

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 18-08-2010		2. REPORT TYPE Final Report		3. DATES COVERED (From – To) 17 August 2009 - 17-Aug-10	
4. TITLE AND SUBTITLE Request for Extension of Grant FA8655-06-1-3017-P00001 Registration of a Dynamic Multimodal Target Image Test Set for the Evaluation of Image Fusion Techniques			5a. CONTRACT NUMBER FA8655-09-1-3095		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Dr. Alexander Toet			5d. PROJECT NUMBER		
			5d. TASK NUMBER		
			5e. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) TNO Defense, Security and Safety Kampweg 5 Soesterberg 3769DE The Netherlands			8. PERFORMING ORGANIZATION REPORT NUMBER N/A		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) EOARD Unit 4515 BOX 14 APO AE 09421			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) Grant 09-3095		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT TNO has completed the construction of the TRICLOBS 3-band nightvision system. This newly developed system consists of two digital image intensifiers (Photonis ICUs) and an uncooled longwave infrared microbolometer (XenICS Gobi 384). This night vision sensor suite registers the visual (400-700 nm), the near-infrared (700-1000 nm) and the longwave infrared bands of the electromagnetic spectrum. The optical axes of the three cameras are aligned, using two dichroic beam splitters (an ITO filter to reflect the LWIR part of the incoming radiation into the thermal camera, and a B43-958 hot mirror to split the transmitted radiation into a visual and NIR part). The field-of-view of the cameras is nearly the same, and any rotations between camera images has been be minimized. The registration of the individual images therefore requires only a minimal amount of computational effort. Software has been developed to register the signals from all 3 cameras simultaneously, display the images, and write them to a hard disk. The system was tested and multiband video was registered during a preliminary pilot field trial in a Dutch MOUT village. The imagery was used to make final adjustments to the camera system before registering imagery in the last phase of this project. The raw imagery has now been registered and fused into a false-color representation, suitable for input to sensor fusion algorithms.					
15. SUBJECT TERMS EOARD, Human Factors, sensors					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UL	18, NUMBER OF PAGES 3	19a. NAME OF RESPONSIBLE PERSON TAMMY SAVOIE, Lt Col, USAF
a. REPORT UNCLAS	b. ABSTRACT UNCLAS	c. THIS PAGE UNCLAS			19b. TELEPHONE NUMBER (Include area code) +44 (0)1895 616459



**DEPARTMENT OF THE AIR FORCE
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO**

August 18, 2010

MEMORANDUM FOR AFRL/HEH (Wright Site Institutional Review Board)

FROM: TNO Defense, Security and Safety, location Soesterberg

SUBJECT: Final report for Grant FA8655-09-1-3095 "Request for Extension of Grant FA8655-06-1-3017-P00001 Registration of a Dynamic Multimodal Target Image Test Set for the Evaluation of Image Fusion Techniques"

1. Status of Study:

TNO has completed the construction of the TRICLOBS 3-band nightvision system. This newly developed system consists of two digital image intensifiers (Photonis ICU's) and an uncooled longwave infrared microbolometer (XenICS Gobi 384). This night vision sensor suite registers the visual (400-700 nm), the near-infrared (700-1000 nm) and the longwave infrared (8-14 μ m) bands of the electromagnetic spectrum. The optical axes of the three cameras are aligned, using two dichroic beam splitters (an ITO filter to reflect the LWIR part of the incoming radiation into the thermal camera, and a B43-958 hot mirror to split the transmitted radiation into a visual and NIR part). The field-of-view of the cameras is nearly the same, and any rotations between camera images has been minimized. The registration of the individual images therefore requires only a minimal amount of computational effort.

Software has been developed to register the signals from all 3 cameras simultaneously, display the images, and write them to a hard disk.

The system was tested and multiband video was registered during a preliminary pilot field trial in a Dutch MOUT village. The imagery was used to make final adjustments to the camera system before registering imagery in the last phase of this project.

Scenarios were designed to record dynamic multispectral imagery during a field trial in the Netherlands in June 2010. The scenarios included targets with a range of different sizes, thermal and visual contrasts. A multimodal test target, especially designed for this purpose, and kindly provided to TNO by Dr. Alan Pinkus (WPAFB, Dayton, Ohio) was also included in the images. The resulting set of multimodal images can be used for the evaluation of objective image quality metrics.

The imagery was collected at a Dutch military base in Amersfoort (The Netherlands), according to the newly developed scenarios. The scenarios involved the TRICLOBS camera system approaching the targets, which were placed against a rural background (rugged countryside with heather and trees), which provided a significant level of clutter.

The position of the camera system relative to the location of the targets was accurately registered.

The raw imagery was handed over to Dr. Alan Pinkus (WPAFB, Dayton, Ohio) .

The raw imagery has now been registered and fused into a false-color representation, suitable for input to sensor fusion algorithms. This data will be handed over to Dr. Alan Pinkus during a WoS visit of two TNO employees to WPAFB in September 2010.

2. Summary of Subjects: This study did not involve any experiments with human subjects.
3. Summary of Resources: From the start of the project until August 1, 2010, 185 man-hours have been made, and Euro 969 has been spent on expendable supplies and materials.
4. Objective: The objective of this project was to acquire and register a multimodal target image test set that can be used to assess the operational effectiveness of image fusion techniques for a range of relevant military tasks. This goal has been fully achieved.
5. Publications or Presentations:
 1. Toet, A. & Hogervorst, M.A. (2010). Real-time full color real-time multiband night vision. Vision Sensors and Edge Detection. www.sciyo.com: Sciyo. In press.
 2. Dijk, D., Schutte, K., Toet, A. & Hogervorst, M.A. (2010). Image enhancement on the INVIS integrated night vision surveillance and observation system. In J.J. Güell & K.L. Bernier (Eds.), *Enhanced and Synthetic Vision 2010*, SPIE-7689-8 (pp. 1-12). Bellingham, WA: SPIE - The International Society for Optical Engineering.
 3. Toet, A., Hogervorst, M.A., Dijk, J. & van Son, R. (2010). INVIS: integrated night vision surveillance and observation system. In J.J. Güell & K.L. Bernier (Eds.), *Enhanced and Synthetic Vision 2010*, SPIE-7689-5 (pp. 1-16). Bellingham, WA: SPIE - The International Society for Optical Engineering.
6. Adverse events: No adverse events occurred in this period.
7. Amendments to Protocol: N.A.

Dr. Alexander Toet
Senior Scientist
Principal Investigator