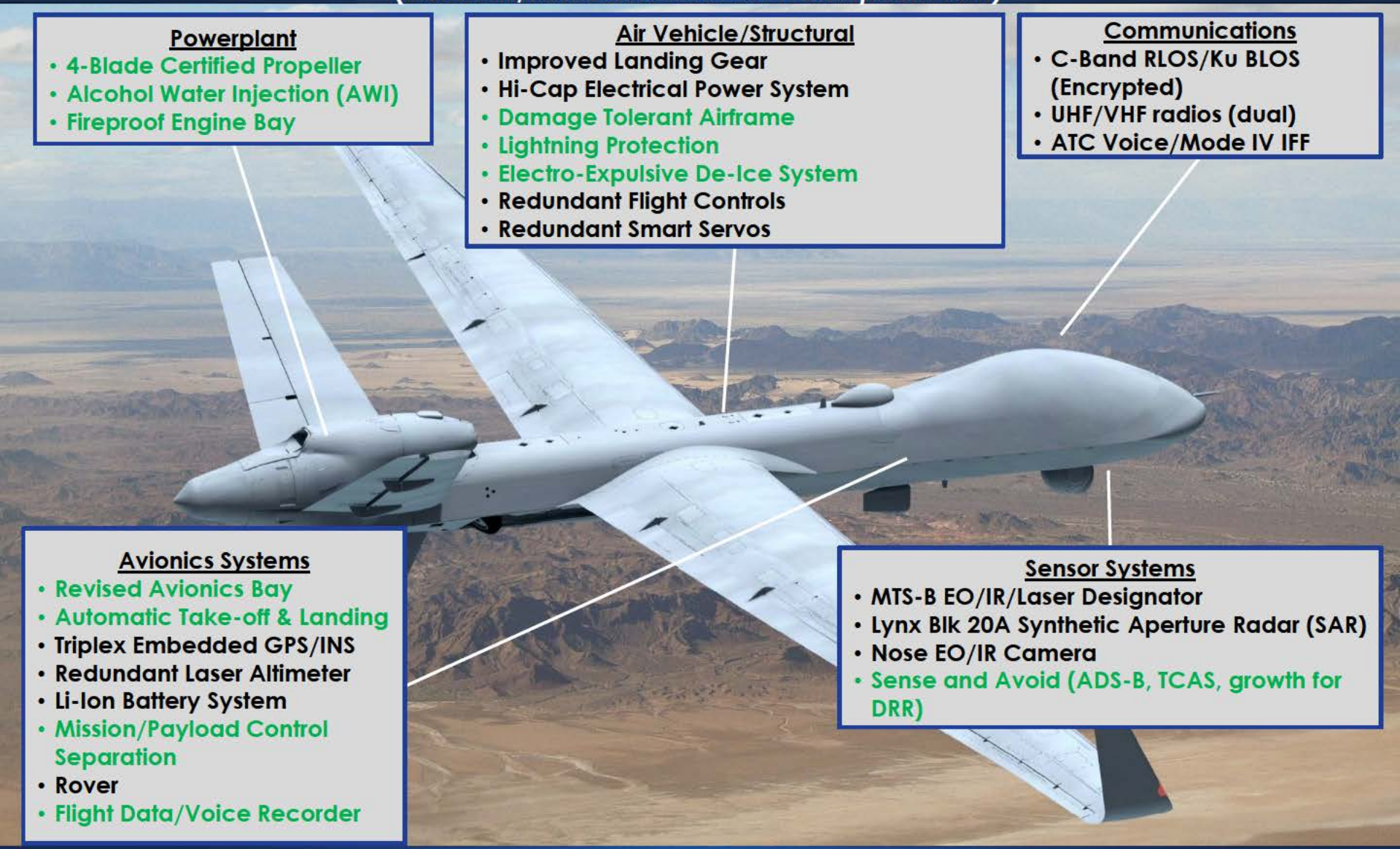
Certifiable Predator B (CPB) RPA

- **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**

Certification Driven Design Changes
Structures • Hot/Wet Capable Composite Materials • Primary and Secondary Load Paths (i.e., Fasteners) • Durable and Damage Tolerant Airframe
DO-254 Avionics • Flight vs. Payload Separation • Thorough environmental testing (23 areas)
DO-178C Software
System-wide Hardening/Protections • Lightning, Icing, Bird Strike and Fire Detection
Sense and Avoid System • Fused sensor products: TCAS, ADS-B (growth to support DRR)

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

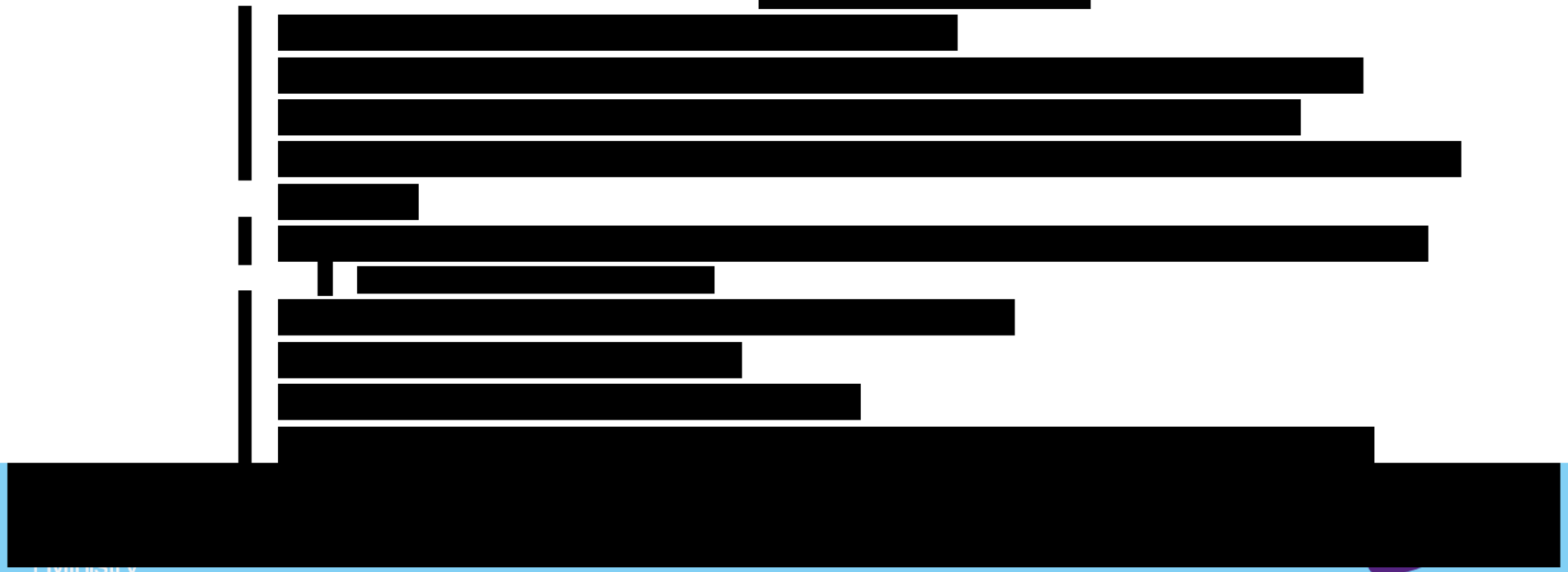
Communications
- C-Band RLOS/Ku BLOS (Encrypted)
- UHF/VHF radios (dual)
- ATC Voice/Mode IV IFF

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

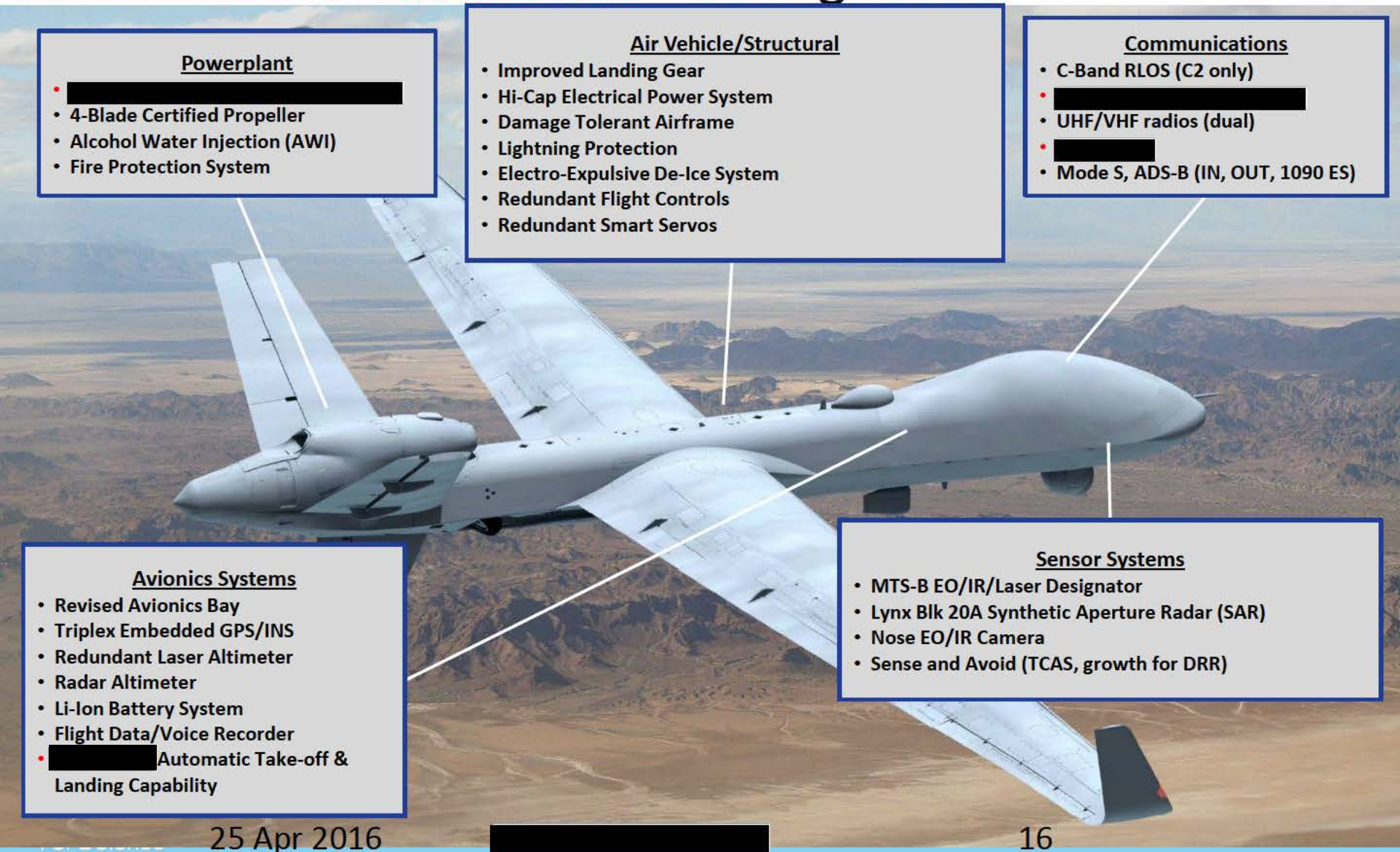
Sensor Systems
- MTS-B EO/IR/Laser Designator
- Lynx Blk 20A Synthetic Aperture Radar (SAR)
- Nose EO/IR Camera
- Sense and Avoid (ADS-B, TCAS, growth for DRR)

Protector RPA

- UK MoD high-level airworthiness requirement:
  - Procure a MALE UAS Weapon System that can be **MAA-certified** to fly in civilian airspace
    - [redacted]
- Details
  - Areas of focus over and above [redacted]:



CPB Aircraft Upgrade to "Protector" Configuration



Powerplant
- [redacted]
- 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)
- [redacted]
- UHF/VHF radios (dual)
- [redacted]
- 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
- [redacted] 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)

Configuration History - Ground Control Station

Mobile GCS

Block 10

Block 15

Block 30

Advanced Cockpit

Block 50

Certifiable-GCS

Certifiable GCS Overview

Airworthy Flight Critical Displays

Secure Power Supplies and Connections

"Cockpit" Voice Recorder

DO-254 Compliant Multi-core Computer

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

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.

[redacted]

[redacted]

Top Certification Risks

(Cert Basis Work In Progress)

- [redacted]
- GCS Certification (Technical Risk)
  - [redacted]
- Engine Certification (Technical Risk)
  - FAR 33 Amdt 3 basis
    - [redacted]

[redacted]

Stephen Rihanne

From: [redacted]) <[redacted] @mod.uk>
Sent: 11 May 2016 23:53
To: [redacted]) [redacted] (US); [redacted] @faa.gov'
Cc: [redacted] @us.af.mil'; [redacted]); [redacted] @faa.gov'; [redacted] @faa.gov'; [redacted] '; [redacted] @ga-asi.com'; [redacted]);
Subject: 20160511-FAA_Support_to_PROTECTOR-Follow_On_Information_ProtectorRASM
Attachments: 20160511-Areas for FAA Technical Support to PROTECTOR.docx

[redacted],

In our Apr 25 conference call with the FAA and CAA, I agreed to articulate in a little more detail the scope and level of support from the FAA that we might envisage in any formal arrangement to support the UK PROTECTOR certification effort. In the attached, [redacted] and I have developed the thoughts we described during the telecon into more detailed areas (5 in all, presented in priority order determined by the perceived benefit to be gained on both sides). As before, this DRAFT is obviously provided as a starting point to explore [redacted]

I hope this helps to explain more what we are looking for, and can frame some discussion moving forward. With this in mind, I think we should seek to identify the next suitable opportunity/availability window for follow-on engagement, either F2F or by telecon, with the key stakeholders needed to inform a strategy and approach to making any formal support arrangements.

Regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA **92064**, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted] @mod.uk

[redacted]

Thanks. One of the things I think we picked up from the previous Telecon was to try to specify [redacted] and I will work on that in advance of the next discussion, so we have something more particular in terms of projected effort to talk to.

Will wait out for further details of next engagement, thanks again for all your support with this.

Regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA 92064, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted] @mod.uk

-----Original Message-----
From: [redacted]) [redacted] (US) [mailto: [redacted] @mail.mil]
Sent: 26 April 2016 06:42
To: [redacted] ([redacted])
Subject: RE: 20160425-Briefing_Pack_to_Support_FAA_Protector_Certification_Support_Telecon_ProtectorRASM

Next step would be a telecon, in conjunction with the next overall Protector telecon. Dates TBD.

[redacted]

-----Original Message-----
From: [redacted] ([redacted]) [mailto [redacted] @mod.uk]
Sent: Monday, April 25, 2016 6:48 PM
To: [redacted] ([redacted]) [redacted] (US) < [redacted] @mail.mil>
Subject: [Non-DoD Source] 20160425-
Briefing_Pack_to_Support_FAA_Protector_Certification_Support_Telecon_ProtectorRASM

[redacted]

[redacted]

[redacted]

At some point I see this needing a face-to-face with Embassy and USG staff in DC, but that might be later...

Thanks again

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA 92064, USA
Desk: [redacted] | BB [redacted] | dii: [redacted] | e-mail: [redacted] @mod.uk

-----Original Message-----
From: [redacted]) [redacted] (US) [mailto: [redacted] @mail.mil]
Sent: 25 April 2016 12:35
To: [redacted] ([redacted])
Cc: [redacted] ([redacted])
Subject: RE: 20160425-Briefing_Pack_to_Support_FAA_Protector_Certification_Support_Telecon_ProtectorRASM

[redacted]

[redacted]

-----Original Message-----
From: [redacted] ([redacted]) [mailto [redacted]@mod.uk]
Sent: Monday, April 25, 2016 3:09 PM
To: [redacted] ([redacted]) [redacted] (US) <[redacted]@mail.mil>
Cc: [redacted] ([redacted]) <[redacted]@mod.uk>
Subject: [Non-DoD Source] 20160425-Briefing_Pack_to_Support_FAA_Protector_Certification_Support_Telecon_ProtectorRASM

[redacted]

Just following up from the abrupt end to the Telecon this morning, when I'm sure [redacted] was summing up next steps.

[redacted]

[redacted]

[redacted]

[redacted]

Regards

[redacted]

[redacted] | [redacted] | International Office - Bldg A27 Rm 1130, General Atomics Aeronautical Systems Inc, 14200 Kirkham Way, Poway, CA 92064, USA
Desk: [redacted] | BB: [redacted] | dii: [redacted] | e-mail: [redacted]@mod.uk

-----Original Message-----
From: [redacted] [redacted]) [redacted] (US) [mailto:[redacted]@mail.mil]
Sent: 25 April 2016 05:43
To: [redacted] ([redacted]); [redacted]; [redacted]; [redacted] (US); [redacted]@faa.gov'; [redacted]@faa.gov'; [redacted] ([redacted])
Cc: [redacted] ([redacted]); [redacted] ([redacted]); [redacted]; [redacted]'; [redacted] ([redacted])
Subject: RE: 20160425-Briefing Pack to Support FAA Protector Certification Support Telecon

Please review the slides in advance, and be prepared with any initial questions before we dive into the last 2 slides. We will not have time to go through all the slides.

[redacted]

-----Original Message-----
From: [redacted] ([redacted]) [mailto [redacted]@mod.uk]
Sent: Monday, April 25, 2016 2:38 AM
To: [redacted] ([redacted]) [redacted] (US) <[redacted]@mail.mil>; [redacted] <[redacted]@caa.co.uk>; [redacted] <[redacted]@faa.gov>; [redacted] (US) <[redacted]@us.af.mil>; [redacted]@faa.gov'; [redacted]@faa.gov'; [redacted] [redacted] [redacted]) <[redacted]@mod.uk>
Cc: [redacted] ([redacted]) <[redacted]@mod.uk>; [redacted] ([redacted]) <[redacted]@mod.uk>; [redacted] <[redacted]@ga-asi.com>; [redacted]' <[redacted]@ga-asi.com>; [redacted] ([redacted]) <[redacted]@mod.uk>
Subject: [Non-DoD Source] 20160425-Briefing Pack to Support FAA Protector Certification Support Telecon

All,

Please find attached a brief slide pack which I hope can serve as reference information for today's telecon. It's intended to give a general overview of where Protector is to date, how Protector relates to CPB, and list the identified UK certification issues (last two slides) for which external certification support is likely to be beneficial.

Best regards,

[redacted]

[redacted]

[redacted]

PROTECTOR Resident Team (UAS PT)

International Office (Rm 1130), Mail Point #5, Bldg A27,

General Atomics Aeronautical Systems Inc,

12395 First American Way, Poway, CA 92064, USA

Office: [redacted] / BB: [redacted]

Defence Equipment & Support

Ministry of Defence

de&s

[redacted]

Stephen Rihanne

Subject: 20160920-PROTECTOR_Airspace_Integration_WG-[redacted]
Location: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Start: Fri 07/10/2016 09:00
End: Fri 07/10/2016 17:00
Show Time As: Tentative

Recurrence: (none)

Organizer: [redacted] [redacted])

Sirs, Ma'am, all,

****AGENDA****

0900-0915 Opening address – [redacted]
0915-0945 X-govt update – [redacted]
0945-1015 PROTECTOR Interim proposal update – [redacted] & [redacted]
1015-1100 ACAS policy update – research funding discussion – [redacted]
1100 -1120 Dstl update – research expansion – [redacted]
1120 -1150 Discussion – expansion & Q&A on proposal

1150-1300 Lunch

1310-1340 MAA Update – [redacted]
1310-1340 CAA Update – [redacted]
1340-1400 MCRI process update – [redacted]
1400-1430 GA – PROTECTOR Enhance update – [redacted]

1430-1500 Break

1500-1630 GA Due Regard radar discussion – [redacted]

Fluid timelines – we'll be finished nlt 1645.

Yours aye,

[redacted]

Mtg request for the next PROTECTOR Airspace Integration WG.

Morning:

Update on Interim PROTECTOR Airspace Integration progress.

- Updates from TAA, CAA, MAA
- Update from WECA about broader integration work
- Update from Dstl on research work

Afternoon:

[redacted]

[redacted]

Detailed agenda to follow.

Tea and coffee will be provided but lunch will not.

Please contact me directly if more information is required.

Yours aye,

[redacted]

[redacted]

[redacted]

20160520-Protector_UK_Airspace_Integration

20 May 16

PSO ACAS

PROTECTOR UK AIRSPACE INTEGRATION

1. **Issue.** An appropriate strategy is required to enable integrated Protector operations within UK airspace. These should be aligned to CAA and MAA policy and VCDS' aspiration to normalise RPAS access to UK airspace.

2. **Recommendations.** ACAS is **invited to note**:

   a. While extant ICAO and CAA regulations do not explicitly prohibit RPAS[1] ops outside segregated airspace, 'equivalence' with manned platforms is required when measured against the most testing scenario[2]. However, there are currently no universally accepted performance standards for RPAS Sense and Avoid (SAA).

   b. As a minimum, Protector is required[3] to be capable of transiting through all classes of UK airspace by [redacted]. This is aligned to emerging cross-government aspirations for the integration and normalisation of RPAS operations.

   c. If required, segregated airspace will be enabled via the Airspace Change Process (ACP). However, this would incur additional cost, delay and impact other UK airspace users.

   d. Public acceptance will be an important factor in normalising domestic RPAS ops.

and **agree that**:

   e. DSTL [redacted] and tasked to quantify human performance and define the technical equivalencies required for non-segregated operations in the most testing scenario.

   f. The proposal at Annex A is endorsed and submitted to the TAA.

   g. DAATM is tasked to define the ACP timeline and potential cost at Annex B.

   h. DDC is tasked to establish a supporting RPAS engagement strategy.

Background.

3. The most testing RPAS regulatory scenario is considered to be operations in non-segregated airspace where visual lookout remains the last safeguard for separation from non-coordinated traffic[4]. However, there is no defined technical standard offering equivalence to the human eye or regarding RPAS SAA[5] technology. Although SAA capabilities are being developed, these will not be available in Protector IOC criteria at Annex C[6]. Moreover, these capabilities may set unrealistic regulatory standards beyond the financial and technical resources of other potential airspace

---

[1] Specifically, RPAS operated in the Certified category as defined in EASA regulatory 'Concept of Operations for Drones' (May 2015).
[2] 20160405-CAA_Position_On_Roles_And_Responsibilites_For_Protector_Airspace_Integration.
[3] [redacted]
ICAO defined Class G airspace permits non-participating traffic to operate under VFR. Individual states are permitted to impose more stringent criteria if they so wish; in the UK, the CAA currently chooses not to.
[5] DSTL cite numerous industry approaches to SAA development but highlight the lack of universally accepted methodology or regulated performance standard.
[6] [redacted]

[redacted]

users. RPAS integration into non-segregated airspace can therefore be distilled into the following work-strands:

a. **SAA Equivalence.** Human performance in the most testing scenarios requires definition for a comparable and acceptable RPAS SAA capability to be certified.

b. **C2 Link Fidelity.** RPAS C2 links must have a likelihood of failure below $1x10^{-6}$ per flying hour. If this cannot be achieved, SAA capability must have the ability to act autonomously outside of segregated airspace.

4. **Proposed PROTECTOR Approach.** Assessment of PROTECTOR regulatory compliance will be undertaken by the TAA, with MAA agreement, and will support the Safety Assessment Report (SAR). Should airworthiness standards not be achieved or not exist, then a safety-based argument will be generated within the SAR, with an associated risk transfer note to the DH chain. The following approaches are recommended:

a. **Preferred Hybrid Approach.** Annex A is a methodology similar to that already considered by some to be best practice[7]. This graduated risk assessment will seek near-term integration by proving equivalence with manned aircraft under extant Rules of the Air. This analysis, based on the Protector equipment fit detailed at Annex B, will inform the TAA assessment.

b. **Fallback Segregated Approach.** If RPAS integration cannot be achieved, then segregation via ACP will be necessary. This will incur additional cost and delay, and could impose restrictions on other UK airspace users[8]. Nevertheless, the ACP at Annex B, should be progressed in parallel to de-risk the preferred CoA at IOC.

c. **Communication Strategy.** Public perception will be central to normalising RPAS use in UK airspace, especially for military purposes. An internal and external communication strategy will therefore be essential to support Protector DLoDs.

Summary

5. DSTL research based on defined Protector capabilities is required to define the technical standards required to establish CAA regulation enabling routine Protector use in UK airspace. This in turn will secure TAA approval and potentially allow the UK to become a recognised leader amongst ICAO member states in the integration of RPAS. While regulatory implications may result, the broader economic and reputational benefits for the MoD and Prosperity Agenda may be compelling. However, the perception of RPAS - both by the public and ATM community - will be central to integration and require a coherent cross-government communications strategy.

ISTAR FC

Annexes:

A: Proposed Protector Integration CoAs.
B: Proposed DAATM ACP fallback measures.
C. Protector IOC equipment and criteria.

Attachment:

1. 'ICAO RPAS and Remote ATS Symposium': ISTAR FHQ Trip Report.

---

[7] CANSO "ANSP Considerations for RPAS Operations" Para 7 – "Best practice Switzerland: operation procedures ADS-95".
[8] BZN ACP started in 2011, had to be changed to accommodate Oxford airport, is still not ratified, and has cost over £248 000 so far.

Annex A to
Protector UK Airspace
Integration-[redacted]
Dated 20 May 16

PROTECTOR PREFERRED INTEGRATION APPROACH

1. **Background.** The following bowtie analysis considers potential Risks and mitigations for operating Protector with IOC equipment fit (at Annex C). This preferred approach has been designed to prove equivalence with a participating manned platform on a typical UK flight profile.

2. **Assumptions.** Although not exhaustive, the following assumptions were made:

   a. All pilots are fully qualified with appropriate Instrument Rating.

[redacted]

[redacted]

Annex A to
Protector UK Airspace
Integration-[redacted]
Dated 20 May 16

Hazard: FRPAS operation in UK controlled airspace (MAC)

Hazard name:	FRPAS operation in UK controlled airspace (MAC)
Top event:	RPAS aircraft in close proximity with another aircraft so that their safety is or may be compromised
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat		
	Barrier	
		Escalation Factor
		Barriers (...)
• Participating aircraft in conflict		
	• Flightplan submitted and accepted by ATC	
	• ATC Service Provided	
		• Esc. Lost radio comms with ATC
		• Br. Standard international lost comms procedure
		• Br. Telephone communications between GCS and ATC agency
	• Situational Awareness provided by Collision Warning System (CWS)	
	• ADS-B	
		• Esc. Limited carriage by participating aircraft
	• [redacted]	

[redacted]

• Other aircraft airmanship - prompted by ATC to keep good lookout
• Loss of command and control link while another aircraft is in conflict
• Robustness of BLOS Primary link
• Esc. Manoeuvre impact on link
• Br. Manoeuvre Limited
• Esc. Satellite geographic footprint limitation
• Br. Operations conducted within usable satellite footprint
• Esc. BLOS hardware failure
• Br. Robustness of primary SATCOM physical infrastructure
• Esc. Interruption in services and connectivity
• Br. GCS
• Esc. Primary power failure
• Br. System includes a UPS which provides backup power
• Esc. CIS Failure
• Br. TTPS and reversionary procedures
• Esc. Environmental Control System failure
• Br. Redundant Environmental Control Systems
• Br. Load shed the system
• Br. SOPs
• Br. C2 Circuitry
• Esc. Failure of C2 link between GCS and relay site
• Br. Redundant links at ground sites
• Br. Physical protection of C2 link hardware
[redacted]
• Br. Satellite
• Esc. Satellite fails
• Br. Satellite is manufactured to military specs
• Br. Redundant satellite equipment
• Br. Redundant satellites within constellation
• Br. Redundancy within BLOS system
• Pilot will be given prior indication of degradation and loss of link
• Secondary BLOS link
• Predictable lost-link profile agreed with ATC
• Departure from controlled airspace due to technical failure
• FRPAS Declares in-flight emergency
• Control of aircraft is retained
• Esc. Control system integrity is compromised
• Br. Certified air vehicle
• Esc. Air vehicle integrity is compromised
• Br. Certified air vehicle
• Pre-planned emergency landing zones

[redacted]

Consequences

Consequence		
	Barrier	
		Escalation Factor
		Barriers (...)
• Mid air collision resulting in fatalities		
	• TA/RA from CWS	
		• Esc. May not be able to comply with CWS RA due to performance limitations
		• Br. CWS logic
	• FRPAS Pilot instigates avoiding action (if they are able)	
	• Other aircraft pilot instigates avoiding action (if they are able)	
• Third party fatalities on the ground (see separate tech failure bowtie)		

[redacted]

[redacted]

Hazard: FRPAS Terminal Operation (Take off and landing)

Hazard name:	FRPAS Terminal Operation (Take off and landing)
Top event:	Unplanned deviation from normal launch and recovery profile
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat			
	Barrier		
		Escalation Factor	
			Barriers (...)
• Aircraft in conflict			
	• FRPAS operating in controlled airspace		
	• ATC service		
• Failure to maintain separation with terrain or obstacle			
	• FRPAS flies approved arrival and departure procedures		
	• FRPAS is fitted with CNS - ATM approved navigation system		
	• FRPAS scheduled performance is defined		
• Engine Failure			
	• Engine is envisaged to be certified in accordance with appropriate standards		
• Loss of BLOS link			
	• Alternate Line of Sight (LOS) control link		
		• Esc. Loss of LOS control	
			• Br. Pre-programmed loiter profile
• Runway becomes unavailable			
	• Contingency Fuel		
	• Executes diversion procedure		

	• Commanded forced landing

Consequences

Consequence	
	Barrier
• Results in loss of life	
	• Abort/go around procedures
	• Pre programmed loiter profile
	• Pre-agreed surveyed forced landing sites within the ATZ

[redacted]

Hazard: FRPAS operation in UK class G (uncontrolled) airspace (MAC)

Hazard name:	FRPAS operation in UK class G (uncontrolled) airspace (MAC)
Top event:	RPAS aircraft in close proximity with another aircraft so that their safety is or may be compromised
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat			
	Barrier		
		Escalation Factor	
			Barriers (...)
• Participating aircraft in conflict			
	• Minimise time in Class G airspace		
	• NOTAMS		
	• ATC Service Provided		
	• Local agreements achieved between ATC units		
	• Situational Awareness provided by Collision Warning System (CWS)		
	• ADS-B		
		• Esc. Limited carriage by participating aircraft	
	• [redacted]		
		[redacted]	
			[redacted]
			[redacted]
			[redacted]
	• FRPAS controlled by qualified pilots		
	• FRPAS Crew Fatigue Management		
	• Other aircraft airmanship - prompted by ATC to keep good lookout		

	• FRPAS Conspicuity	
• Non-participating aircraft in conflict		
	• RPAS to Minimise time in Class G airspace	
	• NOTAMS	
	• ATC Service Provided	
	• De-confliction by time of day for reduced traffic density (take-off and recover by night)	
		• Esc. FRPAS does not have sufficient fuel to wait until night time to be recovered
		• Br. Maintain sufficient fuel reserve for recovery at night
		• Esc. FRPAS undergoes critical failure during daylight hours
		• Br. FRPAS declares emergency as per procedures used by manned aircraft
	• SA provided by CWS	
		• Esc. Other aircraft not fitted with CWS
	• [redacted]	
	• FRPAS controlled by qualified pilots	
	• FRPAS Crew Fatigue Management	
	• Other aircraft airmanship - required to keep good lookout	
	• FRPAS Conspicuity	
• Loss of command and control link while another aircraft is in conflict		
	• Robustness of BLOS Primary link	
		• Esc. Manoeuvre impacts on link
		• Br. Manoeuvre Limited
		• Esc. Satellite geographic footprint limitation
		• Br. Operations conducted within usable satellite footprint
		• Esc. BLOS hardware failure
		• Br. Robustness of primary SATCOM physical infrastructure
		• Esc. Interruption in services and connectivity
		• Br. GCS
		• Esc. Primary power failure
		• Br. System includes a UPS which provides backup power
		• Esc. CIS Failure
		• Br. TTPS and reversionary procedures
		• Esc. Environmental Control System failure
		• Br. Redundant Environmental Control Systems
		• Br. Load shed the system
		• Br. C2 Circuitry
		• Esc. Failure of C2 link between GCS and relay site
		• Br. Redundant links at ground sites
		• Br. Physical protection of C2 link hardware
		[redacted]

		• [redacted]
		• Br. Satellite
		• Esc. Satellite fails
		• Br. Satellite is manufactured to military specifications
		• Br. Redundant satellite equipment
		• Br. Redundant Satellites within constellation
		• Br. Redundancy within BLOS system
	• Pilot will be given prior indication of degradation and loss of link	
	• Secondary BLOS link	
	• Line Of Sight control system	
	• Predictable lost-link profile agreed with ATC	

Consequences

Consequence		
	Barrier	
		Escalation Factor
		Barriers (...)
• Mid air collision resulting in fatalities		
	• TA/RA from CWS	
		• Esc. May not be able to comply with CWS RA due to performance limitations
		• Br. CWS logic
		• Esc. TA/RA only generated for participating aircraft
	• FRPAS Pilot instigates avoiding action (if they are able)	
	• Other aircraft pilot instigates avoiding action (if they are able)	

[redacted]

Hazard: FRPAS Technical Failure in Controlled Airspace/with Engine Failure

Hazard name:	FRPAS Technical Failure in Controlled Airspace/with Engine Failure
BowTie Group:	New Location
Top event:	RPAS aircraft inability to remain airborne
Affects:	<NULL> <No Value Assigned>
Build complete:	No

Threats

Threat		
	Barrier	
		Escalation Factor
		Barriers (...)
• Departure from controlled airspace due to technical failure		
	• FRPAS Declares in-flight emergency	
	• Control of aircraft is retained	
		• Esc. Control system integrity is compromised
		• Br. Certified air vehicle
		• Esc. Air vehicle integrity is compromised
		• Br. Certified air vehicle
	• Pre-planned emergency landing zones	

Consequences

Consequence	
	Barrier
• Third party fatalities on the ground	
	• Emergency procedures
	• Pilot lands aircraft at Pre-planned emergency landing zones

[redacted]

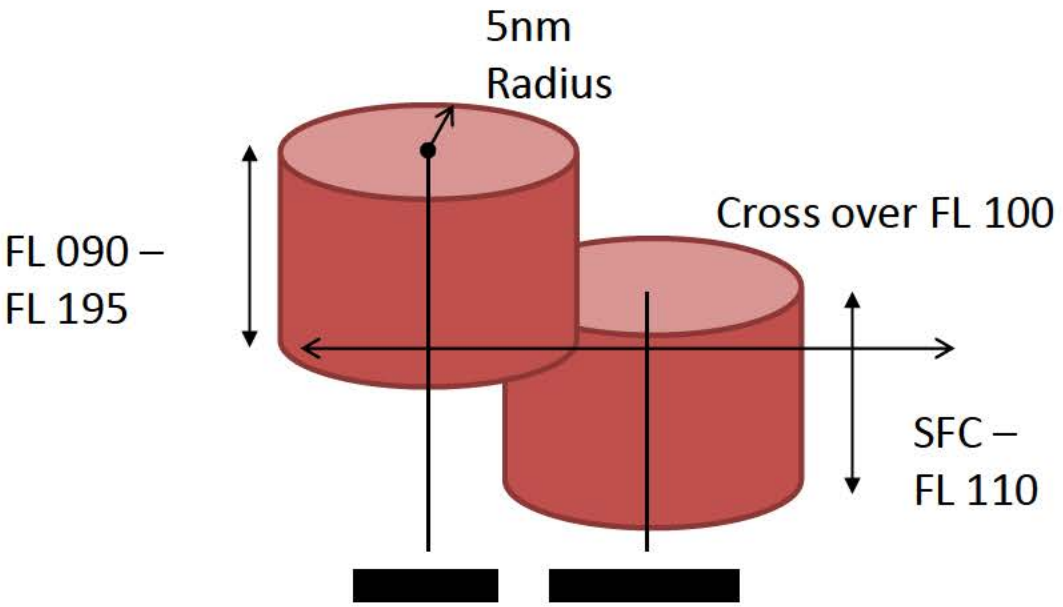
[redacted]

CLASS G AIRSPACE SEGREGATION OPTION

[redacted]

- **This would require an ACP; Approx 2 years with consultation.**

CLASS G AIRSPACE SEGREGATION OPTION

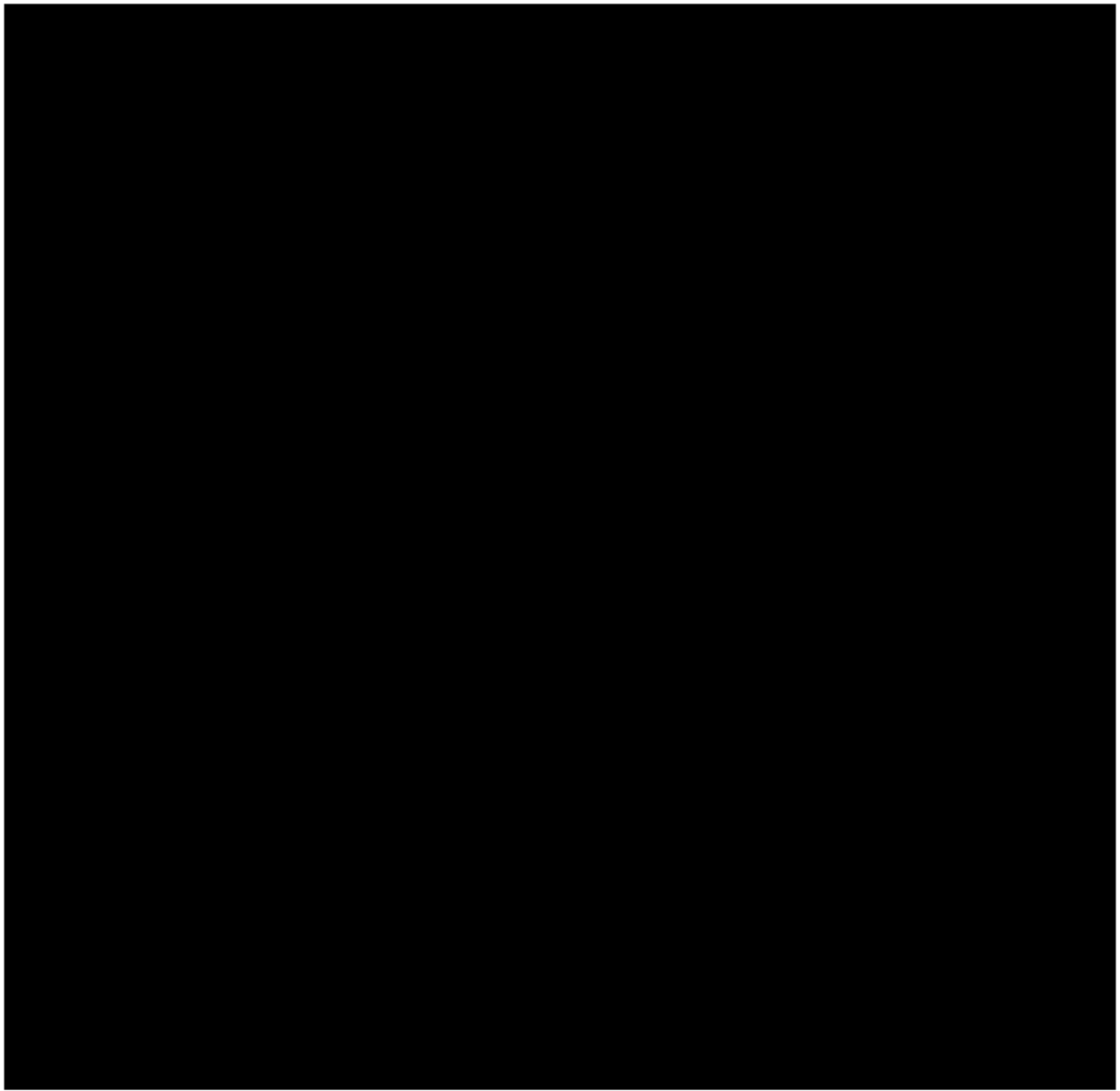


- **Cross section view depicting spiral climb and crossover requirement.**
- **Once Protector reaches FL200 will route in CAS as OAT.**
- **Integration within CAS still requires acceptance by the CAA.**

[redacted]

Annex B to
PROTECTOR UK
Airspace Integration
Dated 20 May 16

CLASS C AIRSPACE ROUTINGS



[redacted]

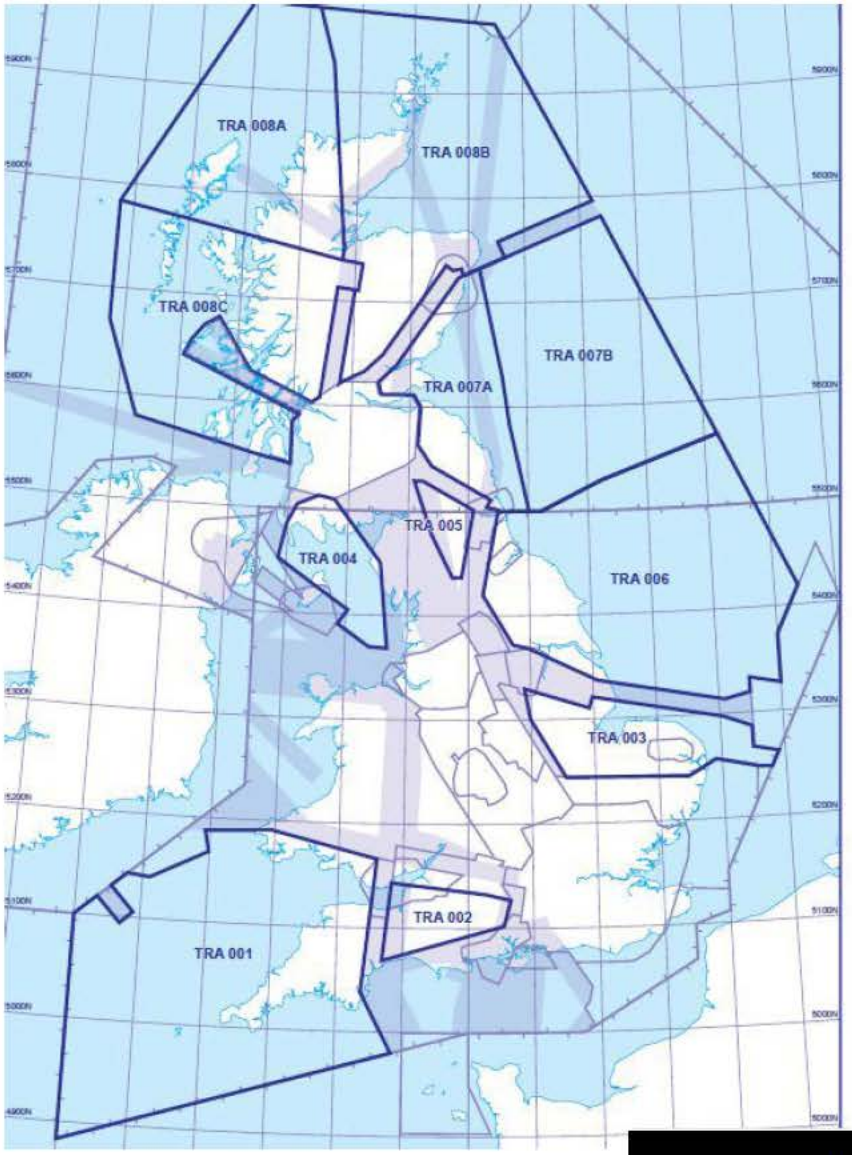
Annex B to
PROTECTOR UK
Airspace Integration
Dated 20 May 16

CLASS C AIRSPACE ROUTINGS

[redacted]

- [redacted]

CLASS C TEMPORARY RESERVE AREAS



- [redacted]
- **TRAs already Established between FL195 and FL245.**
- **TRAs designed to allow autonomous VFR access for Mil ac.**
- **Use of TRAs minimises interaction with Civil ac.**
- **Changes to ATC rules required to accommodate mandatory Separation between Civil ac and Protector.**

[redacted]

[redacted]

Annex C to
Protector UK Airspace
Integration-[redacted]
Dated 20 May 16

[redacted]

[redacted]

[redacted] - COMMERCIAL

[redacted]

[redacted]

20160516-ICAO RPAS Trip Report[redacted]

16 May 16

ISTAR FC
DFC
AS Strat 3
AS International 1

ICAO RPAS AND REMOTE ATS SYMPOSIUM TRIP REPORT

1. **Issue.** SO1 RPAS and Shadow attended the ICAO 'RPAS and Remote Air Traffic Service (RATS)' Symposium in Stockholm, 10-11 May 16.

2. **Timing.** Routine.

3. **Recommendations.** The FC and DFC are invited to **note** that:

   a. **The international civilian air traffic community is overwhelmed by the expansion of unregulated small (<150 kg) UAS use.**

   b. **RPAS are viewed as a 'disruptive technology' requiring a fundamental change to Air Traffic Management (ATM) regulation and methodology.**

   c. **ICAO and CAA representatives opined that industry should drive 'regulatory answers' to RPAS integration challenges including 'Detect and Avoid'.**

   d. **RATS sensor technology is already considered to exceed the acuity of the human eye.**

Background

4. The Symposium was attended primarily by ICAO member state and industry representatives. It therefore provided an excellent insight into the civilian ATM regulatory community's thinking regarding RPAS integration and RATS. It is evident that they are overwhelmed by the rapid proliferation of unregulated small UAS (SUAS).[1] The overall ICAO mindset was illustrated by RPAS/UAS and RATS being described as 'disruptive' and 'sustaining' technologies respectively despite arguably presenting similar cultural challenges.

5. Although ICAO focus remains on SUAS, this may increasingly be offset by the introduction of large commercial RPAS in the next decade. Indeed, the Facebook Director of Aeronautical Platforms stated an intention to deploy up to 10 000 solar powered High Altitude Long Endurance RPAS by 2025 globally.[2] This presents an opportunity for Defence to share the lessons of over 20 years of military MALE operations. Equally, emerging 'Unmanned Traffic Management' (UTM) concepts using 'self organised air network' wifi Cloud technology to deconflict SUAS with General Air Traffic may prove relevant to military RPAS and swarming weapons.

6. There was considerable discussion regarding how ATM policy bodies should adapt to the 'Drone Age.' It was widely accepted that the current 3-7 year period required for new civilian aviation regulation was unsuited to the rapid evolution of drone technology. Therefore, both the ICAO and CAA advocated a more agile block upgrade strategy for global regulation; this would also consider upper airspace and commercial space activity. Moreover, there was likely to be a

[1] Although definitions differed between nations, SUAS were generally considered to fall below 150 kg in weight. The US FAA stated that there were now some 400 000 registered SUAS and an unknown number of unregistered systems. This compared with a total of 300 000 registered civilian manned aircraft in the US.
[2] These appear to be in a similar class to Zephyr T.

[redacted]

[redacted]

requirement to introduce new rules of the air including ‘non-direct’ or ‘synthetic VFR’ and Accident Data Recorder equivalency for remote data storage. Addressing the question of who defined standards, both ICAO and the CAA tacitly acknowledged the need for industry to offer the technological solutions upon which ICAO would base policy. This may present an opportunity for the RAF to gain disproportionate influence as Protector paves the way with RPAS airspace integration. If appropriately highlighted by Centre, the associated technological and commercial benefits to be derived from integrating military and commercial RPAS into airspace may also prove a powerful lever to assure Protector timescales and funding.

7. Perhaps unsurprisingly, the audience was far more positive concerning RATS. Increasing numbers of these remotely manned and operated towers are now operational at isolated airfields in Scandinavia and North America; such technology also has clear relevance to expeditionary military ATC. Of particular note, it is already widely accepted that visual sensors used in RATS architecture exceed the visual acuity of the human eye; this precedence should be exploited to erode resistance regarding RPAS ‘detect and warn’ technology. Interestingly, parallels to military Ku-Ku RPAS ops are already emerging regarding the implications for sustained 24/7 workload and ‘follow the sun’ handovers of airfield control. There is also potential for the visual presentations inherent in RATS to be used for the remote supervision of RPA taxiing and ATOL. This may reduce the need for Protector engineers to be SQEP in this role.

Summary

8. This symposium offered a valuable insight into the mindset of the ATM community and industry regarding remote technology. While ICAO remains overwhelmed by the explosion in unregulated SUAS, there is emerging commercial interest in larger RPAS. This may dictate fundamental changes to aviation law and regulatory tempo. However, continued ICAO focus on SUAS also presents an opportunity for the military to assume a degree of leadership in RPAS regulatory standards via industry. Moreover, the commercial and economic benefits of the UK becoming a recognised leader in RPAS integration may prove compelling for UK ministers. This could in turn act as a positive lever for Protector and Zephyr development. Similarly, the acceptance of RATS synthetic visual technology sets a valuable precedence for RPA ‘detect and avoid’ certification.

SO1 RPAS and Shadow

[redacted]

24 Jun 16

See distribution

RECORD OF DECISIONS FROM THE PROTECTOR AIRSPACE INTEGRATION DLOD WORKING GROUP HELD AT RAF BENEVOLENT FUND ON 15 JUN 16

Present	[redacted]	[redacted] FHQ [redacted] FHQ [redacted], JFC [redacted] [redacted] DAATM [redacted] DAATM [redacted] GA-ASI Dstl UAS SAW UAS TES UAS TES	Chairperson
Apologies	[redacted]	CAS AS MAA UAS PT [redacted] CAA	

ITEM 1 – REVIEW OF MINUTES FROM 18 MAY MTG WITH ACAS	**Action**
1. Work continued on outstanding items.	
ITEM 2 – PROGRAMME UPDATE 2. The Chairman opened by reiterating the aim and focus of the mtg: to seek a viable way of transiting PROTECTOR through all classes of Airspace at PROTECTOR IOC while also meeting senior military and x-govt strategic intent. He further outlined that the purpose of the mtg was to add detail to the ISTAR FHQ's Interim Integration Proposal while providing forum for questions and explanations. The Chairman stressed the importance of education and communication, especially with the CAA, and highlighted DAATM's key role in that process. In particular, the Chairman focused on the importance of clearly bounding where the risk in the proposal lay – with this mtg deliberately focusing on the MAC aspect, the key to progress will be defining a list of Class G airspace users and discounting them as potential source of conflict by listing and tailoring specific barriers e.g. defining the detection thresholds for military radar provision around the RAF Waddington locale.	
ITEM 3 – Dstl Update 3. Having examined the ISTAR FHQ proposal closely, as tasked on the 18 May 16, [redacted] expanded on some of the work he could do to assist the TAA in their safety case and risk assessment endeavours. The proposed effort included: - Approaching QinetiQ to see what, if any, of a recent Typhoon Collision Model study for RAF Conningsby operations would be transferable to PROTECTOR operations. - Approaching Helios (the authors of the Swiss Class G RPAS airspace	[redacted]

[redacted]

[redacted]

integration Safety Case) to see what, if any, of their findings would be applicable to PROTECTOR integration aspirations.

- [redacted]

[redacted]

ITEM 4 – PROTECTOR RM Update

4. The PROTECTOR [redacted] agreed to answer several RFIs in support of the PROTECTOR Airspace Integration proposal. These included:

- Confirming what the PROTECTOR IOC Nav and anti-col light fit will be and liaising with TAA to see if this was adequate.

- [redacted]

[redacted]

ITEM 5 – DAATM Update

5. The DAATM team continued to provide expert information and explanation of airspace regulation to the assembled body. In addition to this, they specifically agreed to:

- Noting the importance the Chairman placed on communication strategy, details and timelines to ISTAR FHQ on the NATMAC process for briefing [redacted] Airspace Users and the broader GA community. [redacted] **DAATM**

- Refine their work on the 'fall-back' segregation proposal and provide timelines relative to PROTECTOR IOC to ACAS accordingly. [redacted] **DAATM**

- [redacted] **DAATM**

ITEM 9 – GA-ASI Update

6. [redacted] updated that he was grateful to be included in the progression of PROTECTOR Airspace Integration and [redacted] In particular, he agreed to investigate the following:

- Provide ISTAR FHQ and [redacted] with details of the testing that has been carried out already on the PROTECTOR IOC GA-ASI nose camera and further details of what, if any, additional testing could be carried out by UAS TES if required.

[redacted]

[redacted]

[redacted]

ITEM 10 – DATE OF NEXT MEETING	[redacted] PROT
7. The next meeting will take place in CAA house on 18 Aug 16 and will further discuss the proposal with the CAA.	

(Original signed)

[redacted]

[redacted]

Stephen Rihanne

From: [redacted]) <[redacted]@mod.uk>
Sent: 02 February 2017 13:02
To: [redacted]
Cc: [redacted]
Subject: 20170202 - PROTECTOR Airspace Integration Swiss Visit - [redacted]

Ma'am,

Understood fully, I think it was more of a 'nice to have him there' if he was available but noting the additional priorities I have made [redacted] aware that [redacted] is unable to join us for the Switzerland trip. If there are any issues then we can bring them back with us and liaise with you accordingly. I think [redacted] has been overseas lately as I have struggled to get any contact with/info from him, and as a result a few of those originally asked to participate are now unavailable too. Thanks again for keeping us in the loop. Speak soon.

Regards,

[redacted]

[redacted] | [redacted] | Unmanned Air Systems Team | Protector
MOD Abbey Wood, #1251 | Yew 2B | Bristol | BS34 8JH
CIV: [redacted] | MIL: [redacted] |

Ministry of Defence de&s

Defence Equipment & Support

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: 02 February 2017 12:21
To: [redacted] ([redacted])
Cc: [redacted]
Subject: RE: 20170126 - PROTECTOR Airspace Integration WG 6 Feb 17 - [redacted]

[redacted],

On a related note, [redacted] had been trying to get into contact in the New Year (I think with [redacted] / [redacted] ?) to get confirmation as to whether the trip to Switzerland was still on and whether he was required.

[redacted] has been holding the appt since the idea was mooted before Christmas but without confirmation that he was still required I made a decision last week for him to support some other high priority activity which we are desperate to complete. Apologies if this causes any issues; however, I think [redacted] 's attendance was a desirable rather than an essential so hopefully this will not be a problem.

Please give me a ring if you want to chat through.

[redacted]
Intelligence, Strategy and Policy
Civil Aviation Authority

Tel: [redacted]
Mob: [redacted]

Follow us on Twitter: @UK_CAA

Please consider the environment. Think before printing this email.

From: [redacted]
Sent: 26 January 2017 16:56
To: [redacted]; [redacted]; [redacted] ([redacted])'
Subject: FW: 20170126 - PROTECTOR Airspace Integration WG 6 Feb 17 - [redacted]

[redacted]/[redacted],

To Note.

[redacted],

Hope it's OK if CAA bring 3 to the meeting? I would Like [redacted] to attend as he will be supporting the CAA PROTECTOR work.

[redacted]
Intelligence, Strategy and Policy
Civil Aviation Authority

Tel: [redacted]
Mob: [redacted]

Follow us on Twitter: @UK_CAA

Please consider the environment. Think before printing this email.

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 26 January 2017 13:56
To: [redacted]
Cc: [redacted]
Subject: 20170126 - PROTECTOR Airspace Integration WG 6 Feb 17 - [redacted]

Sir's, all

I have just spoken to [redacted] as there has been some confusion as to whether the next ASI WG scheduled for the 6 Feb 17 will go ahead as planned. Please take this email as confirmation that the meeting will proceed if you have previously heard otherwise. An agenda will follow in due course.

Regards,

[redacted]

[redacted] | [redacted] | Unmanned Air Systems Team | Protector
MOD Abbey Wood, #1251 | Yew 2B | Bristol | BS34 8JH
CIV: [redacted] | MIL: [redacted] |

Defence Equipment & Support

-----Original Appointment-----
From: [redacted] ([redacted])
Sent: 14 November 2016 13:27
To: [redacted]@caa.co.uk'; [redacted]@caa.co.uk'; [redacted] ([redacted])
Subject: PROTECTOR Airspace Integration WG Feb 17
When: 06 February 2017 09:00-17:00 (UTC+00:00) Dublin, Edinburgh, Lisbon, London.
Where: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Sirs, Ma'am, all,

This is a diary marker for the next Protector Airspace Integration Working Group; the agenda will be sent out idc.

<< File: 20161007-Protector_Airspace_Integration_Oct16-Minutes-[redacted].docx >>

Kind regards,

[redacted]

[redacted] | [redacted] | RAF Waddington | LN5 9NB | Mil: [redacted] | Civ: [redacted] | Internal: [redacted] | External: [redacted]@mod.uk

We cannot accept any liability for any loss or damage sustained as a result of software viruses. You must carry out such virus checking as is necessary before opening any attachment to this message.

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Stephen Rihanne

From: [redacted] ([redacted]) <[redacted]@mod.uk>
Sent: 26 April 2016 12:54
To: [redacted]
Subject: RE: meeting Thu 28 Apr

[redacted]

Just after 1500 works well for me. Parking can be problematic here (albeit it may be OK by the time you arrive), but you can get 2hrs free parking in Asda (!!!) that is next to ABW.

I'll book you in and meet you at reception….just ring/text me when you arrive and I'll come to you.

Regards

[redacted]

[redacted]
Unmanned Air Systems' Type Airworthiness Authority
DE&S, UAS PT
Yew 2c, Mail Point #1251

Ministry of Defence
Abbeywood
Bristol BS34 8JH

E-mail: [redacted]@mod.uk
Personal: [redacted]@mod.uk
Telephone: Office: [redacted] Mil: [redacted] Mobile: [redacted]

Please note change of email address

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: 26 April 2016 08:27
To: [redacted] ([redacted])
Subject: RE: meeting Thu 28 Apr

[redacted],

I will need to drive over so 15:00 or just after is the plan.
Can you also advise your location at ABW.
If you can book me in that would be a help.

Thanks,

[redacted]

From: [redacted] ([redacted]) [mailto:[redacted]@mod.uk]
Sent: 26 April 2016 07:31
To: [redacted]
Subject: Re: meeting Thu 28 Apr

[redacted]

Great. If possible a meeting @ ABW would work best for me. Sounds like I'll see you at 1500ish. Do you need booking into ABW?

Regards

[redacted]
Unmanned Air Systems' Type Airworthiness Authority
DE&S, UAS PT
Yew 2c, Mail Point #1251
Ministry of Defence
Abbeywood
Bristol BS34 8JH

E-mail: [redacted]@mod.uk
Personal: [redacted]@mod.uk
Telephone: Office: [redacted] Mil: [redacted] Mobile: [redacted]

From: [redacted] [mailto:[redacted]@caa.co.uk]
Sent: Monday, April 25, 2016 09:31 PM
To: [redacted] ([redacted])
Subject: RE: meeting Thu 28 Apr

Hi [redacted],

I'm over at CFMS Services Ltd, Emersons Green, Bristol BS16 7FR, for an Aerospace Technology Institute meeting. It's due to run until 16:00 but usually finishes early. I can therefore be comfortable to jump out from around 14:30 or so and head down to ABW or meet nearby if that suits. I'll be driving so can be flexible.

Regards,

[redacted]

[redacted]
Tel. [redacted]
Mob. [redacted]

Sent with Good (www.good.com)

-----Original Message-----
From: [redacted] ([redacted]) [[redacted]@mod.uk]
Sent: Monday, April 25, 2016 06:51 PM GMT Standard Time
To: [redacted]
Subject: meeting Thu 28 Apr

[redacted]

Thanks for contributing in the Protector discussions to day and I'm aware that you and [redacted] had a follow-on discussion. [redacted] also mentioned that you were in the Bristol area on Thu. It would be useful to catch-up face to face (rather than the somewhat abrupt cut-off today!)

Thu is good for me, I'm only busy 1000-1100 and then 1400-1500, but free apart from that…does that work for you? Can you make it to ABW, or would you prefer to meet elsewhere?

Regards

[redacted]

[redacted]
Unmanned Air Systems' Type Airworthiness Authority
DE&S, UAS PT
Yew 2c, Mail Point #1251

Ministry of Defence
Abbeywood
Bristol BS34 8JH

E-mail: [redacted]@mod.uk
Personal: [redacted]@mod.uk
Telephone: Office: [redacted] Mil: [redacted] Mobile: [redacted]

Please note change of email address

****

****

Stephen Rihanne

From: [redacted]) <[redacted]@mod.uk>

Sent: 11 October 2016 13:31

To: [redacted]@caa.co.uk'; [redacted]@caa.co.uk'; [redacted]'; [redacted]'

Subject: Protector Airspace Integration Oct 16 minutes

Attachments: 20161007-Protector_Airspace_Integration_Oct16-Minutes-[redacted].docx; Annex A to Airspace Integration Minutes Oct 16.docx

Categories: Red Category

Sirs, ma'am, all,

PFA the minutes from the Airspace Integration meeting held 07 Oct 16; the next meeting is expected to be 6 Feb 17 pending RAFBF confirmation.

Kind regards,

[redacted]

[redacted] | [redacted] | RAF Waddington | LN5 9NB | Mil: [redacted] | Civ: [redacted] | Internal: [redacted] | External: [redacted]@mod.uk

[redacted]

MINUTES OF A MEETING TO DISCUSS PROTECTOR AIRSPACE INTEGRATION HELD AT THE RAF BENEVOLENT FUND 0900 7 OCT 16

[redacted]	[redacted]	JFC CAP C4ISR Dep Hd Collect Mgr Safety Programmes CAA CAS AS Strat 3 DSA MAA Reg Fly DES UAS Strat PE Air 1Gp ISTAR Protector SO2 DES UAS RM2 DAATUM Airspace 2SO2 Air 1Gp ISTAR Protector SO3 FMC WECA Eval Cap Man GA-ASI GA-UK CAA TL A&M Enablers DSTL DES UAS Prot DRASM Cert	PM only Chair Sec
Apologies	[redacted]	DES UAS Protector DASM Air Cap Del ISTAR SO2	

ITEM 1 – OPENING ADDRESS - [redacted]	**Action**
1. The chair welcomed everyone to the meeting.	
ITEM 2 – CROSS GOVERNMENT UPDATE – [redacted]	
2. [redacted] reminded all of the background to the present position; - HMG strategy aspiration for BVLOS fg for all UAVs by 2020. - 10 Pathfinder programmes, of which 4 provided useful data, sparking 3 new projects. - [redacted] - 23 barriers identified; looking for programmes to be endorsed and funded within next 6 months - will share as plans mature, on-going. - Aspiration for Protector to help UK government in parallel; ties KUR for A-C airspace in short term into CAA aim and cross government directive long term; work with ACAS' team to push forward. - After the update, the Chair highlighted that, while detailed understanding of timeline was key, there was opportunity for PROTECTOR research activity to aid the 3 x-government projects. Staying lockstep with WECA is essential.	
ITEM 3 – PROTECTOR INTERIM PROPOSAL UPDATE – [redacted]	

[redacted]

[redacted] **AND** [redacted]

3. Airspace Integration Plan (AIP) is a 'crawl, walk, run' proposal that allows PROTECTOR to transit through all classes of airspace at IOC. Though the PROTECTOR [redacted], strategic senior direction is driving aspirations to normalise RPAS ops in line with x-government intent.

Using current rules for see and avoid; Protector will be participating air traffic so can abide by rules of the air. CAP 722 speaks to performing "as well, if not better, than the human equivalent". This capability can be provided by a single system or a system of systems. The Interim Proposal[1] will use a system of systems, and covers 4 strands of research activity;

1. Airspace density study (expansion of previous Helios Typhoon trial dataset).
2. Project Marshall capability; the new radar service for the military in the UK.
3. Nose camera capability.
4. Helios Swiss use case (noting they transited Class G airspace with an RPAS 15 years ago).

- Problem = Class G airspace transit; Project Marshall capability and airspace density study required to move forward.
- Protector will be certified by MAA through submission of a full Safety Assessment Review (SAR) by the TAA. Where no regulatory standards exist, [redacted].
- Both the MAA & CAA agree Protector needs to demonstrate that is safe to fly and flown safely; the prime interface is regulator to regulator with the MAA having overall regulatory control. **Action:** SO2 Protector to write note confirming MAA/CAA interface to move programme forward, SRO & ACAS artefact required. [redacted]
- **Action:** Summary of framework and endorsement of approach is required for ACAS, copying in DG MAA and Mr Mark Swan at CAA. Covers framework, process, endorsement of current vector and how to proceed. Summary **required by 09 Nov** in time for meeting between DG MAA & Mr Swan. [redacted]
- The Interim Protector proposal can be agreed in principle prior to CDR2, but can't be signed off by MAA (required) until liability letter received. Detailed understanding of development timelines for the PROTECTOR AV is required. The MAA Cert Div must have as much lead time as possible to understand and endorse the Interim Proposal. The finished proposal will be submitted to the TAA NLT Jul 18. **Action:** for a strategic timeline vs. CDR dates to be drawn up. [redacted]
- The Chair asked all those present to raise any regulatory concerns or

[1] 20160520_Protector_UK_Airspace_Integration

[redacted]

issues with the Interim Proposal. No issues were raised.

- If the Interim Proposal fails then PROTECTOR [redacted] will need to be achieved through segregated airspace and ACP. The last safe moment for ACP establishment (to still meet PROTECTOR IOC aspirations) is Dec 18. ACP funding will have to be raised from within programme hide.

- [redacted]

- **Action:** to engage with airspace community via NATMAG; [redacted] requested to pass appropriate engagement process and timelines to [redacted]

ITEM 4 – ACAS POLICY UPDATE AND RESEARCH FUNDING DISCUSSION – [redacted]

- [redacted]

ITEM 5 – DSTL UPDATE – [redacted]

4. The following points were raised:

- Research progress ties in with current requirements; information from the NATO STANREC/STANAG meetings runs in parallel to/feeds into development of the PROTECTOR SAR process.

- [redacted]

- MAA mandated to be an equivalent or better level of safety; focus on what the nose camera can do i.e. work with DSTL & FMC to draft a research plan.

- [redacted]

- Project Marshall capability clear ([redacted]), airspace density study by QQ for collision avoidance complete. FHQ request density update for protector performance and link to Project Marshall performance.

- Sequence for activity;

  -- Airspace user information from Helios study sought.

[redacted]

-- Adapt to [redacted] and Protector, feed into density study. -- Tie into performance comparison at action above to assess airspace integration as per the Interim Proposal. **Action:** tied into most recent action [redacted]	[redacted]
ITEM 6 – DISCUSSION 5. Morning discussion summaries and points; FHQ confirmed funding for studies to inform these processes is the current greatest risk. All persons acknowledged wish to keep momentum moving forward, with manpower shortages being a limiting factor.	
ITEM 7 – MAA UPDATE – [redacted] 6. Mainly covered throughout earlier discussion, but as confirmation: - MAA take ownership for regulatory concerns for Protector. - MAA will liaise with CAA on Protector's behalf. - The relationship will be formalised by the note at action above. - MAA Cert Div are working with DE&S wrt type certification and design assurance. - **Action**: MAA to apprise [redacted] on arrival of progress; DE&S are putting together their argument for how to get type certification and therefore compliance, MAA will highlight where regulations change.	[redacted]
ITEM 8 – CAA UPDATE – [redacted] 7. Type certification drives functional policy; - Although the CAA has no formal regulation of Protector, [redacted] offered to assist on a consultation basis; proposed requirements on licencing are due to be agreed at next meeting for ICAO approval. Following that will be first drafts of airworthiness and operational requirements; those three deliverables are the minimum required for international operations. - The CAA are now using an online portal for promulgating standardisation documents; at a recent meeting in Poway two members of the Protector team were given access to this and can now have oversight of CAA standardisation procedures. - ICAO CONOP now on the same portal; [redacted] asked those present with access to review and highlight if it causes consternation before being released to the Air Navigation Committee for wider circulation.	
[redacted]	

[redacted]

[redacted]	[redacted]
ITEM 11 – DATE OF NEXT MEETING 10. The next meeting date and location will be promulgated in due course; expected date will be Monday 6 February pending RAFBF confirmation.	**SO3 PROT**

[redacted]
Sec

Annex A to Airspace Integration Minutes Oct 16

Dated 07 Oct 16

MAA DSA PROTECTOR UPDATE

The text below was sent by [redacted] to [redacted] following the Airspace Integration meeting 07 October. [redacted] felt it was necessary to include this note as a succinct addition to the actions within the minutes.

'After a very productive series of discussions with the PROTECTOR Airspace Integration DLOD over the past few days it would seem appropriate that the MAA Senior Leadership receives an update on progression, future work strands and likely next actions.

The CAA and MAA appear completely aligned in how we see the regulatory aspects progressing. It was agreed that in order to clearly delineate the boundaries of responsibility, the PROTECTOR team would not deal directly with the CAA, but would rather act through the MAA. This is in line with the fact that the system will be on the MAR, and therefore Type Certification and the associated Air System Safety Case will need to be completed to the MAAs satisfaction. The PROTECTOR team had wanted to demonstrate to the CAA that they would be 'responsible users' of the airspace, and it was agreed by all that this was a laudable aspiration (and indeed showed a commendable degree of transparency), but that it may lead to some confusion as to who is actually assuring the activity. As this is clearly a MAA activity, it was agreed that the MAA would liaise with the CAA rather than the team directly. Although the programme may utilise specific expertise within the CAA (potentially CAAi), this approach will ensure that the two regulators talk directly. The upshot of this agreement is that the programme will prepare a note to go to ACAS, copied into D MAA outlining their approach. It was then agreed that the MAA would forward this to Mark Swann such that the approach was clear and agreed ([redacted] was supportive of this approach). D MAA can expect this note to have been received prior to 9 Nov 16 such that it can potentially be discussed as part of his meeting with Mark Swann.

There was much talk about the route to 'certification' [redacted] *but rather see the Military Type Certificate as being but a part of the ASSC; even if this single aspect of the air system wasn't certified, they could still argue the benefits of having it as part of their layered safety system, and this would still be of benefit within the overall SC. It does beg the question as to how Cert Div sees this working in the future, and I would recommend that we have an internal meeting with Cert Div such that we can bash out our own boundaries and ensure we are all aligned and speak to the PROTECTOR community with clear direction and guidance as to what is expected; I am conscious that the advice I have given needs to be confirmed by Cert Div and we correct any errors/omissions that I may have made.*

X-Govt RPAS strategy. There is a tremendous amount of work going on across Government wrt using RPAS/UAS in the very near future. We can expect the Maritime and CoastGuard Agency to go out for tender next year for a major RPAS contract, and the Royal Mail is working with the CAA now in what sounds like a very interesting and major leap forward in the domestic use of RPAS. All of this leads me to believe that the MAA needs to be clear and consistent in the direction of travel that we expect, and what we expect/will accept. I have no doubt that we have a clear line, but perhaps this would benefit from an update in the MAA Flyer and/or a SNAK session in the New Year to ensure we don't see any inadvertent 'stray voltage' internally. We can also expect the programme and the CAA to begin the engagement/education process with the rest of the aviation community and I believe there is merit in us being alongside to present a united front.

Overall Sir, I see much value in the meetings and hope that the agreements made are acceptable to the MAAs SLT. Allowing us to establish clear lines of responsibility (as it is the MAA that will

issue Type Certification and regulate the activity) should mean that once we are content we merely need to discuss with the CAA as opposed to have to prove the safety case over again. Notwithstanding that, the transparency and close liaison between the two regulators will continue and will allow for 'best practice' to be shared but without confusing the issue of who 'approves' the interim solution.

Admittedly this is a short précis of what I took away as the most important factors for us, and there was a significant amount of other valuable discussion. I am happy to provide a more detailed brief if you wish, although I expect the minute sto be out soon and they should add much more detail.'

Stephen Rihanne

From: [redacted]) <[redacted]@mod.uk>

Sent: 14 December 2016 09:10

To: [redacted]; (VACANT); [redacted]@caa.co.uk'; [redacted]@caa.co.uk'; (jonny.king@ga-as.co.uk)'; [redacted]@ga-asi.com)';

Cc: [redacted])

Subject: Protector Airspace Integration WG 06 Feb 17

Sirs, Ma'am, all,

The next Protector Airspace Integration WG will be held at the RAFBF, 67 Portland Place, W1B 1AR on 6 Feb 2017. As it has been a few months since the last meeting & with the Christmas break coming up shortly, may I remind everyone of the following actions that arose:

Action	Lead	Update
SO2 Protector to write note confirming MAA/CAA interface to move programme forward, SRO & ACAS artefact required.	[redacted]	
Summary of framework and endorsement of approach is required for ACAS, copying in DG MAA and Mr Mark Swan at CAA. Covers framework, process, endorsement of current vector and how to proceed.	[redacted], [redacted]	
A strategic timeline vs. CDR dates to be drawn up.	[redacted], [redacted]	
Engagement with airspace community via NATMAG; [redacted] requested to pass appropriate engagement process and timelines to [redacted].	[redacted]	
A detailed SoR for specified Protector performance comparison for the [redacted] phone conference between DSTL, DE&S, FMC and UAS TES	[redacted], [redacted], [redacted], [redacted] **UAS TES**	Phone conference led to development of Airspace Study BC, submitted by FHQ mid Nov 16; funding for 4 fold study approved late Nov 17. DSTL awaiting tasking via PT for two parts (Marshall data & airspace density evaluation), FHQ pursuing Swiss AF RPAS integration LIs. Routes to carry out [redacted] evaluation being investigated by FHQ with [redacted].

Tied into most recent action above, DSTL requested to send FMC the requirements and SoR for 4 key areas of research activity, (copying in [redacted], [redacted]) with an estimated training timeline.	[redacted], [redacted]	
MAA to apprise [redacted] on arrival of progress; DE&S are putting together their argument for how to get type certification and therefore compliance, MAA will highlight where regulations change.	[redacted]	

May I ask for any action updates as per the example I have populated in Action 5? If replying in January, please send directly to [redacted], as I am posted within FHQ; I will still be involved in the RPAS world as SO2 Reaper, & so hope to meet you all again as the RAF RPAS transition from Reaper to Protector progresses.

Best wishes & Merry Christmas,

Kind regards,

[redacted]

[redacted] | [redacted] | RAF Waddington | LN5 9NB | Mil: [redacted] | Civ: [redacted] | Internal: [redacted] | External: [redacted]@mod.uk

Stephen Rihanne

From: [redacted] <[redacted]@mod.uk>
Sent: 02 February 2017 22:48
To: [redacted] (VACANT); [redacted]
Cc: [redacted] (MULTIUSER)
Subject: PROTECTOR Airspace Integration WG Feb 17 - TAA Presentation for Prior Review
Attachments: 20161014-Protector TAA Airspace Access Strategy Brief v1_7 (Summary Version).pptx

[redacted], and all WG members,

[redacted] will be attending next week's meeting in my place, and will be providing a summary briefing of how Protector's Airspace Access is expected to evolve, from TAA and GA-ASI perspectives. In the interests of expediency, this presentation is being provided as pre-reading (attached to this email) to allow prior review and time for questions and answers within the meeting.

Best regards,

[redacted]

[redacted] | [redacted] | UAS Project Team
GA-ASI International Office, Rm 1111 | Bldg A27 | Poway | 92064
OFFICE: [redacted] | MOB: [redacted]

Defence Equipment & Support

From: [redacted]
Sent: 02 February 2017 10:08
To: [redacted] (VACANT); [redacted] @caa.co.uk; [redacted] @caa.co.uk; [redacted]
Cc: [redacted] (MULTIUSER)
Subject: RE: PROTECTOR Airspace Integration WG Feb 17

Sirs, Ma'am, all,

A brief agenda for Mon's mtg:

- Review previous minutes and actions (minutes with calling notice)
- Update on research activity – [redacted] & [redacted]
- Update on TAA activity – [redacted]
- Update from ACAS/GA – [redacted] & [redacted]
- PROTECTOR Enhance discussion
- AOB

The mtg will start at 0900 – however, there may be a Tube strike. If so, I will play it by ear and wait for people to arrive.

Yours aye

[redacted] | [redacted] | [redacted] | RAF Waddington, Lincoln, LN5 9NB | Mil: [redacted] | Civ: [redacted] | Secure: [redacted] | DII(F) [redacted]@mod.uk

-----Original Appointment-----
From: [redacted] ([redacted])
Sent: 14 November 2016 13:27
To: [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted] ([redacted]); [redacted]'; [redacted]'; [redacted]; [redacted] ([redacted]); [redacted]; [redacted] ([redacted]); [redacted]'; [redacted] ([redacted]); [redacted]@caa.co.uk'; [redacted]@caa.co.uk'; [redacted]
Subject: PROTECTOR Airspace Integration WG Feb 17
When: 06 February 2017 09:00-17:00 (UTC+00:00) Dublin, Edinburgh, Lisbon, London.
Where: Royal Air Force Benevolent Fund - 67 Portland Place, London, W1B 1AR

Sirs, Ma'am, all,

This is a diary marker for the next Protector Airspace Integration Working Group; the agenda will be sent out idc.

<< File: 20161007-Protector_Airspace_Integration_Oct16-Minutes-[redacted].docx >>

Kind regards,

[redacted]

[redacted] | [redacted] | RAF Waddington | LN5 9NB | Mil: [redacted] | Civ: [redacted] | Internal: [redacted] | External: [redacted]@mod.uk

[redacted]

Protector TAA

Airspace Access Strategy Brief

[redacted]

Pr ctor RASM

Ai pace Access Strategy Brief - 7th Feb 2017

Terminology, Context and Incremental Approach

[redacted]

Within the Protector CQ programme the following terms are used related to “Airspace Integration”:

- FISAS (Flight In Segregated AirSpace)
- FINAS (Flight Into Non-segregated AirSpace)

[redacted]

- FINAS capability stages are then considered in line with the following ICAO/CAA/EUROCONTROL/FAA recognised airspace access regulatory stages:
  - **Accommodation** (Initial operations under authority restriction, mostly in segregated airspace)
  - **Initial Integration** (Alleviation of most restrictions/limitations through harmonized regulations and mature technologies)
  - **Final Integration** or “Evolution” (Complete integration into European civil aviation system, allowing unfettered access to airspace)

[redacted]

Noting that:

- Protector capability is limited within IOC timescales.
- Necessary regulations and standards are still in development.
- Protector Cert./Qual. (CQ) management is through FINAS CQ Interface Panels, held at GA-ASI, Poway.

[1] ICAO RPASP Regulatory ConOps (Draft Version 2)

Operational Capabilities/Outcomes

Time, Complexity

Accommodation (Restricted MTC at IOC) (MTC for segregated airspace)

- **Case-by-case basis**
- OAT IFR en-route flight **in UK class A-C airspace, separated from manned flights**.
- Terminal Access to specified military ATZ only. Minimizes exposure beyond A-C airspace.
- Minimum exposure OAT transit through pre-defined class G airspace between RAF Waddington and class A-C airspace (NOTAM publicised) .
  Note: CAP 722 equivalence provided by SoS for S&A subject to Operational Safety Case.
- Contingency procedures pre-agreed and predictable, according to certification limitations.

CQ programme limited to class A-C operation

Integration (Initial) (Full MTC at FOC – Class A-G)

- **Routine flight**
- OAT IFR flight **in UK airspace without geographic/route restrictions**, separated from other flights by ATS (in class A-C airspace) and onboard D&A (in class D-G airspace).
  Note: Based on performance requirements, some areas will still be off limit, such as major airports and Terminal Airspace and some bottlenecks for all airspace users.
- OAT IFR **cross-border flight within European airspace** through pre-defined **NATO transit routes** with routine Dip Clearances.
- OAT IFR flight in **global airspace routes with Diplomatic Clearances**.

CQ programme covers full operations

Note: Final Integration allowing VFR-like operations and civil regulatory compliance, which allows “unfettered access”, does not apply to Protector at this time.

Acronyms: OAT: Operational Air Traffic GAT: General Air Traffic

Configurations

Time, Complexity

Accommodation (Restricted MTC)

- Basic CNS/ATM equipage, composing:
  - D&A "Bridge" solution: TCAS II v7.1, Mode S (ELS), ADS-B (1090 ES).
  - "Off-Route Service" compliant C2 Link (limited to BRLOS).
- Limited D&A "Bridge" System, designed/certified with limitations:
  - Collision Avoidance function only against cooperative traffic.
  - Only single EO/IR cameras are designed/certified for taxi operations only.

CQ programme limited to class A-C operation

Integration (Initial) (Full MTC)

- Advanced CNS/ATM equipage, composing:
- D&A Enhanced "Bridge"
  - D&A 'bridge' solution: *TCAS II* + TSO-Certified D&A System (incl TSO-certified DRR).
  - "Route-Service" compliant C2 Link for both RLOS and BRLOS (incl. TSO'd equipment, with option to switch between best link for specific airspace usage).
- Full D&A system, designed and certified without limitations:
  - Collision Avoidance function against coop. & non-coop traffic.
  - Note: 2024 determined by regulations, standards, equipment availability and approvals.

CQ programme covers full operations

Note: Final Integration allowing VFR-like operations and civil regulatory compliance, which allows "unfettered access", does not apply to Protector at this time.

Processes and Methodologies

Time, Complexity

Accommodation (Restricted MTC)

- Certification that RPAS is airworthy against applicable requirements. Full compliance to Special Conditions F-25/O-01, and AEP 4761 USARs 1301/1309 for IFR flight in class A-C airspace only.
- C2 Link and D&A capabilities cannot be assured by TC, due to lack of standards, hence Restricted TC.
- Operational Approval for limited FINAS based on Safety Case approach (outside MTC).
- Approved by UK MAA; Recognised by UK CAA.

CQ programme limited to class A-C operation

Integration (Initial) (Full MTC)

- Operational Approval based on Certified equipment fully complying to RPAS certification standards for D&A and C2 Link. (e.g. NATO S&A requirements, and RTCA/EUROCAE TSOs/ETSOs)
- Output of Protector CQ programme (FINAS CQ Panel) leading to full compliance with certification requirements (Special Conditions F-25/O-01, USAR 1301/1309) for IFR flight in class A-G airspace. To be developed in parallel to ICAO SARPs development.
- Operational Approval based fully on MTC.

CQ programme covers full operations

Note: Final Integration allowing VFR-like operations and civil regulatory compliance, which allows “unfettered access”, does not apply to Protector at this time.

“Final Integration” (Currently out of Scope to Protector)

Capabilities & Outcomes:

“Seamless” flight with no efficiency impacts for routine flights.

- GAT flight within global airspace in compliance to ICAO Annexes and regional regulatory implementations. (“Seamless” Integration)
- Cross-border flight based only upon “File and Fly” principle.
- **“Unfettered”** access to all airspace.
- Managed the same as any other (manned) aircraft, i.e. VFR-like operations with delegated separation.
- Note: It is also likely that manned aircraft will be required to fit new CNS equipment.

Configuration:

TBD, as required to comply with:

- Operating experience from above phases;
- Requirements for civil certification, outside military TCB;
- ICAO ASBU requirements; and
- US/European/Asian “NextGen” ATM requirements.

- Note: Integration of ACAS Xu for D&A and civil (5030-5091 MHz) spectrum for C2 Link are two examples.

Processes and Methodologies:

- Certification against validated civil standards for D&A and C2 Link.
- Operational approval based on integration of certified equipment for Full/Open FINAS will require new MTC.
- Fully assured critical enablers (D&A, C2 link)
- Within through-life equipment programme, review developed civil/Intl. CNS requirements to maintain full freedom of flight in international airspace.