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INFORMAL REPORT
NCSL 101-72

February 1972

A SWIMMER DEFENSE SYSTEM USING DOGS (U)

S2705X, Task 15640

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ABSTRACT

(U) A swimmer defense system using specially trained German Shepherd dogs was established and evaluated. The U. S. Air Force provided instructors for training dogs and handlers. Naval Personnel Research and Development Laboratory analyzed and defined the billeting requirements. The system consisted of five dogs, five dog handlers, two boat operators, one outboard repairman and boat operator, a supervisor and kennel master, and two 16-foot Boston Whalers each equipped with two 40 hp outboard engines.

(C) Results indicate that this approach is feasible and practical. It is especially useful for those situations where both hostile and non-hostile swimmers could be encountered requiring real-time target identification and subsequent capture or destruction. Probability of Detection for surface swimmers was found to be .83 bounded by .69 to .9 at the 95% confidence level. This value applies to operations on warm summer nights of a warm water bay.

(U) It is recommended that this approach enter the Engineering Development Phase under S2705X to prepare it for operational evaluation and service approval at the earliest possible time.

ADMINISTRATIVE INFORMATION

(U) This effort was performed as an Added Capabilities Task 15640 under S2705X, Defense Against Swimmer Attack. NAVSHIPS 03542 authorized the work in December 1970. This was an independent follow-on effort of the Vietnam Laboratory Assistance Program sponsored WATERDOG task which proved that dogs could be used to detect swimmers.

(U) Five men from the Special Warfare Group - Atlantic were assigned to the task in March and they began 8 weeks of training at the Military Working Dog School, Lackland AFB, on 31 March 1971. Advanced training began 7 June at NSEDL/PC and the team remained there until dissolution of the system in September 1971.

(U) This report concludes the task effort.

(U) The cooperative assistance and contributions of Mr. Earl Nunley, Air Training Command (DCS/TT(TTHM)), MSGT W. D. Rhame and TSGT E. R. Rush of the USAF Military Working Dog School are gratefully acknowledged. Mr. Gordon Villars of NCSL and Mr. John M. Richardson of NPRDL also made generous contributions to the task effort.

APPROVED
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INTRODUCTION

(C) A previous VLAP/NSAP Project WATERDOG established the feasibility of using specially trained dogs for swimmer detection. Favorable characteristics of this approach and its evaluation in Republic of Vietnam (RVN) by U. S. Navy Research and Development Unit - Vietnam (NRDU-V) as an effective swimmer defense approach justified further development of the concept into a system for general swimmer defense. Task AQUADOG was established in December 1970 to determine the feasibility and practicality of establishing and maintaining an operational system for use and ready deployment at any U. S. Navy base where high priority naval assets could be stationed.

(U) The concept centers around a team of dogs trained especially to detect persons in and/or under the water. These animals perform this function best when patrolled in a relatively small, highly maneuverable craft similar to the 16-foot Boston Whaler used in the R&D program. The dogs' senses of sight, sound, and especially scent give the system its unique capabilities. In addition to detection, the team on patrol can follow up an alert to localize, identify, capture, or destroy any intruder. Relative simplicity is also inherent in system establishment, operation, and support.

OBJECTIVE

(U) The overall goal of this task is to develop a swimmer defense system using the specially trained dog as the primary detector. This goal includes the determination of system staffing manpower, personnel qualifications, training requirements; and support equipment, supplies, and facilities needed for establishing and supporting an operational team.

(U) An evaluation of the system capabilities and limitations was needed to define the performance level and assess effectiveness of various patrol techniques. Tests were also conducted to obtain data on the effectiveness of the system in detecting swimmers using various types of underwater breathing apparatus.

SYSTEM ESTABLISHMENT

TEAM

(U) Because minimum personnel requirements for the system had not been defined based upon current U. S. Navy standards, the Naval Personnel Research and Development Laboratory (NPRDL), was tasked in January 1971 to study the system and report their findings.

(U) Using best estimates available at the time, a team of five men from the Special Warfare Group-Atlantic and five dogs from the DoD Dog Center, Lackland Air Force Base, Texas, was assembled and trained under USAF instructors and supervision at the Military Working Dog School, Lackland AFB, Texas. A modified 8-week Sentry Dog course covered the basics of dog handling and utilization. Specialized training was conducted over an additional 6-week period at NSRDL.

EQUIPMENT

(U) While the men and dogs were being trained at Lackland AFB, the necessary system support equipment was acquired. Two 16-foot Boston Whalers, each equipped with two 40-horsepower electric start outboard engines, dog food, and kennels are the major support equipments required.

TEST AND EVALUATION PROCEDURES

PERSONNEL

(U) Naval Personnel Research and Development Laboratory (NPRDL) based their recommendations upon information and experiences of U. S. Navy and U. S. Air Force personnel involved in the previous WATERDOG effort. Present and projected billeting requirements within the Navy were developed. Training requirements and job functions were also considered.

(U) A team was trained, established, and evaluated on a short term basis to validate the earlier recommendation.

EQUIPMENT

(U) System equipment was used by the team for the periods of specialized training and during the evaluation. Total length of use was 3-1/2 months. Their performance over this period gave a measure of durability and suitability.

SYSTEM EFFECTIVENESS

(U) A 3-week team evaluation, consisting of a point defense problem using an anchored battleship buoy as the protected asset, was conducted from 26 July to 13 August 1971. Only surface swimmers were used to make a total of 72 "attacks." A KAAR LN-66 radar mounted on the Ammunition pier provided positions and tracking of swimmers and dog patrol craft. Environmental parameters in the target area including water and wind direction and velocity were measured by oceanographers for later correlation.

(U) Results of the evaluation were modeled for computer determination of the influencing factors, and their degree of significance and the overall quality of the evaluation.

RESULTS

SYSTEM DESCRIPTION

Personnel

(U) AQUADOG team staffing and training requirements were outlined in NPRDL Report WRM-71-47, Personnel and Training Implications for AQUADOG (U), by John M. Richardson, Jr., of June 1971. There are two possibilities for staffing a team. If an all-Navy team is desired, the following billets are recommended:

	1 PO1 (SNEC 9542)	Kennel Master
	5 SN/FN (SNEC 9541)	Dog Handlers
	1 EN3/ENFN	Outboard Motor Repairman/ Boat Operator
	2 BM3/BMSN	Boat Operator
Total	9 USN	

(U) Because the Navy presently has few billets for dog handlers and kennel masters, and future plans reduce the present billets, it might be desirable to use USAF dog handlers and kennel masters for a limited number of AQUADOG teams. The recommended billets would be:

	1 TSGT (AFSC 811X0-A)	Kennel Master
	5 A1C (AFSC 811X0-A)	Dog Handler
	1 EN3/ENFN	Outboard Motor Repairman/ Boat Operator
	2 BM3/BMSN	Boat Operator
Total	6 USAF, 3 USN	

(U) The advantages of using a USAF-USN team are: (1) Handlers and kennel masters could be obtained with little interruption of their career pattern; (2) the Navy would not have to concern itself particularly with the training and administration of AQUADOG handlers and kennel masters; and (3) the expertise of the Air Force in selection, training, and support of military working dogs and handlers could be taken advantage of.

(U) USAF personnel would require a Navy orientation course to acquaint them with Navy ranks, rates, and responsibilities of the Navy personnel with whom they would be attached. A formal inter-service agreement would have to be executed to assure close liaison and proper utilization of AQUADOG teams.

Training and Equipment

(U) The 14 weeks (8 weeks - USAF Sentry Dog course and 6 weeks Specialized Water Detection training) total used during this effort is adequate. For a formal established training program, the total time could be reduced to about 8 weeks by using a site on the water for the entire training period. The dogs' orientation to working around water could begin early in the course.

(U) Course content should emphasize controlled aggressiveness and compatibility with other personnel in close quarters. A Patrol Dog has many desirable characteristics for this program. Sentry Dogs require much more caution and physical control to prevent attacks and injuries to team personnel. Any other specialized skills that a dog might be called upon to use (marijuana, explosives, contraband detection, or general Patrol or Sentry Dog duties) would require additional training time.

(U) The 16-foot Boston Whaler equipped with twin 40-hp electric start outboard engines provided the needed reliability and safety factor for this operation. Like any other craft that remains in a salt water environment, extra care and effort is required to prevent hull fouling and equipment deterioration.

(U) A special portable kennel designed by the Army for field use was investigated and found to be prohibitively expensive to build. It was found that the standard aluminum shipping crates can be used under some type of shade for a temporary kennel. A 4 foot by 8 foot sheet of 1/2 inch plywood supported by 4 inch x 4 inch posts and a 2 inch x 4 inch frame was adequate for the 3 month period. More permanent kennels are recommended for operations of longer duration. Disease and parasite control around the kennel can become a problem unless dogs are kenneled off the bare ground.

Performance

(C) For a measure of system performance using the aggregate of all dog-handler-boat operator teams together, the swimmers were detected 59 times out of 72 attempts for a probability of detection of 0.82. At the 95 percent confidence level, this figure is bounded by 0.69 to 0.9. Most "misses" were caused by handler-boat operator error. The men exhibited a tendency to have more trust in their own ability to detect surface swimmers than in their dog's. Improper patrol techniques therefore placed the dog at a disadvantage.

(C) During the test, many parameters were measured and recorded for a determination of factors affecting the system performance. The variables measured were detection range, wind speed, wind direction, illumination, precipitation, humidity, water current speed, water current direction, and swimmer attack direction. Computer correlation revealed that for these tests there was no significant influencing factor. In other words, the environment had no significant effect upon the dogs' ability to detect surface swimmers. Because there were no great changes in the environment during the test period, it can be said that small changes are not critical to the performance of the system. Typical test conditions may be described as warm humid nights of a coastal bay with light winds of 2 to 5 knots and an illumination level equivalent to or less than 1/4 moon.

(C) A second 3-week test period would have been necessary to obtain significant performance levels of the team against subsurface open-circuit scuba-equipped swimmers. This test was not conducted due to the swimmer safety and time elements involved. Experience indicates that the dog's ability to detect these swimmers is not diminished significantly.

(C) Three days of testing were performed using Mark VI and Emerson equipment in semiclosed and closed modes with oxygen and nitrogen-oxygen. The dogs could detect the reduced flow of exhaled gas at shorter ranges. Maximum range was about 250 yards. Some conditioning of the animals was necessary to increase their sensitivity to the weaker scents. Additional training may have improved their performance.

(C) One day of testing was performed with closed-circuit Emerson equipment. Two stationary divers were placed 20 feet below the water surface in 30 feet of water. No surface float or bubbles were visible at any time. Three of four dogs detected the swimmers from 50 to 200 yards down current. They apparently detected the body odor from the men. It therefore appears that a dry suited diver could not be detected by the dogs because there could be very little escaping body odor.

CONCLUSIONS

(C) An operational system composed of five dogs, five dog handlers, one kennel master/supervisor, and three boat operators can secure and protect a limited area against attacks by surface and subsurface swimmers during the hours of darkness and under most environmental conditions. The maximum area that can be secured is a square approximately 250 yards on a side.

(C) Since the mobile dog patrols use relatively small boats, there will be times when the patrol cannot operate because of rough water conditions. The percentage of time this will occur is dependent upon the local area configuration and weather conditions. There are other critical times such as during slack tide and/or slack wind when two teams should be placed on patrol duty. When only one team is on patrol, a second team should be on standby to provide double coverage or replace a team when emergencies occur.

(C) The AQUADOG defensive system can detect and localize a swimmer adequately to deter, identify, capture, or destroy him using conventional surface or subsurface weapons. This capability can be especially useful when operating in "friendly" ports of host countries where a nonhostile swimmer could inadvertently enter a restricted area.

(U) A system can be established in 8 to 12 weeks from the time when personnel are available for training. USAF and DoD Dog Center support is necessary for this training and the necessary agreements to provide this support on a possible short notice basis should be established before it is needed. Because the time to establish the system is relatively short, the system could essentially be called an "off-the-shelf" item. Some engineering development is needed before the system can be added to the inventory of swimmer defense systems available to operating forces.

(C) This system is feasible and useful for swimmer defense in many areas where other more sophisticated or complex systems are unsuitable or impractical. It also has unique capabilities and versatility that broadens its application to include certain critical and sensitive areas.

RECOMMENDATIONS

(C) It is recommended that the system enter the Engineering Development phase under S2705X to prepare it for operational evaluation and service approval. All CONUS and RVN tests have been successful to date, thereby assuring that this new use of military working dogs is both feasible and applicable to the problem. The Engineering Development should begin as soon as possible to facilitate early introduction of the system into the fleet.

BIBLIOGRAPHY

Department of the Air Force, AF Manual 125-5, USAF Military Working Dog Program (U), 30 April 1971.

Department of the Army, FM 20-20, Military Dog Training and Employment (U), May 1967.

Naval Personnel Research and Development Laboratory, Report WRM 71-47, Personnel and Training Implications for AQUADOG (U), by John M. Richardson, Jr., June 1971.

Naval Ship Research and Development Laboratory, Panama City, Report C3469, Dogs for Swimmer Defense (U), by Paul M. Eisenhauer, September 1971.

Navy Research and Development Unit - Vietnam, Final Report on Project 104-68, WATERDOG (U), November 1970.

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13. ABSTRACT

(U) A swimmer defense system using specially trained German Shepherd dogs was established and evaluated. The U. S. Air Force provided instructors for training dogs and handlers. Naval Personnel Research and Development Laboratory analyzed and defined the billeting requirements. The system consisted of five dogs, five dog handlers, two boat operators, one outboard repairman and boat operator, a supervisor and kennel master, and two 16-foot Boston Whalers each equipped with two 40 hp outboard engines.

(C) Results indicate that this approach is feasible and practical. It is especially useful for those situations where both hostile and non-hostile swimmers could be encountered requiring real-time target identification and subsequent capture or destruction. Probability of Detection for surface swimmers was found to be .83 bounded by .69 to .9 at the 95% confidence level. This value applies to operations on warm summer nights of a warm water bay.

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APPENDIX A

PROPOSED MILITARY SPECIFICATION

SWIMMER DEFENSE SYSTEM USING TRAINED DOGS (U)

MILITARY SPECIFICATION

SWIMMER DEFENSE SYSTEM USING TRAINED DOGS

1. SCOPE

1.1 Scope. This specification covers development and performance of a swimmer defense system using specially trained military working dogs.

2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the current issue in effect shall apply.

STANDARDS

MILITARY

MIL-STD-129 - Marking for Shipment and Storage

PUBLICATIONS

U. S. Department of the Air Force

USAF Military Working Dog Program AFM 125-5

U. S. Department of the Army

Military Dog Training and Employment FM 20-20

3. REQUIREMENTS

3.1 General Requirements. The basic system described herein shall consist of the following: five (5) military working dogs, five (5) qualified dog handlers, one (1) outboard motor repairman/boat operator, two (2) boat operators, one (1) kennel master/supervisor, and two (2) 16-foot outboard boats, each equipped with two (2) 40-hp outboard engines. All dogs and men shall be capable of meeting the performance requirements stated herein after special training.

3.2 Parts and Materials.

3.2.1 Dogs. The dogs shall meet the standards for basic senses, sensitivity, energy, aggressiveness, intelligence, willingness and motivation given in AFM 125-5. At the beginning of training the dogs should be between 12 and 36 months old and in good health.

3.2.2 Dog Handlers. All dog handlers shall meet the requirements stated in FM 20-20. They should have demonstrated a friendly attitude

toward dogs, intelligence, patience and perseverence, mental and physical coordination, resourcefulness, dependability, and have the necessary security clearances.

3.2.3 Kennel master/Supervisor. The kennel master/supervisor should have had previous dog handler training and be thoroughly versed in techniques of dog handling, care, kennel, and system supervision.

3.2.4 Outboard Motor Repairman/Boat Operator. He shall have the minimum rating or capabilities of the rating, EN3/ENFN. He shall also be capable of small boat operating and handling, and working in the near vicinity of a military working dog without fear.

3.2.5 Boat Operators. All boat operators shall have the minimum rating or the capabilities of BM3/BMSN. They must be capable of working in the near vicinity of a military working dog without fear.

3.2.6 Boats. The boats shall have the stability, seakeeping and low-bowed properties of or equivalent to the 16-foot Boston Whaler. These boats shall be equipped with either manual or electric start 40-hp outboard engines. When the system will be deployed in areas where a hostile attack by weapons fire upon the team is possible, electric start engines shall be used.

3.2.7 Other Support Equipment.

Kenneling. Temporary kenneling shall meet the requirements stated in FM 20-20. Permanent kenneling shall meet the requirements stated in AFM 125-5 and if possible, be constructed using the guidelines given by USAF Standard Design Drawing AD-19-01-R4 found in AFM 125-5.

Dock Facilities. A dock facility suitable for safe loading/offloading of dogs, men, and equipment shall be available. A floating dock is needed in areas having a tide range greater than 2 feet.

Fuel and Oil. Adequate supplies of suitable gasoline and two-cycle engine oil must be available at the dock area for use by the boats.

Dog-Handling Equipment. All dog handling equipments such as collars, chains, and food pans will conform with that found in AFM 125-5.

Spare Parts. A stock of spare parts for the mechanical steering and outboard engines will be maintained or be readily available.

3.3 (C) Performance. This system will be capable of protecting an asset area of 250 yards by 250 yards from attacks by swimmers that must reach their target to achieve their objective(s). It shall be able to detect, locate, and counter multiple attacking swimmers who allow adequate amounts of exhaled breath and/or body odor to escape permitting detection by scent and are not equipped with aid to propulsion which increases his speed of approach. Swimmers equipped with closed-circuit

scuba and only wet suit top can be detected. The system as configured herein shall be capable of securing the specified asset/area a total of 12 hours per day, 7 days per week during both day and night time conditions when patrol operations in the 16-foot boat are feasible and necessary. Additional assets/areas can be protected by increasing proportionately the number of teams and boats that can be fielded.

3.3.1 (C) Probability of Detection. The probability of detection by the dog of a surface swimmer shall be no less than 0.82. For a submerged closed-circuit scuba equipped swimmer, the probability of detection will be no less than 0.50. These are minimum performance requirements and should be exceeded by all teams.

3.3.2 (C) Environmental Requirements. The system shall be capable of operating under any environmental conditions that permit small boat operations with an acceptable risk to the craft and its crew. The dog is more durable than the men on the team.

The team can operate in the rain; the team's effectiveness will be dependent upon the rate of rainfall. A reduction in effectiveness of 25 to 30 percent can be expected.

A dog requires a 2-3 week period to acclimate himself to a radically different temperature environment.

The dogs are subject to overheating when forced to exercise strenuously in a hot tropical sun on land. Usually it is much cooler over the water moving in the small patrol boat. Caution is required.

3.3.3 Operating Life. The average working life of a military working dog is between 7 and 9 years. Dog handlers can be changed by a dog should remain with one handler as long as possible. The dog-handler relationship and performance both improve with time. The absolute minimum time of this relationship is 6 months. The dog works to satisfy his handler and will eventually become frustrated and finally quit working if handlers are changed too often.

There are certain critical periods during which it will be necessary to deploy two patrol teams. Slack wind and water currents are the two significant factors adversely affecting system performance and enhancing a swimmer's probability of success.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all requirements as specified herein. Except as otherwise specified, the supplier may utilize his facilities or any commercial laboratory acceptable to the government. The government reserves the right to perform any of the tests and inspections set forth in this

specification where such tests and inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality Conformance Inspection. Before acceptance for system deployment, the system shall demonstrate through a short-term operational-like test period of 1 week or more that the performance requirements of this specification have been met.

After acceptance and deployment, the system supervisor and responsible command shall test each individual team's performance on a random basis by inserting a friendly swimmer when operational conditions are permissible.

4.3 Test Methods. The short-term operational-like test shall be as realistic as possible. An asset/area should be assigned to be protected and random swimmer "attacks" executed. Normally this should be done during night-time conditions.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Unless otherwise specified in the contract, all system equipment and components except the dogs shall be preserved and packaged at Level A.

5.2 Packing. Unless otherwise specified in the contract, Level B Limited Military Package will be used.

5.3 Marking. All packages and containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Ordering Data. Some of the items used in this system have been introduced into the Federal Stock System and are available under their respective Federal Stock Numbers.

Untrained Military Working Dogs	FSN 8820-935-6677DX
Dog Shipping Crates	FSN 8115-803-3172
Manual Start 40-hp Outboard Engine	FSN 2805-488-5570
Dog Food, Military Stress Diet	FSN 8410-403-4565
Waterdogs	FSN 8820-260-0120DX

APPENDIX IA

A SUGGESTED APPROACH TO TRAINING SYSTEM MEN AND ANIMALS

10. SCOPE

10.1 This appendix outlines a method that has been and can be used to establish a system using only DoD(Department of Defense)assets for in-house development. The information contained herein is not intended to limit or prohibit other means of system establishment. It is only a guide to what has been performed.

20. REFERENCE DOCUMENT

20.1 The following document provides ancillary information to this appendix and its use as a supplement is recommended. It is a classified document and should be available to those agencies having the need-to-know and the security clearance necessary to have access to this specification and appendix.

Naval Ship Research and Development Laboratory, Panama City, Florida Report C3469, Dogs for Swimmer Defense (U), by Paul Eisenhauer, (CONFIDENTIAL), September 1971.

30. GENERAL

30.1 All previous system development and training was done for and coordinated by the Inshore Undersea Warfare Division of the Naval Ship Research and Development Laboratory, Panama City, Florida. It is recommended that this division be contacted to render any assistance that might be needed.

30.2 All dog and handler training was performed by qualified instructors from the Military Working Dog School, 3275th Technical School, Lackland AFB, Texas. Requests for their assistance must be cleared through Air Training Command, DCS/TT (TTMM), Randolph AFB, Texas and Headquarters USAF, DPTTA, Washington, D. C.

30.3 Suitable facilities for the advanced portions of the training using the boats and swimmers are necessary. When these portions cannot be performed at the intended operational site, a facility such as the Naval Ship Research and Development Laboratory, Panama City, Florida (NSRDL) or Naval Station, Key West, Florida, should be contacted for use of their facilities. An area of at least 1 square mile of protected, isolated or semi-isolated warm water is needed. A nearby temporary kennel and dock facility is also necessary.

40. COURSE OF TRAINING

40.1 An average of 12 weeks is required to train dogs and handlers

for this system. This includes 8 weeks at the Military Working Dog School, Lackland AFB, attending the Sentry Dog Handler Course 3AZR81130A and 4 weeks at the water training site described in paragraph 30.3 above. A thirteenth week of tests is necessary to prove the team's capabilities.

40.2 Qualified instructors should teach all portions of the training for optimum results.

40.3 The kennel master/supervisor should attend the Sentry Dog Handler Supervisor Course 3SZR81170A for 2 weeks at the Military Working Dog School during the same period as dogs and handlers are being trained at Lackland. He should then be present during all water training.

40.4 Boat operators should assemble and check out their equipment during the first 8 weeks of dog and handler training. Boats and equipment should be available at the water training site for use during the training. All boat operators shall be trained jointly during this 4 week period.

40.5 The reference document provides a detailed description of the course content.

50. OPTIONS

50.1 In addition to their anti-swimmer duties it is possible to use the dogs and handlers for other duties if given additional training. This includes sentry, patrol, marijuana detection, and explosives detection duties. Additional specialized training is necessary for all duties except those of a sentry dog. A Patrol Dog can be trained by attending the 12-week Patrol Dog Handler Course 3ALR81130A-1 instead of the Sentry Dog Handler Course.

60. SYSTEM MAINTENANCE TRAINING

60.1 Periodic refresher training is necessary for the operational system. This can be performed, in most instances, at the operational site. The dogs should be exposed to a swimmer at least once a month.

60.2 Replacement dogs and handlers can usually be trained at the operational site after they have received the basic 8 week course at the Military Working Dog School. USAF instructors may be requested to assist in this training if it is beyond the capabilities of the handlers and supervisors.

APPENDIX IIA

SYSTEM OPERATING RATIONALE

10. SCOPE

10.1 This appendix contains detailed operational philosophy and use techniques and is presented to inform both the developer and user of the system's applications and versatility. The dog is only a sensor and his proficiency is very dependent upon his handler and boat operator's ability to properly position the team under all conditions they may encounter.

20. SWIMMER CAPABILITIES

20.1 The positioning and movements of the swimmer defense team are critical to assure system effectiveness. An understanding of the enemy's capabilities is therefore essential.

20.2 (C) Primary Controlling Factors. A swimmer making an attack on a target is influenced in his mission planning and execution by three primary controlling factors. These are the requirements for concealment throughout the mission, navigating from the water entry point to the target, and the swimming range as determined by his swimming endurance and speed. There are other factors to be considered for the mission but all are subordinate to these three.

20.2.1 (U) Concealment. Concealment is important because the element of surprise is the key to success. When covertness is lost, the swimmer must either escape or gamble with his life to complete the mission. Only in rare instances when he is highly motivated will the latter course of action be selected. Concealment can be attained by either swimming beneath the surface using scuba gear, swimming just below the surface with a breathing tube, or swimming unaided on the surface. Periods of low light levels provided by dim moonlight, cloud cover, rain, and fog may be used to an advantage in making the swimmer less visible to sentries.

20.2.2 (U) Navigation. Without the aid of sophisticated navigational equipment or unusual circumstances favoring him, a swimmer must rely on periodic visual surface sightings to avoid missing his target. Test results obtained using highly trained personnel navigating only by wrist compass in daylight conditions indicate a lateral error of 150 yards per 1000 yards swum. The error under less optimum conditions by a poorly trained swimmer would be much larger.

(C) An example situation where a scuba swimmer could attack and retreat completely submerged from a considerable distance is that where several targets of opportunity are docked across a relatively shallow body of water (less than 30 feet). He could swim along the

bottom using a wrist compass until he found the dock, find a target by feel, plant his charge, and swim away.

20.2.3 (U) Swimmer Range. The distance a swimmer can traverse is determined by the physical condition of the individual, his swimming ability, water temperature, water currents, navigational requirements, and whether or not he has an aid to propulsion such as a swimmer delivery vehicle.

(C) An individual's physical condition varies from person to person, the time he has to practice swimming, and how he lives before an attack. Swimming speed and endurance limits of men are placed at 3.4 knots for a short burst and an average 1.2 knots for 20 hours. These are world records and it is improbable that a swimmer having these speeds and endurance capabilities would be encountered. Average swimmer speed and endurance, assisted by currents, have generally been set at 1 knot sustained for 4 hours with a resulting range of 4 nautical miles. These figures assume that the swimmer times his approach to coincide with slack tide so he can approach from any side, work easier alongside his target, and use the reversed current direction to carry him to his original water entry point.

(U) A swimmer's endurance and range is affected by the water temperature. Best conditions for the loincloth or unprotected swimmer exist when water temperatures are between 70°and 85°F. At temperatures between 70°and 40°F, some type of protective clothing or wet suit is required unless total time in the water is 3 hours or less.

(C) Both river and tidal currents can be and are used to increase swimmer speed and ranges. While decreasing the mission length and effort required to move to and from the target, use of the currents can increase the problems of navigation and make it more difficult to work at the target itself. Employment of a magnetic limpet mine will minimize working time required at the target. A survey of all world ports and anchorages shows that river or tidal currents generally do not exceed 2.5 knots. Only 25 percent of world-wide dockside currents are greater than 1.5 knots and the same percentage applied to the number of open anchorage areas having currents in excess of 0.5 knots.

20.3 Swimmer Tactics

20.3.1 (U) Water Entry Point. A swimmer chooses his water entry point to provide concealment and a range to the target within his swimming capabilities. A bank covered by vegetation or buildings with water at least 3 feet deep are preferred locations. Another desirable site would be near the mouth of a small tributary where he could enter the water unobserved. The swimmer could also use an indigenous surface craft to carry him to an appropriate drop-off point nearer his target than could otherwise be obtained. A skilled swimmer may also use an underwater cave or tunnel to execute his attack from and retreat to for hiding.

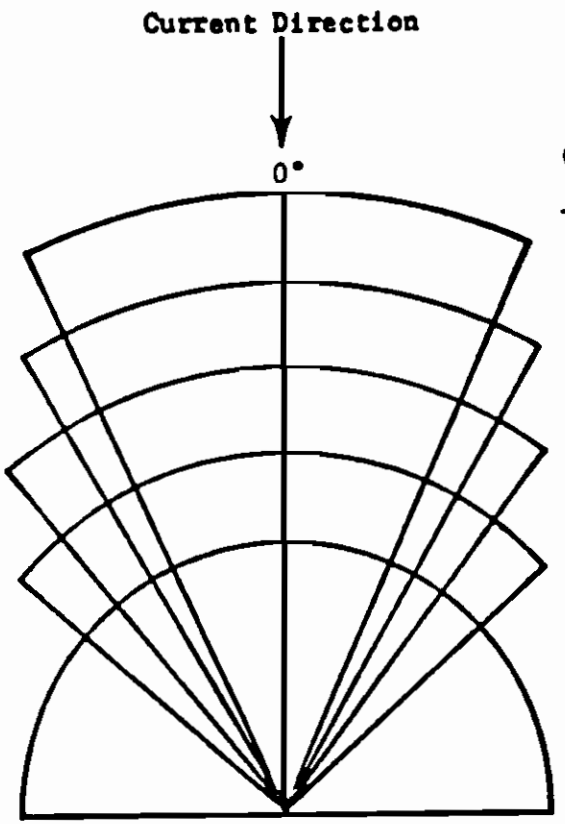
20.3.2 (C) Approach Sectors. As with other guerrilla and insurgent attacks, the swimmer can usually choose his own time, place, direction, and mode of attack. Extensive study and observations will precede most attacks to learn all possible facts about the target, approach conditions, security measures in effect, escape routes, and guard personnel habits. Analyses of incidents in Vietnam indicate that 65 percent of the swimmers used slack tide and nights having little or no moon illumination. Use of slack tide permits the swimmer to approach from any side where a sentry is not alert and makes it easier for him to attach his charge to the target.

(U) For a target in rivers or waters strongly influenced by tide, most of the time there is a current running that will limit the direction from which a swimmer can approach his target. Figure A1 illustrates the swimmer approach sectors for various water current speeds and swimmer speeds of 1.0 and 1.5 knots. Swimming speeds greater than 1.5 knots would most likely be noisy due to splashing of hands and feet and therefore not useful to a swimmer who needs to remain covert.

(C) It should be noted that the figures given in the table of Figure A1 are half-angles. The full sector widths are double the half angles given. It is important to note that a 1-knot swimmer can approach the target anywhere in a relatively wide angle. When currents are 1 knot or less this swimmer can approach from any angle, so a full 360-degree surveillance capability is needed at times for any swimmer defense system.

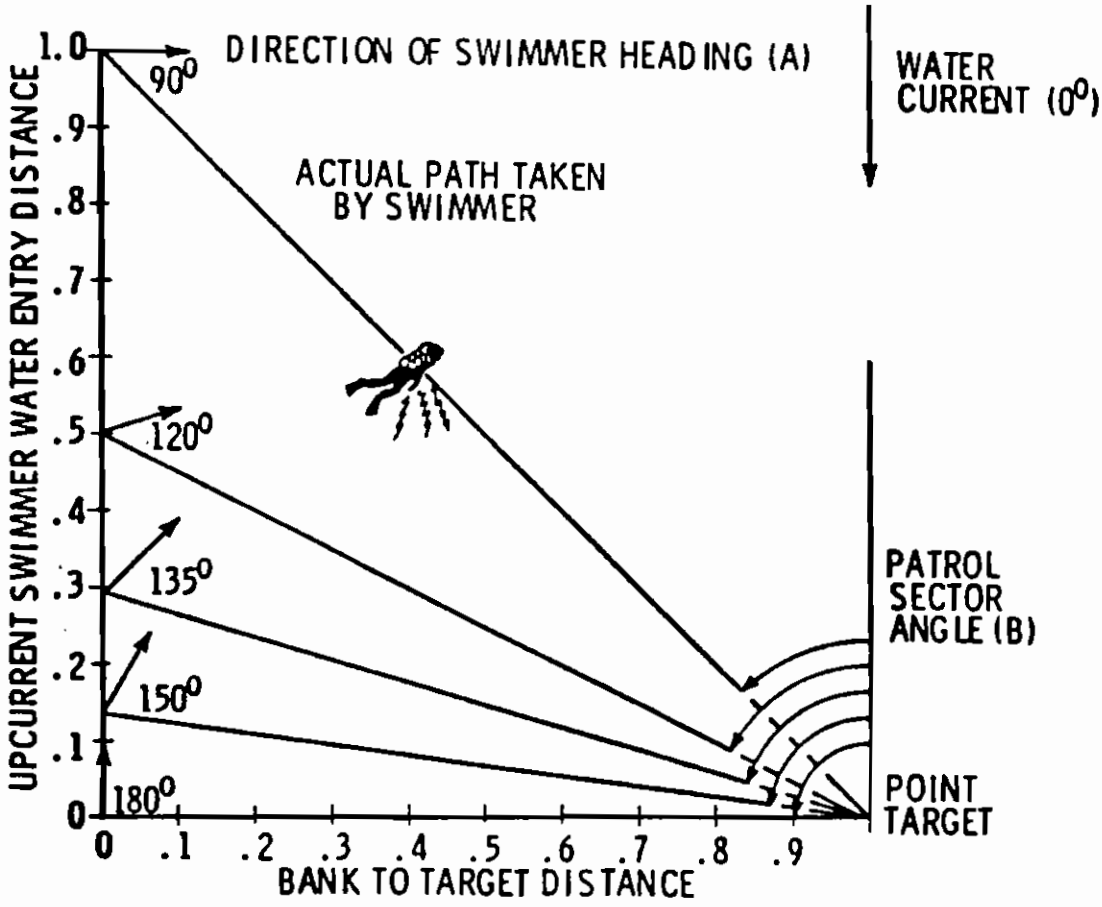
(C) The sector widths given in Figure A1 may seem unnecessarily large at first. However, further study substantiates their need. A swimmer sapper is not restricted to swimming with the water current. He can vector himself at an angle into the current, enter the stream at the right point, and can get to his target even though both his transit time and total effort will be increased. It may also make is possible for him to defeat a narrow sector scan antiswimmer device by avoiding its search sector. Figure A2 presents a mathematical analysis of swimmer water entry points and time to transit for various vectors he may take in reaching the target. It assumes a sustained swimming capability equivalent to water current. When (1) a better swimmer is encountered or (2) water current is decreased, the patrol sector must be widened; i.e., if a swimmer can average 1 knot swim speed and current is 1/2 knot, the water entry point is 1/2 the distance upcurrent required for a 1-knot current. For a given swimmer speed, the time of transit will remain the same.

20.3.3 (C) Swimmer Approach Pattern. Figure A3 is an illustration of what an average snorkel equipped swimmer's path might look like. The presence of a patrol boat, certain weather conditions, or personal preference would modify this path. An average swimmer must remain on the surface from 5 to 20 seconds to clear his vision, take a compass or visual sighting, and correct his course. This allows opportunities for visual detection. Any swimmer defense must examine all possible modes, types, and directions of attack and be prepared to counter any threat regardless of how little it may seem to promise success to an attacking swimmer.



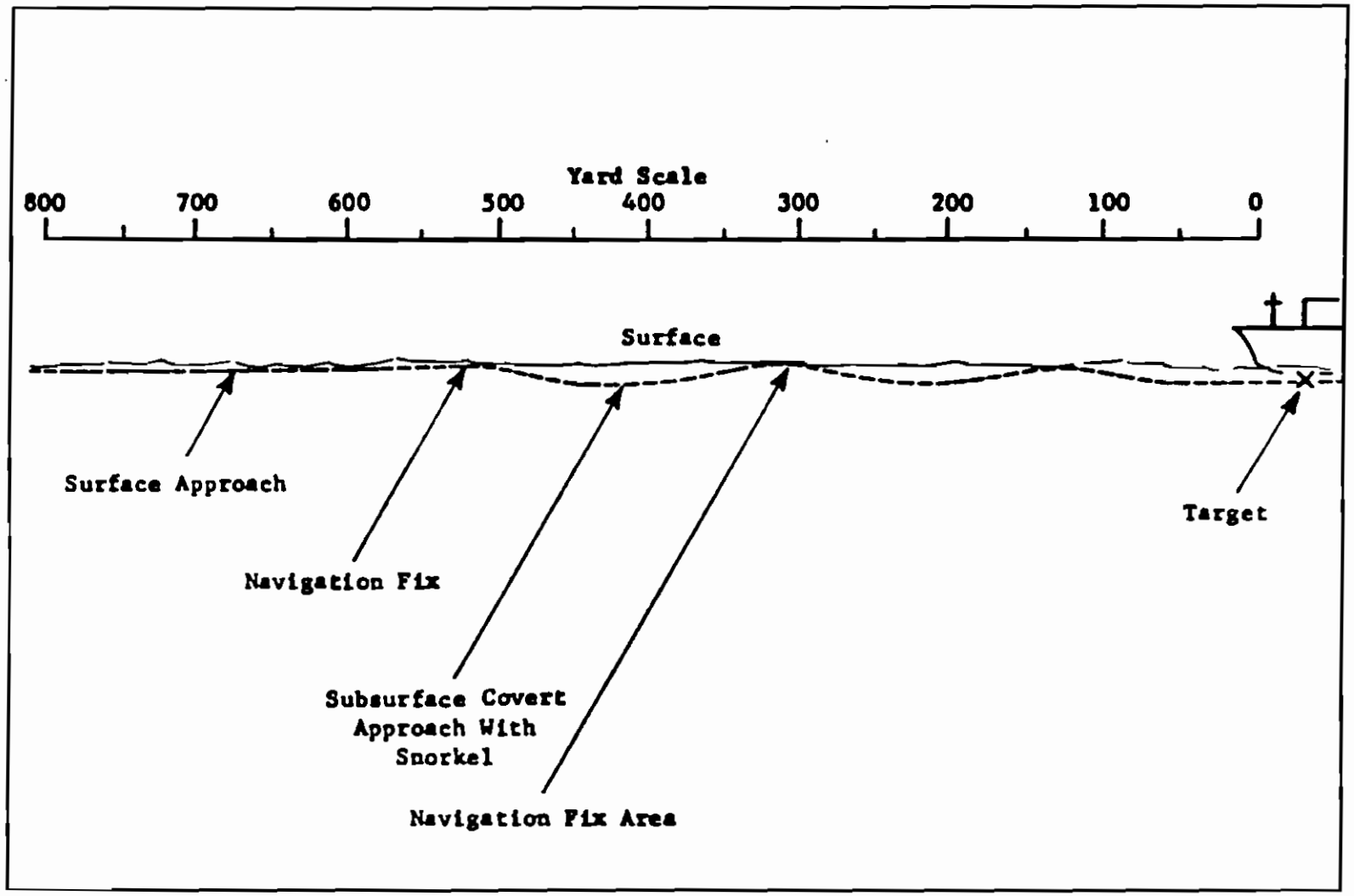
Current Speed	Half Angles Maximum Bearing	
	1.5-Knot Swimmer	1.0-Knot Swimmer
3.5K	25.4°	17.0°
3.0K	30.0°	20.0°
2.5K	36.9°	24.0°
2.0K	48.5°	30.0°
1.5K	90.0°	42.0°
1.0K	180.0°	90.0°

(U) FIGURE A1. SWIMMER APPROACH SECTORS



SWIM ANGLE (A)	90°	120°	135°	150°	165°	180°
TIME TO TRANSIT (RELATIVE TO SHORTEST TIME POSSIBLE)	1.0	1.15	1.40	2.0	3.86	
PATROL SECTOR ANGLE (HALF-ANGLE) (B)	45°	63.5°	73.5°	82.5°	88°	90°

(C) FIGURE A2. APPROACH PATHS, TRANSIT TIMES, AND PATROL SECTOR ANGLES FOR SWIM CAPABILITY EQUAL TO CURRENT SPEED (U)



(C) FIGURE A3. TYPICAL SWIMMER APPROACH PATTERN (U)

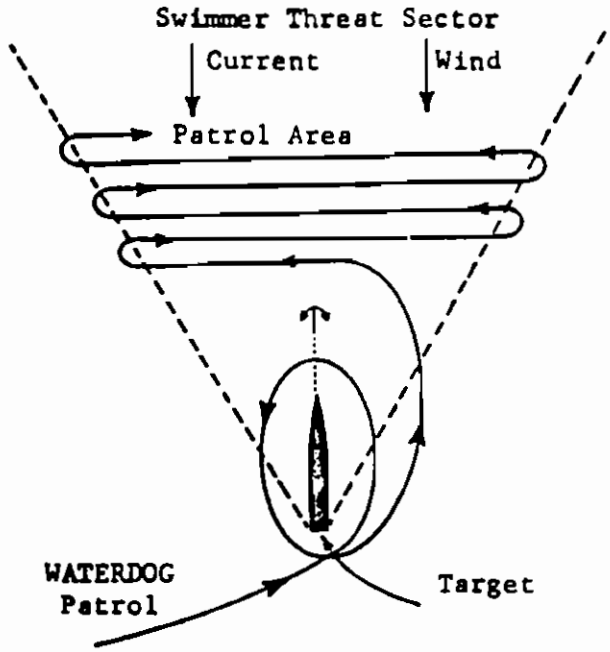
20.4 (C) Sea Experience. South Vietnam has ideal conditions for swimmer activities and much has been learned by experience there. The swimmer/sapper team consists of a leader and three or more men who usually operate in cells of three men during an attack. The leader is experienced in guerrilla tactics and is well trained in reconnaissance techniques, explosives, and other pertinent subjects. The swimmers are usually given about 40 hours of formal training but this may be increased to include semi-closed and closed circuit scuba. They are typical guerrillas, living off the country, dependent upon some local support, and will usually obtain the larger items such as explosive charges near the site of the attack. They are patient and careful in observing defensive measures and in planning their attack to take advantage of any weakness. Diversionary tactics such as civilian disturbances, fires, intentional swimmer exposures, and small arms firing, are used to draw attention away from the real effort. Advantage is taken of the dark of the moon, rain, fog, cloud cover, choppy water, floating debris, and normal movements of indigenous personnel and water craft near or through their operating area. Targets are chosen near favorable water entry points and where currents will assist the swimmer approach to and withdrawal from the target. The approach is usually made on the surface using homemade snorkels. The hours of darkness are most often used with 2300 to 0400 hours being the most frequent choice. Lights on the target or dim moonlight back lighting are used to guide the swimmer. A well lighted ship, especially at the waterline, with alert sentries will be avoided. The explosive charge is usually a crude homemade expedient detonated by command wire and battery but delay fuse and chemical detonators are also used. The attacks are not suicidal in nature.

20.5 (U) Operating Procedures.

20.5.1 (U) Applications. Waterdogs can be used to protect almost any asset, fixed or floating, against attacks by nearly all swimmers. The number of patrol teams required is dependent upon many factors unique to each particular site and variable from day to day. Section 20, Swimmer Capabilities, presents what the swimmer can be expected to do. Other parameters affecting the patrol team and the dogs are wind speed and direction, current speed and direction, amount of debris and other distractions in the area, and restrictions of patrol craft maneuverability affected by area configuration. All these factors must be considered in setting up Waterdog patrols and patterns.

20.5.2 (C) Optimum Patrolling Situation. A large asset, such as a single ship or assemblage of barges, is easiest to protect if anchored or moored in a bay or large river at least 500 yards from land areas or indigenous traffic lanes that might serve as swimmer water entry points. The presence of a current of 1 knot or greater and a steady wind of 5 to 10 knots in the same direction as the water current will also make swimmer detection easier. A patrol should begin by a pass around the target to clear the target itself; i.e., make sure there are no swimmers already there. This also allows the dog to get used to and identify whatever distractions that might be there. After clearing the target, the patrol boat should move upcurrent approximately 100 yards and begin

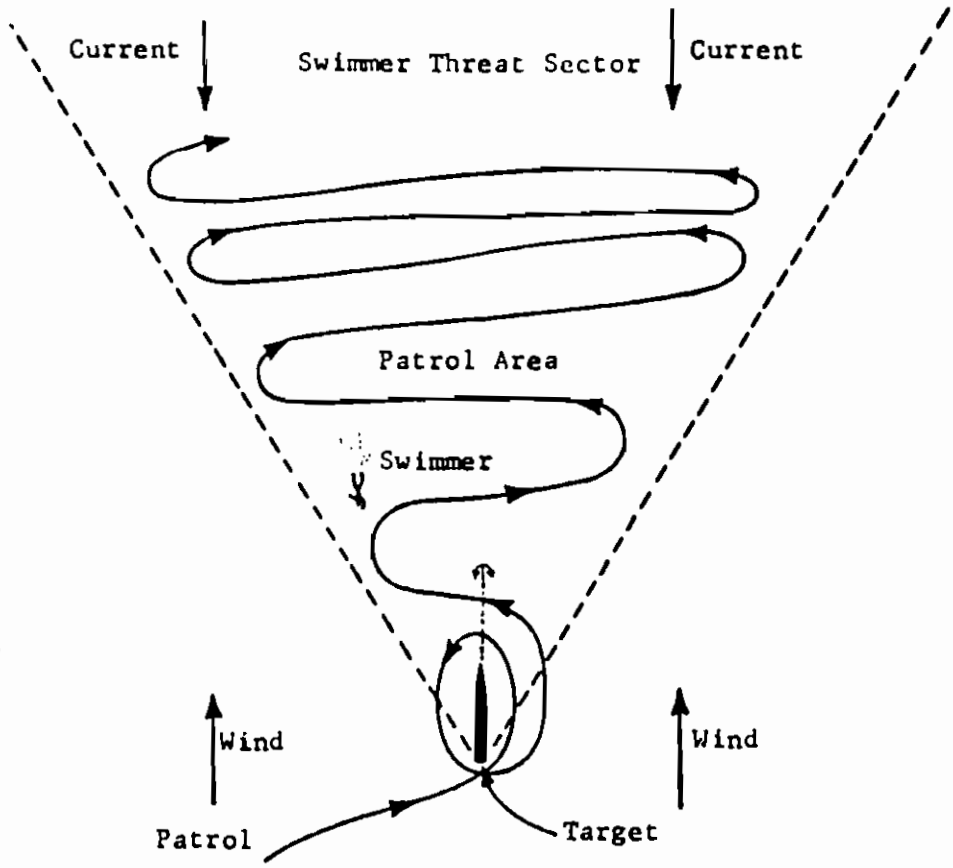
a back-and-forth patrol pattern making sure that the pattern is wide enough to periodically place the dog downwind of an approaching swimmer wherever he may decide to transit in swimming to the target. This patrol width is dependent upon the width of the asset and the water current speed (Figure A4). See Figure A1 for the effect of water current upon swimmer approach sector width. A normal patrol speed of 3 to 5 knots is recommended.



(C) FIGURE A4. AN OPTIMUM PATROL SITUATION (U)

20.5.3 (C) Less than Optimum Situations.

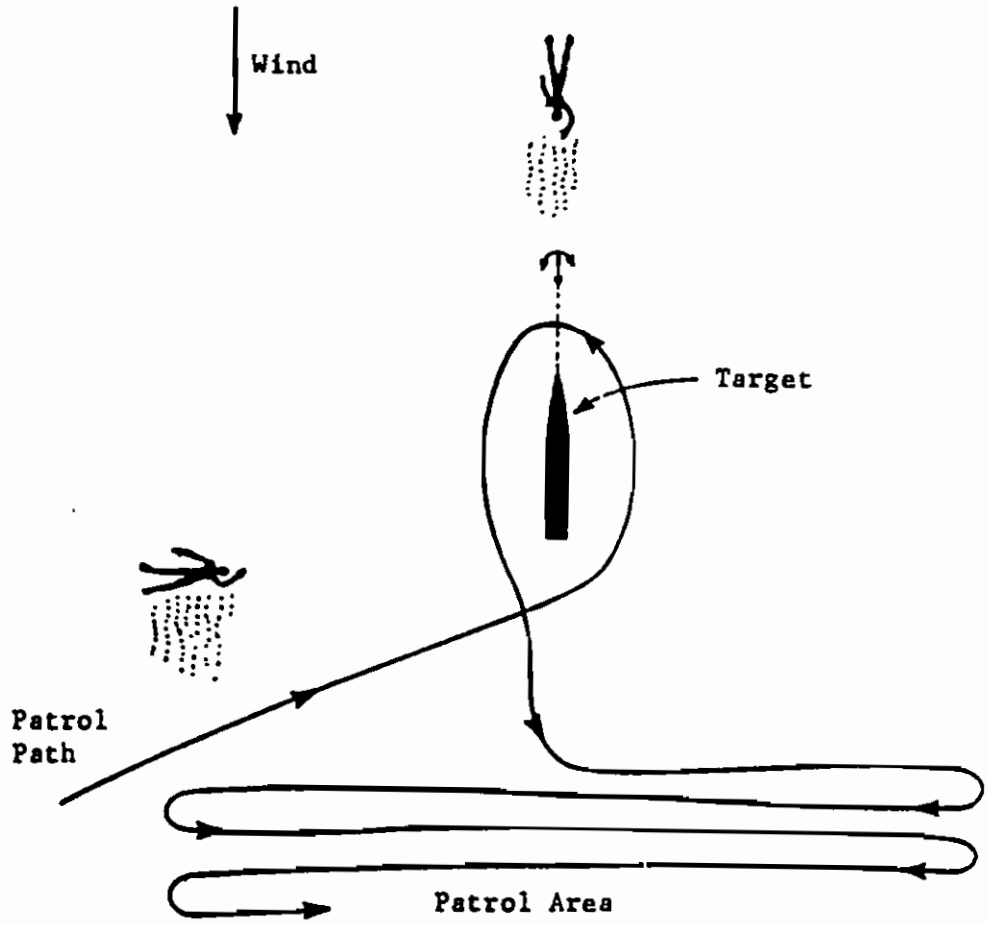
Wind Direction Opposite Water Current Direction. Begin the patrol by clearing the protected asset. This should always be performed first and can be repeated periodically during a patrol. The patrol area for this situation is enlarged and moved upcurrent farther because the swimmer must get between the protected asset and the Waterdog team before he can be detected by scent (Figure A5). The swimmer must also be detected far enough away to permit localization and countering before he reaches the asset. The Waterdog team also has a chance to detect the swimmer by sight or hearing when he passes through the patrol area.



(C) FIGURE A5. A PATROL SITUATION WITH OPPOSING WIND AND CURRENT DIRECTIONS (U)

(C) Water Currents Less than 1 Knot. The swimmer has access to the protected asset from all sides. Begin patrol by clearing asset. Move downwind of asset no more than 100 yards and begin patrol (Figure A6). It may be necessary to increase patrol speed slightly. Avoid setting up a pattern of movement by varying speed and direction occasionally. Periodic re-clearing of asset may be necessary.

(C) Protecting Other Assets. Each situation must be carefully studied to determine where a swimmer could come from. No possibilities should be excluded, no matter how remote. Determine the closest water entry points for a swimmer to approach by land and enter water. A friendly village might not be so "friendly." Study and, if possible, measure water currents and directions. Determine when a slack tide occurs so the patrol pattern may be adjusted accordingly. When on patrol, be aware of wind conditions at all times and correct patrol pattern for changes immediately. Restrict indigenous boat traffic in the area so a swimmer cannot approach from them.



(C) FIGURE A6. A 360-DEGREE PATROL SITUATION (U)

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Dogs (mammals)						
Swimmer diver						
Antiswimmer defense						
Inshore Undersea Warfare						
Animal training						
Enemy personnel						

UNCLASSIFIED
Security Classification