Technical Evaluation Report

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INTRODUCTION

This symposium aimed at addressing the problems of protection of coalition forces operating in the littorals, focusing on the maritime element. It also considered the protection of naval assets while in home waters.

The symposium consisted of 9 technical sessions, the first of which was a Keynote session. It concluded with a round table discussion.

SESSION SUMMARIES

Keynote Papers

Keynote Address #1: RDML Nimmich (USA) focused on strategic challenges facing the national maritime domain awareness and security. With the possibility of terrorists sailing into harbor with massive destructive force, the need for tight interagency and international cooperation has been heightened. Transparency between agencies and countries must replace anonymity, resulting in a unity of effort and information sharing.

Whereas in traditional encounters, where the enemy is easy to locate but hard to kill, the terrorist threat is hard to locate, but once identified and located, is easy to kill. This paradigm shift requires the ability to identify anomalous behavior of a craft and its crew, and a reaction time measured in minutes, not hours.

Keynote Address #2: RAdm Veri (ITA) focused on the need for appropriate doctrinal procedures to enable appropriate decision making at all levels, in order to respond in a timely manner to a terrorist threat. The decision making process requires enhanced situational awareness information, with sufficient time to process the information. In conflict with this is the need for speed of execution of a response. The scale of an operation may have decreased from traditional encounters, but the necessary pace of operations has increased. To this end, the Italian Navy is introducing programs focused on educational, technical and procedural levels. The educational level introduces decision-making abilities for all levels of personnel; the technical level is developing systems to aid in the decision making; and the procedural level encourages the delegation of authority down the chain of command.

Situation Awareness / Maritime Domain Awareness

This session included 4 presentations.

Mr. Barkley presented a paper stressing the need for a collaborative information environment, including the development of smart agents for anomaly detection. The critical process steps of sense, process, fuse and

analyze, decide, and act require information sharing between distinct agencies and between coalition members.

Mr. Dwyer stressed that information sharing is crucial to achieve a comprehensive maritime awareness. Threats may be the actual vessel, or the cargo, or the people onboard the vessel. Vessel acquisition and tracking, validation, fusion and correlation, and report generation data are currently handled manually, but are in process ofbeing automated.

Mr. Radu presented a paper on harbor protection against terrorist threats. Terrorists prefer targets that represent a symbol, such as a drilling platform, a cruse ship or a navel ship, and usually use traditional explosives. The two high-probability-of-attack methods with high destructive potential are the use of fast inshore attack craft (FIAC) and underwater divers. For sonar protection from underwater divers, it takes approximately 17 minutes for the diver to traverse the 500 m range of a typical sonar. This then provides the time line available from the start of a hostile approach for a first alarm to be sound, the alarm to be evaluated, and the aggressor to be neutralized. A database of sonar fingerprints of non-hostile targets (dolphins) can help keep the false alarm probability low. . The three levels of educational, technical, and procedural, in the Italian Navy program, as described in second Keynote Paper, address this fast response time requirement for harbor protection.

Mr. Sendstad discussed the use of passive sensors / ESM sensors for littoral force protection. Target location can be determined from spatially distributed sensors, each providing bearing information, with the use of sat-com links, such as Iridium. This results in a network-centric warfare capability.

Systems for Complex Scenarios

This session included 3 presentations.

Mr. Sendstad presented several implementations for air defense for the Norwegian frigates in littoral waters. The organic, onboard long-range missile defense system presents a very high investment cost, but a very low running cost. Alternative implementations involving land-based fighter aircraft on direct support to the frigate presents a low investment cost (assuming that the fighter aircraft are already available), but a very high running cost. Two scenarios for the fighter aircraft were discussed; one with the aircraft on station above the frigate, and the other with the aircraft on alert.

Mr. Kimpel discussed countering asymmetric threats in the maritime and littoral environments. Whereas in the past, sensors were developed to detect and identify an opponent from a long distance, sensors and weapons are now needed for very short distances. Compounding this is the difficulty that sensor technology has in helping to reveal the intensions of the unknown vessel. Non-lethal weapons can be used to help determine the intensions; if the vessel does not react adequately to the use of the non-lethal weapon, then it should be considered suspect.

Mr. Benaskeur presented a paper on military sensor management. Several distributed control schemes were introduced. Centralized control was considered unsuitable, since a central node must be kept intact at all times. Fully decentralized control was also considered unsuitable, since it can lead to chaotic behavior. Hierarchical control has difficulties in that it is inflexible, and branches can become isolated if an element is incapacitated. A holonic approach was introduced that consists of autonomous, self-reliant units that cooperated to achieve the overall system objectives. The holons have the properties of autonomy, cooperation, self-organization (with other holons), and reconfigurability.

Advanced Technologies & Systems

This session consisted of 3 presentations.

Mr. Beharrel presented a summary of electronic surveillance systems in a dense radar signal environment. The trade-offs affecting the intercept probability for a single scan illuminator were used to present the multi-channel IFM receiver, and the scanned channelized receiver. Improvements in the probability of intercept by the simultaneous use of two (or more) channels having different scan ranges were given.

Ms. Reid presented a paper on the surveillance and countermeasures against laser and optical threats. Laser rangefinders, laser designators and laser beam-riders were discussed. Laser off-axis signatures were introduced as a means to counter beam-rider missile attacks in a maritime (high humidity, high aerosol content) environment. Also, retro-reflection, with adaptive time gating, was discussed as a means to locate all types of optical surveillance equipment pointed in the general direction of the vessel.

Ms. Deaver discussed small craft identification and discrimination criteria in a maritime environment. The ability of test subjects to identify several different types of craft, from several different aspect angles of observation, with different levels of focus and contrast were presented. A metric was developed that predicts the probability of identification for a given range (focus) and contrast.

Modeling & Simulation

This session consisted of 4 presentations.

Mr. Forand presented a paper discussing the effects of real-time environmental data, both meteorological and ship dynamic, on the ability to predict the detection performance of own-ship IR and RF sensors. Also, the ability of off-board IR and RF sensors to detect own-ship in the littoral environment was presented. An environmental processor was introduced that incorporates meteorological sensors, meteorological models, ship operation sensors, and ship operation models. The own-ship sensor capability and own-ship visibility are then computed and displayed as IR and RF range-height indicators, or Constant Altitude Plan Position Indicators.

Mr. Hazen discussed a virtual battle experiment focused on swarm attack command and control. The humans-in-the-loop, experiment will help in the study of military and team decision-making in confused tactical situations. A convoy of two high-value vessels being escorted through a constrained strait, by two coalition frigates was chosen for the scenario. Issues in organizing and orchestrating a lengthy, geographically distributed (multi time-zone) simulation exercise with humans-in-the-loop were presented.

Mr. Jeffrey presented a suite of simulation models combined to provide a hard-kill effectiveness prediction. The suite includes a weapon's lethality and fly-out model, and a target vulnerability and fly-out model. These are brought together in an engagement simulation to provide the vulnerability / lethality prediction. The complete suite for hard-kill effectiveness prediction is then integrated with a ship self-defense model that includes models for C^2, decision support, sensors, soft / hard kill defense, platform, environment and threats.

Mr. Hassaine discussed aspects of a synthetic environment for maritime-air tactical experiments.

Protection Systems: Underwater Aspects

This session consisted of 2 papers.

Mr. Kessel presented a paper dealing with the evaluation of force protection in ports against underwater intruders. After evaluating several commercial sonars, Mr. Kessel concluded that the sonar technology is mature, and efforts ought to be directed towards the integration of underwater surveillance and rapid response against underwater intruders. Capability is dependent on both the surveillance capability and on the ability to respond. The ability to respond must be a rapid, graded-level response, and the graded-level response could include non-lethal acoustic "boomers". Hostile intent must be positively identified before going to the next level.

Mr. Hagen discussed the HUGIN autonomous underwater vehicle program in Norway. The pilot HUGIN AUVs provide good range resolution and along track resolution, whereas the high resolution synthetic aperture sonar on the HUGIN 1000-MR provides excellent range and along track resolution. It can provide contact information bordering on inspection quality for a very wide swath, detecting the locations of underwater mines, and allowing the planning of safe routes around them.

Scenarios and Threats

This classified session included 3 papers.

Mr. Peekstok discussed aspects of the Netherlands research program on above water warfare in the littoral. An overview was given of the concept development process, including the need for demonstrations, experiments, modeling and simulation and analysis. Scenarios and threats were discussed, focusing on situational awareness, decision-making, weapons (including concepts and doctrines / tactics), and counter measures (laser retro-reflectors). A discussion on coordination and command covered rules of engagement, collaboration between cultures, and decision moments. The presentation ended with a discussion of the importance and difficulty of classification and identification, of tactically important events and the use of less lethal weapons.

Mr. Beard provided a presentation on defense against unconventional surface threats, focusing on fast inshore attack craft. The need to rapidly detect, classify, identify, warn and challenge such threats was stressed. The difficulty in achieving this centers on identifying the intent of any approaching craft. The use of surface unmanned vehicles, unmanned aeronautical vehicles and standoff craft or patrol boats to aid in this was discussed. Finally, the use of non-lethal weapons as a deterrence / identifier was covered.

Mr. Irwin presented a paper highlighting the vulnerability to top attack in littoral operations. An electronic warfare system, termed the Shortstop Electronic Protection System (SEPS), was discussed. This system receives the radio signal from the RF proximity fuse on an incoming artillery, and transmits a signal to the artillery causing it to detonate at a high elevation above ground.

Advanced Technologies and Systems

This classified session consisted of 2 papers.

Mr. Perkins discussed the role of directed energy weapons in future naval applications. The weapons include laser damage weapons and EO countermeasures. Issues of interoperability, and tactics, training, and procedures were presented.

Mr. Schelijpen presented a paper on countermeasures that are available against an asymmetrical threat in the littoral. The use of retro-reflection to locate and counter optical systems such as rangefinders, laser designators and laser beam-riders was covered. The use of the 250 to 300 nm wavelength optical region, where the sun has very low emission, was discussed for the observation of combatants. The need to detect unusual behavior, and to identify clues for hostile action was stressed.

Situation Awareness / Modeling & Simulation

This classified session, a combined one covering two themes, included 3 papers.

Mr. Van Bavel discussed the effect of the time-evolution of intelligence, surveillance, and reconnaissance operations. The timely detection, classification, and identification (for example, by using length measurements) of a possible threat were stressed.

Mr. Meijer presented a paper on the use of simulations for the evaluation of weapon effectiveness. The use of various non-lethal or "less"-lethal weapons was discussed.

Mr. Theil presented a paper on picture compilation in a multi-platform sensor network. Different approaches to the fusing of data were discussed, including contact level fusion and track level fusion. Dramatic improvements in performance parameters, such as gate size adaptation, were obtained with track level fusion over that achieved with a single sensor.

ROUND TABLE

Participants at the round table included Dr. Ashley, Dr. Lawrence, Mr. Simpson, Mr. Stordal, Ir. Willemsen, and Dr. Wight. Dr. Wight, the Technical Evaluation Reporter, led off the discussions, which quickly centered on the issues and difficulties of achieving information sharing between agencies and coalition members.

SYMPOSIUM PARTICIPANTS QUESTIONNAIRE RESULTS

Twenty-nine questionnaire responses were collected at the end of the symposium.

Most participants ranked the symposium as being sufficiently worthwhile. While approximately 20% found the symposium to be only partially worthwhile, an equal number found it to be very worthwhile.

All respondents found the theme of the symposium to be either appealing and topical, or very appealing and topical. However, 50% of the respondents felt that only about half of the papers met the objective of the symposium, while 25% of the respondents felt that only about half of the papers were relevant to the theme of the symposium.

While most participants felt that the general level of the papers was satisfactory, 20% felt that the general level was too superficial.

Three quarters of the respondents felt that the presentations of the speakers were well organized and effective, with the remaining feeling that about half of the speakers were was good.

All respondents felt that the time allowed for the speakers was about right, while 90% felt that the time allowed for discussion and exchange of ideas was about right. The remaining 10% felt that the time was too short.

All respondents felt that the symposium was effectively organized. Eighty percent of the participants gave an overall assessment of the symposium as good to very good, with the remaining 20% being equally divided between poor and excellent.

The winner of the most interesting paper competition was “Defense Against the Unconventional Surface Threat”, presented by Mr. A. Beard. Honorable mention was given to “Small Craft Identification Discrimination Criteria for Maritime Anti-Terrorism and Force Protection”, authored by Ms. Deaver and Mr. K. Krapels

SUMMARY

It became apparent to the technical evaluation reporter that really two scenarios to force protection against terrorist attack in the littorals exist. The first is an attack from a vessel entering a harbor, arriving from a foreign port, and laden with weapons of mass destruction. In this scenario, the vessel becomes the weapon. Vessel tracking through international waters, through the sharing of data between countries becomes an important tool in countering this type of threat. The information to be shared and updated would include the history of port visits by the vessel prior to arrival at the target port.

The second scenario is an attack on a high value vessel or littoral asset (oil platform) by fast inshore attack craft, or underwater divers. This would most likely be a suicidal attack, with the intent to achieve international attention. Here, the time to respond is very short. It becomes very important to detect unusual or anomalous behavior quickly, and to respond in a progressive manner. The use of non-lethal weapons becomes important in this second scenario. Above water, such weapons include the use of cannon deployed nets, water cannons, loud acoustic “boomers”, RF heaters, and laser dazzlers. Below water, nets and sonar “boomers” are useful.

For both scenarios, the paradigm has shifted from the classic encounter where the enemy is easy to find but hard to kill, to one in which the enemy is hard to find, but once found is easy to kill. As such, technologies that help track the history of port calls of a vessel in international waters, and to identify and counter anomalous behavior of a vessel in a harbor, become as important as the more traditional technologies of ESM sensors and systems.

Finally, the rapid response required to the second threat scenario requires a reevaluation of the decision-making procedure. A doctrine of delegation down the chain of command of certain responses should be examined.