

NATO TEST AND EVALUATION RANGE STAVANGER, NORWAY

**Ernest A. Dahl
Project Engineer
NATO PUTTS System
Naval Ship Weapon Systems Engineering Station
Port Hueneme, California**

ABSTRACT

The NATO Test Range at Stavanger, Norway permits cold environment testing of NATO Systems, common TLM data processing for many types of missiles, with both ship/shore control as well as evaluation. Figure 1 shows the location.

INTRODUCTION

The NATO Countries have unique requirements for Range Operations. The ship and systems originate in different countries with common requirements, firing both a Common Point Defense Missile System and other systems as procured or developed by each country. The testing and evaluation of these different systems must be conducted in an area that permits operation of different types of ships, but with a TLM system which permits standard data receiving and analysis.

While participation in other ranges of missile testing in areas such as the Caribbean and Mediterranean, most missile testing and evaluation for NATO missile systems are done in a range which exists off Stavanger, Norway. This range permits very unique evaluation, since ships are operated in a cold environment and in cold water. This presents realistic combat problems that exist in the Arctic. The cooperation between countries in connection with TLM equipment procurement from the United States, permits a range monitoring which allows a common base for data analysis.

EQUIPMENT DESCRIPTION

In March of 1972, NATO requested that the Naval Ship Weapon Systems Engineering Station develop a portable ultra high frequency telemetering system which would meet the requirements of the Point Defense Missile System used by NATO, and permit recording and processing of data, FM/FM or PAM. PAM data is used for on-board telemetering

coverage and evaluation during operations in the NATO complex, with a requirement to expand the format to PCM or digital formats when necessary. Using NATO requirements, a system was produced that weighs 425 pounds. The RF section could be deck-mounted on a ship operating in the fleet area where a firing took place. This hardware is now part of the operating hardware of the NATO range operation. All sections of this PUTTS system are set up on a modular basis. Any section can be updated to meet changing missile system requirements. The first receiver update took place in 1979, introducing a high performance, frequency synchronized, remote tuned (all channel) receiver, manufactured in the United States by Trak Microwave, Tampa, Florida. This light weight unit with wide angle of coverage (90°), permits placing the receiver on a Patrol Boat, local shore point. The 90° angle reduces the need for auto track on short distance firing.

LOCATION

The Range Operation of the Norwegian complex is located in a fiord outside of Stavanger, Norway. Its operation is based on combining in-fleet recording of missile data. When Ship "A" fires, Ship "B" records the data on the PUTTS. Simultaneously, if possible, a ground point located nearby on a hilltop, receives and also processes the data. Analysis can then be done at both points, and joint decision is issued on the operation success.

SHIP INSTALLATION

Figure 2 shows the original PUTTS installation on a Norwegian destroyer. This portable unit is mounted on a basic frame structure that permits raising it so the angle of view is over the lifelines of the ship. This tracking unit contains two receivers and antennas. Position information and data is transmitted by line to the remote control box that is inside the processing room. This is the standard PUTTS system which has been set up and in operation since 1975. The RF unit is capable of receiving two RF frequencies, and can process the data or readout on an oscillograph type unit with the data from PAM or PCM modulation. The oscillograph recorder is an 18 channel recorder in which analog data is available for analysis. A Doppler type analysis unit is used for processing miss distance. The stern of the ship must face the launch and intercept areas.

Figure 3 shows the typical operation in a fiord. In the distance is a Danish frigate preparing to shoot a missile. The PUTTS assembly on the right side of the picture (RF assembly), is the standard PUTTS tracking unit as designed by NSWSES in 1975. It contains the RF assembly and all the hardware. In the center of the picture, mounted on a tripod, is the new 90° PUTTS self-contained RF assembly which consists of two receivers, receiver performance controls, dual antennas and a dynamic system which provides self test and receiver signal strength monitoring. As the missile flies, in the case pictured here, both

receivers were operational to provide comparative data on the new light weight, low cost system.

Figure 4 shows an EDM model of the PUTTS update (1979). Each receiver has its own antenna. A common test antenna between receiving elements provides a source for calibration and dynamic test prior to missile firing. This also provides 2-wire, touch tone tuning of receivers as well as remote control of the dynamic checkout of the system prior to firing.

Figure 5 shows the long range PUTTS update unit where the narrower antenna angle permits longer range, remaining small in size and cost effective.

Figure 6 shows the hilltop control location providing information for range safety as well as drone control for launching target drones. The monitoring ship in the NATO Fleet has the ability to assume drone control when the drone is in the firing area, and also record all data during firing exercises.

Figure 7 shows system test being conducted at Hackelsvern, prior to ship installation at Stavanger.

Stavanger is located in the southern part of Norway, with reasonable access from Danish areas. It also provides direct access to the main NATO Base at Hackelsvern, Norway, which is adjacent to Bergen. The equipment test and evaluation can be conducted in this modern facility at Hackelsvern without environmental problems.

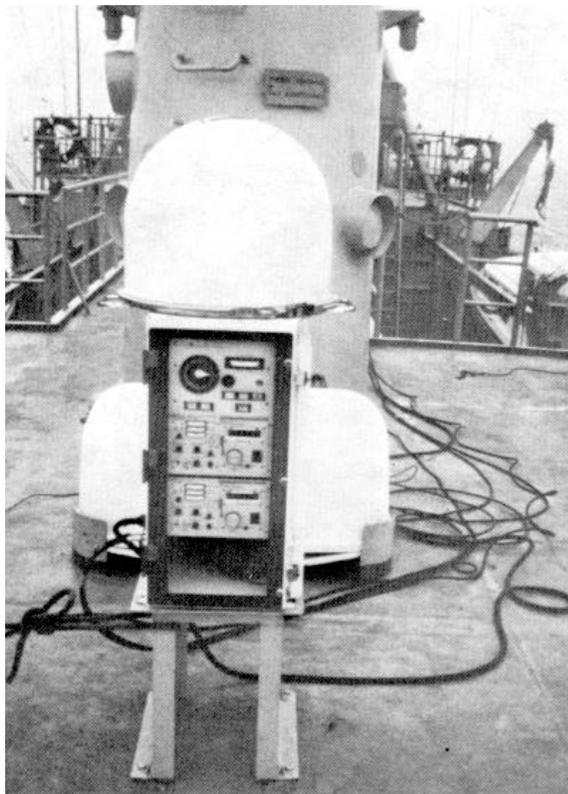


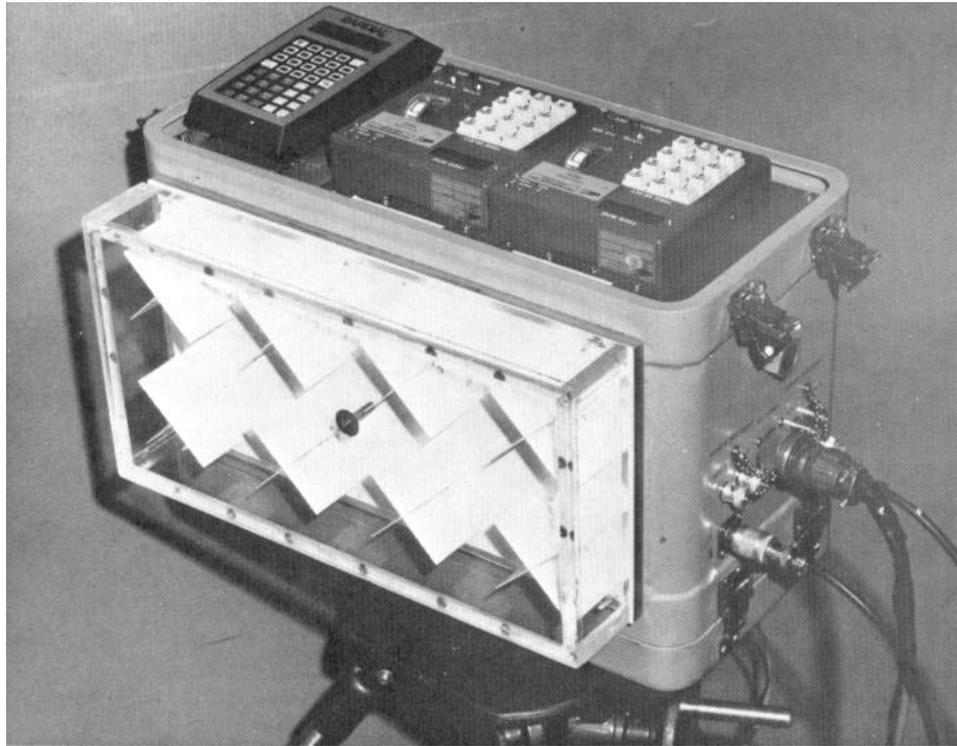
FIGURE 2. PUTTS RF RECEIVING SYSTEM - DUAL CHANNEL - 100 LBS RECEIVER UNIT - TRACKING ANTENNA UNDER DOME



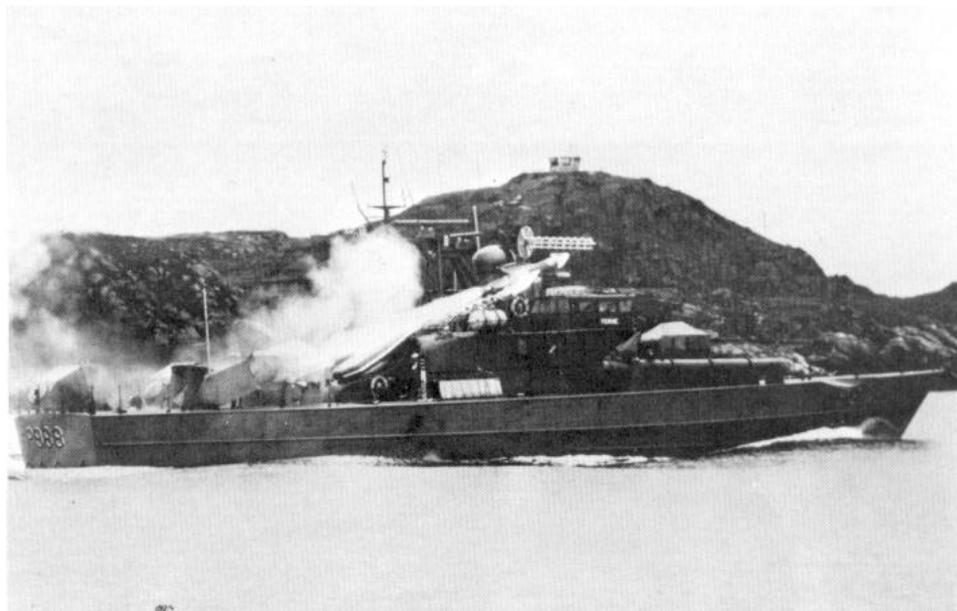
FIGURE 3. OPERATIONAL USE - PUTTS 1 - PUTTS UPDATE



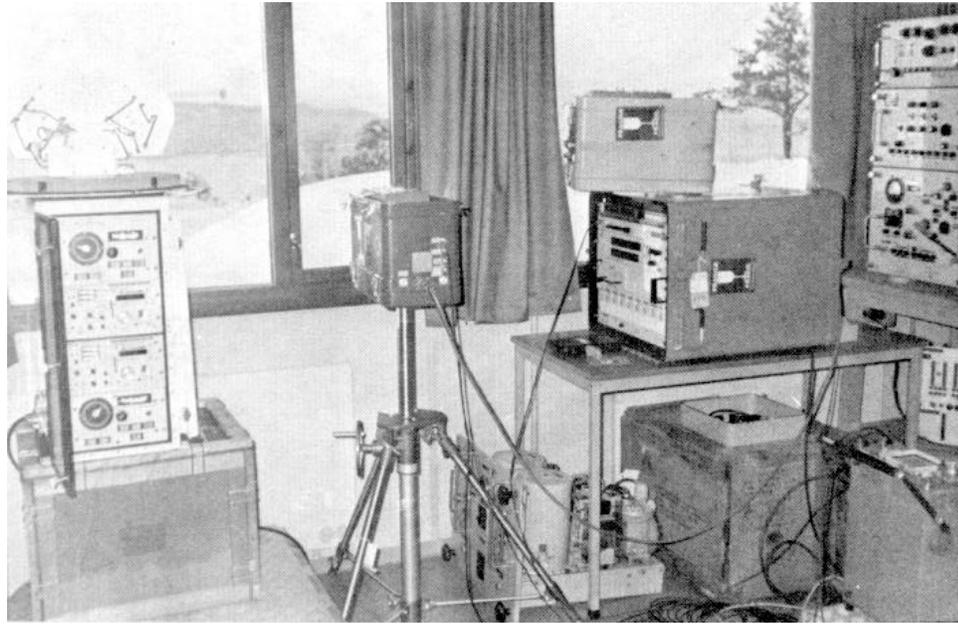
**FIGURE 4. PUTTS - UPDATE - SR - RECEIVING SYSTEM DUAL CHANNEL
35 LBS UNIT - 90° ANTENNA BEAM WIDTH**



**FIGURE 5. PUTTS UPDATE - LR - RECEIVER SYSTEM - TRACKING
38° - 38 LBS UNIT**



**FIGURE 6. NORWEGIAN FAST PATROL BOAT FIRING PENGUIN MISSILE
NOTE - TLM RECEIVING OUT ON BOAT & TLM LAND BASED REC. STA.**



**FIGURE 7. SYSTEM TEST AT NATO HEADQUARTERS,
HACKELSVERN, NORWAY**