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SITREP

"To dissuade and defeat threats as early and as far from U.S. borders as possible."

APPLIED AT-SEA TECHNOLOGY RESEARCH

ESTIMATION OF ATMOSPHERE AND OCEAN SURFACE INFLUENCE ON RADAR AND IR SENSOR PERFORMANCE FOR MDP

Threat surveillance and knowledge of detectability of own forces are essential in Maritime Domain Protection, as evidenced by the three successive attacks by unidentified small boats in the Northern Arabian Gulf last month. While coalition forces successfully stopped the attacks, unfortunately, loss of life did occur.

The explosive armed vessels were detected in broad daylight around 1700 local time. The time of day, lower atmosphere, and gulf surface conditions impacted detecting the threat and influenced the response in these cases. The success of the response could have been different if atmosphere and ocean surface effects were different.

Several MDP-TF researchers are currently studying the variations on radar and IR surveillance sensor performance caused by lower atmosphere and ocean surface conditions, emphasizing low radar cross section and low thermal cross section targets.

The project is based on transitions of models and procedures developed for U.S. Navy (USN) sensor performance prediction, to apply in port and coastal surveillance and also in response detection estimations. The U.S. Coast Guard, Research and Development Center (USCG/R&DC) is also adapting USN propagation effects tools in initiated programs to account for atmosphere and ocean surface effects in Search and Rescue Operations Planning Software (SAROPS). SAROPS uses a Multi-Sensor Performance Prediction (MSPP) toolset based on USN radar and IR effects models.

NPS experience in supporting field tests on radar/IR sensor performance suggests that, for port and coastal security, surveillance has to take atmosphere and ocean surface effects into account. The recent Northern Arabian Gulf incidents with low radar cross section and low thermal contrast small boats indicate that knowledge of such influences on surveillance sensor performance, and of the threat characteristics, will become essential in the design and selection of different procedures and assignments of resources. The environmental conditions affecting sensors, the targets involved, and the threat procedures important to Maritime Domain Protection are very different from ship self-defense against mach-1 surface-skimming missiles. Hence, special integration of models and testing of approaches are necessary.

The planned MDP measurement and data transmission system/network systems/ procedures will be designed on the basis of field collection that occurred with NAVSPECWARCOM combatant craft radar signature tests and in SOCOM/3rd Fleet endorsed overland network and surveillance systems demonstrations in several locations:

- Dam Neck, Virginia, August 2002
- San Clemente Island, California, June 2003
- NPS Surveillance, Targeting Acquisition Network (STAN-5) field test, Camp Roberts, California, February 2004.

Continuous small vessel measurements in the combatant craft target signature tests provided information on non-radar cross-section related variability in target range. Although fielded for target signature verification/validation, the combatant craft test involvement provided an excellent demonstration of application of sensors and propagation models for real-time descriptions for radar. Continuous multi-location measurements of the lower atmosphere and surface in STAN-5 NETWARCOM based demonstration provided a measure of the value of wireless network links between the field sensors to a Tactical Operations Center.

In a MDP NETWARCOM operation, the atmosphere data would be derived from deployed sensor nets to provide COP of

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MDP-TF to Host Two MDP Symposia

NPS and the MDP-TF will host a Threat and Vulnerability Assessment Symposium from 15-17 June at the Naval Postgraduate School in Monterey, California. The symposium will focus on an assessment of threats and vulnerabilities related to the maritime domain, and assist in the future coordination of MDP goals and methods by providing a platform for discussion and understanding of current efforts. The symposium will serve as the start of an iterative process to help bind together current thoughts, ideas, and concepts. This process will feed into systems engineering, maritime domain awareness working groups and a network of networks to help enable all MDP related organizations move rapidly from assessment to operations.

Designed as a series of presentations and panel discussions, the symposium will devote one day to threat assessments; one day to vulnerability assessments; and one day to future MDP related challenges and the requirements needed to meet these challenges. Many commands are already involved with symposium presentations and discussions, providing a great step forward in fostering cooperation and communication.

If you have not already done so, please refer to NPS Monterey, CA 290800Z APR 04 for further details, as well as clearance and registration information. Registration, accommodation, and administrative questions can be addressed to Mr. Will Costello or LT Mark Steliga commercial phone: (831) 656-2565 or by email to **mastelig@nps.edu.** We look forward to seeing you in June!

Mini-MDP Symposium

The NPS MDP-TF will host a Mini-symposium on Maritime Domain Protection from 9-11 June. Participants, including MDP-TF research teams, NPS Homeland Security curriculum faculty, and guests, will exchange initial progress information and share ideas.

If you are interested in participating in this informal symposium, please contact CAPT Jeff Kline at jekline@nps.edu and copy to Ms. Ann Wells at abwells@nps.edu.

The Mini-symposium schedule will be made available as it develops. If attending, please prepare a thirty-minute discussion on your organization's activities to present to the Task Force on 9 June.

NORTHCOM Maritime Threat Identification and Tracking Conference

NORTHCOM held their second annual Maritime Threat Identification and Tracking Conference from 30 March to 1 April 2004 at the Combined Intelligence Fusion Center on Peterson Air Force Base in Colorado. The purpose of the conference was to discuss and coordinate interagency and bi-national communication links and input into the Common Intelligence Picture (CIP) and its subsequent feed into the Common Operating Picture (COP).

Participants included ONI, MTAC, NMIC, NCIS, HQ USCG, MIFC, JFMCC, 2nd and 3rd Fleets, NSA, DIA, and Canadian NDHQ, Navy, and Trinity and Athena Joint Ocean Surveillance and Information Centres (JSOIC). Mark Stevens of the Systems Engineering and Integration group attended on behalf of the MDP-TF and NPS.

The first day of the conference was devoted to a synchronous threat, while the second and third days focused on an asynchronous threat. Participants divided into three major working groups for discussion of CIP/COP requirements, the actual Joint and Bi-national intelligence process and products, and collection of intelligence. The conference provided a great deal of information and insight into the current state of maritime intelligence and MDA within NORTHCOM and the degree to which that information is shared with Canada, and vice versa.

For details on this conference, please contact Mark Stevens, mstevens@nps.edu.

MDP Web Site Now Live!

The NPS Maritime Domain Protection Task Force is pleased to announce that our web site is now live and can be viewed at:

http://www.nps.edu/Academics/MeyerInstitute/MDP/

Please take a moment to view the Maritime Domain Protection Task Force logo. The logo represents the goals and aspirations of the Task Force:

- **Shield:** Represents Protection
- **Stripes**: Represent American Strength
- **Stars:** Represent Patriotism
- **Anchor:** Represents the Maritime Domain
- **Olive Branches:** Represent Peace

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surveillance capabilities, and response detection that varies with conditions.

Figure 1 illustrates distance versus time-of-day variability of predicted 2-way loss, exclusively caused by measured variability of atmosphere and ocean surface condition, during an August field test off Dam Neck, Virginia. Unclassified effects for a test of radar signatures of low cross section combatant craft are shown.

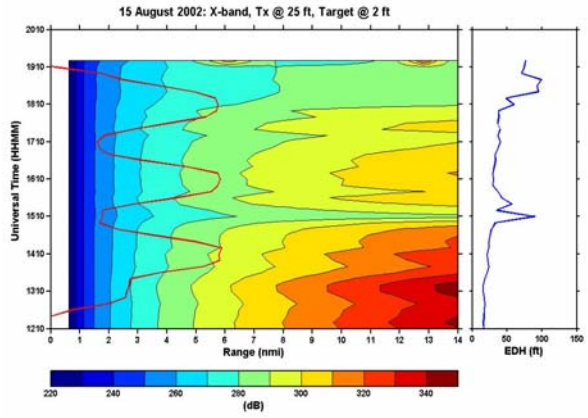

Figure 1: X-band 2-way loss out to 14 nmi as versus time-of-day. Right hand panel is calculated evaporation duct height. Estimated from lower atmosphere and ocean surface measurements and propagation model. Coastal region off Dam Neck, VA, August '02.

However, the significant variability shown in these results was confirmed in the actual detection results, for S- as well as X-band radars. Knowing the variations during execution of the described surveillance detection in the Northern Arabian Gulf or, better, forecasting the variation 24 hours in advance, would be critical to MDP operations. The influencing condition in the Dam Neck tests was associated with warm surface temperature (~26 C) that occurs in the Arabian Gulf and in the vicinity of Singapore, another MDP region of interest. An additional feature of this field test and a similar test off San Clemente Island, California, was to assess the value of mesoscale model 24-hour predictions for estimating the changes and, hence, being a part of mission planning.

The comprehensive approach followed in the MDP-TF effort encompasses five components:

- **Integration** of operational/near-term in situ and remote METOC measurement and prediction systems, including real-time satellite retrievals (3-D) and meso-scale model predictions (4-D).
- **Data transfer** from surface platforms to a tactical operations center to produce a Common Operating Picture (COP). The building blocks of the proposed mobile network include: Wireless data transmission unit in a forward (field) measurement vessel linked to base METOC receiver unit on the command platform; and Software/hardware interface between the base METOC receiver installed with multi-agent architecture for 2-way information exchange via network to Tactical Operations Center (TOC).
- **Adapt and integrate** physical environmental models (developed and verified) that produce radar refraction profiles and clutter and IR refraction, absorption, and turbulence (scintillation) from available METOC data sources (platform-measured, meso-scale model and satellite-based).
- **Selection and adaptation** of operational propagation models that use atmospheric descriptions (3-D refractivity profiles and 2-D surface roughness) to determine propagation characteristics.
- **Selection** of surveillance/detection Tactical Decision Aids (TDAs), which predict detection range probabilities for various sensors and targets and can be available both on operational platforms themselves and at a C4I center.

Integration of existing technologies for MDP purposes must be based on: Present remote and in situ measurement of atmosphere and ocean surface properties; High resolution model prediction and assimilation of dynamic processes of both the atmosphere and ocean; Open-ended information systems architecture; Radar and IR sensor modeling/representation; and Full evaluation of threat concepts and capabilities.

This project will integrate existing technology and provide surveillance operations information on the detectability of low cross section and low thermal contrast targets by radar and IR, and eventually by acoustic sensors. The outcome of this effort will be a highly modular set of components that can be "shaped together" in a variety of operational configurations for multiple uses including port security surveillance and small unit response team C4I support.

For additional information contact Team Project Leader, Professor Ken Davidson at kldavids@nps.edu.