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An Unmanned Combat Air System Concept of Use

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Executive summary

This Concept of Use (CONUSE) aims to provide a broad outline of how it is envisioned that an Unmanned Combat Air System (UCAS) may be employed both in preparation for, and when operationally deployed from 2020 and beyond. It has been developed to provide a foundation for the underpinning science and technology programme. It provides a vision of a potential UCAS, from which questions will naturally be generated, possibilities assessed and conclusions drawn. These questions, analysis and conclusions will further collective knowledge of a UCAS and support future procurement decisions with regard to the utility of UCAS in any future force mix.

This CONUSE will describe an Unmanned Combat Air Vehicle (UCAV), the control nodes, the architecture that enables the system, and the structures that will be required to support an UCAS during training and when operationally deployed. '

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1 Introduction

1.1 Aims

1.1.1 The purpose of this Concept of Use (CONUSE) is to provide a broad outline of how it is envisioned that an Unmanned Combat Air System (UCAS) will be employed both in preparation for, and when operationally deployed from 2020 and beyond. It has been developed to underpin the analysis process, and technology development within the UK research programme, by providing a vision of a potential UCAS from which questions will naturally be generated, possibilities assessed and conclusions drawn. These questions, analysis and conclusions will further the UK's knowledge of UCAS and therefore support future procurement decisions with regard to the utility of UCAS in any future force mix.

1.2 Scope

1.2.1 This document has been produced collaboratively by the UK's Defence Science and Technology Laboratory (Dstl) and the Strategic Unmanned Air System Experimental Integrated Project Team (S-UAV(E) IPT). The scope of this CONUSE is driven by the direction given by supporting studies such as Project Churchill and Concepts & Studies research programme. The CONUSE builds upon this previous research and guidance by specifying how an UCAS could potentially be operated within a joint coalition environment beyond 2020. It will also consider the whole life of a UCAS in terms of how the system would be structured and supported when not deployed on operations.

1.2.2 The CONUSE describes the Unmanned Combat Air Vehicle (UCAV), the control nodes, the architecture that enables the system, and the structures that will be required to support a UCAS during training and when deployed in support of operations.

2 UCAS Capability Description

2.1 The following paragraphs will define the UCAS. The definition will start by describing the characteristics of an individual UCAV, and then build upon this to conceptualise the overall employment of the system. The prioritised mission set will be utilised as a framework to describe the capabilities of the UCAV. This will be followed by a description of the system in detail and its associated architecture, which will help to explore the nature of a UCAS as a whole. Throughout, the UCAS will be put into both the context of an operational deployment and its use within a peacetime training environment so as to capture the whole life of the system.

2.2 [redacted]

2.3 UCAV

2.3.1 The basic element of the UCAS is the UCAV which, in line with the requirements documentation, is capable of undertaking multiple mission profiles persistently and in areas that are geographically considered to be deep battlespace. The basic design elements of the UCAV which underpin the fulfilment of the objectives above are those that increase the survivability of the air vehicle, and increase its range or endurance above that of manned platforms achieving initial operating capability in a similar timeframe. It must be understood though, that although a UCAV could work independently on some missions, it will always be deployed as one element of a scalable system.

2.3.2 [redacted]

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2.4 Missions

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2.4.9.2

2.4.9.3 [redacted]

2.4.9.4 [redacted]

2.4.9.5 [redacted]

2.4.9.6 [redacted]

2.5 UCAS

2.5.1 The previous section of the CONUSE concentrated primarily on the UCAV and its use within specific mission areas. However, a UCAV will never be launched as a single entity; it will always be launched as one or more airborne elements of a scalable system. This system includes not only the airborne elements, including their weapons and sensors, but also: the architecture that allows them to operate efficiently and coherently; cross platform and system control measures, which includes varying levels of autonomy for sensor and route optimisation; and the human to system interfaces, that allow the commander's guidance to be executed efficiently.

2.5.2 [redacted]

2.5.3 Network Architecture

2.5.3.1

2.5.3.2

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2.5.4 Autonomy and System Control Measures

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2.5.5.1

2.5.5.2 [redacted]

2.5.5.3 [redacted]

2.5.5.4 [redacted]

2.5.5.5 [redacted]

3 Defence Lines Of Development.

3.1 The UK's Defence Lines Of Development (DLOD) have been used as a framework to explore further detailed CONUSE. The following sub-sections are discussed in the following order: starting with *'Equipment or Materiel'* which describes the tangible items that a UCAS is constructed from and/or requires in order to function; 'Logistics' describes the support that is required to sustain the UCAS; *'Organisation or Leadership'* describes the structure that will be required to command, control and maintain the UCAS; *'Personnel'* describes the major personnel requirements that differ when a comparison is made to operating manned platforms; *'Training'* of the personnel; the UCAS specific *'Infrastructure or Facilities'* that will need to be provided to accommodate a UCAS; the *'Information'* or data dissemination and handling requirements; and finally the *'Doctrine and Concepts'* which underpin the operational deployment of a UCAS.

3.2 Each sub-section is prefixed by a statement which describes the functional area, along with assumptions that bound its scope. The sub-sections will then provide guidance, where appropriate, on how each area will be defined in terms of a UCAS, proposing possible generic structures or methods of how a UCAS will be utilised. This approach will therefore highlight some of the areas that may enable a UCAS to provide a more cost effective solution than a manned alternative and also provide insight in to different perspectives that will require further analysis.

3.3 Equipment / Materiel.

3.3.1 The equipment or materiel is the provision of military platforms, systems and weapons (expendable and non-expendable, including updates to legacy systems) needed to outfit or equip an individual, group or organisation. The UCAS materiel will consist of: the UCAVs; UCAS specific control stations, ground and airborne, along with their associated hardware for network connectivity; specialist UCAV handling equipment and materiel required to operate an unmanned system.

3.3.2 **UCAV**

3.3.2.1

3.3.2.2

3.3.2.3

3.3.2.4

3.3.2.5

3.3.2.6

3.3.3 **Ground Support Equipment.**

3.3.4 **Airborne Control Stations.**

3.3.4.1

3.3.4.2

3.3.4.3

3.3.5 **Ground Control Stations (GCS).**

3.3.6

3.3.7 **Architecture.**

3.3.8 **Weapons.**

3.4 Logistics.

3.4.1 Logistics is the science of planning and carrying out the operational movement and maintenance of forces. In its most comprehensive sense, it relates to the aspects of

military operations which deal with: the design and development, acquisition, storage, transport, distribution, maintenance, evacuation and disposition of materiel; the transport of personnel; the acquisition, construction, maintenance, operation, and disposition of facilities; the acquisition or furnishing of services, medical and health service support. However, this section will primarily consider the high-level planning assumptions towards supporting a home-based and a deployed UCAS. It will also highlight the critical differences between the two approaches, whilst highlighting areas where the procurement of a UCAS may prove to be more cost effective than a similarly capable manned solution.

3.4.2 **Peacetime Operations**[1]. During peacetime, the majority of UCAVs will be maintained within long-term storage facilities until required for wartime operations or large training exercises. Small numbers of UCAVs will be in use at relatively small training bases which will require logistics support. The training bases will predominantly make use of the control station element of the UCAS so the logistics focus will be on providing a large sustainable synthetic training environment supported by limited flying activity. Therefore, the logistics requirement to maintain in-use UCAVs will be significantly less than supporting manned alternatives. However, the logistics system must be resourced to allow a transition from training to operations.

3.4.2.1 In order to provide the capability to surge from a peacetime synthetic and limited flying operation, to deployed flying operations of an entire UCAS the logistics system will have to maintain a large quantity of UCAS spares available for immediate use. However, there must be a balance between storing costly items that are rarely used, along with the associated cost of providing storage facilities, against how quickly items can be manufactured or supplied by industry. Therefore, in addition to in-use stock and operationally deployed UCAS, training UCAVs and control stations, enough stock should be held to match the anticipated regeneration rates of UCAVs into operational use, but balanced against industry production lead times. For example if the anticipated regeneration rate is UCAVs per month, items with short lead in times of less than a week could be kept in small quantities, whereas items which required 1 months notice would have to stocked in large amounts. Moreover, based on forecasts, replacement stock of some specialist items that are forecast to fail very infrequently may have to be manufactured, purchased and stored from initial production for the life of UCAS.

3.4.2.2 Maximum commonality of parts between UCAVs and manned platforms will ensure that areas of industry that supplied certain parts during initial production and build-up of logistics stock are sustained across the life of the UCAV. It may not be financially viable for a company to produce large quantities of stock during initial production and then maintain a capability to surge production at some future but unknown point within a 20 or 30 year period, without a certain level of underlying sustained production throughout the period. Sustainment of these producers could be provided by manufacturing spares for manned platforms which will require more sustained production due to their increased flying requirement.

3.4.2.3 The majority of the peacetime logistics will be conducted by civilian contractors who will be responsible for the day-to-day maintenance of the stored UCAS. A large logistics

[1] The peacetime conops are subject to on-going research. The CONOP described here has been developed to investigate a possible, although extreme case to investigate the potential to save operation and support costs.

facility will be collocated with long-term storage facilities. These facilities will ensure that UCAVs and their equipment can be deployed within the necessary timeframes. These facilities will contain the necessary logistics elements required for the deployment of the UCAS. This will include UCAV control stations, avionics payloads, and deployable support equipment such as LO maintenance facilities and ground support equipment.

3.4.3 **Deployed Operations.**

3.4.3.1

3.4.3.2

3.4.3.3

3.4.4 **Operations in/out of Theatre.**

3.4.4.1 [redacted]

3.4.4.2 [redacted]

3.4.4.3 [redacted]

3.4.4.4 [redacted]

3.5 Organisation / Leadership.

3.5.1 Relates to the operational and non-operational organisational relationships of people. It typically includes military force structures, civilian organisational structures and defence contractors providing support.

3.5.2 [redacted]

3.5.3 **Core Organisation.**

3.5.4 **Logistics.**

3.5.5 **Equipment.**

3.5.5.

3.5.6 **Training & Operations.**

3.5.6.1

3.5.6.2

3.5.6.3 [redacted]

3.5.6.4 [redacted]

3.5.6.5 [redacted]

3.6 Personnel.

3.6.1 Personnel includes the timely provision of sufficient, capable and motivated personnel to deliver Defence outputs, now and in the future. This sub-section will not consider detailed individual national requirements but will concentrate on the broader aspects of personnel roles and likely quantities based upon a scalable approach to operating a UCAS.

3.6.2 [redacted]

3.6.3 [redacted]

[redacted]

3.6.4 [redacted]

3.6.5 [redacted]

3.7 Training.

3.7.1 Training is the provision of the means to practise, develop and validate, within constraints, the practical application of a common military doctrine to deliver a military capability. In the broadest sense it is how we prepare to fight.

3.7.2 [redacted]

3.7.3 [redacted]

3.7.4 [redacted]

3.7.5 [redacted]

3.7. [redacted]

3.7 [redacted]

[redacted]

3.7.8 [redacted]

3.7.9 [redacted]

3.7.10 [redacted]

[redacted]

[redacted]

3.8 Infrastructure / Facilities.

3.8.1 Infrastructure or facilities includes the acquisition, development, management and disposal of all fixed, permanent buildings and structures, land, utilities and facility management services (both Hard & Soft facility management) in support of defence capabilities. It includes estate development and structures that support both military and civilian personnel but does not include the materiel elements of the system. As with materiel and personnel this sub-section will take a scalable approach to identifying key infrastructure requirements which enable the operation of a UCAS. It will not however consider either nations individual situations in terms of location, quantity or quality of existing infrastructure.

3.8.2 **MOB.**

[redacted]

[redacted]

3.8.2.1 [redacted]

3.8.2.2 [redacted]

3.8.2.3 **Deployed.** [redacted]

[redacted]

3.9 Information.

3.9.1 The provision of a coherent development of data, information and knowledge requirements for capabilities and all processes designed to gather and handle data, information and knowledge. Data is defined as raw facts, without inherent meaning, used

by humans and systems. Information is defined as data placed in context. Knowledge is Information applied to a particular situation.

3.9.2

3.9.3 **Direction.**

3.9.4 **Collection.**

3.9.4.1

3.9.4.2

3.9.5 **Processing.**

3.9.6 **Dissemination.**

3.9.6.1

3.9.6.2 [redacted]

3.9.6.3 [redacted]

3.9.6.4 [redacted]

3.9.6.5 [redacted]

3.10 Doctrine & Concepts.

3.10.1 A Concept is an expression of the capabilities that are likely to be used to accomplish an activity in the future. Doctrine is an expression of the principles by which military forces guide their actions and is a codification of how activity is conducted today. It is authoritative, but requires judgement in application. This sub-section will only consider very broad areas where the introduction of a UCAS in 2020 could influence or radically change future doctrine.

3.10.2 [redacted]

4 Acronyms

A-A	Air-to-Air
AAR	Air-to-Air Refuelling
ACO	Airspace Coordination Order
AESA	Active Electronically Scanned Array
AFAC	Airborne Forward Air Controller
A-G	Air-to-Ground
AI	Air Interdiction
AOR	Area Of Responsibility
AOSE	Air Operations for Strategic Effect
ASW	Anti-Submarine Warfare
ASuW	Anti-Surface Unit Warfare
ATC	Air Traffic Control
ATO	Air Tasking Order
BDA	Battle Damage Assessment
BDI	Battle Damage Indicators
BHA	Bomb Hit Assessment
BLOS	Beyond Line Of Site
C^2	Command and Control
C^2W	Command and Control Warfare
CAS	Close Air Support
CBRNE	Chemical, Biological, Radiological, Nuclear and high-yield Explosive
CBT	Computer Based Training
CDE	Collateral Damage Estimate
COCOM	Combatant Command
CONOP	Concept of Operation
CONUSE	Concept of Use
CWE	Collaborative Warfare Environment
CWSD	Coalition Warfare System Demonstration
DEC(DTA)	Directorate of Equipment Capability Deep Target Attack
DEAD	Destruction of Enemy Air Defences
DLOD	Defence Lines Of Development
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel and Facilities
DPM	Deputy Programme Manager
DPOC	Deep & Persistent Offensive Capability
Dstl	Defence Science & Technology Laboratory
EBO	Effects Based Operations
ELS	Emitter Location System
EO	Electro Optical
EOB	Electronic Order of Battle
ESM	Electronic Support Measure

ER	Extended Range
EW	Electronic Warfare
F^2T^2EA	Find, Fix, Track, Target, Engage & Assess
FAC	Forward Air Controller
FMV	Full Motion Video
Fn	FORCEnet
GCS	Ground Control Station
GIG	Global Information Grid
GMTI	Ground Moving Target Indicator
HARM	High-Speed Anti-radiation Missile
HITL	Human In The Loop
HIS	Human System Interface
IADS	Integrated Air Defence System
IPB	Intelligence Preparation of the Battlespace
IR	Infra-Red
ISR	Intelligence Surveillance and Reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
IOC	Initial Operating Capability
JDAM	Joint Direct Attack Munition
JIPTL	Joint Integrated Prioritised Target List
J-UCAS	Joint Unmanned Combat Air System
LFJ	Legacy Fast Jet
LO	Low Observable
LOS	Line Of Sight
LPI	Low Probability of Intercept
MDAL	Master Data & Assumptions List
MEZ	Missile Engagement Zones
MOU	Memorandum Of Understanding
NAVAIR	Naval Air Systems Command
NFoV	Narrow Field View
NIIRS	National Image Interpretability Rating Scale
OCA	Offensive Counter Air
OODA	Observe, Orient, Decide, Act
ORBAT	Order of Battle
PA	Project Arrangement
PJOB	Permanent Joint Operating Base
PMA	Programme Manager Air
PSI	Project Security Instruction
PSO	Peace Support Operations
RAI	Reconnaissance Attack Interface
RAP	Recognised Air Picture
RDP	Research & Development Projects
RoA	Radius of Action
ROE	Rules Of Engagement
SA	Situational Awareness
SAMS	Surface to Air Missile System
SAR	Synthetic Aperture Radar

SDB	Small Diameter Bomb
SEAD	Suppression of Enemy Air Defences
SIGINT	Signals Intelligence
SOF	Special Operations Force
SSMN	Single Statement of Mission Need
SUAV(E) IPT	Strategic Unmanned Air Vehicle (Experiment) Integrated Project Team
TASMO	Tactical Air Support to Maritime Operations
TEPIDOIL	Training, Equipment / Materiel, Personnel, Information, Doctrine & Concepts, Organisation / Leadership, Infrastructure and Logistics
TIC	Troops In Contact
TOS	Time On Station
UAS	Unmanned Air System
UAV	Unmanned Air Vehicle
UCAS	Unmanned Combat Air System
UCAV	Unmanned Combat Air Vehicle
WAS	Wide Area Search

5 List of references

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