NAVAL COMMAND,
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RDT&E DIVISION
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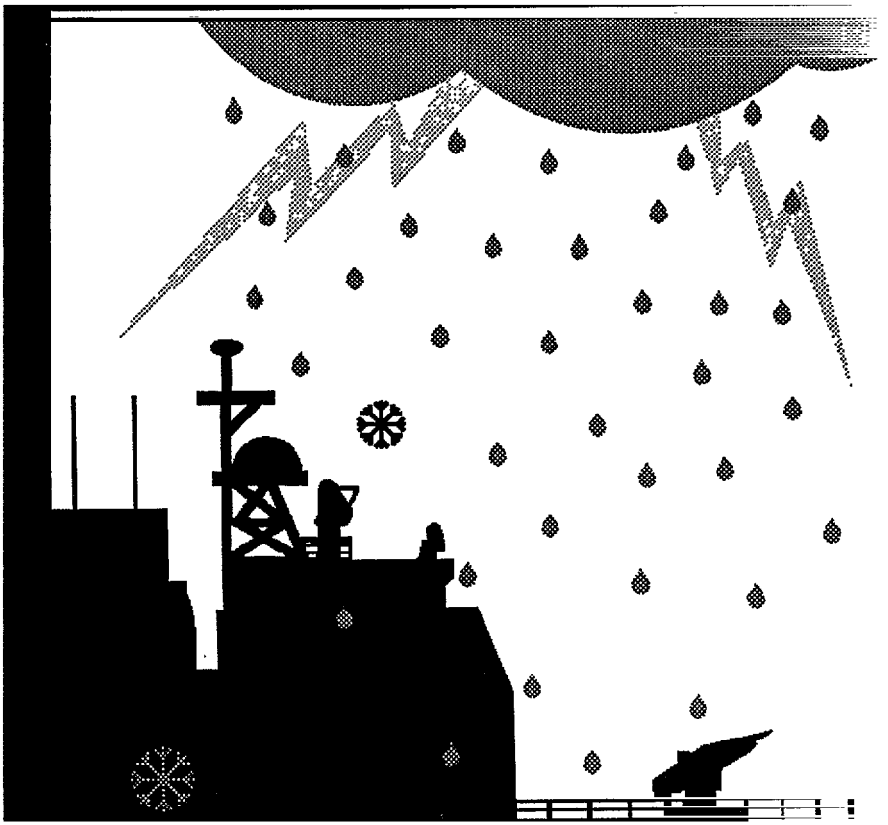

RUGGEDIZING
What Does it Mean!

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ADMINISTRATIVE INFORMATION

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RUGGEDIZED EQUIPMENT

WHAT DOES IT MEAN?
WHAT IS IT?
HOW MUCH TESTING IS NEEDED?

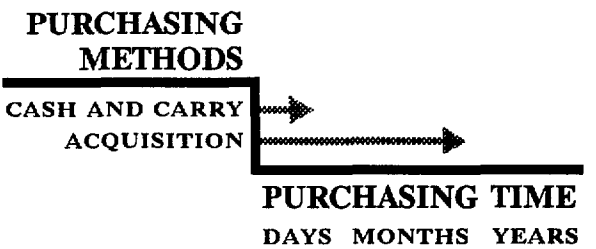
RUGGEDIZING?

"Ruggedized equipment" has been the term used during the past few years to describe equipment not designed to full Military Specifications (MIL-SPECs), but advertised to function under adverse conditions (the military environment). This booklet will attempt to clear up the confusion as to what the term ruggedized equipment means, what ruggedized equipment is, and how much testing is required. But first, let's become acquainted with the Navy's way of procuring equipment.

SHOPPING AROUND

The Navy uses several different methods to buy items. These range from:

- The quick and easy "cash and carry" method (e.g., brooms, pencils, soap, etc.); to
- The lengthy and expensive "acquisition" process (e.g., F-14s, SSBNs, etc.).



Because the Navy needs quality, reliability, maintainability, availability, supportability, safety, and, yes, even affordability in its combat weapons, items, such as the F-14s, must be bought to full MIL-SPEC. Adding to the high cost (a relative term) is complete documentation: manuals, training plans, integrated logistics, etc. These allow Navy personnel to operate and maintain the system over an expected lifespan of 20 years or more.

COMBAT WEAPONS REQUIREMENTS

T&E	AVAILABILITY
PERFORMANCE	SUPPORTABILITY
QUALITY	SAFETY
RELIABILITY	AFFORDABILITY
MAINTAINABILITY	ETC.

TESTING AND MORE TESTING FOR MIL-SPEC

MIL-SPEC hardware requires extensive testing and evaluation to assure that the system works, and works as planned, under hostile environments and combat situations. Considerable effort is devoted to stringent environmental tests. Normal shipboard conditions include vibrations (ship's propellers), high humidity, temperature extremes, electrical interference, salt air, dust, and handling mishaps (dropping or bumping). Because the Navy operates warships and not cruiseships, the environment is compounded by combat conditions, e.g., underwater explosions, gunfire, missile attacks, electromagnetic pulses (EMP), smoke, and fire. The stress on the equipment (not to mention the crew) becomes immense.

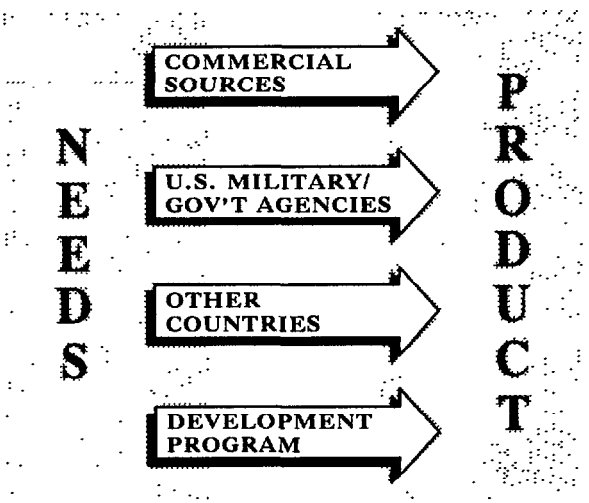
However, if everything onboard had a MIL-SPEC price tag, the Navy would never be able to leave port. This is where the nondevelopment items (NDIs) and commercial off-the-shelf (COTS) equipment play a major role in keeping the Fleet afloat.

THE TECHNOLOGICAL DILEMMA

To avoid reinventing the wheel, to save money, and to take advantage of rapidly changing technology, the Navy prefers to buy NDIs. NDIs are selected from the following sources:

- Commercial sources (may require ruggedization or militarization);
- Other U.S. military or Government agencies; and
- Other countries.

If these sources cannot provide the needed items, a very expensive development program is initiated—and therein lies the technological dilemma. Development time from concept to Fleet is from 10 to 15 years. Compare computers over a 10-year period and you will see how quickly technology becomes antiquated. Thus, if the solution to a mission need is commercially available, procure it—if it can operate in the military environment. (Logistic and product assurance are other considerations that are too complex to cover in this booklet.)



Shipboard equipment ranges from untested, off-the-shelf items to fully qualified MIL-SPEC systems. If the equipment is mission critical (contributes significantly to the platform's safety, maneuverability, and continued combat capability), full MIL-SPEC must be met, including full environmental testing. It's important to note that much of NDI is fully qualified. Even if an item is not mission critical, it still must work in its intended environment, which usually involves ruggedizing. (C^4I equipment is not treated as mission critical per MIL-STD-2036.)

COMMERCIAL OFF-THE-SHELF (COTS) EQUIPMENT

The three categories of COTS are:

- Used as is: no changes. An example of this category would be equipment (e.g., a telephone) located at an air-conditioned shore facility. Most items are designed for this condition.

- Modified to meet functional requirement (e.g., a telephone with a different connector).

- Ruggedized to meet harsher service requirements (e.g., a telephone with shock absorbers, heavy duty cord, moisture resistant, etc.). If the equipment is "ruggedized" to withstand full environmental tests, it is commonly called "militarized." A plethora of commercial products are advertised as "ruggedized for military use." Claims range from a new coat of paint to almost MIL-SPEC. Some claims work; others—buyer beware! There are relatively few specs and standards addressing "ruggedized" as compared to those for "qualified." (This is a plus because the manufacturer can tailor the item to the environment without being bogged down by excessive specifications.)

The Golden Rule: All COTS must be designed to operate in their intended environment.

LET'S PUT IT TO THE TEST

Ruggedized equipment must be tested to develop confidence that it will work in the intended environment. The type and amount of testing needed is determined by the expected life-cycle of the item. Because not all non-mission critical equipment is up 100% of the time, lower levels of testing may be appropriate. A good starting point would be to use MIL-STD-810 as a guideline, and tailor the tests as necessary. The skills of the test engineer are invaluable for this process. Many of the commercial suppliers of COTS have already performed the necessary tests and can provide the results. However, these should be verified because a few shoddy vendors try to sell junk they claim is ruggedized.

RUGGEDIZED? BUYER BEWARE!!

There are some very good ruggedized NDIs available on the market for a fraction of the cost of full MIL-SPEC hardware. Vendors have upgraded the commercial products by using conformally coated boards, electrical and mechanical filters, shock isolation systems, workmanship screening, repackaging, etc. Good examples of this are the Navy's DTC-II and its successor, the TAC-3; large C^3 processing systems, consisting of commercial hardware (processors, displays, and ancillary items) ruggedized and tested for the shipboard environment.

LOOKING AHEAD

The hard facts of economics dictate that the Navy will not be able to afford as many full development type programs as it has in the past. More mission needs will be fulfilled with NDIs. Thus, the program managers must be smart buyers because the responsibility of providing reliable systems to the Fleet is on their shoulders. MIL-SPEC equipment may no longer be affordable, but the Navy can afford even less to have nonoperational equipment. New specifications, like MIL-STD-2036, encourage NDIs, but each NDI will have to be carefully tailored. Commercial vendors are realizing the need for and benefit of ruggedizing their products, not only for the military, but for industrial and personal uses as well.

PRESENT **FUTURE**

Sometime in the near future, everything you need to know about ruggedizing will be in some MIL-STD. However, for now, refer to the sources in the bibliography.

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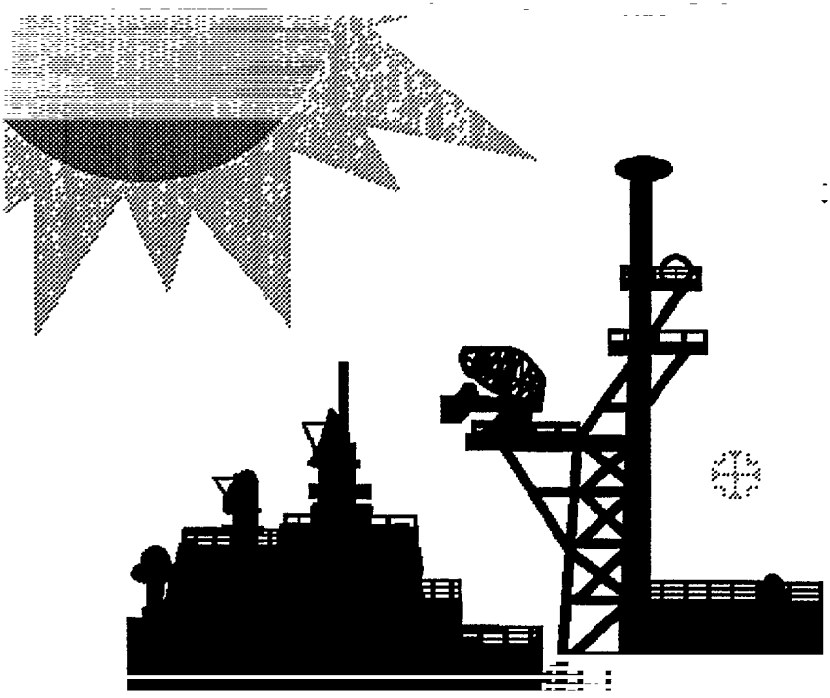

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