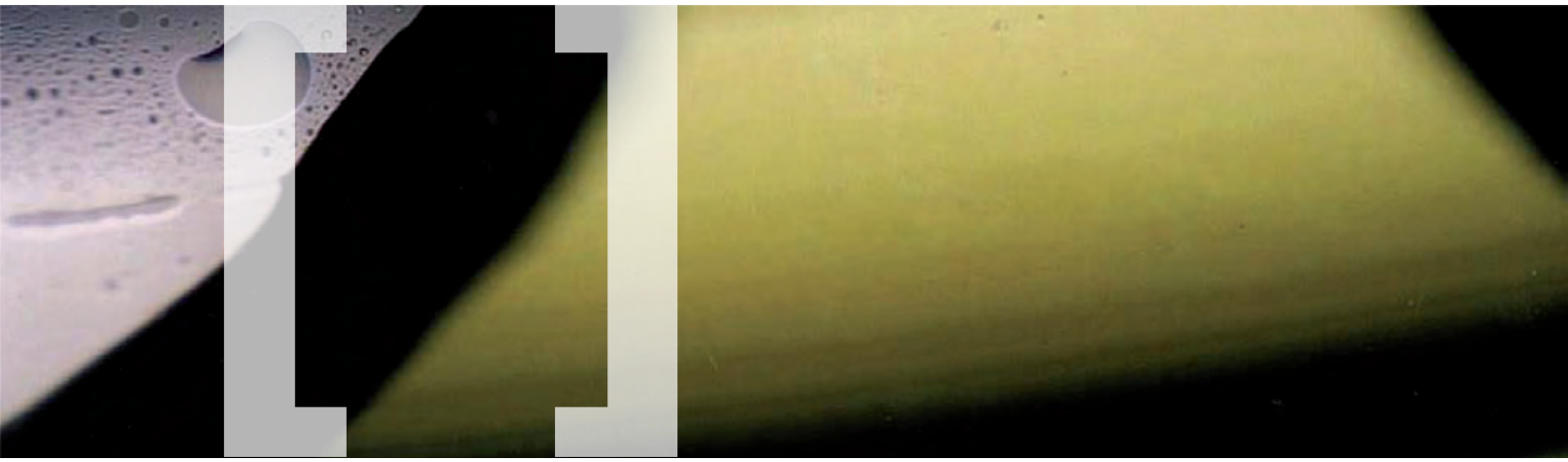
Spring 2012
Produced by Dstl

Defence Reporter



Defence Reporter is a free service providing citations of recently published defence science and technology literature. Defence Reporter is one part of a series of services and products produced by ATHENA to keep readers up-to-date with the latest developments in key areas of defence science and technology.

Published every four months, Defence Reporter provides an update of reports, with unclassified citations, which have been added to the MOD's ATHENA Collection.

Defence Reporter is available by subscription. To sign up for this free service, please send an e-mail with your full name and address details to: DefenceReporter@dstl.gov.uk.

ATHENA
Your Gateway to Defence Science and Technology

Sample citation
The components for a typical citation, as they appear in Defence Reporter, are illustrated below:

Collection system identifier
Title

R0001C6D0
Airframe Structural Integrity Research and Technology Strategy - Phase 2
Dstl Porton Down (GB) (2009)
Within this report, Phase 2 of the task raised by CASD-ASI to develop a Structural Integrity Research and Technology Strategy is described. Additionally, development of fatigue data management systems to support several in-service aircraft fleets and expansion of low-cost Operational Loads Measurement capability development tasks are detailed.

Publisher, year of publication
Abstract

Defence Science and Technology

[dstl]

MINISTRY OF DEFENCE

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2012		**00-00-2012 to 00-00-2012**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Defence Reporter	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **DSTL,Defence Science and Technology,Laboratory, ,United Kingdom, , ,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**15**	

Defence Reports

This section provides details of scientific and technical reports added to the MOD's ATHENA Collection in the previous period.

How to request reports
Reports from MOD's ATHENA Collection can be requested from Knowledge and Information Services
Tel: 01980 613971
Email: DefenceReporter@dstl.gov.uk

Note: The report citations listed in this publication have been generated using an automated document scanning process. As a result, some references may contain formatting and/or punctuation irregularities.

R00027D76
A framework for the elicitation of subjective data with application to CBRN capability modelling
Dstl, Porton Down (GB) (2011)
Subject matter experts (SMEs) are frequently consulted to provide subjective judgements about data items for which there is no existing historical, operational or experimental data. In this report, a general framework for the process of eliciting subjective data is provided, and methods for capturing uncertainty are described. In particular, the use of probability distributions to represent SME judgements and capture uncertainty is recommended. A range of documentation templates are provided so that all aspects of the elicitation process can be recorded, increasing consistency, robustness and auditability. The framework is applied to the CBRN capability modelling domain. Probability distributions representing SME judgement about the efficacy of medical countermeasures against a selection of biological agents are obtained. The resulting distributions are used as input to the CBRN Capability System Model (GSM), allowing it to be used stochastically for the first time. The results of CSM are then expressed in probabilistic terms, allowing the presence of uncertainty to remain apparent. This is a step forward in the level of detail available to stakeholders to inform capability management decision-making.

R000297AB
Air vehicle survivability good practice
Dstl, Portsdown West (GB) (2012)
Accepted good practice is described for the specification, assessment, verification and validation of air vehicle survivability through life. This guidance is relevant to all military air vehicles exposed to hostile threat effects. It is applicable to new and existing projects throughout the project life cycle, and should be used as the basis for identifying survivability programme tasks. It is intended as a guide for Capability area sponsors in setting coherent and verifiable survivability requirements, for Delivery area providers in delivering and managing system survivability attributes through life, and for Dstl analysts and others coming afresh to the subject. The initial issue of this good practice guidance is limited to mitigations for the more prolific and more capable hostile threats facing UK air power in the first quarter of the 21st century. Non- lethal threats, and risks posed by Chemical, Biological, Radiological and Nuclear (CBRN) threats, will be addressed at a later date.

R00028659
Aircrew Protective Equipment and Detection (APED) Minimum Operating Capability (MOC) Assessment Programme: Laboratory Assessments Phase 3
Dstl, Porton Down (GB) (2011)
Under the Aircrew Protective Equipment and Detection (APED) Minimum Operational Capability (MOC) programme, an integrated lightweight rotary wing aircrew helmet and clip-on respirator is being developed by Crew Systems Corporation (CSC) on behalf of UK MOD. As part of the acceptance process, Dstl is undertaking a series of tests and trials on behalf of Defence Equipment and Support (DE&S) under the direction of the APED MOC Integrated Test Evaluation and Acceptance (ITEA) working group. The Dstl trials / test programme forms part of a larger assessment activity, involving QinetiQ and other agencies, which will ultimately serve to qualify the system for flight. In this phase of the programme, laboratory assessments of the system were carried out to provide evidence that the system meets the requirements defined in the APED User Requirements Document (URD). The laboratory assessment of the APED MOC system assessed misting of the respirator and helmet visors, valve icing, and helmet functionality under varying environmental conditions using the Dstl Fogging and Respiratory Simulation System (FARSS). This phase covers the testing of the size 1 and size 2 helmets, and the size 1, size 2, and size 3 respirators.

R000282A0
Aircrew Protective Equipment and Detection Programme Minimum Operating Capability (MOC) Test Programme : Assessment of the In-Service Chemical, Biological and Radiological Below Neck Aircrew Equipment Assembly
Dstl, Porton Down (GB) (2010)
This report details a study carried out for the APED MOC Programme. The testing carried out assessed the protection afforded by the current in-service Aircrew Chemical, Biological and Radiological below neck Personal Protective Equipment against the newly defined APED challenge requirements. The protection this system affords was determined by measuring skin level dosages under the test garment using the Porton Animated Mannequin test system.

R0002945C
An Enterprise Architecture for the Delivery of a Modular Interoperability Solution
Dstl, Portsdown West (GB) (2011)
Operational needs are not static; they change rapidly, as the situation in the field evolves, forcing command and control information system providers to react. Interoperability solutions must be flexible to enable changes in such compressed timeframes. However, the development of a modular interoperability solution requires a well-documented and well-understood methodology and organization structure. In this paper, we propose an approach that is based upon the concept of capability packages and the use of the Unified Modelling Language (UML), the NATO Architecture

Framework (NAF), Model-Driven Architecture (MDA), and techniques that enable the automated generation of artefacts. The methodology has been developed within the Multilateral Interoperability Programme (MIP), a standardization committee supported by 29 nations and NATO. A case study was set up to prove that the capability package approach allows the rapid delivery of service specifications that are easily implementable in the various national C2ISs.

R00028AFA
Assessing camouflage, concealment and deception: another thinkpiece
Dstl, Fort Halstead (GB) (2010)
This paper reports the results of a literature review and subject-matter expert (SME) investigation of the potential of camouflage, concealment and deception (CCD) to improve the survivability of UK ground forces. It discusses the psychological framework for deception in the mind of the decision-maker, then reviews camouflage, concealment and deception in turn with regard to land operations. It also discusses how the CCD functions might be assessed in operational analysis (OA) studies, with the view to being able to evaluate potential CCD interventions in the training, equipment, information, doctrine and policy, infrastructure and personnel defence lines of development.

R000275EF
Assessment of Mobile Counter-IED Trainer (MCIT)
Dstl, Portsdown West (GB) (2011)
This report details a visit carried out by a Ministry of Defence team to assess the Mobile Counter IED Trainer (MCIT) at Fort Campbell, Kentucky, and documents discussions, observations and conclusions from the visit.

R0002866A
C-IED Balance of Investment - A Mixed-Method Approach
Dstl, Portsdown West (GB) (2011)
The many disparate and interrelated strands of Counter-Improvised Explosive Device (C-IED) make taking coherent decisions about how best to improve our C-IED capabilities difficult. As a result, attempts to undertake a quantified analysis of the relative effects of the various elements of C-IED across the whole C-IED domain have been limited. This paper describes an analytically feasible way forward which will enable us to answer the higher-level Balance of Capability (BoC) and Balance of Investment (BoI) questions around C-IED. It fleshes out the issues and provides sufficient detail to show that the problem is tractable and that we do now have most of the required tools in place.

R00029411
Comparing the design and potential military performance restriction of neck collars from different body armour systems
Dstl, Porton Down (GB) (2010)
The aim of this trial was to perform the first human factors trial of ballistic neck collars, comparing common designs specifically assessing comfort and potential performance restriction. We recruited 71 service personnel to assess these factors in neck collars from six countries with each participant assessing two different collars. Shorter and thinner collars such as the Dutch and Danish were rated the most comfortable. It was easier to fire a rifle using collars made of overlapping segments. Although the OSPREY collars fared worse overall, this may be offset by their higher levels of ballistic protection they provide.

R00027E45
Development of a Strategic Planning Objectives Model
Dstl, Porton Down (GB) (2011)
The aim of this study was to construct a Bayesian Belief Network (BBN) of the Strategic Planning Objectives comprising a military scenario. The BBN provides a representation of the causality between scenario objectives and shows how the potential likelihood of achieving any objective is affected by the success or failure in achieving any of the others. The initial application of the model is to investigate the impact of a CBRN attack against one of the bases within the scenario on achieving the planning objectives.

R00027635
Dogs and biological warfare agent (BWA) infections
Dstl, Porton Down (GB) (2011)
Dogs are used in a wide variety of roles in civilian and military applications which may put them at risk of exposure to a variety of infectious agents. Generally dogs are expected to work forward of and remotely from their handlers and may return contaminated generating the risk of spread of contamination to civilian emergency or military personnel. The present paper looks at the risk to humans from exposure of dogs to pathogens of concern as potential biological warfare agents, concentrating on natural exposures, but also with consideration for a deliberate biological release. In each case, susceptibility of dogs to infection, the risk of the agent being spread to handlers and canine treatment for the hazard has been investigated.

R000281E3
Enabling Networks -Work Package 3: International Interoperability
Dstl, Portsdown West (GB) (2011)
The report aims to assist in efforts to contribute to improvements in international interoperability. The goal is to improve our capability to interoperate in deployed operations to the fullest extent, utilising the UK Command, Control, Communications, Computers, intelligence, Surveillance, Target Acquisition and Reconnaissance {C4ISTAR) architecture, and the equivalent assets of the US. This report delivers three main sections; the potential breadth of International Interoperability; the Combined Joint Task Force (CJTF) Brigade and Below Architecture; updated “Strength, Weaknesses, Opportunities and Threats” (SWOT) analysis. Recommendations are made as follows; research should be undertaken to determine the full extent of the international interoperability requirements; investigate how the UK will fulfil its obligations to the UK - US IOC; The SWOT analysis modelling should be advanced, broadened and deepened.

R0002868C
Evaluating risk in the CBRN domain
Dstl, Porton Down (GB) (2011)
CBRN events are currently believed to be unlikely events. However, if they were to occur, the financial cost of their rectification and the strategic political-military impact of their occurrence would be extremely high. After a CBRN event, society will scrutinise investment and mitigation decisions to determine whether sufficient effort was spent to mitigate the impact of the event. A rigorous and auditable framework for assessing CBRN risk mitigation investment is therefore required to demonstrate that money invested in risk mitigation was appropriate for the scale of the problem that would manifest, given the likelihood of its occurrence. This report outlines such a methodology.

R00028913
Future Concepts for Rotary Wing Vehicles - Technology Watch
Dstl, Portsdown West (GB) (2011)
There is an opportunity to introduce new vertical lift capability, or new ways of achieving this capability, from 2025 as the current generation of helicopters reach their Out of Service Date (OSD). The Future Rotary Wing (RW) project will develop the requirements for future UK military vertical lift capability through operational analysis to develop future fleet options, and technology watching to provide awareness of emerging concepts, gather data to support the OA and identify technologies for future rotorcraft. This report is the output from the technology watch and identifies a range of the developing and future rotary wing platform concepts, and a range of the relevant developing technology which might be applied to helicopters to enhance or broaden operational effect. The report covers a range of platform concepts such as military helicopter developments, tilt rotors and tilt wings, compound helicopters, Unmanned Air Vehicles (UAVs), autogyros, gyroplanes and heliplanes. Included with each concept is data taken from the public domain to give an estimation of the performance that can be achieved with each type of rotorcraft concepts. This will inform the operational analysis of how capable future platforms can be.

R000283B2
Generic Aggregator Model Valuator (GAMOV) Logistical Representation
Dstl, Portsdown West (GB) (2011)
This report outlines an investigation into the capabilities of the Generic Aggregator Model Valuator (GAMOV) modelling framework. GAMOV was used to produce a representation of the Aerial Delivery Model (ADM), which had previously been implemented within Excel. Excel limited the implementation that was possible and prevented the generation of a model able to address a broader range of study questions. The results showed that GAMOV produced a representation of aerial delivery closer to the reality that it was trying to model over its original Excel implementation. The inherent flexibility of the GAMOV solution was also examined through a think piece and could be rapidly developed for study usage if tasked.

R00027E75
Human Factors Trials Report on the Cased Telescoped Cannon
Dstl, Porton Down (GB) (2011)
Dstl were tasked to provide Human Factors (HF) support to the assessment of the Cased Telescoped Cannon (CTC). The findings of this assessment supplement the findings from a 2009 Human Factors Integration (HFI) report. The 2009 HFI report presented the findings from a HF assessment conducted on the CTC by Atkins . These findings led to a number of recommendations, some of which were implemented by CTA international (CTAI). The current report presents the findings from a follow up HF assessment undertaken by a Dstl HF Specialist completed in May 2011. The purpose of this document is to compare the findings from a Human Factors assessment with the Cannon System Requirements (CASRs) and to highlight any requirements that are not fulfilled. The results in this report cover the mandated components of the CTAi CTC only. Where the system is considered to be affected by future integration into a turret, this has also been commented on.

R00028531
Injury Modelling Gap Analysis
Dstl, Porton Down (GB) (2011)
An injury modelling gap analysis was carried out. The principal objectives of this work were to understand the current injury modelling capability and identify gaps in this capability. The principal conclusions and recommendations are: •Work is already being carried out to address a number of the shortcomings relating to the top three priority injury modelling gaps; i.e. metallic and non-metallic fragments, large fragments and gunshot. It is important that these activities continue to be supported until a satisfactory resolution of the injury modelling gap is achieved. •Burns, primary blast, crush injuries, body acceleration induced injuries and fragments from shattered glazing (in approximate priority order) were the next most prominent injury modelling gaps. No injury modelling work is currently being carried out in these areas. Programmes of work should be setup to resolve these injury modelling gaps. •The casualty database is an invaluable resource for identifying injury modelling gaps. Efforts should continue to maintain the casualty database and analyse the data even post withdrawal from Afghanistan to fully appreciate the benefits of this valuable resource. •Injury models focus principally on predicting injury severity. An ability to predict the long term effects of injuries in addition to severity would offer greater potential to use injury models to mitigate life changing injuries. Work needs to be carried out to understand how to make best use of quality of life metrics, such as the Functional Capability Index, in injury model predictions.

R00027BE1
Integrated Armour for Future Naval Combatants
Dstl, Porton Down (GB) (2011)
The application of armour technology to naval combatants is considered. The threat specification and armour materials are discussed. Armour options for the hull above the water line and the superstructure are discussed.

R0002982E
Laser Based Communications Literature Review
Dstl, Fort Halstead (GB) (2011)
This report contains an overview of research undertaken in the field of laser based communication systems and its surrounding technologies over the last 20 years, carried out by military, academic and commercial organisations. It finds that advances in technology over this time have made submarine laser based communication systems demonstrable, however they are yet to be used as standard.

R000281B9
Laser Damage Weapon Modelling User Requirements Document
Dstl, Portsdown West (GB) (2011)
This is a user requirement document for the addition of a laser damage weapons performance modelling capability to the Weapon Target Interaction model. This will capture the customer and stakeholder requirements by listing all the capabilities that the model should meet from an end user perspective.

R00029A1B
Level 1 Human Factors Assessment of Load Carriage Equipment
Dstl (GB) (2012)
This report has been prepared as part of Work Package 301 (WP 301) (Optimisation of load carriage) of the HERCULES project. The aim of HERCULES is to reduce the physiological and cognitive burden on the dismounted soldier in Op HERRICK. The aim of the assessment was to provide Human Factors (HF) advice and practical input to the down-select, test and evaluation of other nations load carriage, as a quick win solution to reducing the load burden of current UK load carriage equipment. This is to ensure that the Urgent Operational Requirement (UOR) procurement of any replacement load carriage is de-risked in relation to HF and that the integration of the load carriage on the military user is optimised. The purpose of the assessment v/as to identify benefit or risk features with each option rather than assessing the system as a complete product. This de-risking study found a number of recommendations to optimise the load carriage system.

R00028927
Depleted Uranium Environmental Survey: QinetiQ Eskmeals 2009 & 2010
Dstl, Gosport (GB) (2011)
Depleted uranium (DU) ammunition has been historically test fired at the Eskmeals ranges. Routine environmental monitoring has been carried out at Eskmeals since 1981 to assess the environmental impact of the firings on the terrestrial environment and any associated radiological risks. This report presents the findings of the terrestrial survey undertaken at Eskmeals during 2009 and 2010. Although some low level DU contamination was detected on site, no sample was radioactive within the meaning of the Environmental Permitting Regulations 2011, nor exceeded a small fraction of the relevant Generalised Derived Limit. The levels detected were well below anything which could be considered a health hazard either to those who work on the range or those who live nearby.

R0002827E
Psychological approaches to understanding Non-State Actors
Dstl, Portsdown West (GB) (2011)
This document details the work conducted under the Representing Non-State Actors strand of the Upstream Activities Project during April-July 2011. This report draws upon social and organisational psychology literature with the aim of ascertaining the feasibility of applying this literature to the understanding of the nature of non- state actors (NSAs), their decision-making processes and their likely responses to internal and external change. It was found that this literature can be applied to NSAs, and can contribute to a more detailed understanding of the internal dynamics of NSAs. As such, the findings of this research can be applied to support influence strategies focusing on specific NSAs. Although this research has identified a range of factors relevant to NSAs, further research could study how to identify, measure and assess these features within NSAs. Published alongside this report, the customer report Non-State Actor Study: Summary of Work Conducted in FY2011 -12 & Recommendations for Future Work (DSTL/CR57542), elaborates on how this could be achieved, and assesses the feasibility of applying the findings of this report to the representation of NSAs within planning and training exercises.

R00028ABD
Mapping Typhoon Aircrew Experiences to Scenarios
Dstl, Portsdown West (GB) (2011)
Provides a mapping between Mission Essential Competency (MECs) experiences for Typhoon aircrew and roles in the Future Combat Air Capability (FCAC) Study taxonomy, and a mapping between those roles and Studies Assumptions Group (SAG) scenarios.

R00027636
Maritime Data Maintenance Within High Level Models
Dstl, Portsdown West (GB) (2011)
This report has looked at how data is currently maintained and updated within the Strategic Balance of Investment (Strat BoI) and Command, Control and Communications (C3) Orientated Model of Air and Naval Domains (COMAND) models. It has provided recommendations for how this should be done in future to ensure a robust representation of maritime capabilities within high level operational analysis.

R00027E68
Maritime Geospatial and Temporal Reference (G&TR) Requirements - Interim advice for DEFSTAN Update
Dstl, Portsdown West. (GB) (2011)
This document is constructed from previous documents [1, 16, 18,] which led to the creation of the DEFSTAN 09-100 Geospatial and Temporal Requirements Part 1 (Maritime) [37] which was created around 6 years ago and is now due a major update. Much of the work captured in the extant DEFSTAN is reproduced below in order to provide guidance to MoD and Industry in the short term until the next edition of the Geospatial

Requirements Standard is endorsed and published. This document defines the warfare accuracy requirements for naval operations as guidance and is therefore set in the context previously provided by the Warfare Accuracy Policy Paper. It includes additional smoothness requirements that were derived in support of the WECDIS procurement project. The recommendation is that these requirements be promulgated to DE&S and Industry as best practice until the extant DEFSTAN has been updated and re issued.

R0002874A
MARVEL Evaluation: Deterrence Case Study: The Failure of Deterrence in 1982
Dstl, Portsdown West (GB) (2011)
The group model building system dynamics tool, MARVEL, is evaluated for its suitability to investigate complex problems such as deterrence. A Dstl internal model-building exercise, focusing on the build-up to the Falklands Conflict of 1982, identified the strengths and weaknesses of MARVEL in the context of deterrence and concluded that MARVEL may be suitable for developing understanding in issues as complex as deterrence.

R000281E6
MAST STC strategy and implementation plan 2011 -2016
Dstl, Porton Down (GB) (2011)
The Materials and Structures Technology Science and Technology Centre (MAST STC) is leading the process to create an open organisation dedicated to materials research into relevant technologies which can contribute to MoD capability. This document details the strategy of the MAST STC looking across the time period 2011 to 2016; it then also states the implementation plan for this strategy. The strategy is set out to the year 2016, setting the overall direction of the MAST STC. This 5 year period is regarded as the first phase of the STC in which it is hoped to establish a credible and viable Centre for the future. The Implementation Plan sets out the framework for how the strategy will be delivered over the next 5 years. This document should be read in conjunction with the MAST STC Integrated Project Plan (IPP) which details all the activities planned during the current financial year.

R0002868A
MECsploitation method for Rotary Wing Live/Synthetic Blend Study
Dstl, Portsdown West (GB) (2011)
Achieving the most cost-efficient and operationally effective blend of training is a problem that military commanders constantly confront. Recently, demonstrations of the potential effectiveness of simulation have prompted reconsideration of that blend. Dstl was commissioned to further investigate training for Rotary Wing (RW). Analysis identified elements of training and experience that indicated potential for a shift in the current Live/Synthetic Blend (LSB), and the feasibility of those changes given current and anticipated synthetic capabilities. The LSB of training is not simplistic. It is subject to many variables: different platforms, crew positions, experiences and an operator's position in the training cycle all play a part, resulting in a different optimal LSB for every combination of these variables. In general, the study found that a re-blend in favour of synthetic training is possible. The fidelity of current synthetic capabilities does not always expose operators to sufficiently high standard experiences to retain knowledges and skills. Aspirations to re-blend will need to be correctly resourced, likely with significant near-term cost and time implications. The study highlights improvements to RW training that could mitigate and plug some capability gaps, facilitate better and enhanced training, and potentially lessen the requirement for Live flying. The study generated a number of recommendations relating to the Wing and individual platforms, plus the scoping of RW requirements for the Defence Operational Training Capability (Air). Most vital is stakeholder recognition that training should be subject to a flexible blend of Live and Synthetic media, with training syllabi designed in a complementary way for optimum benefit.

R000281C0
Models for Negotiation Analysis: A Short Investigation
Dstl, Portsdown West (GB) (2011)
This report is a short investigation of Drama Theory and the Graph Model for Conflict Resolution. It provides a short briefing on the two techniques and recommends developing awareness of, but not investing in developing a capability in, the application of these techniques.

R0002818B
Molecular viability assays for the verification of surface decontamination - Selection of molecular targets
Dstl, Porton Down (GB) (2011)
Current methods for the verification of BWA decontamination involve the use of surrogate organisms and traditional culture methods which are time, labour and facility intensive. Molecular viability assays have the potential to provide rapid, high-throughput screening of samples during BW decontamination trials. Using the 454™ sequencer, we have produced consensus sequences for the genomes of BG and E. coli MRE 162. We have developed methods for the production of high quality mRNA samples from healthy and decontaminant stressed bacterial cultures for subsequent transcriptome sequencing. These are the first steps in the design of low burden, high throughput, sensitive and specific molecular viability assays, optimised for the verification of bacterial decontamination.

R00029183
Norms of Behaviour in Cyberspace: A Capping Paper
Dstl, Portsdown West (GB) (2012)
This paper summarises a Dstl-commissioned Royal United Services Institute (RUSI) report that explores the potential for international norms of behaviour to play a role in governing state conduct in cyberspace, as well as establishing what implications the report's findings may have for the Ministry of Defence.

R00027E95
Position paper on Plastic Electronics
Dstl Porton Down (GB) (2011)
This paper provides an outline assessment of the set of emerging technologies commonly referred to as 'Plastic

Electronics'. This paper seeks to give some background on the technologies and their future development, and attempts to identify areas of application to military capability where there are short-, medium- and longer-term potential benefits to be gained. This is in particular to inform the managers and technical leads in the Materials and Structures Technology Science and Technology Centre (MAST STC) when formulating future directions for the programme.

R000297AD
Quality Control Test of the Gamma Spectrometry Emergency Response Systems - October 2011
Dstl, Gosport (GB) (2012)
Annual performance test of emergency monitoring gamma spectrometers using a spiked source to check reported activities and calculated radiation body doses. 11 systems checked at Faslane, Devonport, Alverstoke and Gibraltar. No significant discrepancies between systems were observed. Some minor issues were detected:- Administrator access at Gib, commonality between systems at Alverstoke and time difference at Gibraltar. Difficulties with the transport of radioactive source to Gibraltar were experienced which will need to be anticipated in future.

R00028AFB
Recommendations for improving CCD in analytical assessments
Dstl, Fort Halstead (GB) (2010)
This report discusses how the representation of camouflage, concealment and deception (CCD) in operational analysis (OA) studies might be improved, with the view to evaluating CCD interventions for special forces, and maintaining consistency across OA studies. It discusses the scope of the problem, then the details of how we might improve our understanding of CCD, how we might model it, and collecting the necessary data. But it also highlights the need to educate all the stakeholders, both inside and outside DSTL, in the importance of CCD, and where appropriate, how it should be assessed. While some feasible steps towards achieving this are proposed, it is seen as part of the much broader issue that lies well beyond the scope of this project.

R000281CA
Representing Deterrence in Operational Analysis: A Comparison of Quantitative Empirical Studies of Deterrence
Dstl, Portsdown West (GB) (2011)
This document reports the progress of the Representing Deterrence strand of the Understanding Deterrence project, which is seeking to improve the representation of deterrence in Operational Analysis (OA). Four contrasting academic studies that quantitatively assess theories of deterrence are compared, to determine if the results of any are appropriate for use in OA. The theoretical basis and statistical methods of each study are examined. A study that investigated the sources of threat credibility in the context of extended-immediate deterrence used well established statistical methods and presented compelling evidence for the hypotheses tested and so may be appropriate for exploitation in OA. A study testing a new theory of deterrence, known as Perfect Deterrence Theory, on a new data set showed mixed results. However, Perfect Deterrence Theory is more logically consistent than previous theories of deterrence and may be useful to provide a structured approach to understanding a broad range of deterrence types. Further work should identify the relevance of extended-immediate deterrence to UK Defence and develop a method for assessing these problems based on the findings of the existing work. The potential of Perfect Deterrence Theory for understanding cases of other types of deterrence problem should be investigated.

R0002874C
Task Force Helmand Information Operations Process Map
Dstl, Portdown West (GB) (2011)
This paper captures the current IO processes at Task Force Helmand (TFH) Brigade and Battle Group (BG) level in order to provide guidance material for IO practitioners joining TFH and also codify the processes for use on future operations. It is intended to complement existing IO literature in TFH. The paper also provides a number of IO process improvement recommendations. The research conducted to produce this paper was undertaken during a visit to TFH and the BG.

R0002868F
Technology Assessment Seminars for STTDI - Force Protection in the Land Environment
Dstl, Portsdown West (GB) (2010)
This report details the process for, execution and outcomes of the Science and Technology Trends and Defence Implications (STTDI) Technology Assessment Seminars examining the defence implications of emerging and future technology for Force Protection in the Land Environment held at DCDC Shrivenham on 19 March 2010.

R0002868D
Technology Assessment Seminars for STTDI - Security and Counter-terrorism
Dstl, Portsdown West (GB) (2010)
This report details the process for, execution and outcomes of the Science and Technology Trends and Defence Implications (STTDI) Technology Assessment Seminars examining the defence implications of emerging and future technology for Security and Counter-terrorism held at Dstl Porton Down on Tuesday 22 February 2010.

R00028F7C
The Effect of Relative Humidity on Mass Uptake of Sulphur Mustard Vapour by Sampling Adsorbents
Dstl, Porton Down (GB) (2011)
The current sampling technique used in UK CBR clothing research to quantify the amount of chemical vapour that has penetrated through a protective clothing system involves the use of adsorbent based dosimeters - PADs (Passive adsorbent dosimeters) and dosimeter (DOS) tubes. At present, there is little understanding or available data regarding the effect humidity has

on the uptake (both passive and active) of agent by a number of adsorbents that are currently used; it is vital to address this knowledge gap. The data will also support a number of programmes, which use test and evaluation facilities that rely on the use of adsorbents including: • The new enhanced quantitative penetration (QP) cells (swatch testing). • Typhoon and JSF CB test rigs. A new experimental rig was designed and built to generate and introduce a humidified sulphur mustard (HD) vapour challenge to an enclosure containing the adsorbent samplers. The study has demonstrated that varying relative humidity has no effect on the uptake of HD by DOS tubes at the concentrations generated. It has been shown that variations in relative humidity have no effect on the uptake of HD by actively sampling onto Tenax and Porapak adsorbent tubes. The study also suggests relative humidity has no effect on the HD uptake by PADs but due to inconsistencies in sampling, further work will need to be carried out. Studies should continue to investigate adsorbent uptake at higher HD concentrations. It is recommended conditions such as varying sampling flow rate and adsorbent storage conditions at different humidities and temperatures should be investigated.

R0002828C
THE NEC Approach Space and Social Network Analysis
Dstl, Fort Halstead (GB) (2011)
The Network Enabled Capability Approach Space provides a theoretical model for considering Command and Control Maturity. In this report, we make initial steps towards quantifying positions within the Approach Space using metrics developed for Social Network Analysis.

R00028C02
The termination of the MOD Software Systems Engineering Initiative (SSEI) - Dstl closure report
Dstl, Porton Down (GB) (2011)
Following its termination, this report retrospectively documents information pertinent to the execution the of the Software Systems Engineering Initiative (SSEI) contract. To benefit from this experience, it is recommended that the information captured in this report is considered by MOD personnel working on other research consortia or change programmes.

R00027DA9
Typhoon Aircrew NBC Protection: Qualification Test Report for the Product Gas Outlet Filter (PGOF) for CW
Dstl, Porton Down (GB) (2011)
Typhoon aircrew NBC protection will be provided by the Locality Specific Protection (LSP) subsystem. The LSP subsystem transfers the bulk of the protection from the Pilot to the aircraft via a number of subsystems / capabilities that are embodied on the aircraft. This report describes the qualification testing conducted using CW agents on PGOF CW filters supplied by the manufacturer B/E Aerospace Systems (BEAS) GmbH. It also describes particulate performance tests conducted on a number of the filters submitted for CW agent testing. The PGOF CW filter is used in conjunction with the Molecular Sieve Oxygen Concentrator (MSOC) to ensure that the gas supplies to the aircrew are free on NBC contaminants. All of the filters provided fully acceptable performance against CW agents when tested according to the agreed qualification test plan. This is on the basis that the PGOF CW filter will not be used on a standalone basis (i.e. always in conjunction with the MSOC (and located downstream of it)).! Five PGOF CW filters submitted for CW agent testing were subjected to particulate testing using an aerosol challenge to determine the compatibility of the filter design with the MSOGS specification requirement for PGOF particulate filtration performance (efficiency). Testing was conducted in accordance with an agreed QTP, and all of the filters met (and exceeded) the requirement.

R00028334
Virtual Environment for Developing Government Experimentation: User Requirements Document
Dstl, Portsdown West (GB) (2011)
This document defines a set of User Requirements for a proposed capability called the “Virtual Environment for Developing Government Experimentation” that aims to provide a facilitated environment to support cross-government decision makers and first responders in the development and testing of policies, procedures and techniques for dealing with disruptive events.

R0002869D
Visualisation Techniques: Communicating Results to Senior Decision-Makers
Dstl, Portsdown West (GB) (2011)
Analysts must communicate complex research to senior decision-makers using methods which are conducive to both rapid understanding and accurate recall of key information. Open-source literature provides evidence that good visualisations aid effective communication of abstract or complex information. General principles regarding the design of visualisations for use in presentations or reports are provided. Best practice relating specifically to Dstl is also discussed. This section incorporates both Customer views regarding aspects of research presentation which Dstl can improve, and Analysts’ opinions as to why these presentational issues arise and how they can be overcome. Examples of visualisations are used throughout the report and aim to emphasise the range of visualisation methods which analysts can employ, while also highlighting the importance of effective and interesting means of communicating information to individuals unfamiliar with the technical aspects of work undertaken.

R0002875F
A survey of crew exposure to noise in a fast assault craft, the Combat Boat 90
Institute of Naval Medicine, Alverstoke (GB) (2011)
Noise measurements were made in a Combat Boat 90, a fast assault craft originally developed for the Swedish Navy. Time histories of sound pressure were acquired onto an Edirol audio recorder from four locations (commander, coxswain and rear crew seats) with the vessel being operated at a number of speeds and during a series of standardised manoeuvres. Measurements were made approximately 15 cm from the ear of the crew; measurements were also made at a third rear crew seat and in the engine space using a 01 dB-Stell Solo. The data have been assessed and interpreted in

accord with the Control of Noise at Work Regulations 2005. Average noise levels within the vessel ranged from 73 dB(A) during travel at 20 knots to 84 dB(A) during travel at maximum speed. Noise levels were similar throughout the vessel. The noise exposure of all crew would be expected to exceed the 'upper exposure action value' specified in the CNAWR if travelling at maximum speed for about 12 hours. The exposure period required to reach the 'upper exposure action value' for crew performing engine checks is estimated to be about 1 hour 30 minutes. It is understood that personnel are unlikely to spend more then one hour a day in the engine space, hence it is unlikely that the noise exposure of crew members performing engine checks would exceed the upper exposure action value'. Appropriate hearing protection (e.g. the Peltor H61 FA) should be worn if crew remain in the engine compartment for longer then 90 minutes.

R00027DEA
A Survey of Noise Exposure from A Large Area Screening System
Institute of Naval Medicine, Alverstoke (GB) (2011)
Noise measurements were made when operating a Large Area Screening System (LASS) which is used for producing smoke for training purposes. Time histories of sound pressure were acquired onto a Prosig Data Acquisition System from microphones positioned at various distances from the source: 5 metres, 10 metres, 15 metres, 20 metres and 25 metres distance from the exhaust. Measurements were also made at the LASS operator's positions. The data have been assessed and interpreted in accord with the Control of Noise at Work Regulations 2005. Noise levels (LAeq) ranged from 73 dB(A), obtained at 25 metres distance from the exhaust, to 103 dB(A), obtained at 2 metres distance from the device. Higher noise levels were obtained at positions that would be occupied by the LASS operators. Exposure periods required to reach the 'upper exposure action value' of 85 dB(A) varied from about 7 minutes to over 24 hours depending on the distance from the LASS. The noise exposure of LASS operators could exceed the upper exposure action value' specified in the CNAWR. Recommendations have been made including provision of information and training on the forms of action that personnel may take to reduce their exposure to noise, a programme of maintenance for all hearing protection devices used and appropriate health surveillance for noise-exposed personnel.

R00027D78
A Trial to Identify A Test of Perseverance for Inclusion at the Admiralty Interview Board
Institute of Naval Medicine, Alverstoke (GB) (2011)
This trial identified two scales, measuring courage and resilience, which could be included in the selection process for Naval Officers. Three hundred and fifty one officer candidates took part in the trial, which involved completing a 20m shuttle run test (the 'AERO' test) as an indicator of physical grit, and seven well-established psychometric tests which measured various traits deemed to potentially reflect the concept of grit, e.g. resilience, courage and self-confidence. One hundred and fifteen of the participants joined Initial Officer Training (IOT) at the Britannia Royal Naval College, and were followed-up through the 28-week course. Outcome data were obtained for 92 cadets, excluding those who had dropped out of training, were backtrooped, or were female. It was found that two of the psychometric scales (measuring courage and resilience) significantly added to the predictive power of the existing selection tasks. The shuttle run test did not predict officer training performance, possibly because the candidates knew that the test did not contribute to the assessment process and therefore had no reason to utilise their maximum capacity. It is recommended that the courage and resilience scales should form part of the Admiralty Interview Board (AIB) assessment, and that the AERO test be introduced as a trial measure to assess its predictive abilities when candidates are trying their hardest. An incidental finding was that the AIB tasks should be scored by task rather than competence.

R00028CA2
An Assessment of the Work Demands on Royal Fleet Auxiliary Personnel Working in A Hot Climate
Institute of Naval Medicine, Alverstoke (GB) (2012)
The Royal Fleet Auxiliary (RFA) provides support to the Royal Navy (RN) and so may be deployed to many regions around the world. RFA personnel may therefore be required to work in a wide variety of climatic conditions and RFA management has a duty of care to manage any risk associated with working in these climates. Concerns regarding RFA personnel working in the Gulf called for a risk assessment where environmental and individual factors related to the risk of heat illness were investigated. A pilot study taking measures of oxygen uptake and cardiorespiratory fitness was also conducted in situ. High environmental temperatures (WBGT of 31-33 °C) were measured both on deck and in the engine rooms. Work demands, as measured by heart rate responses, were moderate, with occasional high peaks of activity. Regular monitoring of activity levels and environmental temperature is recommended when personnel are exposed to these climates. Guidance for commanders and management is available in JSP 539.

R000280C5
Assessment of Exposure to Training Smoke from A Large Area Screening System
Institute of Naval Medicine, Alverstoke (GB) (2011)
Monitoring of exposure to particulate, volatile organic compounds (VOCs) and gases produced during the release of white oil training smoke from a Large Area Screening System has been carried out on Salisbury Plain. The particulate level was found to be very high (as expected in an obscuring smoke). Concentrations of VOCs were also very high, due to the organic make-up of white oil. The only gases found were carbon monoxide and nitrogen monoxide but at concentrations unlikely to cause adverse health effects. The results obtained were used to calculate the daily maximum safe exposure time to minimise the risk of inhaling sufficient particulate to irritate the lungs. A simple face mask is recommended to provide adequate protection against inhaling the particulate.

R00028CEB
Baseline and occupational noise exposure survey onboard HMS Severn
Institute of Naval Medicine, Alverstoke (GB) (2011)
Noise measurements were made in 52 compartments and cabins at various locations onboard HMS Severn during engine trials around Portsmouth. Measurements included noise in 11 Marine Engineering (ME) spaces. The data have been assessed and interpreted in accord with The Department of Transport's Code of Practice for Noise Levels in Ships (1990) and The MoD Defence Standard 07-254 (1987); personnel of the ME section were assessed for occupational noise exposure in accordance with The Control of Noise at Work Regulations (2005). The A-weighted equivalent continuous sound pressure levels show that six compartments, including three accommodation spaces onboard HMS Severn, exceeded the recommended limits specified in the standards. Although these compartments were seen to exceed the recommended limits, those measurements that exceed the limits by 1 dB(A) or less should be used with caution as the accuracy of the meter should be taken into account. It is estimated that ME personnel would be expected to reach the upper exposure action value (85 dB(A)) based on a given typical working day. Hearing protection currently available within the MoD, if well maintained and used appropriately, should provide sufficient protection against the high sound pressure levels measured in these spaces.

R00028187
Body Mass Index and Body Mass Index Changes in Royal Naval Personnel 2007-2011
Institute of Naval Medicine, Alverstoke (GB) (2011)
This report details the findings of the longitudinal study of Naval Service Stress with regards to self reported body mass index (BMI) and changes to body mass from 2007 to 2011. Self reported height and weight were gathered in 2007 and again in 2011, with waist circumference being reported in 2011; a sample of 991 Royal Navy personnel provided viable responses. Mean body mass change over the four years was positive, increasing approximately 1.47 (± 6.1) kg in both males and females (0.37 kg/year). Thirty seven percent of females and 14% of males were at increased risk of health problems according to high self reported waist circumference. In 2011 obese males were 2.8 times and obese females 4.5 times more likely to be medically downgraded. The prevalence of obesity increased over the period.

R000281BB
Body Mass, Weight Loss and Psychological Strain in the Rn
Institute of Naval Medicine, Gosport (GB) (2011)
In early 2011, the health and lifestyle section of the 'Work and Well-Being Questionnaire' was sent to 1896 participants in the Royal Navy Longitudinal Survey of Stress (2007-2011). Data on Body Mass Index (BMI) and waist circumference in 2011 were used to categorise respondents according to their risk of developing health problems. This report investigates whether the self-reported desire to lose weight was associated with either being at increased risk according to BMI and waist circumference, or with psychological strain. It was found that those at increased risk were more likely to want to lose weight, as were those who had gained body mass since 2007. Only a very weak relationship was found between change in strain levels and change in body mass 2007-2011, suggesting that these two variables are not strongly related. The proportion of the last four years spent serving onboard ship, as opposed to in a shore-based establishment, was not related to weight loss desire or change in body mass. It was concluded that over half the personnel in the sample reported that they would like to lose weight, and therefore interventions which target weight loss are likely to be well received.

R000281C5
Factors Which Influence the Employment Retention and Voluntary Outflow from the Royal Navy
Institute of Naval Medicine, Gosport (GB) (2011)
The Institute of Naval Medicine (INM) was tasked by Fleet Naval Life Management (FNLM) to conduct a cohort study of occupational stress in the Naval Service, commencing in 2007 and continuing until 2012. This five-year research programme is investigating the operational implications of stress upon hard outcomes (such as accidents in the work place and fitness for work) in the Naval Service. This report specifically looks at the role of stress and other physical health, and psychosocial factors on whether an individual will leave the Naval service prematurely. Analysis of data captured in January 2007, using a work and well-being questionnaire, identified the demographics of personnel most likely to leave the Naval service early. Further investigation identified specific characteristic differences between premature leavers and a group of retained personnel matched for age, gender, rank and length of service in 2007. The results show clearly that, although premature leavers experienced more stress compared to retained personnel, stress was not a causal factor in predicting their early exit from the Naval service. Factors that did predict premature leaving were found to be very different between ranks. Junior rates who left the Naval service early had intended to serve for a shorter length of time, felt less organisational commitment, and reported more back problems. On the other hand, senior rates left because they felt they had less autonomy and control over their work. Officers leaving early reported poorer coping strategies for dealing with problems and a feeling of being disrespected in the workplace. The implications of these findings are discussed in relation to reducing early release in the Naval Service.

R00028CE9
Noise exposure from firing a General Purpose Machine Gun from a Bulldog Protected Weapons System
Institute of Naval Medicine, Alverstoke (GB) (2011)
Recordings were made of noise exposure of different crew members involved in firing a General Purpose Machine Gun from a Bulldog Protected Weapons System. Time histories were acquired of noise from live rounds fired at rates of 25 and 100 rounds per minute. The data have been assessed and interpreted in accord with current standards concerned with health effects

of exposure to noise: MoD DEFSTAN 00-27 and the Control of Noise at Work Regulations (CNAWR) 2005. The highest peak sound pressure level measured was 157 dB(C) (1349 Pa) at the driver's location; the corresponding sound exposure level was 128 dB(A). The data show that the peak upper exposure action value (peak sound pressure level of 137 dB(C)), was exceeded on firing the protected weapons system. The CNAWR peak exposure limit value of 140 dB(C), that takes into account the protection afforded by hearing protection, is unlikely to be exceeded using any of the commonly available hearing protection within the MoD. If personnel are regularly exposed to such noise levels, then it is recommended that they be informed and trained on the forms of action that they can take to reduce their exposure to noise and that a programme of health surveillance is put in place.

R00028CEC
Noise exposure from firing a Phalanx 1B Close In Weapon System onboard HMS Daring
Institute of Naval Medicine, Alverstoke (GB) (2011)
Recordings were made of noise exposure of different crew members involved in firing a Phalanx IB Close In Weapon System guns onboard HMS Daring. Time histories were acquired of noise from live rounds fired at rates of 50 and 75 rounds per second. The data have been assessed and interpreted in accord with current standards concerned with health effects of exposure to noise: MoD DEFSTAN 00-27 and the Control of Noise at Work Regulations (CNAWR) 2005. The maximum peak sound pressure level measured was 156dB(C) at the operator's (Gunnery Safety Officer) location. The sound exposure level for firing the Phalanx gun was 141 dB(A) based on a burst comprising 460 rounds. The data show that the peak upper exposure action value (peak sound pressure level of 137 dB(C)), was exceeded after firing the Phalanx guns. The CNAWR peak exposure limit value of 140 dB(C), that takes into account the protection afforded by hearing protection, would probably not be exceeded using the current combination of hearing protectors. If personnel are regularly exposed to such noise levels, then it is recommended that they be informed and trained on the forms of action that they can take to reduce their exposure to noise and that a programme of health surveillance is put in place.

R00029402
Occupational noise exposure survey onboard HMS Ocean
Institute of Naval Medicine, Alverstoke (GB) (2012)
Noise measurements were made in 29 compartments and cabins at various locations onboard HMS Ocean during transit from Gibraltar to Devonport, UK. Measurements included noise in 15 accommodation spaces. The data have been assessed and interpreted in accord with The Department of Transport's Code of Practice for Noise Levels in Ships (1990) and The MoD Defence Standard 07-254 (1987). The A-weighted equivalent continuous sound pressure levels show that 7 accommodation spaces onboard HMS Ocean exceeded the recommended limits specified in the standards. Nine other compartments were found to exceed the recommended limits, these include the ME tech office, the pay office, the main ward of the medical complex and the computer room. Although these compartments and spaces were seen to exceed the recommended limits, those measurements that exceed the limits by 1 dB(A) or less should be used with caution as the accuracy of the sound level meter should be taken into account. Measurements were also made with the ship alongside whilst docked in Gibraltar and running off its own power supply. The highest A-weighted equivalent continuous sound pressure level measured was 76 dB(A) with the supply and exhaust fans operating. Personnel working alongside the ship whilst these fans are operating are not likely to exceed the Lower Exposure Action Value (80 dB(A)).

R000283BF
Submarine Exposure Limit Review: Carbon Dioxide (2011)
Institute of Naval Medicine, Alverstoke (GB) (2011)
The toxicology of carbon dioxide has been reviewed to assess whether the current 90 day maximum permissible concentration (MPC90) of 0.7% requires amending, to support future submarine design. Current research indicates that the 0.7% limit is sufficient to protect submariners' health.

R00027D80
Survey of Accidents in the Royal Navy in Relation to Measures of Stress and Cognitive Demands
Institute of Naval Medicine, Alverstoke (GB) (2011)
The Institute of Naval Medicine (INM) was tasked by Fleet Naval Life Management (FNLM) to conduct a cohort study of occupational stress in the Naval Service, commencing in 2007 and continuing until 2012. This 5-year research programme will investigate the operational implications of stress upon hard outcomes in the Naval Service. This report specifically looks at the role of stress and cognitive failures in workplace accidents. Retrospective analysis of accident-case individuals vs. control-match case individuals on general health questionnaire (GHQ) score and Cognitive Failures Questionnaire (CFQ) score from amalgamated data of two Royal Navy databases was undertaken. Individuals in the accident- case sub-sample had higher GHQ and CFQ scores when compared to controls. Further analysis revealed individuals with high GHQ scores {strain cases) to be almost 3 times more likely to have an accident, compared to those with low GHQ scores. Similarly, individuals with high CFQ scores were 4 times more likely to have an accident than those with low CFQ scores. This report concludes that GHQ and CFQ are both strong indicators of an individual's susceptibility to having an accident and highlights recommendations to reduce accident-occurrence within the Naval workplace.

R00027DE6
Vibration measurements on riveting tools used at Naval Air Squadron, Portsmouth
Institute of Naval Medicine, Alverstoke (GB) (2011)
Vibration measurements were made on hand-held tools (riveting gun and dollies (reaction bars)) used at 1710 NAS Portsmouth. Vibration measurements were made

on the handles of the tools during normal operations. The vibrations have been analysed and interpreted according to the current standards and guidelines including the Control of Vibration at Work Regulations 2005 (CVAWR). The assessments have been conducted with respect to the daily exposure action (2.5 ms-2 r.m.s.) and limit (5 ms-2 r.m.s.) values specified in the CVAWR. Total vibration magnitude measured on the riveting gun was 1.2 ms-2 r.m.s. and that measured on the dolly was 2.7 ms-2 r.m.s. The numbers of operations required to exceed these values have been calculated. The results suggest that the riveting gun and the dollies would have to be operated on more than 1000 rivets to reach the action value. These estimates for the numbers of operations and duration are dependent on other factors including the manner of operation and maintenance of the machine. Recommendations are made on the actions that could be implemented to minimise the risk of injury from exposure to vibration.

R00029A1A
Numerical and Experimental Analysis of an ARH Tiger Fuselage
Defence Science and Technology Organisation (AU) (2011)
The Defence Science and Technology Organisation (DSTO) supports the Australian Defence Force (ADF) by developing helicopter flight aerodynamic and slung load models for a variety' of research activities. Simulation models require a unique set of fuselage aerodynamic coefficients for a range of aircraft attitudes. In the absence of data from the Original Equipment Manufacturer (OEM) DSTO must seek alternative data sources. This document compares the findings of numerical and experimental investigations into the fuselage aerodynamic characteristics of an Armed Reconnaissance Helicopter (ARH) Tiger.

R00028928
Rotor-tip Lighting and the Perception of Helicopter Orientation under Simulated Night Vision Goggles Imagery
Defence Science and Technology Organisation (AU) (2011)
Night formation flying in military helicopters is often a demanding perceptual-motor task that requires aircrew to make accurate and timely judgements about the relative separation and orientation from other aircraft. One technology that may offer improvements in the perception of relative movement under night time visual conditions is rotor-tip lighting. In this study, participants viewed static, computer generated images of a Black Hawk helicopter similar to the view obtained through Night Vision Goggles (NVGs). The task was to determine whether a subsequent image was at the same or a different orientation as the first image. Images differed in either pitch or roll between 1 and 6 deg. In the first condition, formation and position lights where visible, and in the second condition rotor-tip lights were added. The results showed a significant improvement in the sensitivity and response time to detect changes in roll greater than 2 deg when rotor-tip lights were visible. There was a smaller improvement in sensitivity and response time to detect changes in pitch. The possible factors that made perception of changes in orientation easier with rotor lights include the increased size and contrast of the rotor disk, and cues from the rotor-tip ellipse including its orientation, curvature, and aspect ratio. An increased awareness of relative movement of aircraft information is likely to contribute to an increased level of aircrew situation awareness.

R00029A19
Use of Maritime Operations Tasks (MOTs) for Force Structure Evaluation (U)
Defence Science and Technology Organisation (AU) (2011)
A Navy Force Structure Assessment framework has been developed based on a list of Maritime Operations Tasks (MOTs). This report details version 2.0 of the MOTs, the database tool developed to collect and store assessments by subject matter experts and a web application to allow Navy staff to access those assessments. A review of a number of assessment workshops with results compatible with the framework is included.

R00027EE2
Issues and Approaches for the Application of SOA to Dependable Systems
IBM (GB) (2010)
Network Enabled Capability is the primary motivating force in the MOD driving the adoption of a Service Oriented Architecture approach for managing complexity in systems integration. The objective of this report is to investigate and recommend ways to address the challenges that this approach introduces in providing systems that are sufficiently trustworthy for NEC. It was found that in general the current body of knowledge related to the dependability of systems when an SOA style is used is immature, with the majority of practices present in research papers rather than hardened in industry best practice. This is not necessarily a reflection on SOA but more on the aspirations of NEC and its ultimate requirements for interoperability and agility.

R000280FF
Framework Protyping for Distributed Users of Distributed Rigs
Loughborough University (GB) (2009)
SSEI Project Task 4 aims to define and validate, through demonstrable prototypes, a Distributed Integration Framework (DIF) to integrate and test realtime embedded software systems. In particular, it tackles the situation where the hardware and software elements of such a system have been developed by different organizations in physically different locations, and there is value in performing distributed integration before all hardware is brought to a single physical rig. In the previous activities of Task 4, initial framework prototypes were developed for distributed users of a single rig (Activity 3) [1], and single user of multiple rigs (Activity 4) [2]. The activity reported (Activity 5) in this document is a further investigation of the DIF. Now, multiple distributed rigs can be tested and monitored

by multiple users (or integrators). The key architectural technologies adopted in the development of the DIF prototype are Data Distribution Service (DDS) [5] and Service-Oriented Architecture (SOA). This document reports the outcomes of this DIF prototype.

R00027E9C
State of the Art in Distributed Integration Frameworks
Loughborough University (GB) (2008)
This particular document is a review of the state-of-the-art in the field of remote integration, maintenance and testing. The reviews covers current distributed framework standards, implementation technologies and a range of available or ongoing applications in various industries. As a consequence of the review, it is proposed that the DIF definition will be based on the SOA (Service Oriented Architecture) concept and implemented in the form of a data-centric publisher/subscribe architecture, employing OMG standard DDS (Data Distribution Service) middleware for communications.

R00028136
Resilient Distributed Control in Hostile Communications Environments
Roke Manor Research Ltd, Romsey (GB) (2008)
This report contains the conclusions of the SEAS DTC project to investigate resilient distributed control in unreliable communications. A mechanism for the distribution of control within a multi-agent system is presented, together with a communications architecture and data transfer algorithms to support it. The performance of these mechanisms and algorithms is investigated in simulations of multi-agent systems operating unreliable communications. The main outcome of the simulations is successful operation of distributed applications in communication conditions which would defeat standard internet Protocol, or most similar protocols using automatic retransmission request methods to provide resilience. This result depends on the appropriate decentralisation of the applications involved. The proposed decentralised communication manager solution does not solve all of the problems that are solved by Internet Protocol or other, application specific protocols. The best deployment strategy may be to operate the communication manager over communication links multiplexed with existing protocols, at the link layer for example. In this configuration it is anticipated that, as well as supporting decentralised applications, the communication manager would also increase communication system utilisation without compromising existing resilience.

R00027EDD
Application of Air Systems IMS Concepts to Land Systems Applications
SEIC (GB) (2009)
Defence procurement is traditionally organised by military sector, for example projects targeted at providing land, sea or air capabilities. Expertise and tailored technical solutions will always be required to meet sector specific needs. However, it is well recognised that many technologies developed within a single military sector or project could benefit other defence projects and sectors. This is particularly true for software engineering activities, where challenges such as reducing lifecycle costs, improved platform availability and obsolescence mitigation are faced across a broad range of defence software projects. Reusing best practice software concepts across military sectors may help meet these challenges. One candidate technology for supporting this reuse is Integrated Modular Systems (IMS), an established architectural approach for building high integrity electronics and software architectures onboard aircraft. This report has assessed how the IMS concepts can be extended to support other domains, using the military land sector as a case study. As a long term vision, due to the similar top-level requirements from software between the land and air sectors there is certainly an opportunity to adopt common standards and technologies. This would benefit the UK MoD in that it would allow greater reuse of software development activities and artefacts across projects. However, it would probably be impossible to find this commonality in a one size fits all solution, as there will always be requirements that differ between the sectors (for example integrity requirements).

R00028188
Towards Multi-Level Security for NATO Collective Mission Training - a White Paper
SISO, Florida (US) (2011)
Distributed simulation is rapidly becoming a necessity for collective mission training. With missions being joint and combined, we will never fight alone. Thus we need to train together, within and between nations. However, in any such scenario it is likely that some or all of the information may be classified at some level and need protection, be it scenarios, weapon and sensor capabilities or doctrines. In order for simulations to be interactive, one-way approaches such as data diodes will not work. Reclassification of systems using a “system high” approach has proven too complicated and expensive. This raises the need for true multi level security in collective mission training. This is indeed one of the big challenges in realizing the full potential of distributed simulation for defence purposes, As part of the NATO RTO program a new modelling and simulation working group has been formed, MSG-080, to look at this topic. Initial members include Canada, Estonia, France, the Netherlands, Norway, Sweden, UK and the US. A kick-off meeting has taken place in October 2010 and a first round of knowledge exchange has taken place. An early conclusion is that most participating nations have similar requirements. This paper summarizes the starting point for this group, including typical use cases where security solutions are needed, some basics about Multi-Level Security principles as well as a description of a few recent experiments carried out by some participants. Finally it describes some early considerations that were raised during the kick-off. Some examples are the need to obscure system capabilities, the need to support both simulation protocols and IT protocols (VoIP etc), the need for adequate performance and the need to get accreditation offices involved.

R00027E76
JFires Final Report Volume 1
Thales UK, Crawley (GB) (2011)
Team ForSIS was tasked by Capability Joint Training Evaluation and Simulation (Cap JTES) to support the Royal School of Artillery (RSA) in implementing a Joint Fires/Surveillance Target Acquisition Capability Concept Demonstrator (JFI/STA CCD). The work was proposed as a DCSIS event known as JFires. This is Volume 1 of the JFires Final Report, a summary document which highlights the main issues and lessons learnt from the JFires task, and should be read in conjunction with Volume 2 which details the technical information.

R00027E77
JFires Final Report Volume 2
Thales UK, Crawley (GB) (2011)
Team ForSIS was tasked by Capability Joint Training Evaluation and Simulation (Cap JTES) to support the Royal School of Artillery (RSA) in implementing a Joint Fires/Surveillance Target Acquisition Capability Concept Demonstrator (JFI/STA CCD). The work was proposed as a DCSIS event known as JFires. This is Volume 2 of the JFires Final Report, which follows on from the Interim Report provided in March 2011, and details the work undertaken by Team ForSIS during the whole of the JFires task, from January to May 2011. It should be read in conjunction v/ith Volume 1, which provides a summary of the main issues and lessons learnt from JFires.

R00027EE1
Behavioural Compatibility in Models
University of York (GB) (2010)
This report presents a method for checking behavioural compatibility and incompatibility between two models by comparing the functionality and messaging of the systems being integrated. It looks at a number of scenarios covering the amount of overlap between the two models, the systems are modelled using different notations, the systems are modelled using the same notation but applied in different ways, the systems are modelled in the same notation in similar ways but may contain inconsistencies. Comparisons between systems are made by construction of correspondence models for each system which can then be compared. Where possible, correspondence models should be constructed automatically from the systems models. The method described in this report explains the conceptual approach to resolving behavioural incompatibility but also includes a language and a tool (implementing an execution engine) that allows programmatic specification on how to compare models. This platform has the working title SMILE (Simple Model Integration Language and Execution engine). The structure checking part is called SMILE-X.

Project ATHENA is a MOD-funded project run by Dstl to provide MOD with a central repository for storing scientific and technical (S&T) reports of current and past research programmes and projects. This repository is known as the ATHENA Collection and is made available to MOD and Industry through a variety of products and services.

For further information about Defence Reporter, or to provide feedback, please contact: DefenceReporter@dstl.gov.uk

Acknowledgements
This publication was supported by the Defence Science and Technology Organisation (DSTO) of Australia and the Institute of Naval Medicine, who have provided report citations for inclusion in Defence Reporter.