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U. S. NAVY SHIPBOARD FURNITURE - DESIGN FOR NEED

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DESIGN FOR NEED

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Abstract

Hundreds of commercial companies manufacture furniture, and thousands of retail stores display and sell hundreds of thousands of different furniture items for home and office. Yet with very few exceptions, none of these items are acceptable for use on board U.S. Navy ships. Why is this so? Why is Navy furniture so different that special designs must be created and special procurements contracted? This paper attempts to clarify what makes Navy shipboard furniture unique.

The discussion addresses various aspects and characteristics of furniture provided to the Fleet. Primarily, the types of materials used and the matter of "approved" materials are discussed. Other topics include weight considerations, maintenance, size, strength, safety, shock, standardization and special purpose designs.

The author also briefly presents his opinions about the Navy's furniture program shortcomings and identifies major areas for future development and improvement.

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1. Introduction

The U.S. Navy attack aircraft carrier glides majestically through the light seas of the Mediterranean Sea. It is late afternoon. Seven bells have just been heard throughout the ship.

The OOD walks to the starboard side of the bridge, steps up on the foot rest, and settles into his bulkhead mounted pilothouse chair. Leaning on the padded arm rest, he carefully scans the seas ahead of the ship's bow from his lofty perch and awaits his relief, due to arrive shortly.

Deep in the ship, the Marine sentry leans forward in his swivel chair, with his elbow resting on the single pedestal aluminum desk, and glances across the brig vestibule into the stainless steel convex mirror mounted high on the bulkhead. He notices that the three incarcerated seamen are resting quietly on their austere but comfortable berths in the community detention cell.

The Catholic chaplain, a Navy Captain, arranges assorted pamphlets in the religious literature rack mounted in the passageway just outside his office on the second deck.

A young seaman dropping his latest letter to his girlfriend in the red, white and blue post office letter box, glances at the bulletin board for any new notices; and eyes once again that watch he wants through the acrylic showcase window of the ship store as he hurries to the crew messroom. There he will sit with a few of his buddies on colorful molded aluminum stacking chairs at a portable six-man mess table for a short rap session before going on watch.

The Disbursing Officer rises from the low, open door of the safe. He methodically and carefully closes the safe door, turns the securing handle and scrambles the combination lock. Locking the office door, he glances through the security window at the always-lighted safe, making one last mental check before uneasily turning away from the $2.5 million in currency locked inside.

The Public Information Officer casually strolls into the wardroom lounge, picks a magazine from the coffee table and settles back in the deeply padded lounge chair to read until the evening meal.

What is common to each of the above mentioned scenes? Well, all of the items mentioned above, from chairs and tables to convex mirrors and safes, are part of the U.S. Navy Furniture Program. Within one small functional code at the Naval Ship Engineering Center, all shipboard furniture and related furnishings are conceived, developed, designed and maintained for use in a coordinated program of ship design, conversion and fleet engineering services.

Decades of effort in this area have resulted in a technical library of over 1500 separate designs, each contained in a military specification or a hull type or standard drawing*, together with a pool of knowledge regarding use of materials, fabrication techniques, installation problems and the supplemental use of commercial items in selected applications.

Hundreds of commercial companies manufacture and install furniture, and thousands of retail stores display and sell hundreds of thousands of different furniture items for homes, offices, and even campers and boats. As will be shown, with very few exceptions, none of these commercial items are acceptable for use onboard U.S. Navy ships. Why is this so? Why is Navy furniture so different that special designs must be created and special procurements contracted by a full time dedicated staff of Navy engineers?

This paper will attempt for the first time ever to address this question and each of the various design aspects and characteristics of furniture and furnishings provided to the Fleet that makes such furniture different.

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*Standard Drawing - A NAVSEA drawing illustrating arrangement and details of equipment, systems, materials, or components from which no departure in the manufacture of parts or intent of use is permitted without NAVSEA approval.

Type Drawing - A NAVSEA drawing illustrating systems or components which may be subject to development by the Contractor to assure full compliance with requirements. Form, fit and function shall not be altered without NAVSEA approval.

2. Scope of the Program

When thinking of furniture, items that usually come to mind are chairs, sofas, accessory tables, dining chairs and tables, beds, bookshelves and desks. These items are also part of shipboard furniture. But there are dozens of unusual and special purpose functions unique to Navy ships, that requires specialized furnishings not necessarily obvious to the layman. A chart table with chronometer case; portable folding altar; post office pigeon-hole and stamp rack; surface-lookout shock mounted seat; - these are examples of furnishings that are part of the scope of the U.S. Navy Shipboard Furniture Program, in addition to chairs and tables and berths.

The rank and position of Navy personnel provides the need for unique furniture designs. One does not just provide a Navy berth for sleeping. (Figure 1.)

- There are 2, 3, 4, and 6 man berth cubicles for enlisted men with 3 inch foam mattresses.

- There are slightly larger 2, 3, and 6 man berth cubicles for petty officers with 4 inch foam mattresses.

- Junior officers have one or two-man berth modules with 6 inch foam mattresses in two optional sizes, depending on ship size and available space.

- Senior officers have one-man berths or berth-transom combinations.

- Flag-rank officers are provided cabin-stateroom beds with box springs and mattress, as well as a headboard with built-in shelving.

- There are also hospital berths, troop berths and brig berths. There are cots and free-standing (portable) berth modules used to transport additional men in wartime and during heavy troop movement exercises.

- Submarines have an entire line of berths similar to those already described but with unique features required for submarine access and use.

- For use on mine warfare-type ships, the newest furniture program design is a modular crew berth made entirely of fire-retardant wood and glass-reinforced plastic (GRP). The use of this non-magnetic berth will greatly reduce the electromagnetic interference (EMI) of these ships and enhance their mission capabilities. (Figure 2.)

- And, for most of the above-mentioned berths, the designs include options for privacy curtains, partitions, ventilation louvers, integral built-in clothes lockers, lighting, magazine racks, utility shelves, clothes hooks and heavy weather lee straps. Several designs provide for steel or aluminum as an optional material.

- Also, there are design details showing various optional techniques for fastening the berths to the ship structure.

So it can be seen that for just one type of shipboard furniture - a berth - there are literally hundreds of variations to be found on Navy ships based on selections from furniture program design files.

The many hundreds of shipboard furnishings for surface ships* can be grouped into nine major functional categories. In order to appreciate the scope of the furniture program, following is a listing of the generic categories and some specific items found in each of the functional areas.

BERTHING SPACES

Officers

Modular Units including: (Figure 3.)

- Wardrobe
- File Drawer
- Chest of Drawers
- Secretary Unit
- Safe
- Utility Lockers
- Berth
- Flight Clothes Locker
- Lavatory Unit
- Toilet Article Case
- Mattress

CPO & Crew

- Various berth modules (Figure 4.)
- Clothes Lockers
- Writing table
- Peacoat Locker
- Wardrobe Lockers (Figure 5.)
- Cleaning Gear Locker
- Soiled Clothes Locker
- Ironing Board w/Locker
- Mirror
- Lavatory Counter
- Mattress
- Privacy Curtains

LIVING SPACES (PRIMARILY LOUNGES)
(Figure 6)

- Transom
- Lounge Chairs
- Recreation Tables
- Lounge Booth
- Coffee & Side tables
- Card Table (Portable)
- Magazine Rack

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*This paper does not attempt to describe furniture designed specifically for use on submarines although it is part of the Navy's Furniture program.

Other areas excluded from this paper are laundries, dry-cleaning plants, commissary and scullery spaces and special stowage aids (K-Racks, bins, flammable liquid stowage lockers, pipe racks, etc.).

MESS SPACES

Various Mess Tables (fixed)
Portable Mess Tables
Table Leaf Lockers
Booth
Outrigger seats
Sideboard
Serving Table
Napkin Cabinet

FLAG & SENIOR OFFICER QUARTERS

Cabin-Stateroom Bed
Night Table
Berth/Transom
Lounge Chairs
Executive Desks
Berth Spring Unit
Transom
Dining Tables
Occasional Tables
Serving Tables
Credenza

OFFICES

Swivel Chairs
Work Station Desks
Typing Desks (Figure 7.)
Safe Lockers
Plan Cabinet
Book Racks
Key Cabinets
Shelving Units
Book Case Units
Filing Cabinets
Form Cabinet
Stationary Cabinet
Chain Dex Book Shelf
Safes (Figure 8.)

SERVICE AND SUPPLY AREAS

Barber Shop

Barber Chair (Figure 9)
Back Bar Cabinet
Supply Locker
Mirror

Post Office

Storage Units
Safe Locker
Stamp Rack
Customer Counter
Special Purpose Cabinets
Pigeon-Hole Rack
Counter with Drawers
Mail Box (Figure 8.)

Library

Tables
Shelving (Figure 10.)
Study Carrel
Check-Out Counter
Card File Cabinet

Ship Store

- Showcase Units
- Display Gondolas
- Glass Door (Entry)
- Passing/Service Window

Service Areas

- Standing Desk
- Log Desk
- Issue Desk

Brig

- Special Purpose Berth
- Convex Mirror
- Lavatory Unit
- Mail Box
- Drinking Fountain
- Steel Bar Partition
- Literature Locker

MEDICAL AND DENTAL

- Hospital Berth
- Dental Chair
- Sideboards
- First Aid Box
- Special Lockers
- Battle Dressing Table
- Supply Lockers
- Patient Waiting Bench
- Battle Dressing Station Locker

SPECIAL PURPOSE

- Flight Deck Shelter Bench
- Bridge Wing Chairs
- Shock Mounted Chairs
- Pilot House Chair (Figure 11)
- Console Operator Chair
- Primary Fly Control Chair
- Surface Lookout Seat (Figure 9.)
- Chart Tables
- Damage Control Key Cabinet
- Chaplains Literature Locker
- Portable Pulpit
- Bulkhead Mounted Chairs
- Aviator's Ready Room Chair (Figure 11)
- Radio Operator's Desk
- Log Desks
- Chronometer Case
- Portable Folding Altar
- Telephone Booth
- Document Sinking Bag

GENERAL PURPOSE

- Stacking Chairs
- Side Chairs
- Revolving Stool
- Bulletin Boards
- Ash Receivers
- Swivel Chairs
- Folding Chairs
- Folding Tables
- Mirrors
- Various Tables

3. Design Requirements

What makes Navy shipboard furniture "Navy"? Since, as stated before, hundreds of commercial companies manufacture and install furniture, why are the commercial items unacceptable for use and why must we create and maintain special designs?

There are nine major unique design considerations for shipboard furniture. Each is discussed in this section.

MATERIAL

The materials of which Navy furniture are designed and manufactured must meet exceedingly high standards. Approved material lists were developed after years of experience and as a result of tests and studies. The primary considerations are:

- Strength Properties
- Maintainability
- Corrosion Resistance
- Fire Performance
  - Flame Spread
  - Smoke Generation
  - Toxic Products of Combustion
  - BTU Release Rate
  - Ease of Ignition
  - Fire Load
- Aesthetics
- Safety
- Cost
- Fabricability

Most of the above factors are intuitively obvious criteria for consideration.

However, of all the above factors, none has had greater importance and impact on design than fire performance of materials. A residential house fire is serious and fatalities swiftly occur. And yet in a fire, escape to the safety of the street is usually readily available through a close-by window or door. By comparison, a ship fire can be devastating. The habitat of the crew is mostly deep inside the ship structure and is spread over many holes and corners. A toxic fire in one part of a ship does not relieve personnel hundreds of feet away from the danger due to the self-contained recirculating ventilation system. Escape from below decks can involve many vertical and horizontal passages to reach safety. And except for the in extremis condition requiring abandon ship, the ships crew can't really get away "into the street" but must turn and cope with their problem, which is usually compounded by large arsensals of weapons and copious quantities of flammable liquids that lend catastrophe potential.

Because of several serious fires in the late 1960's and because the Navy's Board of Inspection and Survey reported an alarming increase in the use of combustible material (e.g., wooden sheathing, decorative curtains, plastic chairs, rubber backed rugs, stuffed lounge furniture, etc.), the Chief of Naval Operations initiated action in 1972 to prevent combustible materials from being used on board ship. A three-phased program for inventoring all combustibles was established under NAVMAT direction.

One of the first major controls under this program was the issuance of a NAVSEA directive explicitly listing all approved and non-approved habitability materials. This listing even went so far as to name materials by brand name and suppliers to facilitate fast suitable replacements at the local level. Shortly thereafter, a new military standard was issued regarding Fire Performance Requirements and Approval Specifications for Interior Finish Materials and Furnishings, MIL-STD-1623.

What MIL-STD-1623 stipulated as furniture material requirements was very simple, but profound. It said in effect that furniture could only be made using the following materials:

. Metal to be steel in accordance with MIL-F-243 or aluminum in accordance with MIL-F-902.

. Cushioning material, polychloroprene (Common name, Neoprene) in accordance with MIL-R-20092.

. Upholstery material to be either artifical leather, FED SPEC CCC-A-680 or CCC-C-700; or polyaramid and polyaramid novoloid using MIL-C-24500.

. High pressure laminate, for table tops, conforming to MIL-T-17171.

. Acrylic Sheets, in accordance with MIL-P-5425. Very limited use, primarily for ship store showcase windows.

And that was it. No other materials were permitted. Wood, polyurethane, polystyrene, asbestos, cotton and plexiglas. None of these materials were authorized for use. This in effect set up furniture material standards possibly second only to NASA-controlled manned space flights. Subway cars, buses, commercial aircraft, hospitals, cruise ships and hotels - all have less stringent fire performance requirements.

Fortunately, previous designers of Navy furniture over the years had enough foresight. Impact of the new requirements on existing designs is practically nil and almost all of the 1500 furniture designs now available can be used under the new fire performance requirements. Many unsafe and poorly designed furniture items have crept into ships over the years. Now as these items are identified and removed under the first two phases of the CNO Program for control of combustible materials, suitable replacements are already available to be selected and procured under Phase III.

WEIGHT

All combatant ships, and many other ships and submarines should be weight conscious. After all, furnishings of excessive weight affect speed, payload and fuel carrying capacity (range), and in many cases adversely affect stability.

Each ship in service is assigned a stability status. Many ships today are weight and stability critical to the point of requiring weight removals of equal amount each time new systems are installed. Furniture in habitability space is not normally thought of as a significant contributor to ship's weight and stability. But the fact is that berthing for officers and crew on a NIMITZ Class aircraft carrier, that is berths alone, not even including mattresses, weighs more than 400 tons. Much of the furniture in habitability spaces is located high in the ship where increases in weight affect the stability adversely.

Almost all Navy furniture items are available in the choice of either steel or aluminum. Because of this, metal furniture designs have used aluminum in place of steel for many years on weight control combatant ships. The designs for molded seats, office file cabinets and desks, etc. are fabricated in aluminum and are not available in the commercial world. But in the long run it is worth it. On an aircraft carrier, the use of aluminum furnishings in lieu of steel saves over 600 tons.

MAINTENANCE

The manhours devoted to maintenance of furniture can be considerable and therefore is an important factor in determing a design or selection of an item for use. Approved materials and finishes have been selected with consideration given to maintenance-reducing and labor-saving properties.

For example, aluminum is superior to steel, not only from the standpoint of weight saving, but also corrosion resistance. This permits less rust removal and touching up when paint is scratched. And, in the long run, aluminum of equivalent strength will last longer. In the case of decorative finishes, certain factory-bonded vinyls can be cleaned more effectively than painted surfaces. Messing chairs, booths and tables are designed with a minimum of crevices and rough surfaces to permit easy cleaning and better sanitation. Furniture attached to decks is either designed with an enclosed sub-base, or if on legs, more than six inches off the deck to allow easy access to swabs and brooms. Where possible, unpainted aluminum, brass or bronze is avoided to eliminate the need for "busy-work" polishing and maintenance.

STRENGTH

Furniture aboard U.S. Navy ships has to withstand extremely heavy usage around the clock by sailors who are young and strong and who do not always take care of things or who might abuse furniture more than in their own homes. "Sailor-proof" is truly a design consideration.

The strength of an item of furniture is derived from its design, method of construction adopted and the type, quality, and quantity of materials employed. Although an item of Navy furniture such as an office five drawer legal size file cabinet, (Figure 12.), frequently appears to be identical to a less expensive GSA or commercial item, it is not. The Navy file cabinet is made of weight and maintenance reducing aluminum and is designed for attachment to the deck of the shipboard office. It also has been designed to withstand "sailor abuse", motion rolling up to 40^{o} in storm conditions (dynamic loads), ship vibration, and Grade B shock in some cases.

To assure proper strength of shipboard furniture, a Static Load Test Standard, NAVSHIPS dwg No. 805-2217424, has been developed to deliniate various tests for distortion, welds, latches, screws and rivets.

SIZE

Deck areas and compartment volume, especially in habitability spaces, are at a premium aboard ship. Navy furniture is therefore designed to be multifunctional and compact whenever possible. (Figure 13.). Submarine designs epitomize this need. If not compact, furniture must be sectional, collapsible or demountable in order to pass through doors and hatches within a ship.

Officially, for surface ships, a piece of furniture is designed to pass through a 26 inch by 66 inch access door (with 8 inch radius corners) and submarine furniture must be able to clear a 25 inch diameter hatch. Certain items are delivered in a "knockdown" condition of necessity and assembled within the space.

ATTACHMENT TO STRUCTURE

It is somewhat antithetical that we refer to Navy Furnishings as such, since by definition*, furniture is "the movable things in a room which equip it for living, as chairs, sofas, tables, beds, etc.,". Except for portable items such as chairs, all furniture has to be designed to be attached to the ship's structure to prevent movement, i.e., "missile hazards" in a seaway.

Attachments usually consist of welded clips to the deck, overhead or bulkheads, and sub-bases welded to the deck. In areas subject to heavy changing deck loads, such as gun blast or helo landing areas, deflection type attachments are required. Deflection fittings allow the structure to flex without crushing or deforming attached furniture. On small ships, i.e., destroyers and smaller, portable furniture is designed for use with tie-down fittings. For safety on mine warfare ships, special purpose seating is designed with shock isolation pedestals. And many items are designed with adjustable legs which allow attachment to deck with sheer and camber. Sub-base designs also allow for this uneven mounting technique.

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*Webster's New World Dictionary of the American Language, College Edition, World Publishing Company, Cleveland and New York, 1958

SPECIAL PURPOSE

As previously mentioned, many furniture items found aboard Naval ships are truly unique and have no commercial counterpart anywhere. The use of materials such as aluminum, and attachment to ship's structure have been discussed. But the unusual functional needs for special purpose items are responsible for dozens of designs that are found nowhere else.

Furniture aboard mine sweepers, for example, should be non-magnetic. Thus, a presently ongoing design program, will result in a complete suit of GRP furnishings to replace present unsafe aluminum items (high EMI) and poorly designed high fire risk wooden items now being used for lack of a safer choice.

Various chairs have to be shock isolated on special pedestals.

It is impossible to provide an individual stateroom or even an individual "normal" size bed, to each of the hundreds or thousands of men on a Navy ship. Thus, based on available habitability space allotments, the crew "berth with locker under" provides both a comfortable sleeping accommodation and adequate stowage capacity for personnel effects, in three and six-man modules.

On certain ships, one compartment must at one time provide messing tables and chairs for ship crew designed for light weight, ruggedness and attractiveness, and then be quickly cleared for weapons transfer and assembly during combat, requiring all furniture to also be portable and stackable. (Figure 14.)

Furnishings must be designed to transform the forecastle anchor handling room on Saturday to the Protestant chapel on Sunday. (Figure 15.)

These are but a few examples of the numerous special purpose items in current use aboard ship.

SAFETY

The safety aspect is of major concern in the design and manufacture of Naval furniture. As previously discussed, fire performance is of prime importance, resulting in a very select list of approved materials. Other examples of standard safety features include: rounded corners on all items; elimination of burrs and sharp edges from any surface that could conceivably be injurous to personnel even though out of sight (such as the undersided of desks); stops which prevent drawers from leaving their respective cabinets and thumb latches which prevent them from accidentally opening; portable furniture, such as office chairs, equipped with non-slip glides in lieu of castors. Many tables are constructed with edge bindings which form a retaining lip and many mess tables are equipped with lee-rails to prevent items from falling off the edge. Table tops and shelves must be firmly attached to prevent them from coming adrift in heavy seas or under shock conditions. Book shelves also have retaining rails and shelf lips to minimize falling objects.

As part of the promulgation procedures for new Navy furniture designs, safety and materials engineers routinely review and approve all features.

STANDARDIZATION

Especially regarding living, messing and lounge furniture, there is a constant attempt by each of the Navy's 500 ships and even by many of the 300,000 plus seaman to select furniture to individual tastes. Offsetting this attempt is the primary counter argument called standardization.

Cost effectiveness is a primarly arguement for standardization. Procurement of large quantities of standard design items in the supply system, especially with National Stock Numbers (NSN), is normally less expensive and easier to procure. Theoretically, items are also obtainable faster. However, supply system changes in recent years has resulted in less stocking of standard items and delays in deliveries. This has forced ships to buy local commercial goods that are readily obtainable. See Section 4 for a discussion of this problem.

Standardization assures the purchase of all of the safety characteristics, suitability for use in a marine environment and other factors actually designed in for the intended use.

Standardization facilitates the maintenance by a system of repair and spare parts, and shipyard shops knowledgeable in repairing standard items. Total replacement by a standard size item is possible without rearrangement of an entire space. (Take the old file cabinet out of the bank of cabinets, and slip the new one in.)

And standardization permits a workable library of designs and knowledge of equipment by Headquarters and shipyard support personnel. This in turn allows better support to the Fleet whenever requests or problems arise.

Some of the documents described above, and others relating to various aspects of furniture design, materials and construction are described in Appendix A.

4. Future Developments

Needless to say, the U.S. Navy Shipboard Furniture Program has not yet provided a panacea for all of the shortcomings in furniture provided in ship designs to date. If anything, with the increased emphasis in furniture design-related areas , control of combustible materials and the U.S. Navy Habitability Program, for example, more problems have been identified than have been solved.

Feedback from the Fleet comes in five principle ways:

- Ship Complaints
- Observations by NAVSEC & NAVSUP
- Comparision with State of the Art
- Review by Ship Type Commanders
- Concern by INSURV

This feedback provides valuable insight into what is wrong with existing furniture and where emphasis should be placed for future development.

From identification of shortcomings over the past several years, through feedback,the author believes the following areas are now of primary importance:

Problem: Until approximately 1960, unaesthetic furniture was provided with very austere design specifications. The basic line of Navy furniture served a functional purpose at a basic level and was accepted by Fleet personnel with only minor objections to poor appearance and lack of variety. However, current design policy now reflects ship personnel needs for a wide selection of furniture designed to higher aesthetic standards and provisions for variety and change. Many new items, new colors and finishes are being introduced all the time, adding greatly to the items in the Navy standard line. However, having many items from which to choose, combustible materials controls, and promulgation of related guidance (Hab Hints, Color coordination, etc.) has confused the ship personnel, Type Commanders and Shipyard Support personnel who must procure or maintain furniture.

Solution: A U.S. Navy Shipboard Furniture Catalog, NAVSEA 0933-LP-005-5050 has been published for the first time. The purpose of this new reference manual is to provide descriptive, technical and procurement information for both Navy Standard and Commercial furniture acceptable for use in ships and submarines. For the first time, those persons responsible for selecting and procuring shipboard furniture will be able to refer to one document for an understanding of what is involved in furniture selection, who can assist with problems, how to systematically comprehend the options, coordinate and select the appropiate items, and order the desired items of furniture.

Problem: There are over 1500 Navy standard furniture designs, many dating back to World War II, but except for the Naval architect responsible for each design (mostly retired individuals now) and a few old design history folders, no one knows what criteria or standards were used. The Navy's "corporate knowledge" is in jeopardy.

Solution: The development of a Navy Manual regarding Design Criteria for U.S. Navy Shipboard Furniture has been identified for development, at such time as resources can be provided. Publishing of this document will assure that furniture designs are understood and perpetuated by future furniture designers in a logical and standard approach. Reinvention of old criteria will be eliminated each time a new design is needed, providing more efficient use of time. And building on established known criteria and design techniques will instill faster improvements, thus providing quantum jumps in technology and expansion into new areas.

Problems: Until the mid 1960's, very few commercial companies provided furniture to the U.S. Navy, mainly due to the industry's lack of interest in the Navy's stringent requirements and relatively small quantity orders. Since then, there has been an increasing demand by Fleet personnel for commercial style furniture in VIP (Flag & Senior officers) living, messing and even some office spaces to provide greater variety, and commercial manufacturers are showing increasing interest in providing shipboard furniture.

The sale of items currently purchased by means of formal advertising from standard design drawings, especially in lounge furniture and VIP spaces, has declined in recent years. This trend, occurring because of many factors, is primarily due to the static nature of this design area. The styles of the items available are several years old and need drastic updating to keep pace with trends in the commercial market.

Accompanying the decline in sales is a decrease in the number of firms interested in bidding on "old" design specifications which have not kept pace design-wise with industry. In order to keep the Navy designs up-to-date and offer a selection of furniture demanded by the Fleet would require a large increase of staff architects, a totally impracticable consideration in the present climate of dwindling manpower resources and demands by other ship design disciplines.

Solution: The Navy is developing a performance specification for lounge furniture as a first step. The specification will address technical requirements only, (no particular design) for quality, selection of materials, overall dimensions, attachments to ship, spare parts, durability and safety. Quality Assurance provisions will include classification of defects, static, impact, and fatigue strength tests, certification of materials used, and acceptance/rejection criteria.

Instead of the ship or type commander relying on price, past experience with the commodity or manufacturer, and information obtained from the salesperson, the performance specification will be easily written into the contract to insure correct, standard performance and yet allow some freedom of choice regarding appearance, style, and color selection.

Problem: Many of the new ships in the Navy's shipbuilding program are high performance, lightweight compact designs (Hydrofoils, surface-effect ships, air-cushion vehicles, etc.) wherein weight is a primary design factor. Weight growth during design is inevitable and is a constant threat to performance. The reduction of even just a few pounds is sought at all times. And yet, no resources or design effort has been directed into development of compact, multipurpose and/or lighweight furniture.

Solution: A major program for development of a complete suite of furniture for use on high performance ships will be proposed. Use of commercial design techniques for commercial aircraft, recreation vehicles and pleasure craft (sailboats, etc.) will be considered. New lightweight materials, such as GRP now being used in the current design of mine warfare ship furniture, will also be explored.

Problem: Recent policy changes, coupled with financial restraints, have resulted in less stocking of Navy Standard items of furniture. Therefore, when a ship procures furniture, it is informed that deliveries will take months since if not available in Navy Stock Centers and must be ordered. Usually, the ship has a limited availability and finds the delay unacceptable. They then turn to the commercial supplier who is waiting on the pier and is more than willing to provide goods. This in turn results in less future demands in stock furniture, which causes NAVSUP to decrease stock supplies because there are no orders, ad infinitum.

Solution: There are many aspects of Navy controls, directives, stock procedures, etc. that must be changed. However, the biggest single change that can be made to improve this situation is the enlightenment of ship's officers responsible for selection and procurement of shipboard furniture. They must be aware of the advantages of using standard items and insist that the Supply System respond to their needs. And they should, whenever possible, plan ahead and order items well in advance of the next availability, to give the system a chance to work.

Albeit, the above problem areas are significant, but they are but a few of the areas of concern. Many other lesser programs await the availability of funding, available manpower or high level impetus; or a combination of these or other factors. For example:

- Development of the office complex techniques to all new ship designs as a means of decreasing shipboard space, manning, and equipment requirements, and increasing efficiency. (Figure 16.)

- Identification of deficiencies in present submarine standard design furnishings and proposals to develop new items.

- New designs are needed for library furnishings , ship store display racks, modular office furniture, 2-high crew berth, round/square convertible mess table, office chairs and radio operator's console, to name a few.

5. Summary

Virtually every compartment in every ship and submarine in the Fleet has items that are part of the U.S. Navy Shipboard Furniture Program, and yet except for the knowledge held by a handful of individuals, little is known or understood about the scope, problems or achievements of this program.

The Myth

Most of us feel we understand furniture and therefore, easily dismiss it.

Each of us uses many furniture items every day of our lives on board ship, in the office, at a restaurant or at home. Most of us purchase furniture one time or another for our homes. An attitude develops that seems to say:

You need shipboard furniture? Anybody can take care of that. Put someone, anyone, on the job. After all, we're all experts. Get some marine boat supplier, or GSA catalog, and pick out the items you need.

The Intent

Hopefully, this paper has done something positive to dispell this myth. For the first time ever, an attempt has been made to document for the layman, in summary form, the scope and intricacy of Navy furniture design. This paper is only a beginning. Much remains to be done: published design criteria; new designs; new programs. The program is only limited by the resources available, not by lack of ideas.

The next time you're inside a Navy ship, stop and look around. Anywhere. Chances are you will see several items that are part of the U.S. Navy Shipboard Furniture Program. Think about their design. There's more to furniture than meets the eye.

APPENDIX A

U.S. Navy Shipboard Furniture Program
APPLICABLE DOCUMENTS

1. The General Specification for Shipboard Furniture, Military Specification MIL-F-902 for Aluminum Furniture.

2. General Specification for Shipboard Furniture Military Specification MIL-F-243 for Steel Furniture.

These specifications establish minimum acceptable standards with regard to materials, design, fabrication and finishing procedure, workmanship, quality assurance, testing, packing and packaging. These specifications also provide information on ordering shipboard furniture. Virtually all shipboard furniture is controlled by one of these two specifications.

3. Fire Performance Requirements and Approved Specifications for Interior Finish Materials and Furnishings (Naval Shipboard Use) Military Standard, MIL-STD-1623.

This standard establishes fire performance criteria and provides a list of approved specfications for finish materials and furnishings to be used on Naval ships. This military standard lists, in tabular form, those materials which are approved for use in the following applications:

a. Acoustic Materials
b. Adhesives
c. Bulkhead Sheathing
d. Deck Coverings
e. Draperies and Curtains
f. Furniture; (Upholstery Cushions and Frames)
g. Overhead Sheathing
h. Thermal Insulation

4. U.S. Navy Shipboard Color Coordination Guidance Manual NAVSEA 0929-002-7010.

This manual furnishes guidelines to be followed when developing a color scheme for habitability spaces. The manual includes chapters on the physcial characteristics of light, the effects of color and light on individuals, sample color schedules and facsimilies of color boards for typical spaces, a listing of approved habitability materials and their known commercial suppliers, and procedures to be followed for having new habitability materials tested.

5. Hab Hints, NAVSHIPS 0900-007-8010.

This publication is a series of self-help habitability improvement projects including procedures to be followed for the completion of projects. Most of the projects are within the capability of the ship's force although some require tender or shipyard assistance. This manual contains a number of furniture-related items such as the application of paint and vinyl film as well as re-upholstery of existing furniture.

6. Lighting on Naval Ships, NAVSEA 0964-000-2000.

The lighting manual is a guide which gives information concerning the design, maintenance and installation of lighting systems on Naval ships. The manual gives typical installation methods and requirements for all types of lighting systems.

7. Environmental Control Standards OPNAV 9330.5B.

This instruction contains minimum acceptance standards for the living environment aboard U.S. Navy ships. Specific areas of concern are air-conditioning and ventilation, heating, noise, lighting, color, living spaces, berthing, stowage, furniture, and food fittings service and messing spaces, sanitary spaces and facilities, tables and seats, lounge and recreation spaces, service spaces and potable water. Information contained herein is essential to the space planner since it stipulates the size and number of units that should be provided to meet minimum habitability requirements.

8. Afloat Supply Procedures NAVSUP Publication 485.

The Afloat Supply Procedures Manual establishes the policies for the operation and management of afloat supply departments. The procedures contained in this manual shall be followed in all procurement actions of new furniture and the disposal of old and surplus equipment.

9. Requirements for Shock Tests, Shipboard Machinery Equipment and Systems, Military Specification MIL-S-901 (Navy).

Most furniture for habitability spaces is not required to be shock graded. However, when this is required, this document covers the shock testing requirements for shipboard machinery, equipment, and systems which are required to meet high impact mechanical shock. The requirements are for the purpose of determining the suitability of machinery, equipment and systems for use under the effects of severe shock which may be incurred in wartime service.

10. Afloat Shopping Guide (FSC 2090) NAVSUP Publication 4900.

The Afloat Shopping Guide, formerly "The Illustrated Shipboard Shopping Guide", contains a description of some furniture items with all information necessary for procurement. Because of changes in stocking policy, the guide in its current form, is very limited in that it only depicts items actually stocked.

11. Naval Supply Systems Command Operating Procedures Manual MILSTRIP/ MILSTRAP NAVSUP Publication 437.

This manual provides, in detail, the policies, procedures, forms and formats to be used by elements of the Navy supply system to requisition material from the Navy, other DOD service agencies, and GSA.

MILSTRIP is the acronym for Military Standard Requisitioning and Issuing Procedures. MILSTRAP stands for Military Standard Transaction Reporting and Accounting Procedures.

12. Naval Supply Systems Command MILSTRIP/MILSTRAP Desk Guide NAVSUP Publication 409.

For convenience this desk guide, has been prepared which may suffice for general use. Where necessary, the desk guide cross-reference NAVSUP Publication 437 described above.

13. Static Load Test for Metal Furniture, NAVSUP Dwg. No. 805-2217424.

To assure proper strength of shipboard furniture this drawing delineates various static load tests for distortion, welds, latches, screws and rivets.

14. Cloth, Drapery, Bunk Curtain, Slip-Covered and Label, Polyaramid Novoloid Fiber Blends, (Shipboard Use, Military Specification MIL-C-24500 (Ships).

This specification covers inherently fire-safe, shrink-safe, woven Polyaramid and Polyaramid/Novoloid blended fiber cloth, primarily intended for use in fabrication of bunk curtains, draperies, slipcovers, and labels for various shipboard applications.

15. Fastener for Securing Chairs NAVSHIPS Drawing No. 805-1640129.

This drawing illustrates the approved method of securing portable chairs to the deck. All chairs on Destroyer type and smaller ships should be secured as shown on this drawing.

16. General Requirements NAVSHIPS Drawing Nos. 805-4597951 and 52.

The drawings delineate, in detail, the requirements of steel commercial shipboard furniture and accessories. They specify material, design requirements, finish, locks and keys, workmanship, welding, quality assistance, tests and preparing for delivery.

17. Sub-Bases and Clips, Metal Furniture Drawing No. S3306-921770.

This drawing illustrates the details of construction of sub-base and clips necessary to secure various pieces of Navy furniture to a ship's deck.

18. Federal Specification AA-C-00275D (GSA-FSS) Amendment 1. Chairs Rotary and Straight, Aluminum, Office.

This specification covers aluminum chairs in a matching or companion group with respect to appearance, comfort, design and quality of material.

The specification clearly differentiates between two types, four classes and two styles. The specification also addresses glides.

When ordering, it is important to specify Amendment 1 in order to make the chairs acceptable for shipboard use.

19. Hardware for Metal Furniture Hull Type Drawing S3200-860055.

This drawing identifies various pieces of hardware commonly used on standard Navy furniture. (e.g., card holders, drawer pulls, handles, locks, chair glides, and door stops.) This hardware is suited for shipboard use by virtue of its non-corrosive nature and strength. National Stock Numbers are included.

20. Metal Furniture Type Doors, NAVSHIPS Drawing No. 805-1642368.

This drawing shows general arrangement and construction details of furniture doors.

21. Lockers and Wardrobes, Built-In, Typical Details, NAVSHIPS Drawing No. 805-1641660.

This drawing describes general typical details for manufacturing and installing built-in lockers for various shipboard applications.

22. Naval Shipboard Berth Mattresses, Military Specification MIL-M-18351.

All Navy mattresses, including ticking, must conform to this Specification (except Senior Officer innerspring mattresses).

23. Artifical Leather (Cloth Coated), Vinyl Resin Expanded Layer, (Upholstery) Federal Specification CCC-A-680A.

This specification covers requirements for artifical leather treated for fire, mildew and oil resistance, composed of knitted cotton cloth with a vinyl wear layer of vinyl foam, primarily intended for use as upholstery materials. Class 2, treatment a(1) must be specified.

24. Cloth, Coated, Vinyl Coated, (Artifical Leather) Federal Specification CCC-C-700F.

This specification covers coated cloth with and without an embossed leather grain, intended for use as upholstery covering. Class 4, treatment a(1) must be specified.

25. Plastic, Sheet Acrylic, Heat Resistant, Military Specification MIL-P-5425.

Acrylic sheets, used to replace glass, such as ship store showcase windows must conform to this MILSPEC.

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FIGURE 1 TYPICAL BERTHING

1. FLAG OFFICER
2. JUNIOR OFFICER
3. CREW
4. TROOP
5. HOSPITAL
6. COT (GEN. PURPOSE)

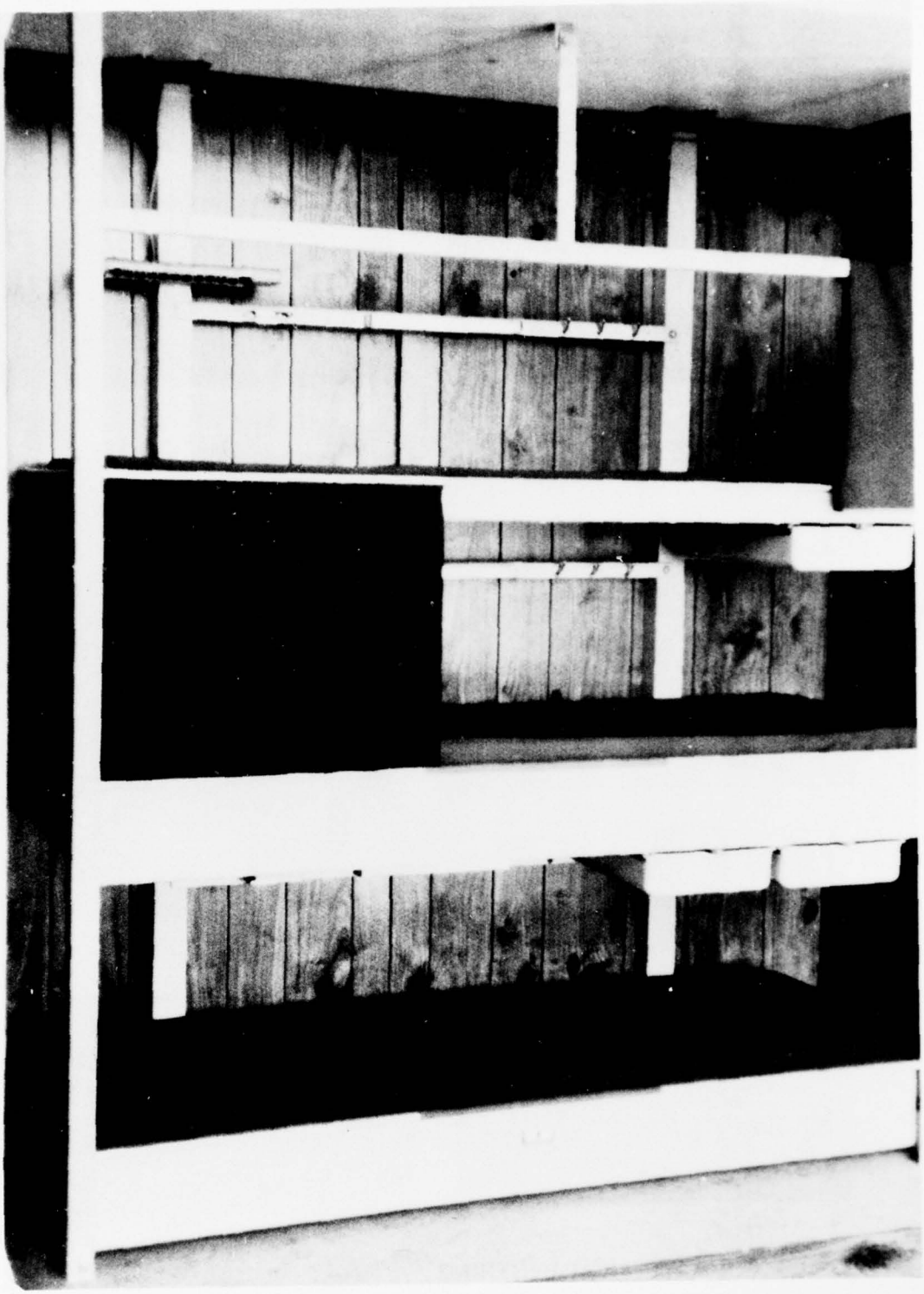

FIGURE 2 GLASS-REINFORCED PLASTIC BERTH (NON-MAGNETIC)
(USE ON MINE WARFARE SHIPS)

FIGURE 3 TYPICAL OFFICERS STATEROOM, MODULAR FURNITURE

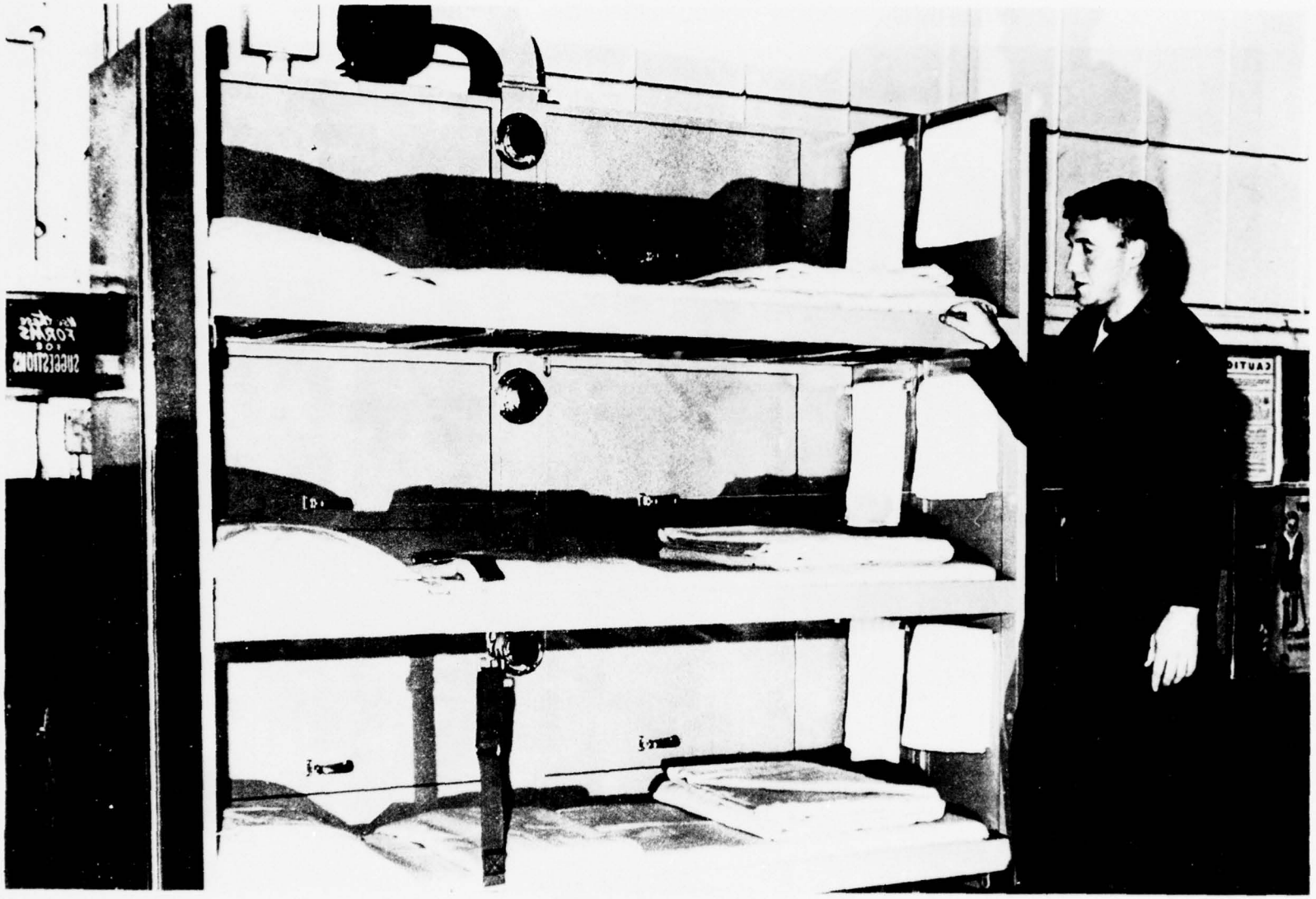

FIGURE 4 3-MAN CREW BERTH MODULE, INCLUDING PRIVACY PARTITIONS, VENITLATION, LIGHTING, STOWAGE LOCKERS, TOWEL RACKS AND HEAVY WEATHER LEE STRAPS

FIGURE 5 CREW WARDROBE LOCKER INCLUDES DRAWERS, HANGING ROD MIRROR, SHELF, PIDGEON HOLES, TIE RACK

FIGURE 6 CREW LOUNGE FURNITURE

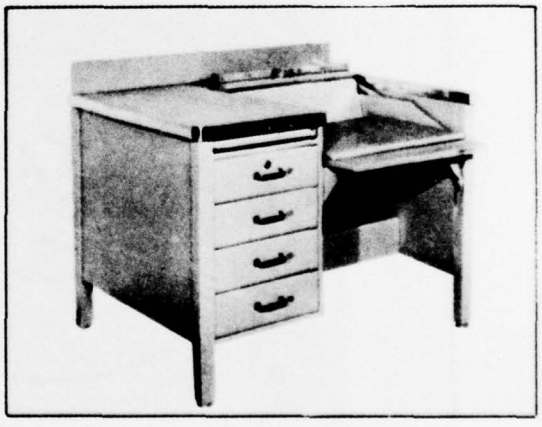

FIGURE 7 SINGLE PEDESTAL TYPEWRITER DESK

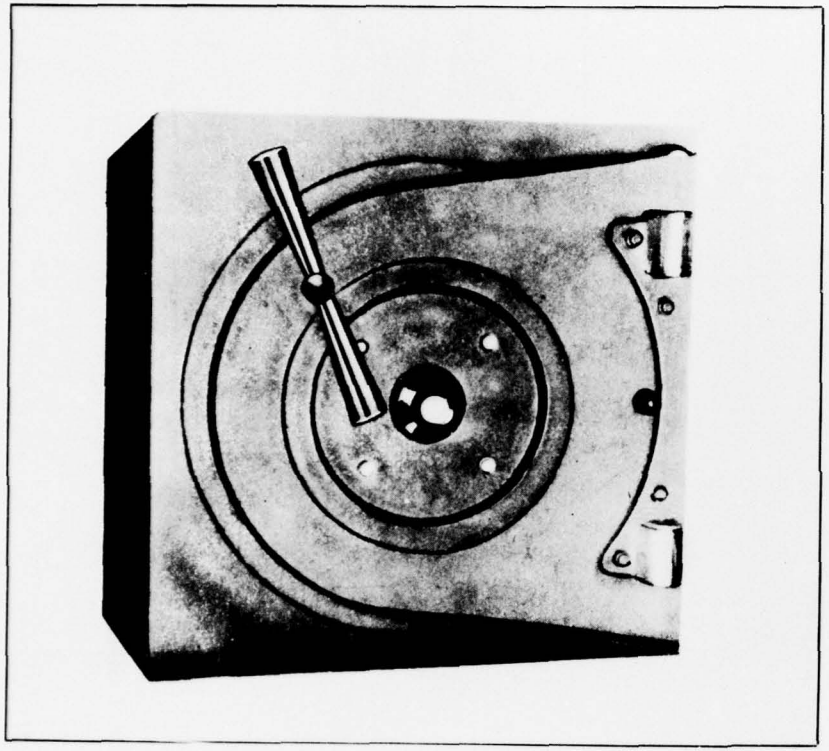

FIGURE 8 LEFT – BURGLAR RESISTANT DISBURSING SAFE
RIGHT – MAIL COLLECTION BOX

FIGURE 9 TOP – SURFACE LOOKOUT SEAT
BOTTOM – BARBER CHAIR

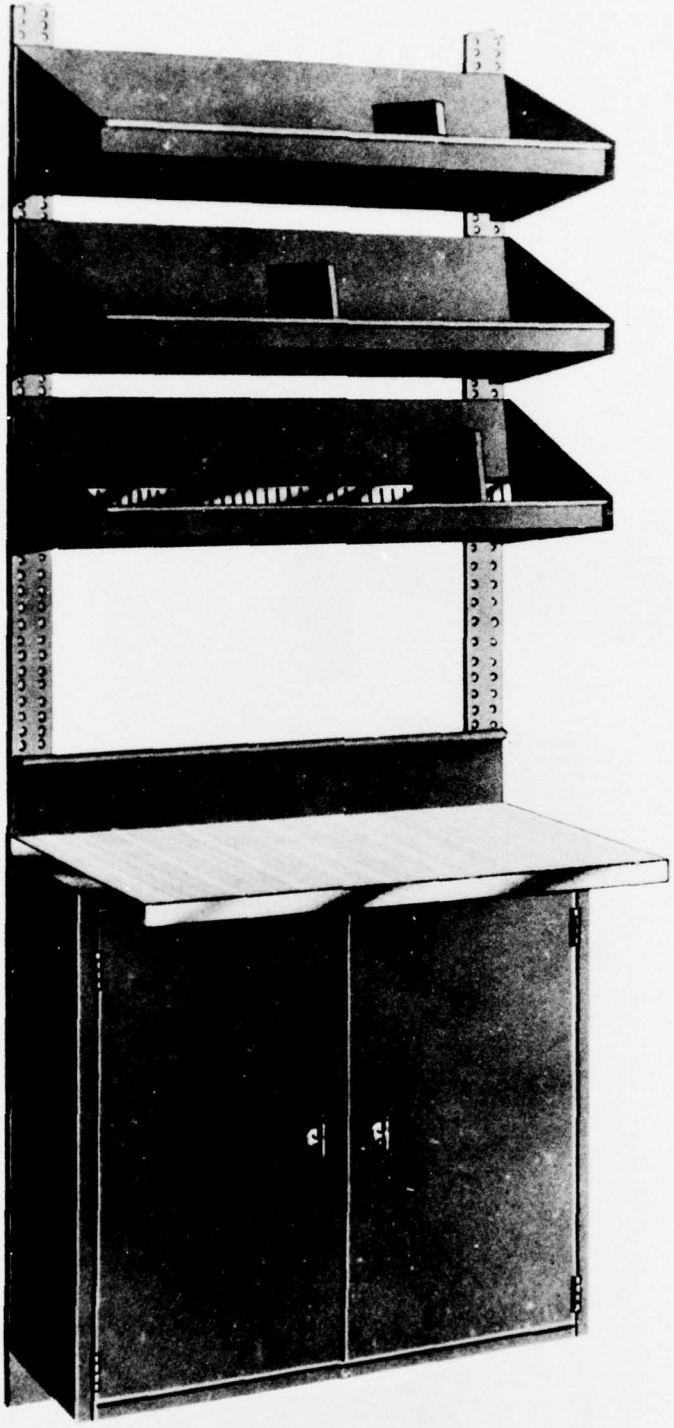

FIGURE 10 LIBRARY SHELVING

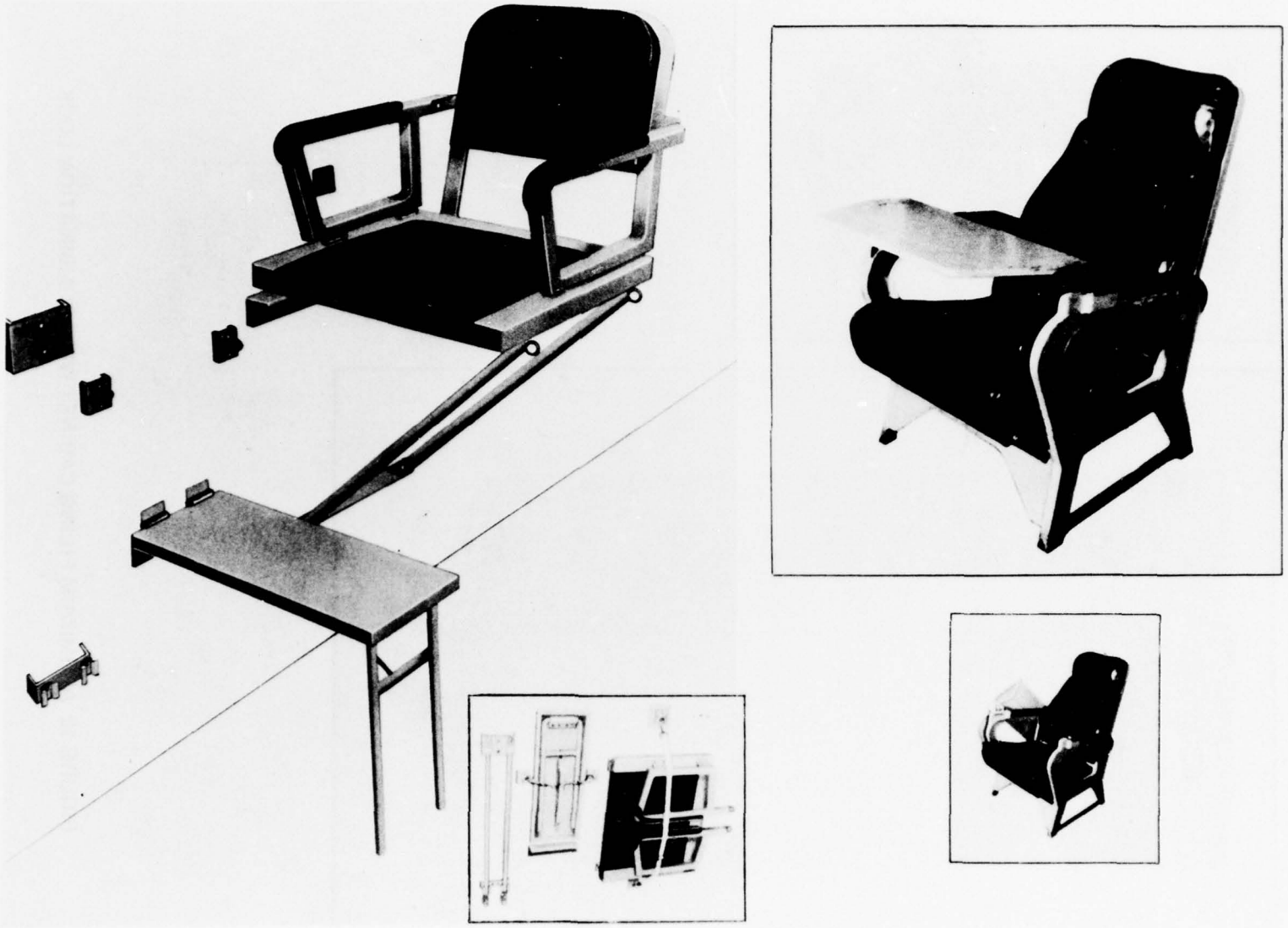

FIGURE 11 LEFT – PILOT HOUSE CHAIR AND FOOT REST
RIGHT – AVIATOR'S READY ROOM CHAIR

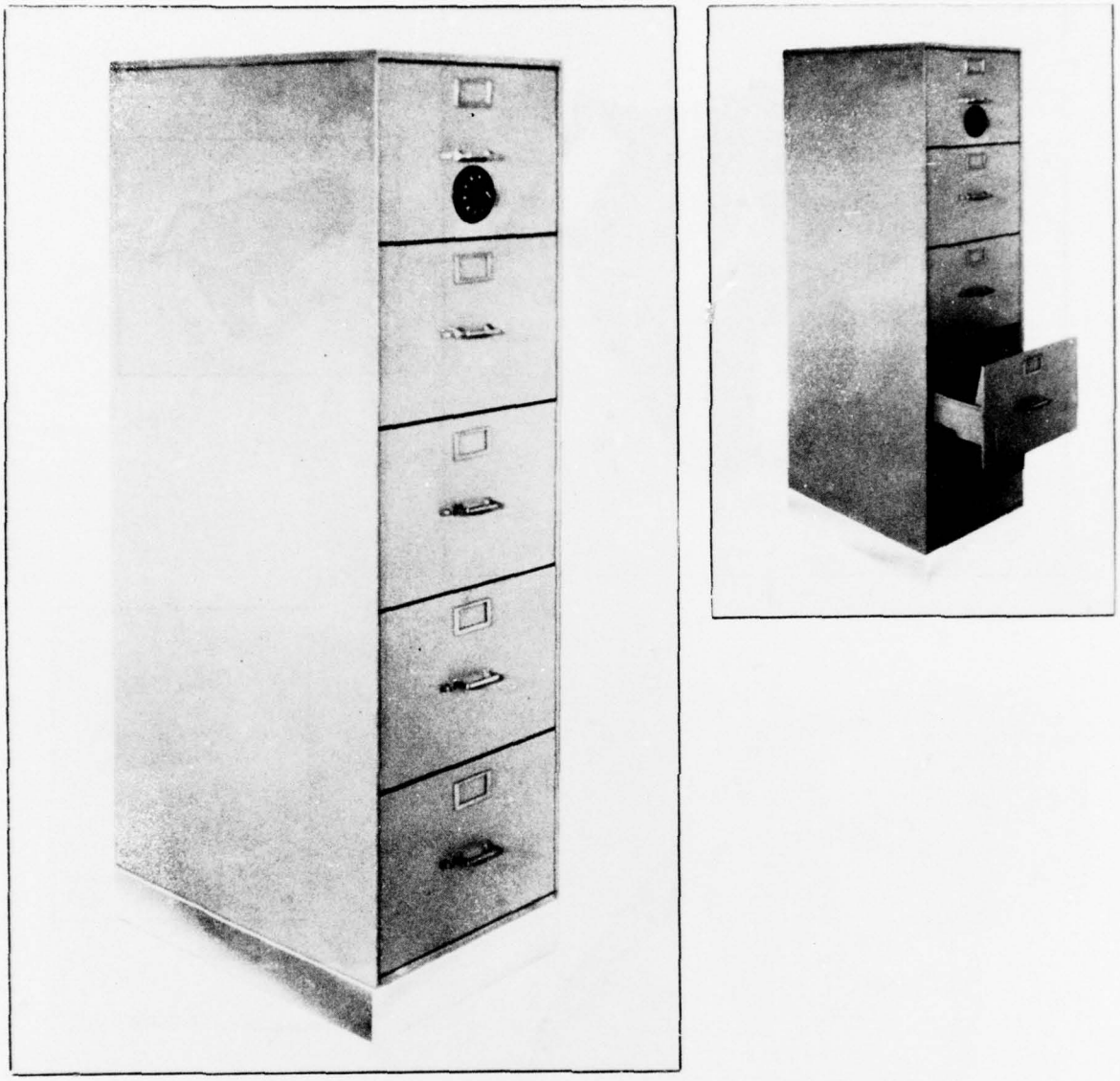

FIGURE 12 ALUMINUM FILING CABINET WITH COMBINATION LOCK

FIGURE 13 SUBMARINE OFFICE (NOTE EFFICIENT USE OF EVERY AVAILABLE SPACE)

FIGURE 14 STACKING CHAIR

FIGURE 15 SHIP'S CHAPEL (SET UP IN RECREATION SPACE) USING PORTABLE ALTAR, AND FOLDING CHAIRS, PULPIT AND COMMUNION RAILS.

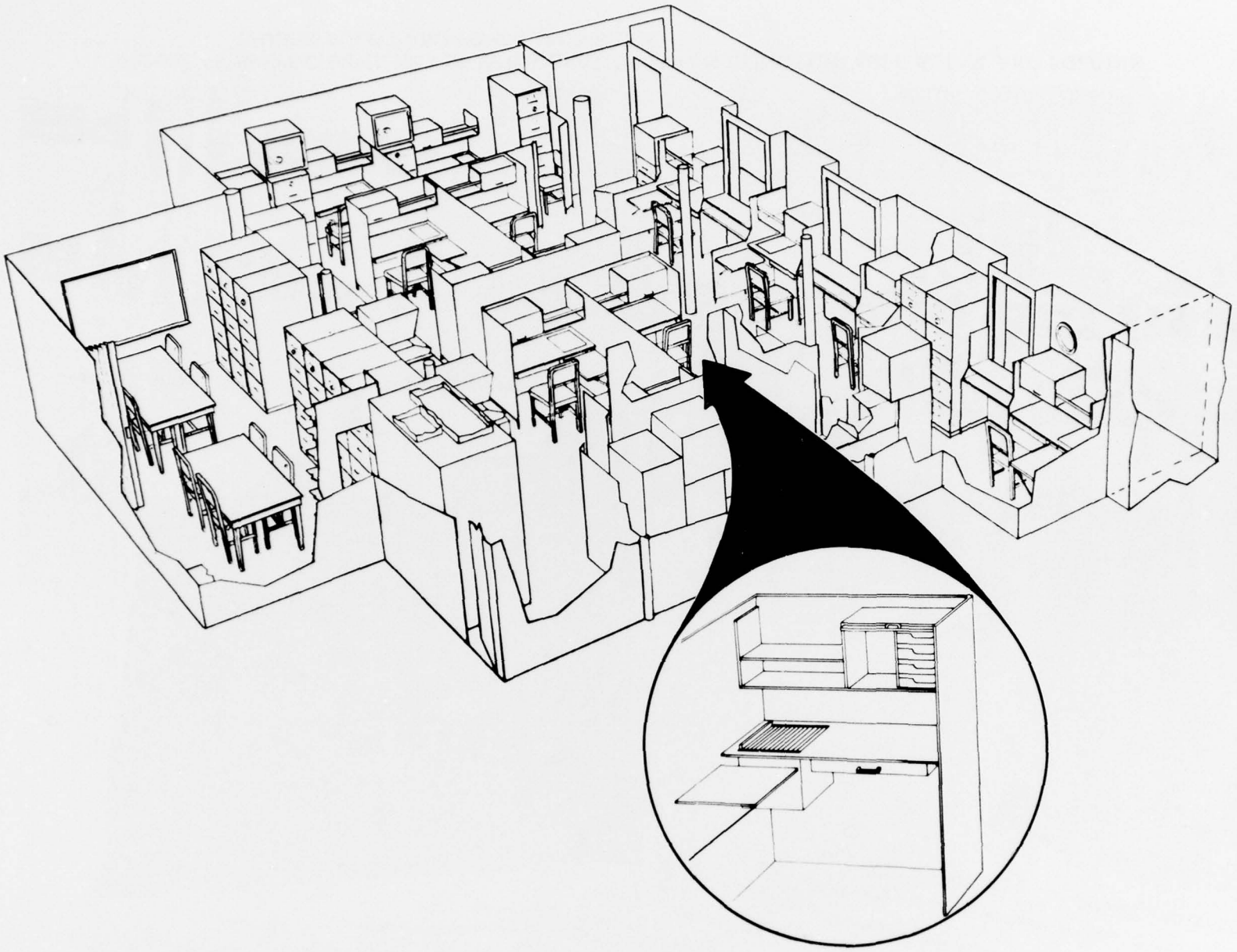

FIGURE 16 TOP – CENTRAL OFFICE COMPLEX
BOTTOM – INDIVIDUAL WORK STATION IN AN OFFICE COMPLEX