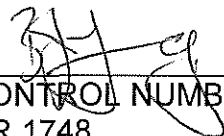
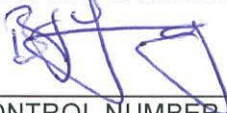



<b>DOCUMENT CONTROL SHEET</b>	
1. ORIGINATING ACTIVITY Defence Technology Agency Auckland, New Zealand	2. RELEASE AUTHORISED BY: 
3. REPORT NUMBER 448	4. CONTROL NUMBER NR 1748
5. DATE March 2021	6. NUMBER OF COPIES 4
7. SECURITY CLASSIFICATION UNCLASSIFIED	8. RELEASE LIMITATIONS UNLIMITED
9. TITLE Potential uses for Virtual Reality in the Defence Force	
10. AUTHOR(S) Iain P Gillies	11. AUTOMATIC DOWNGRADING
12. KEYWORDS EJC THESAURUS TERMS training simulator, simulation, 3D display systems, stereophotography	NON-THESAURUS TERMS VR, virtual reality, headset, 360 video
13. ABSTRACT There are many cases in the New Zealand Defence Force where real equipment is used for training because no suitable simulator exists. Through developments of the video gaming industry Virtual Reality (VR) has advanced to a stage where it can be effectively used for training and could reduce the burden on real equipment. The main benefit of VR is the highly immersive display that brings the user inside the virtual environment and increases the realism. Compared with dome simulators, it has the additional benefits of portability and reduced cost. These benefits enable collective VR training exercises where units can practice their teamwork and coordination. This report discusses how VR is being used by militaries and industry. While the focus is training, other use cases are identified. It discusses the benefits and limitations of VR systems and the ongoing technology improvements. Finally, a checklist is provided to help the services determine if a certain task or role is well suited to VR-based training.	

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<b>DOCUMENT CONTROL SHEET</b>	
1. ORIGINATING ACTIVITY Defence Technology Agency, Auckland, New Zealand	2. RELEASE AUTHORISED BY 
3. REPORT NUMBER DTA Report 441	4. CONTROL NUMBER NR 1736
5. DATE June 2019	6. NUMBER OF COPIES 5
7. SECURITY CLASSIFICATION  Unclassified	8. RELEASE LIMITATIONS
9. TITLE Environmental Controls on the Performance of IR, Laser and Optical Sensors in the Maritime Environment	
10. AUTHOR(S)  Jamie D Halla	11. AUTOMATIC DOWNGRADING
12. KEYWORDS EJC THESAURUS TERMS  NON-THESAURUS TERMS  Environmental Controls, Electro-optical sensors, IR, Laser	
13. ABSTRACT  This report describes the environmental conditions that contribute to both improved and diminished performance of infra-red, laser and other optical sensors in the maritime environment. It then outlines steps to rapidly assess those environmental conditions, both remotely and in situ. Finally, it provides recommendations for how this may be done on current and future vessels of the Royal New Zealand Navy.	

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1. ORIGINATING ACTIVITY Defence Technology Agency Auckland, New Zealand	2. RELEASE AUTHORISED BY: 
3. REPORT NUMBER 436	4. CONTROL NUMBER NR 1731
5. DATE February 2019	6. NUMBER OF COPIES 4
7. SECURITY CLASSIFICATION Unclassified	8. RELEASE LIMITATIONS
9. TITLE  Mixed Reality Training Method: Performance benefits for routine vehicle maintenance tasks.	
10. AUTHOR Janelle Aitken Hayden Ross	11. AUTOMATIC DOWNGRADING
12. KEYWORDS Mixed reality, training, vehicle maintenance.	NON-THESAURUS TERMS
13. ABSTRACT Mixed Reality (MR), as a training medium, has been explored as method to train New Zealand Army automotive technician apprentices in routine vehicle maintenance tasks. It is important to understand how this might impact the task performance of apprentices. This paper explores the topic and addresses the research question: How does a MR training method influence productivity and quality of a routine vehicle maintenance task conducted on military vehicles? To address this topic, a pilot study was conducted that compares the performance of eight automotive technician apprentices who were tasked with conducting a routine vehicle maintenance task using the extant or current training method, and MR training method. Apprentices completed pre-training and post-training surveys to provide their perceptions of the experience. The results suggest that there is no significant difference between the extant and MR training methods with regards to apprentice's task performance times. However, the MR training method led to fewer errors during the training task. Additionally, participants agreed that MR is easy to use, but would not replace the need to have a qualified instructor on hand. While the small sample size limits the extent to which these finding can be generalised, the contribution of this work is in demonstrating, as a proof of concept, that MR training methods can be a viable option for training routine vehicle maintenance tasks and that it can offer advantages that are not currently observed through the use of the extant training method.	




<b>DOCUMENT CONTROL SHEET</b>	
1. ORIGINATING ACTIVITY Defence Technology Agency, Auckland, New Zealand	2. RELEASE AUTHORISED BY: 
3. REPORT NUMBER DTA Report 434	4. CONTROL NUMBER NR 1729
5. DATE March 2021	6. NUMBER OF COPIES 9
7. SECURITY CLASSIFICATION UNCLASSIFIED	8. RELEASE LIMITATIONS
9. TITLE Calibration of a Vector Magnetometer in a Wave Glider SV3	
10. AUTHOR(S) Nathaniel de Lautour, Peter Qiu	11. AUTOMATIC DOWNGRADING
12. KEYWORDS EJC THESAURUS TERMS	NON-THESAURUS TERMS
13. ABSTRACT  In 2018 DTA conducted a sea trial of a Wave Glider SV3, in part to explore its potential as a magnetic sensor platform. Applications of interest are anti-submarine warfare, and magnetic anomaly assisted navigation in which measurements of earth's magnetic anomaly field are used to correct for drift in inertial navigation systems. Because magnetometers are affected by platform noise real-time sensor calibration may be required. This report describes an approach to calibration that exploits platform motion in turns, and applies this to vector magnetometer data collected during the 2018 sea trial. The method did not perform well on this dataset, but may work better on a faster vehicle that generates greater pitch and roll motion in turns.	

<b>DOCUMENT CONTROL SHEET</b>	
1. ORIGINATING ACTIVITY Defence Technology Agency Auckland, New Zealand	2. RELEASE AUTHORISED BY: Ryan E Brookes
3. REPORT NUMBER 430	4. CONTROL NUMBER NR 1725
5. DATE December 2018	6. NUMBER OF COPIES
7. SECURITY CLASSIFICATION Unclassified	8. RELEASE LIMITATIONS Nil
9. TITLE Integration of NZDF Remotely Piloted Aircraft Systems (RPAS) into New Zealand Civil Airspace	
10. AUTHOR(S) James M Pointon	11. AUTOMATIC DOWNGRADING
12. KEYWORDS EJC THESAURUS TERMS	NON-THESAURUS TERMS ADS-B, Airspace, BVLOS, Remotely Piloted Aircraft System, RPAS, Unmanned Aircraft System, UAS, UAV
13. ABSTRACT <p>Integration of Remotely Piloted Aircraft Systems (RPAS) into civil airspace is a complex problem that is being investigated within New Zealand and internationally. For the New Zealand Defence Force (NZDF) seamless access to civil airspace would enhance RPAS operational capability for military training and non-military tasks, whereas current operational restrictions are likely to limit or preclude the use of RPAS for certain roles.</p> <p>This report identifies the current issues associated with integration of NZDF RPAS into New Zealand civil airspace. This is based on a DTA review of public domain information, which illustrates the underlying principles and assumptions currently put forward by various stakeholders involved in addressing RPAS integration in New Zealand and internationally.</p> <p>Technological solutions and other airspace integration enablers are also identified and discussed. Near term NZDF Beyond Visual Line Of Sight (BVLOS) RPAS operations in civil airspace will need to be accommodated via procedural air traffic separation. Seamless airspace integration for RPAS will require Detect-And-Avoid (DAA) technology that is currently in development. An opportunity is identified to facilitate RPAS operations throughout New Zealand by extending current proposals for air traffic surveillance via Automatic Dependent Surveillance–Broadcast (ADS-B) to include uncontrolled airspace.</p> <p>It is recommended that demonstrations or initial restricted operations may be appropriate to gain confidence that the associated technologies and procedures are fit-for-purpose. The NZDF may also be able to leverage experience from partner countries and is well placed to take a lead role where a clear need or benefit exists.</p>	

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<b>DOCUMENT CONTROL SHEET</b>	
1. ORIGINATING ACTIVITY Defence Technology Agency, Auckland, New Zealand	2. RELEASE AUTHORISED BY 
3. REPORT NUMBER 425	4. CONTROL NUMBER NR 1715
5. DATE Sep 2017	6. NUMBER OF COPIES 7
7. SECURITY CLASSIFICATION UNCLASSIFIED	8. RELEASE LIMITATIONS
9. TITLE Impulse Noise Measurement and Assessment in the New Zealand Army: A Scoping Study	
10. AUTHOR(S) Nathaniel de Lautour	11. AUTOMATIC DOWNGRADING
12. KEYWORDS EJC THESAURUS TERMS Impulse noise, hearing protection, gunshot noise, blast noise	NON-THESAURUS TERMS
13. ABSTRACT <p>The New Zealand Army Landworthiness Authority has recently considered the risk of hearing damage in the NZDF due to impulse noise exposure. The need for a consistent noise database of all in-service weapons was identified, with a view to informing a hearing protection program. This report considers the problem of impulse noise measurement and assessment of noise exposure, with the aim of meeting the requirements of the Health and Safety at Work Act. Existing standards and guidelines relating to impulse noise are reviewed, and a measurement system capable of capturing the necessary acoustic data is proposed. Finally, areas where scientific uncertainties remain are identified and mitigation approaches suggested.</p>	

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1. ORIGINATING ACTIVITY Defence Technology Agency Auckland, New Zealand	2. RELEASE AUTHORISED BY: 
3. REPORT NUMBER 416	4. CONTROL NUMBER NR 1702
5. DATE 2017	6. NUMBER OF COPIES 14
7. SECURITY CLASSIFICATION Unclassified	8. RELEASE LIMITATIONS Unlimited
9. TITLE Polyurethane sandwich panel systems for ship hull reinforcement	
10. AUTHOR(S) Benjamin P. Withy	11. AUTOMATIC DOWNGRADING
12. KEYWORDS EJC THESAURUS TERMS Sandwich panels	NON-THESAURUS TERMS Ice protection Ice strengthening
13. ABSTRACT The Royal New Zealand Navy (RNZN) regularly patrol the waters of the Sub-Antarctic Islands and the Southern Ocean in support of the Department of Conservation and Ministry of Primary Industries. Operation in these waters includes the potential presence and threat from ice, and RNZN Offshore Patrol Vessels are protected against ice with a belt of thicker steel about the waterline. Excessive pitch and roll of vessels can however result in thinner and more vulnerable areas of the hull being exposed to sea ice. Defence Technology Agency were tasked by the RNZN to evaluate whether there was potential to enhance the level of ice protection on vessels through the use of a polyurethane cored steel faced sandwich panel system that has recently been offered by commercial suppliers. This report summarises mechanical testing undertaken to explore the viability of this type of sandwich panel system. Testing included shear, flexure and impact testing across the likely temperatures that the system would be operationally exposed to, as well as fatigue and corrosion testing. Results of the tests indicate that a polyurethane cored steel faced sandwich panel system is a viable solution for hull reinforcement, and raised a number of recommended questions that should be answered by any prospective supplier of a solution to the RNZN.	