USING CAI TO MEASURE TEAM READINESS

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COMNAVSURFPACINST C3590.1 requires for all ASW platforms a four-phase ASW training and readiness improvement program, with the first three phases conducted at FLEASWTRACENPAC and the fourth phase conducted at sea. This instruction requires that "All training conducted . . . be evaluated and assigned a numerical grade. In addition, the ship will be provided copies of detailed grading sheets on each team member."

Phase I, Basic Attack Team Training, consists of two days for ships equipped with AN/SQS-23 and three days for ships equipped with AN/SQS-26. It involves classroom instruction in terminology, plotting, tracking, classification, search, localization, and single ship attack procedure. It also includes trainer problems that begin with single ship/single target and progress to dual ship/aircraft coordinated operations (including CZ and LAMPS), culminating with graded attack exercises. The 14A2 ASW team trainer is the backbone of the training program.

Surface Ship ASW Attack Trainers of the 14A2 Series are essentially shorebased ASW tactics training systems that provide full simulation of the sensors, tracking, fire control and weapon deployment systems normally provided on ASW ships of the fleet. Device 14A2 simulates the entire ASW tactical situation, from submarine target acquisition, through tracking, fire control solution, and weapon firing. It simulates own ships, targets, and weapon ballistics, using a general-purpose digital computer to generate and control problems.

The present method for measuring performance is broken down with the following weighting factors:

ASW ESCORT QUALIFICATION PROGRAM
K-000-1070 (PHASE I)

Performance Measuring and Reporting Guide

Position	Points
Command/Evaluator	28
Bridge	4
Sonar	8
Underwater Battery Plot	12
CIC (General/Plotting)	12
Air Control	16
Weapons	20

Penalty Factors to be Applied to All Final Evaluations

-5 Simulated weapons launch such that friendly unit(s) are endangered.

-5 Failure to attack submarine prior to submarine attack on friendly unit.

-3 Improper sound-powered phone procedures and failure of controlling station in maintaining proper discipline.

Overall Grade________

This program is designed to maintain and, if possible, improve fleet readiness. But does it? The answer is a disquieting, "We don't know." The reason for the difficulty in determining the degree of fleet readiness in ASW operations is that the validity of the scoring system used for measuring team performance is questionable.

At first glance, the indisputable scoring tends to obscure the fact that some aspects of performance are so loosely defined that they are subject to varying levels of interpretation by different instructors at different 14A2 sites. Currently in the 14A2 trainers, adequacy of performance is determined by the instructor, based on his individual judgment, because objective measurements, methods, or criteria for the ASW team are nonexistent. In Figure 1, for example, it is hard to imagine that all instructors on East and West coasts will agree on the proper forming up of the SAU and the correct spacing of units, particularly since there are no standard scenarios.

A valid scoring system requires the use of objective methods to evaluate training. However, the problem of developing objective performance criteria for evaluating surface ASW team training is an elusive one. The problem is compounded by the lack of specific training objectives that can be readily converted into measurable criteria. The remainder of this paper addresses certain techniques explored for establishing an objective basis for ASW team evaluation.

PROBLEM

The development of a system based on objective criteria for training and evaluating ASW team performance represents a sizable undertaking. The first step has been one of data collection and analysis. The goal for this phase was to determine what computer aids could be developed to help make more objective the evaluation of team performance. A ground rule during this phase was that training practices were not to be considered as variables but were to be defined as presently employed.

APPROACH

Computer representations of several training sessions were "captured," and various computer techniques for evaluating team performance were explored. The 14A2 computer program was modified to dump to magnetic tape, on a second-by-second basis, the computer system parameter tables. With this modified program, tapes containing all relevant variables that would be available at the time of training were generated at FLEASWTRACENPAC from normal training sessions. In addition, a system of programs was developed for scanning the tapes for particular performance variables and for providing output in suitable formats.

This approach permitted an empirical determination of an analysis technique tailored to the special requirements of ASW team training.

Computer assessment of performance must rely on performance criteria that are specified in terms of computer representations. If the assessment is to be meaningful, these criteria should be valid over a reasonable range of possible training problem scenarios. Under prevailing training practices, it would appear virtually impossible to derive a set of such criteria.

As Device 14A2 is currently used, problems are specified in terms of the vehicles involved and their starting configurations. As a training mission progresses, problem variables change in a freely developing manner. Performance criteria derived on the basis of such a problem specification and valid over the entire range of possible outcomes would be very difficult to imagine. Even if problems were completely "canned" except for own ship parameters, the derivation of criteria would remain indeterminable. For every such canned problem, there are a number of possible tactics, and these tactics can define contrasting sequences of tasks for team members. With any conceivable set of criteria, significant errors in evaluation could result. Any practical computerized scoring system would not be able to adjust to the tactics used.

Although computer assessment appeared infeasible, it still seemed reasonable to assume that the computer could be a valuable tool in the assessment process. Accordingly, the problem chosen for study was the development of a display of information critical to a broad range of training problem developments. The amount of information had to be limited so that the evaluator would not be overwhelmed with it, and it had to be displayed so that performance level could be assessed with a minimum of analytical effort.

Currently, team member performance evaluation in Device 14A2 occurs in the form of a subjective post-problem critique. The analysis relies on the questionable analytical ability of team members in that, as part of the analysis, they are called upon to search their memories to try to report the causes of failures. It appeared that there was much that could be done to aid this process.

The only system-generated records of team performance are in the form of slides, which are normally lost after training. Clearly, there is room for improvement in the capability of the system to generate useful records. The computer system, in addition to its current functions, could be used to collect relevant performance data in real-time and reduce it to meaningful statistics immediately following termination of a problem. The results could be in the training officer's hands in time for his critical review. This feature would enable the training officer to derive an objective analysis of failures, independent of the biased views of the participants.

COMMAND/EVALUATOR

AVAIL.	EARNED	
		COMMAND/EVALUATOR - GENERAL
10		Was SAU Commander aware of tactical employment of all units under his command?
10		Was a low noise level maintained in CIC?
10		Was classification a continuous process by SAU Commander?
20		Were four weapon attacks successful? (An urgent attack does not need to be a hit in order to be considered successful.)
		APPROACH PHASE
8		Was Datum properly disseminated to all units?
6		Was SAU properly formed up, and was spacing correct, considering predicted sonar range?
8		Was SAU search front properly reordered and was approach to Datum proper for tactical situation?
6		Were Cone of Courses, Intercept Course, and time to enter TDA compared and concurred with Assist Ship?
6		Were appropriate countermeasures executed during Approach Phase?
8		Were Plans Red and Black and Weapons Policy passed to Assist Ship?
8		Was controlling station properly kept informed?
6		Were aircraft plots evaluated to determine target course and speed?
8		Was time to enter TDA updated with latest contact information and new Intercept Course executed accordingly?
5		SWAP SITREP requested and obtained prior to execution of SWAP.
5		SWAP SITREP disseminated to command, with State, Weapons, Contact status, and Datum information included.
7		SWAP executed in a timely manner.
5		SAU advised when SAC is assumed.
8		Zig-Zag Plan executed prior to entering TDA.
6		Appropriate Material Countermeasures prepped or executed.

Figure 1. ASW Escort Qualification Program Evaluation Form

PROGRESS

Two types of materials have been developed: a graphical representation of training problem events, and a listing of numerical information associated with critical occurrences. From a plot, the tactical situation and the performance of all subteams except for CIC can readily be determined. This graph is similar to the plot currently produced in slide form by Device 14A2, but it contains considerably more information, and it is presented in hard-copy form.

Figure 2 shows a plot of a simple exercise: single ship (own ship) with one submarine. This plot was produced from a sample of the collected computer data. The black and red trackings are the tracks of own ship and enemy submarine, respectively. Unlike the Device 14A2 slides, here time indices appear on the tracks for use in determining the relative position of ships in any problem and at any time. With very little practice, progression of the tactical situation can also be determined. On each track, positional time is indicated in minutes; the time between each subunit tick is 10 seconds. The symbol X on a track indicates the firing of a torpedo. A dashed line connecting the "fire" symbol to a small circular track depicts the flight path of an ASROC-launched torpedo. The circular track depicts the helical search pattern of a Mk 46 torpedo. The time-tagged torpedo tracks are over-the-side shots by own ship and enemy submarine.

The green track is the tracing of the sonar operator's cursor. This track represents, when systematically in the vicinity of the submarine, where in the ocean the sonar operator was specifying the submarine to be. As can be seen in Figure 2, there appears to be a constant range error in sonar target tracking, which could reflect a deficiency in the sonar operator's performance or perhaps result from uncalibrated equipment. The tracing of sonar tracking is not currently available on Device 14A2.

The blue, sawtooth-like markings that run along-side the red submarine tracing indicate computed course and speed. They are shown at all problem times, even though at various times they may be meaningless, such as computed values before initial contact has been made. At each intersection of a red time tick and the red track (at the submarine's position every 10 seconds), a blue vector is drawn, showing a predicted position of the submarine at an elapsed time of 10 seconds, based on the actual position of the submarine and its computed course and speed. Vector direction indicates computed course, and vector length indicates computed speed. At the end of the vector is a time tick. When computed course and speed are perfect, the blue and red tracks are completely superimposed. Figures 3 and 4 are further examples of training problem plots.

Figure 5 is a numerical printout designed by FLEASWTRACENPAC training personnel. The printout lists training problem information at selected times. A line of printout is generated when any of the following conditions is true:

1. (S) Sonar pulse length is changed.
2. (E) An event symbol is requested by an instructor.
3. (F) A weapon is fired by own ship.
4. (W) An ASROC-launched torpedo enters the water.

The information shown here under runs 1, 2, and 3 was derived from the data used to generate the three plots shown in Figures 2, 3, and 4, respectively.

SIGNIFICANCE OF RESULTS

With the exception of the CIC, the plots present, in comparative form, significant actions of all subteams. Shown together in a single representation, it should be possible to assess how well individual subteams performed and, more importantly, how well coordinated their actions were. With the addition of CIC plotting information, the performance of all subteams would be represented, and an evaluator could readily determine which, if any, of the subteams was responsible for failures in the team's execution of its tactic.

Immediate availability of the plots and training statics following a training session would free the instructor from many of his record-keeping tasks and allow him to evaluate team communications more thoroughly.

A plot serves as the basis of a permanent record of team performance, and a library of plots represents a fleet performance data base. Such records have potential value in several respects:

1. An incontrovertible evidence of team failures (for use when a ship challenges its performance grade).
2. A source of performance statistics, permitting an objective description of fleet readiness.
3. The means for determining the effectiveness of training methods and training devices.
4. A basis for evaluating ASW doctrine.

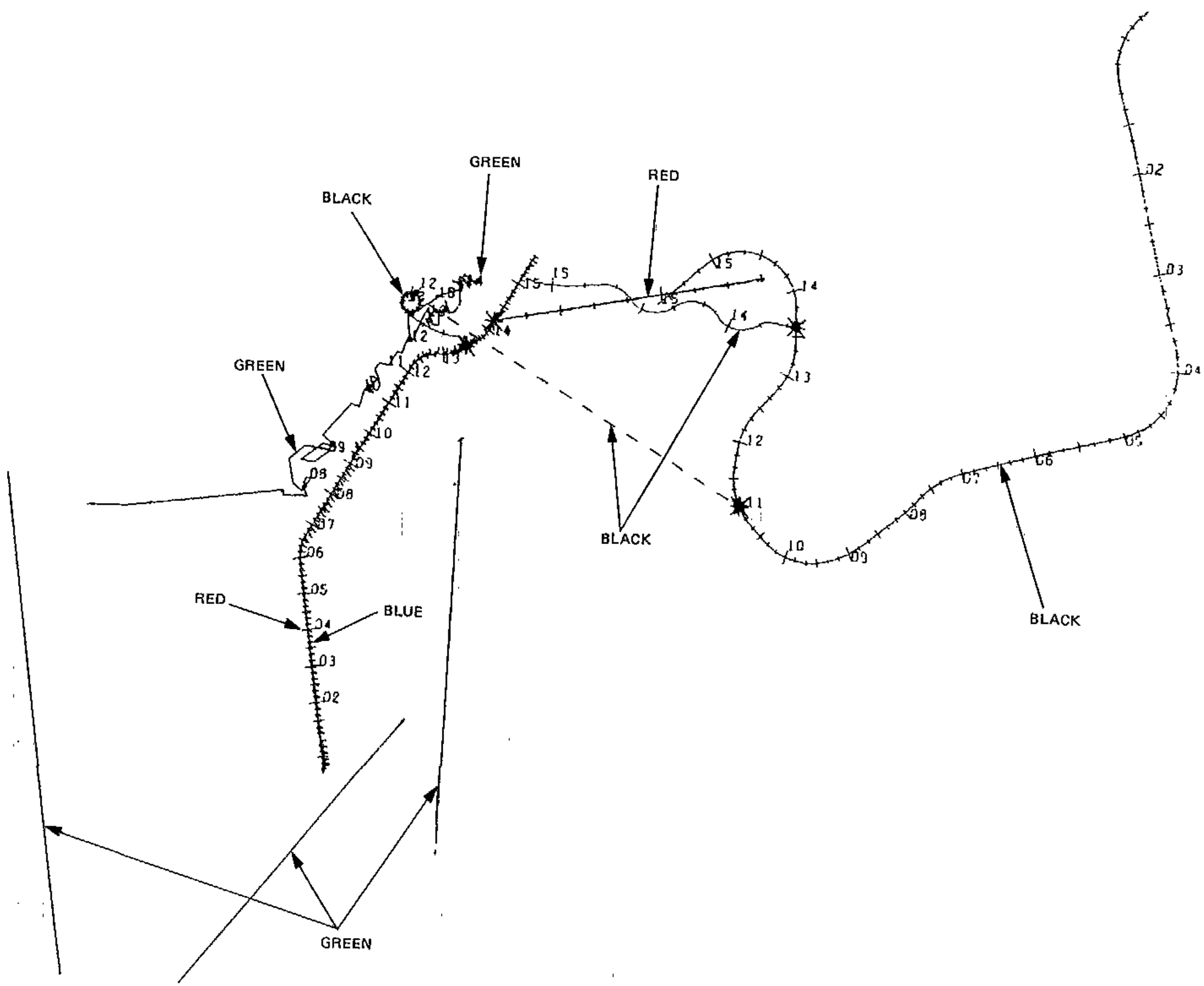

Figure 2. Training Problem Plot, Run

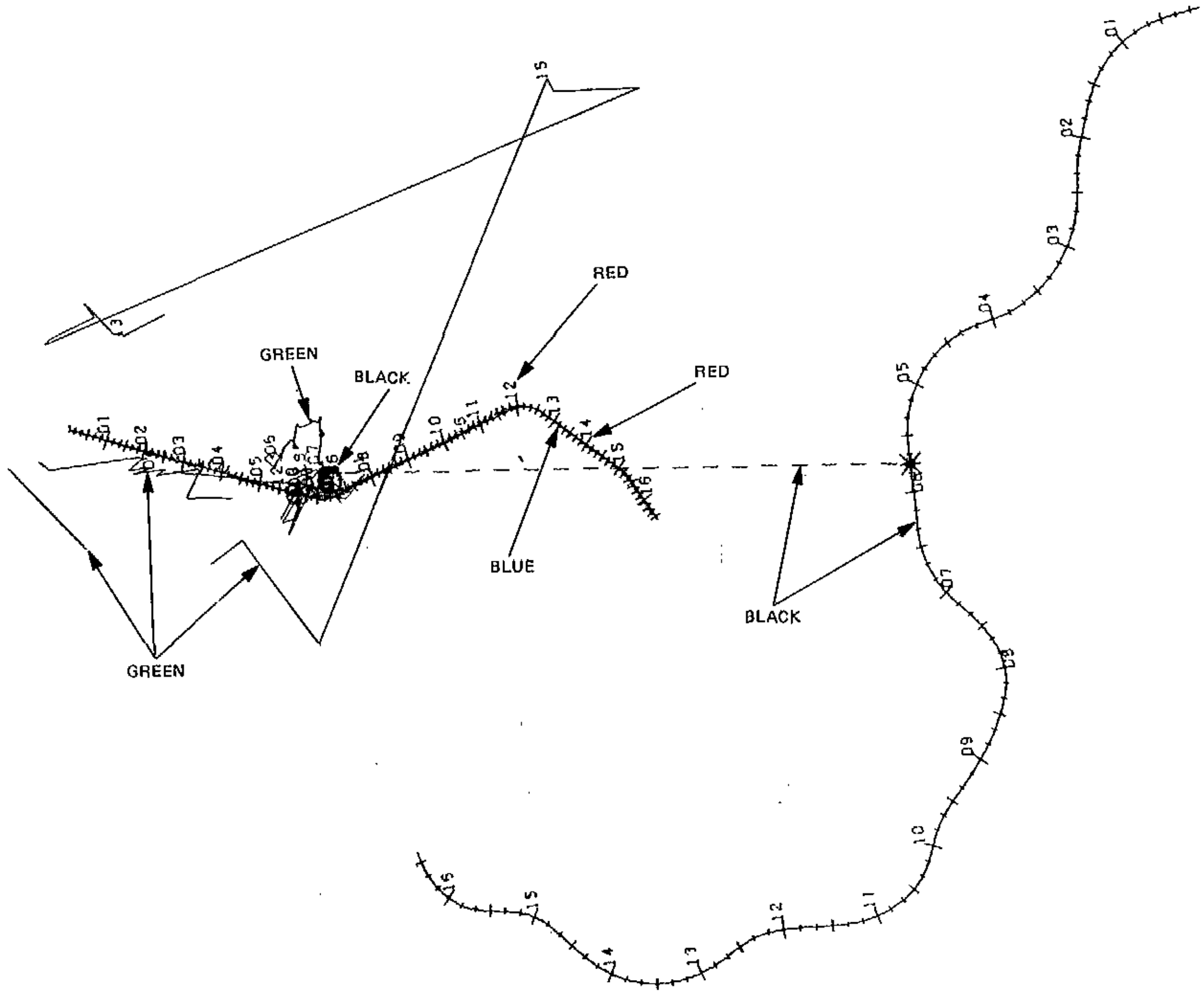

Figure 3. Training Problem Plot, Run

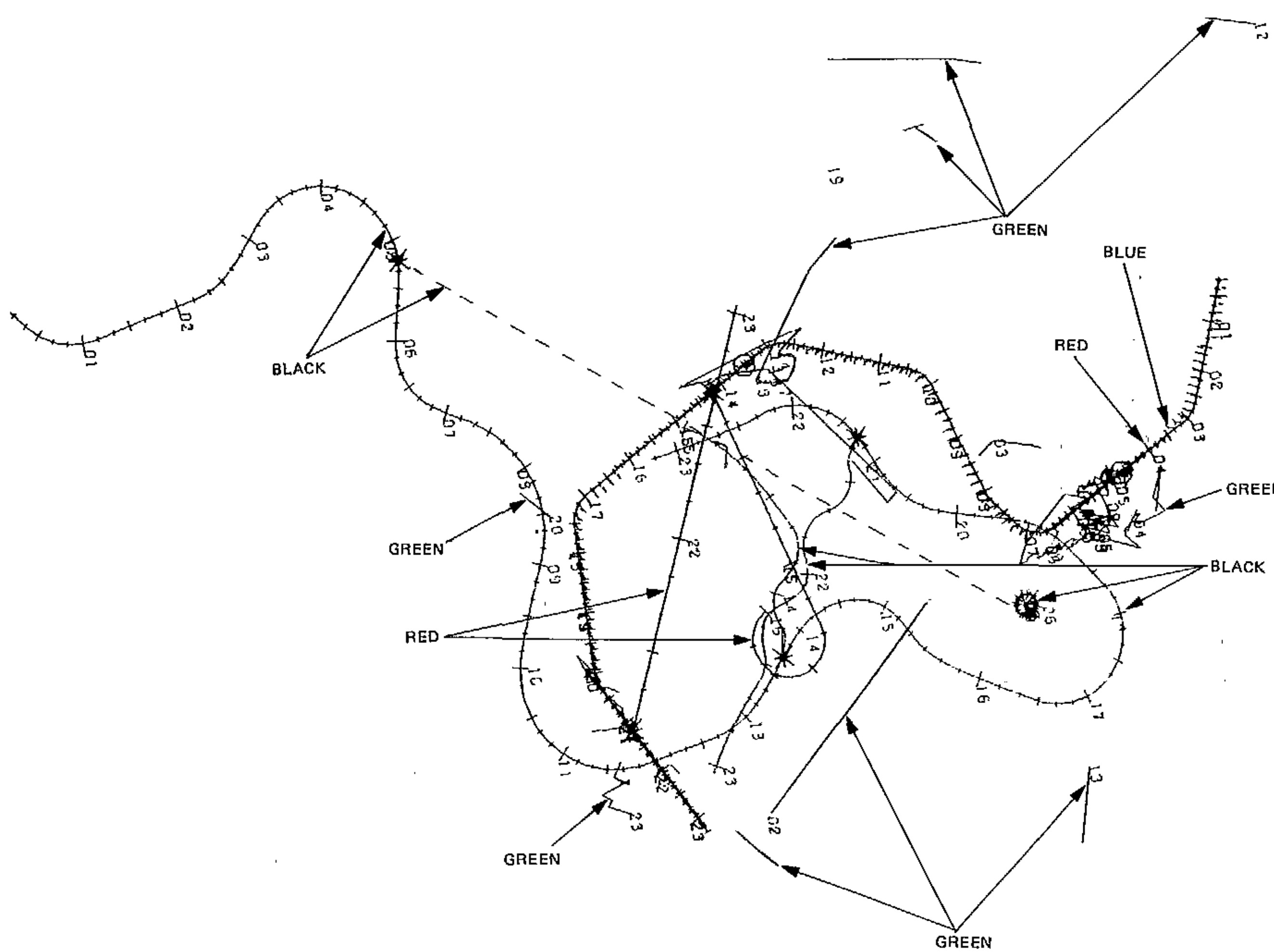

Figure 4. Training Problem Plot, Run

RUN # 1

	TIME	OWN SHIP CRS	OWN SHIP SPD	SJ1 SHIP CRS	SJ1 SHIP SPD	SJ2 SHIP CRS	SJ2 SHIP SPD	SUB1 CRS	SUB1 SPD	SUB1 DEP	SUB2 CRS	SUB2 SPD	SUB2 DEP	FIRE CONTROL CRS	FIRE CONTROL SPD	FIRE CONTROL BRN	FIRE CONTROL RNG	ACTUAL BRN	ACTUAL RNG	WEAPON BRN	WEAPON RNG	WEAPON GYR	SONAR
S	00:02	225	18.0	0	0.0	0	0.0	350	8.0	-32	0	0.0	-32	28	8.6	114	2145	225	8520	56	8465		MD
E	07:39	225	15.2	0	0.0	0	0.0	30	8.0	-16	0	0.0	-16	0	8.6	268	4975	266	4685	56	4623		MD
E	11:01	330	14.2	0	0.0	0	0.0	30	8.0	-16	0	0.0	-16	40	8.6	290	3030	283	2880	73	2843		MD
F	11:04	333	14.2	0	0.0	0	0.0	30	8.0	-16	0	0.0	-16	40	8.6	290	3005	283	2860	343	757	7P	MD
W	11:34	1	14.5	0	0.0	0	0.0	30	8.0	-16	0	0.0	-16	40	8.6	289	2840	281	2715	338	632	7P	MD
F	13:37	357	19.0	0	0.0	0	0.0	60	12.0	-16	0	0.0	-16	40	8.6	274	2690	264	2560	24	2481	7P	MD

RUN # 2

	TIME	OWN SHIP CRS	OWN SHIP SPD	SJ1 SHIP CRS	SJ1 SHIP SPD	SJ2 SHIP CRS	SJ2 SHIP SPD	SUB1 CRS	SUB1 SPD	SUB1 DEP	SUB2 CRS	SUB2 SPD	SUB2 DEP	FIRE CONTROL CRS	FIRE CONTROL SPD	FIRE CONTROL BRN	FIRE CONTROL RNG	ACTUAL BRN	ACTUAL RNG	WEAPON BRN	WEAPON RNG	WEAPON GYR	SONAR
E	03:44	334	20.8	0	0.0	0	0.0	200	8.0	-32	0	0.0	-32	133	8.6	359	6005	355	5610	165	10729	7P	MD
F	05:45	268	21.4	0	0.0	0	0.0	200	8.0	-32	0	0.0	-32	194	9.7	5	4280	3	4227	326	233	0	MD
W	06:20	267	21.4	0	0.0	0	0.0	200	8.0	-32	0	0.0	-32	162	9.7	14	4160	9	4200	151	167	0	MD
E	13:16	353	18.7	0	0.0	0	0.0	220	8.0	-32	0	0.0	-32	7	9.7	49	4680	44	4617	169	732	0	MD

RUN # 3

	TIME	OWN SHIP CRS	OWN SHIP SPD	SJ1 SHIP CRS	SJ1 SHIP SPD	SJ2 SHIP CRS	SJ2 SHIP SPD	SUB1 CRS	SUB1 SPD	SUB1 DEP	SUB2 CRS	SUB2 SPD	SUB2 DEP	FIRE CONTROL CRS	FIRE CONTROL SPD	FIRE CONTROL BRN	FIRE CONTROL RNG	ACTUAL BRN	ACTUAL RNG	WEAPON BRN	WEAPON RNG	WEAPON GYR	SONAR
S	04:21	35	19.0	0	0.0	0	0.0	150	10.0	-32	0	0.0	-32	160	9.7	30	5955	26	5880	310	13557	0	
F	05:13	90	19.2	0	0.0	0	0.0	150	10.0	-32	0	0.0	-32	166	9.7	29	5210	25	5240	344	991	0	MD
W	05:53	101	21.2	0	0.0	0	0.0	150	10.0	-32	0	0.0	-32	166	9.7	26	4885	22	4992	338	775	0	MD
E	10:42	58	19.9	0	0.0	0	0.0	200	12.0	-32	0	0.0	-32	166	9.7	348	4220	349	4492	139	1119	0	MD
S	10:45	55	19.9	0	0.0	0	0.0	200	12.0	-32	0	0.0	-32	166	9.7	348	4190	349	4492	139	1119	0	
F	13:42	309	21.2	0	0.0	0	0.0	150	12.0	-32	0	0.0	-32	166	9.7	279	2010	270	1962	90	1924	7P	MD
E	20:45	233	20.7	0	0.0	0	0.0	60	12.0	-32	0	0.0	-32	66	9.7	159	1940	149	2472	231	1973	7P	MD
F	21:17	239	20.7	0	0.0	0	0.0	60	12.0	-32	0	0.0	-32	66	9.7	145	2530	136	2567	255	2534	7P	MD

Figure 5. Training Problem Printout

PHASE II PLAN

The next phase of the program will include development of a variety of computer-based problem scenarios. These scenarios will provide a training option that should increase training problem standardization by placing target maneuvers under computer control.

At present, target maneuvers are under instructor control. Maneuvers employed in training reflect the instructors' differing concepts of submarine tactics. In addition, instructors use their individual judgment in determining how a submarine's maneuvers should be adjusted to achieve a chosen level of problem difficulty. Under these conditions, it is virtually impossible to derive performance norms to cover the range of possible tactical developments.

Standardized scenarios should permit a valid comparison of the performance of ASW teams of different ships, trained at different times, at different sites, and by different instructor staffs. The goal of this next phase will be to develop scenarios that are graded with respect to problem difficulty and that cover a representative range of tactical possibilities.

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