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NAVAL
DENTAL RESEARCH
INSTITUTE

Naval Medical Research and Development Command
Bethesda, Maryland

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Interim Progress Report on the Marine Corps Expeditionary Dental Shelter (MCEDS)

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Research Progress Report NDRI-PR 80-07
Interim Progress Report
Work Unit M0933PN001.0004
Naval Medical Research and Development Command
National Naval Medical Center
Bethesda, Maryland 20014

Approved and released by:

M. R. WIRTHLIN, JR.
Captain, DC, USN
Commanding Officer

PURPOSE

This interim progress report is intended to provide communication and exchange of ideas on dental facilities support research for fleet health care in the Navy and Marine Corps. Inquiries and comments should be addressed to the Commanding Officer, Naval Dental Research Institute, Naval Base Bldg. 1-H, Great Lakes, Illinois 60088.

CONTENTS

MILITARY DENTISTRY

Beginnings

The treatment of dental disease was known as far back as Greek and Roman times when dental extractions and the wiring of loose teeth were practiced (15), but the use of professional dentists in the military service has a relatively brief history. Prior to the twentieth century, dentistry was performed by physicians or others with only limited dental skills and knowledge.

One of the earliest recorded uses of dental skills in the military was by the British in the seventeenth century, when medical staff members were enlisted under contract for the duration of a campaign -- prior to formation of a standing army in 1660 (3). Before the American Revolution, the French admiralty required naval surgeons to perform dental surgery (11). In Napoleon's Code of Conscription of 1810, odontalgia was one of the authorized causes of hospitalization (3).

In the United States, Dr. McKellops of St. Louis recommended appointment of dentists to the regular Army in 1859. A decade later, Dr. Clark of Savannah noted that more than five of every one hundred men were on the sick list because of tooth problems. However, consistent attention was not given to the military implications of dental disease until after the Spanish-American War (11).

The Advent of Professional Dentistry in the Military

"From time to time various efforts have been made to secure the establishment of a corps of dental surgeons in the Army and Navy of the United States" (12). During the Civil War, for example, the Confederate Army, but not the Union Army, commissioned dentists. Thus, Union soldiers at frontier posts had to travel hundreds of miles by ambulance for dental treatment. "Even at West Point, only a hospital steward with some knowledge of dentistry attended to tooth problems" (12).

The first dentist to be employed by the United States military was in 1873, when Dr. Thomas O. Walton was assigned the duty of caring for Naval Academy midshipmen (5). In time, he was allowed to treat the staff personnel and the Naval Academy became the first, full-time, U.S. Navy dental billet. Walton's successor in 1899, Dr. Richard Grady, recognized as the "father of the national dental hygiene movement," was ultimately one of the first ten officers appointed to the Navy Dental Corps in 1912.

In 1898, a bill to establish a corps of dental surgeons was rejected by the Congress. In 1901 another bill was approved, but it was for establishing a corps on a contract basis only. After the Spanish-American War, a committee on dental legislation vindicated the performance of this corps, but it was not until 1911 that the first Dental Corps was established by the U.S. Army (12). The Naval Dental Corps was then authorized by law under President Taft in 1912 (5). Meanwhile, in Germany in 1907, army surgeons were ordered to earn diplomas at the University of Berlin's Dental Institute for the purpose of forming a dental corps (3).

The effectiveness of the two American military dental corps was demonstrated in the first World War. As Barker wrote, "Europeans did not know that good teeth could be such a common quality until they saw the American Expeditionary Forces, and they still marvel at the splendid teeth of the average American soldier" (2). In the French Army, however volunteer dentists provided their services free and they even paid their own expenses (9).

The Germans, by contrast, were more organized during WWI. The work of German dentists at military hospitals was found so useful that their numbers were increased; dentists were aided by dental students who worked with the troops. Technicians skilled in making prostheses were also utilized. Treatment of jaw wounds was the main activity on the firing lines with full dental care being supplied in the rear camps and occupied towns. As the war progressed, the German dentists accompanied by prosthesis-makers went to the lines on motor trucks equipped with a dental drill and instruments (9).

A Canadian dental corps was established on a wartime basis, but became permanent in 1917 (7). Despite efforts of the British Dental Association to form a military dental corps as early as 1850, it was not until 1921 that Winston Churchill finally signed a Royal Warrant for such a corps. By the start of WWII, there were 77 full-time and 38 part-time military dental centers throughout the United Kingdom (3).

Military dental corps, or medical corps incorporating dentists, are well-established realities today in all armed forces of the world. The U.S. Navy Dental Corps, for example, is a discrete entity within the Medical Department of the Navy (6).

Field Dental Support to the USMC

The first Navy dental officer was assigned to the Marine Corps Depot, Parris Island, in 1913 (16). It was decided to emulate the successful German model of using dentists in combat areas to administer primary care and prevent unnecessary dental related evacuations. Dental personnel were subsequently assigned to specific units of the Fleet Marine Forces. They distinguished themselves during WWII amphibious landings by assisting in casualty care. The encumbrance of the dental equipment prohibited the dental officer's professional skills from being fully utilized resulting in a considerable backlog of unmet dental needs (16).

In 1955, reorganization of the USMC established the force dental companies commanded by dental officers. Each company became a distinct unit with its specific mission of providing support to a marine division, air wing, or force troop element. Dental companies no longer landed with combat units but moved in with their equipment after the beach head was established. The Commanding Officer of a dental company would dispatch dental detachments as needed to assist in the triage of front line casualties, particularly those with maxillofacial injuries (16).

The dental companies were grouped into dental battalions in 1979. This latest reorganization provided centralized control over the provision of dental services to marine forces located in various geographic locations.

The new organization allows far greater efficiency and precision in the planning and logistics for providing dental health care support to all Marine Corps forces (4).

Modern Military Dentistry

A dichotomous level of dental care is required by a combat unit. The garrison clinic in the rear echelon, allows the practice of comprehensive dental care with a full complement of fixed operatory room equipment, trained technicians, immediate supply and repair support, and specialty consultation service in a professional environment. The front line battlefield situation however, necessitates a change in priorities and equipment to provide field dental care. The field dental organization and equipment are designed to permit a considerable degree of flexibility and mobility, as learned from the Germans in WWI. The Field Dental Officer is charged with supporting the combat mission (16), by reducing the number of dental-related evacuations through the alleviation of odontogenic pain and discomfort.

The tent remains the most widely used shelter of military forces during field operations. Dental technology, however, has rapidly advanced in equipment design, restorative materials, and dental health care delivery systems which are best utilized in a controlled environment (10). Thus, to accomplish the task of providing dental treatment for troops in areas of every possible climate and terrain, various other shelter types have been configured and utilized (14). Several nations developed sophisticated mobile dental facility vans. The most publicized were the Royal Australian Air Force, air-portage dental facility, and the U.S. Navy mobile dental clinic developed in 1970 (10, 14). These comprehensive clinics do not enjoy widespread use, probably because of high cost and limited application to mission requirements for field dentistry. With few exceptions the military forces of the world still retain the tent, though technologically improved.

A recent development has been the U.S. Marine Corps decision to reduce reaction time to tactical situation in all environments through the employment of a family of highly mobile rigid shelters developed from the standard 8' x 8' x 20' shipping containers (1). The Marine Corps expeditionary shelter system (MCESS) will be operational in 1985 and will replace their traditional tent encampments (17). To assure dental health maintenance and combat readiness of Marine forces in the field, it has become necessary to adapt these shelters with the authorized dental allowance list for field use. Thus, a practical, low-cost, field-oriented dental clinic with a controlled environment and able to support any combat mission is envisioned by a military service.

Military dentistry has come from its austere beginnings as a voluntary and part-time service to a modern professional service with the ability to meet the needs of uniformed personnel both in garrison and on the battlefield (8).

1. Amphibious Logistics Ashore (ALSA), 3735-77 August 1977, U.S. Marine Corps.

2. Barker, W. P. Dental Prophylaxis in the Army. Military Dental Journal 4:72-74, June 1921.

3. Bradlaw, R. The Royal Army Dental Corps. British Dental Journal, pp. 173-176, February 1971.

4. Dental Battalion, Force Service Support Group, FMF Table of Organization, No. 3850, 1979, U.S. Marine Corps.

5. Designate Birthplace of Naval Dentistry. Journal of the American Dental Association 79:1123-1124, December 1975.

6. Elliott, R. W. Organization of the Navy Dental Corps. International Dental Journal 25:266-275, December 1975.

7. Gullett, D. W. A History of Dentistry in Canada. Toronto, University of Toronto Press, 1971.

8. Hartel, P. P. The Role of the Comprehensive Dentist in the Navy's Dental Health Care Delivery System. Military Medicine 143:642-646, September 1978.

9. The Journal 60 Years Ago: Another Era, Another War. American Journal of Orthodontics 68:75-76, July 1975.

10. Klima, J. E., Shelton, S. W. and Baldwin, J. E. Prototype Design for a Mobile Dental Clinic. Military Medicine 140:350-353, 1975.

11. Koch, C. R. E., ed. History of Dental Surgery. 2 vols. Vol. 1, Chicago, The National Art Publishing Co., 1909.

12. Marshall, J. S. The United States Army Dental Corps. In: History of Dental Surgery, Vol. 1, edited by Charles R. E. Koch, Chicago, The National Art Publishing Co., 1909.

13. Ruliffson, F. R. Dental Lessons Learned in Vietnam. U.S. Navy Medicine 57:18-30, 1971.

14. Sharp, R. E. RAF Air Portable Dental Facilities. Australian Dental Journal 15:16-18, 1970.

15. Singer, C. and Underwood, E. A. A Short History of Medicine. 2nd ed., New York, Oxford University Press, 1962.

16. U.S. Department of the Navy, Bureau of Medicine and Surgery. Dental Administration, NAVEDTRA 10483-A:59, 1974.

17. USMC Standard Family of Shelters and Logistic Trailer Project, 90-69-02. U.S. Marine Corps, 1974.

Figure 1. Field dental equipment was extensively used during World War II by Navy dentists serving with the Marine Corps. (Courtesy of U.S. Navy Medicine)

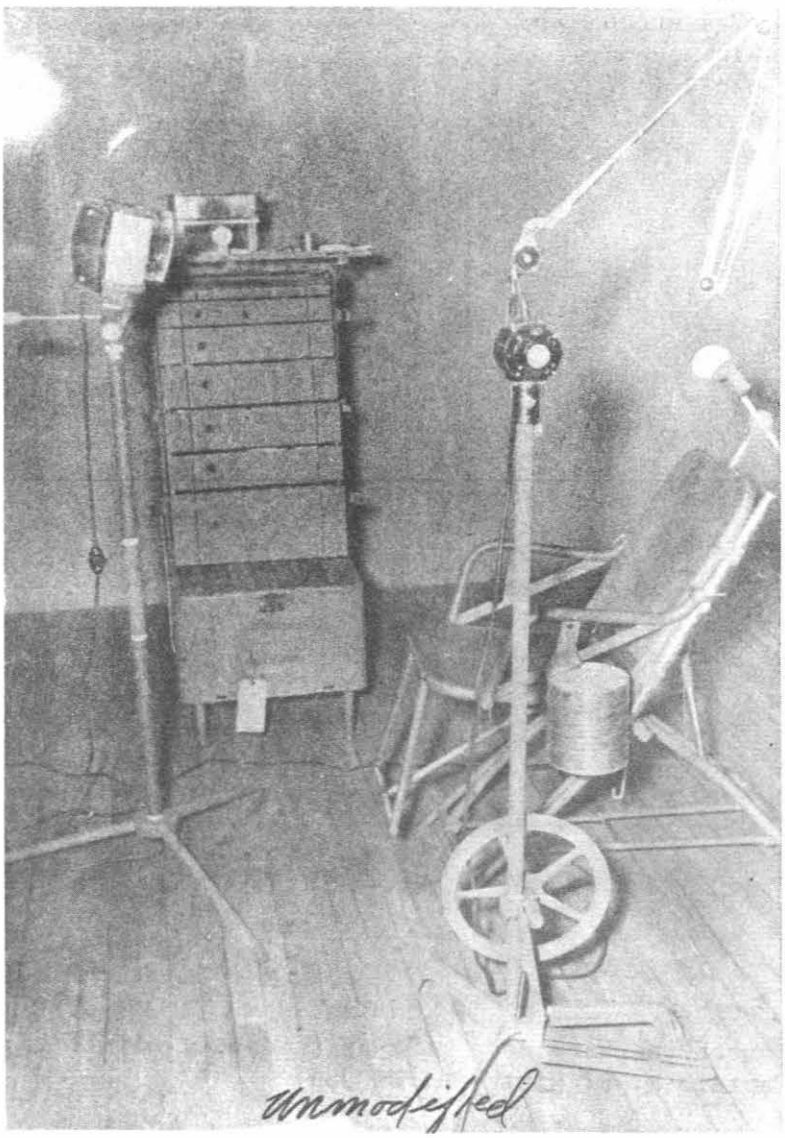


Figure 2. The dental equipment was "modernized" for use during the Korean conflict. (Courtesy of U.S. Navy Medicine)

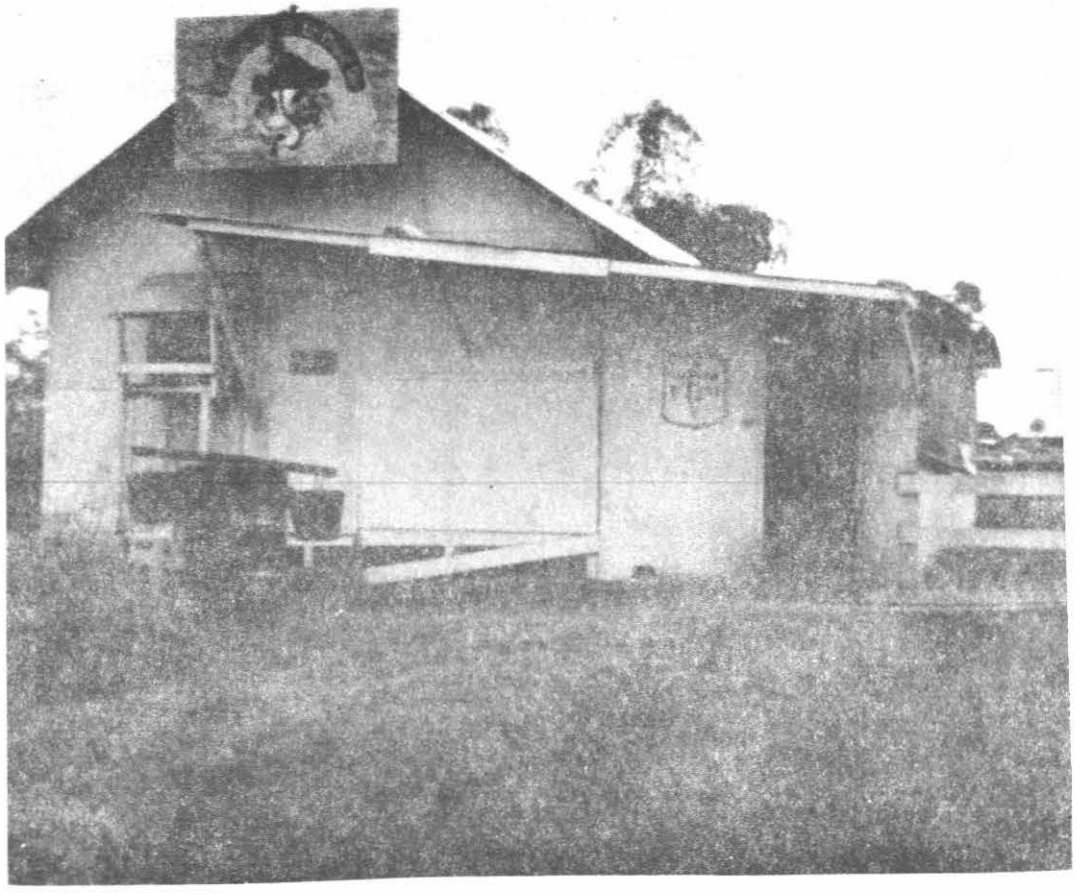


Figure 3. A "hooch" serving as a make-shift dental clinic in Vietnam. (Courtesy of Captain M. R. Wirthlin, DC USN)

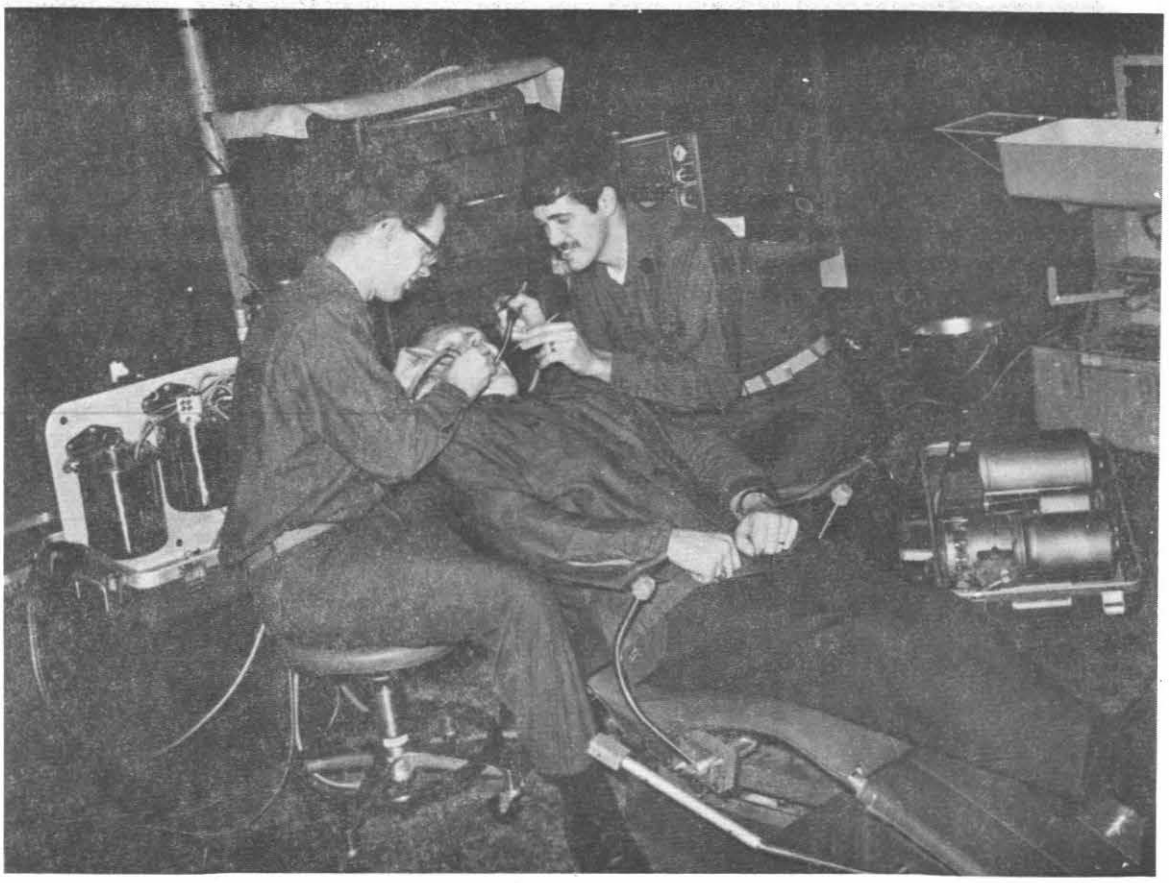


Figure 4. This field dental equipment featuring the Encore unit and Den-Tal-Ez chair was in use during the latter half of the Vietnam conflict. (Courtesy of U.S. Navy Medicine)

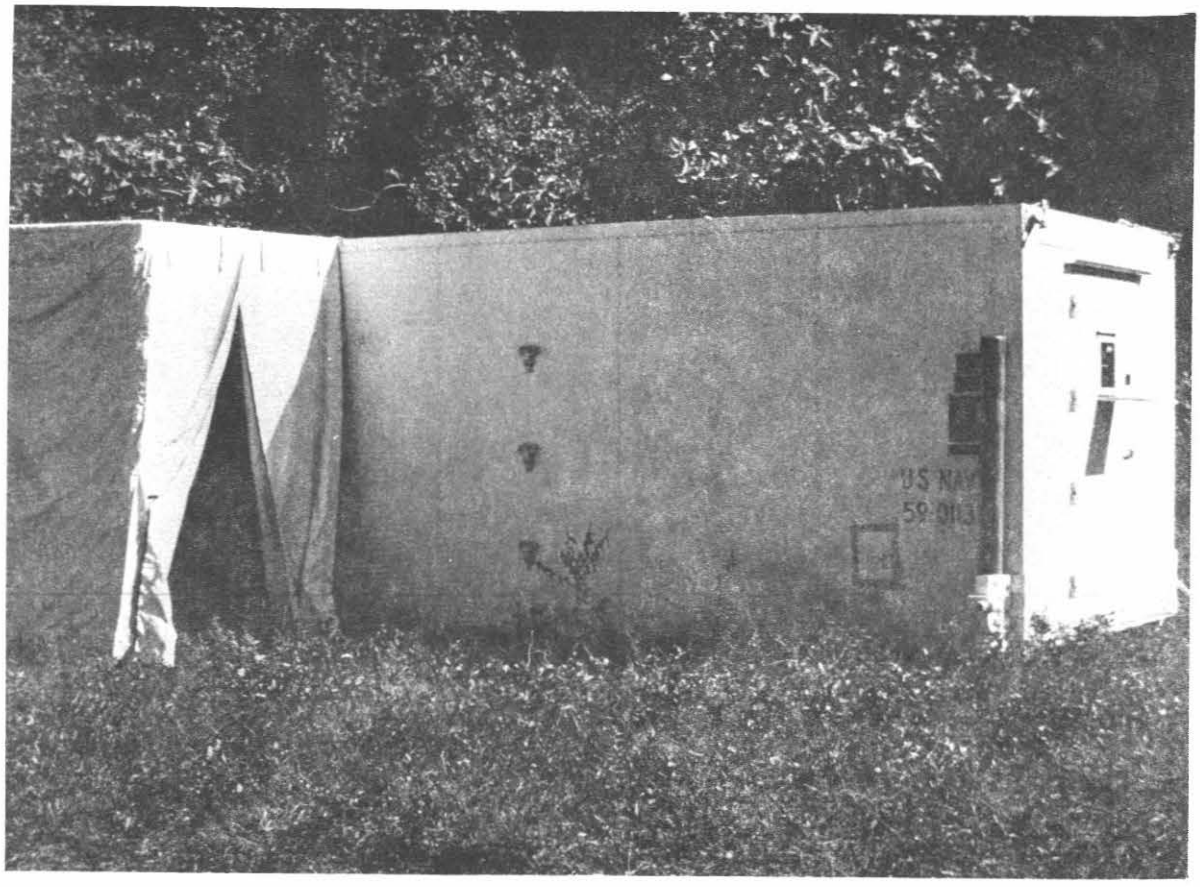


Figure 5. U.S. Navy SATS van, a mobile comprehensive dental facility designed and tested in the early 1970's. (Courtesy of Naval Dental Research Institute)

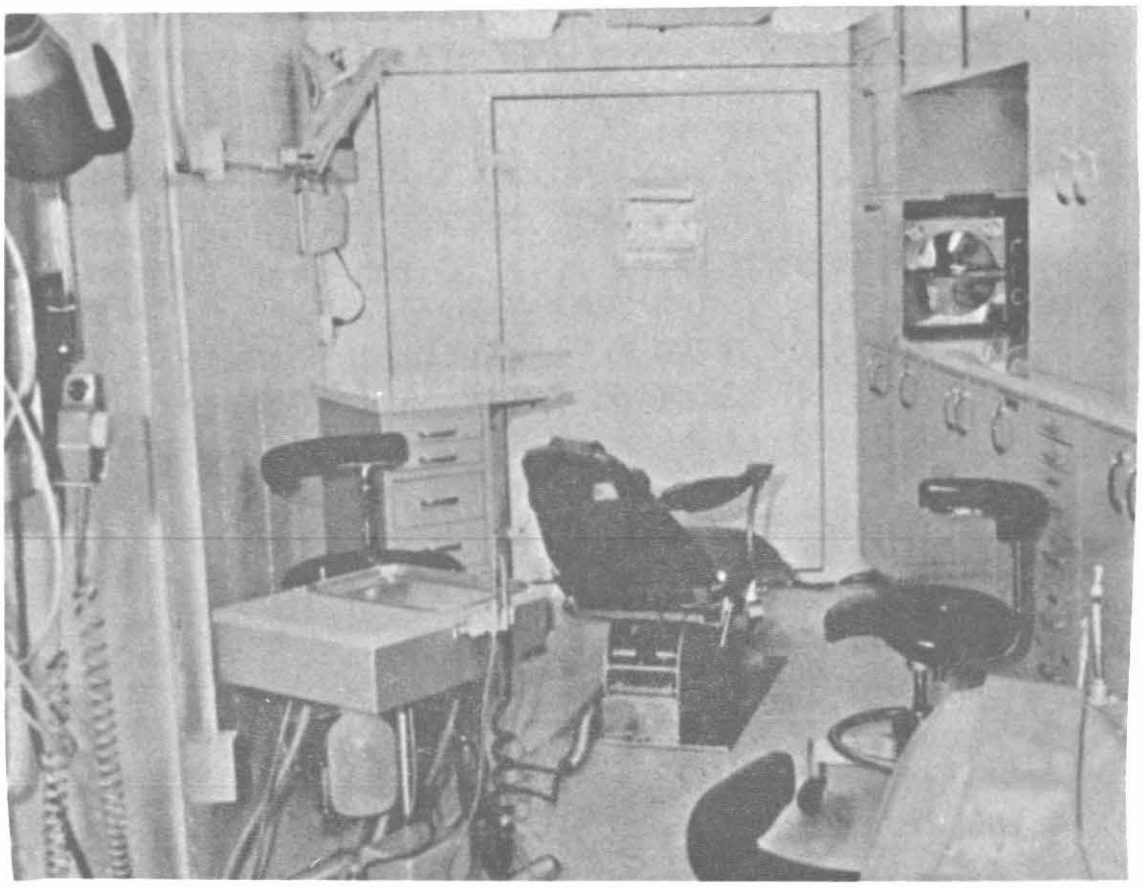


Figure 6. The interior of the SATS van with the Adec Porta-Cart replacing the Encore unit. (Courtesy of Naval Dental Research Institute)

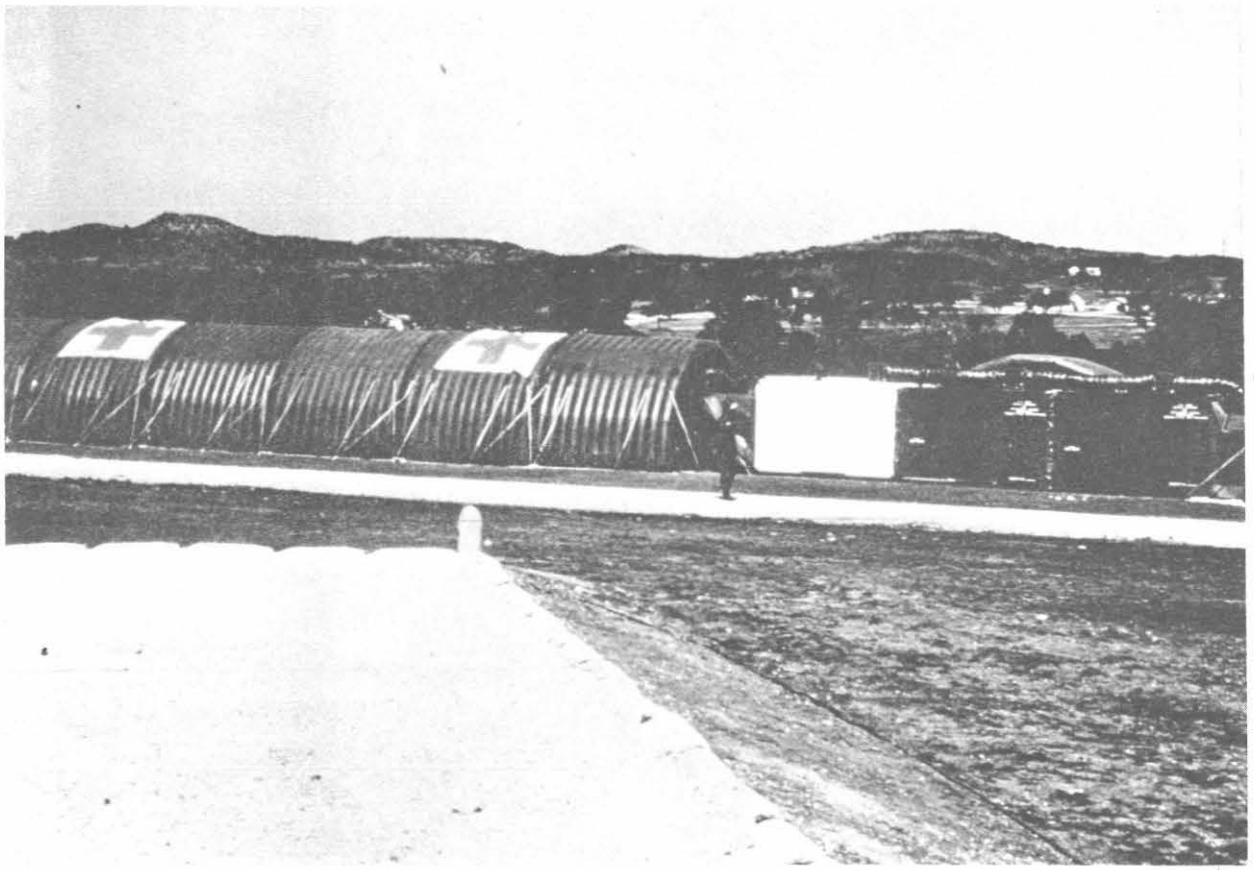


Figure 7. The "modern" tent. This shows a U.S. Army MUST tent inflated and ready to receive casualties. (Courtesy of Captain M. R. Wirthlin, DC USN)

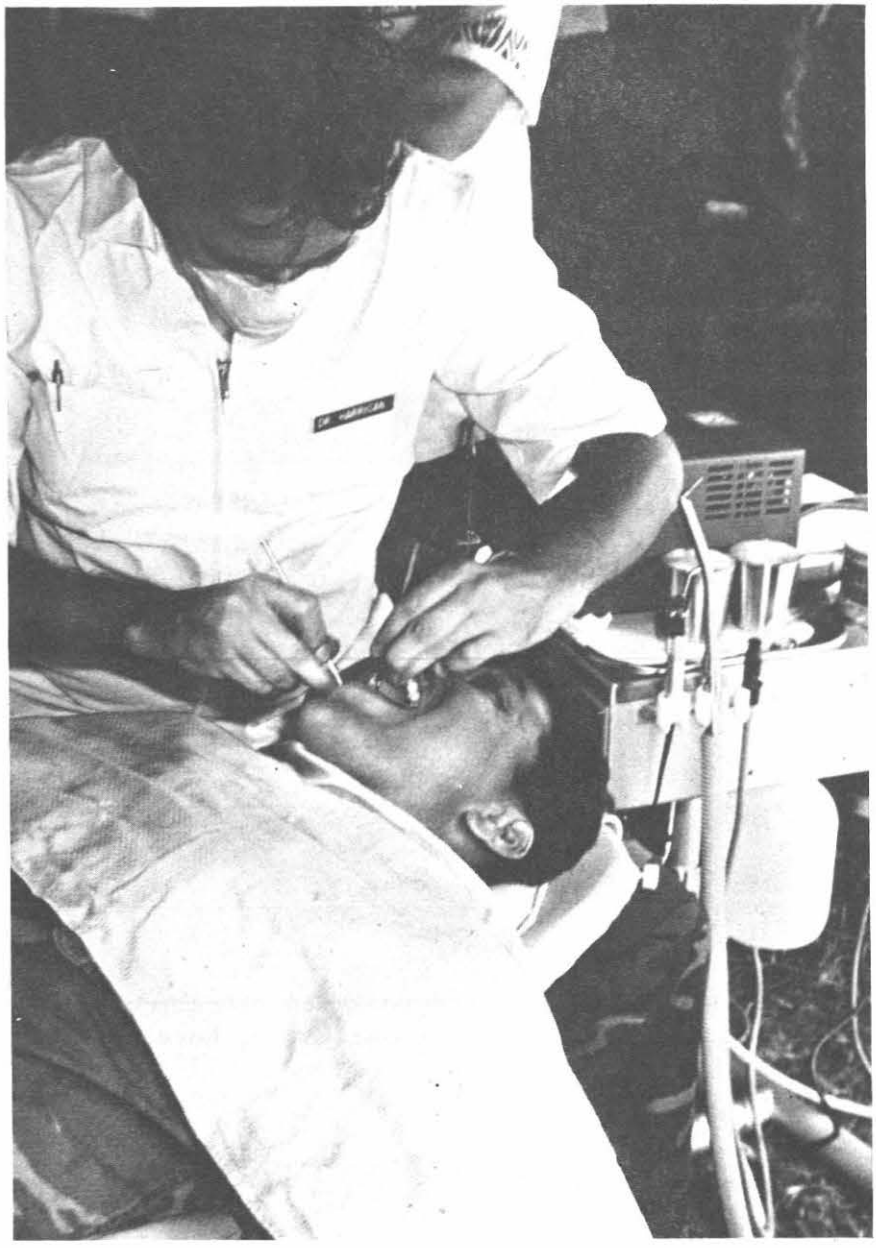


Figure 8. Post-Vietnam field dental equipment being used in a field training exercise near Kaneohe Bay, Hawaii. (Courtesy of U.S. Navy Medicine)

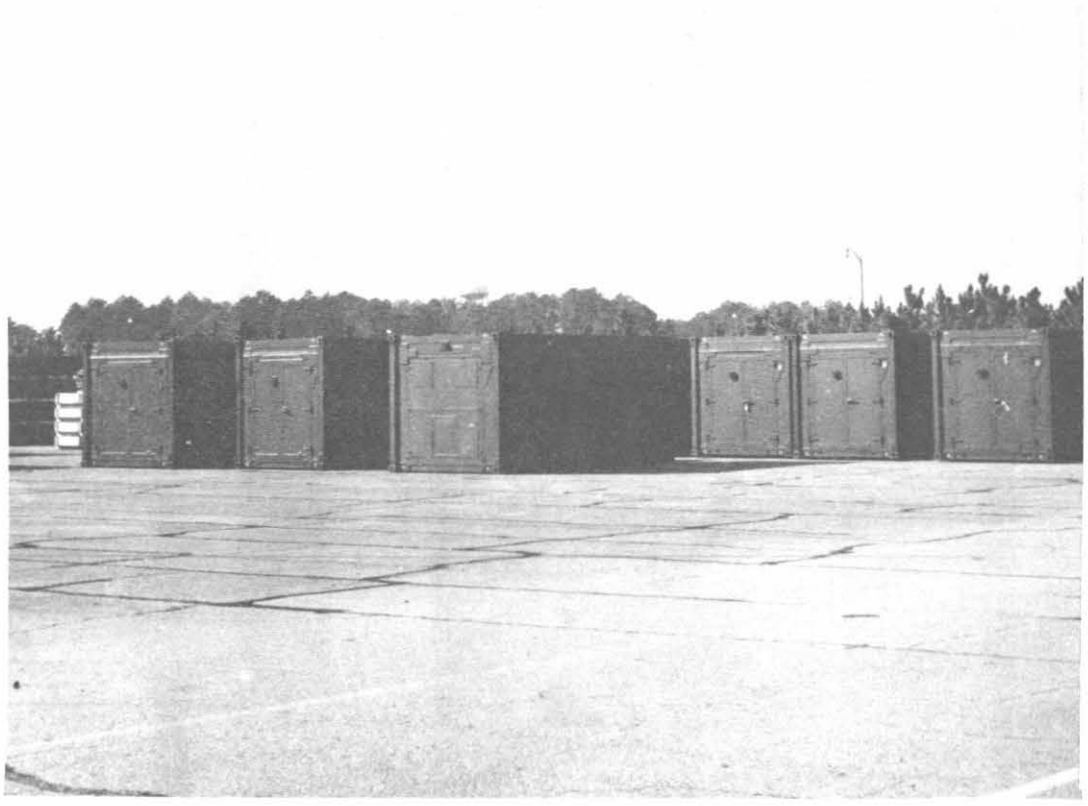


Figure 9. Containers of the Marine Corps Expeditionary Shelter System (MCESS) that will be in use by 1985. (Courtesy of Naval Dental Research Institute)

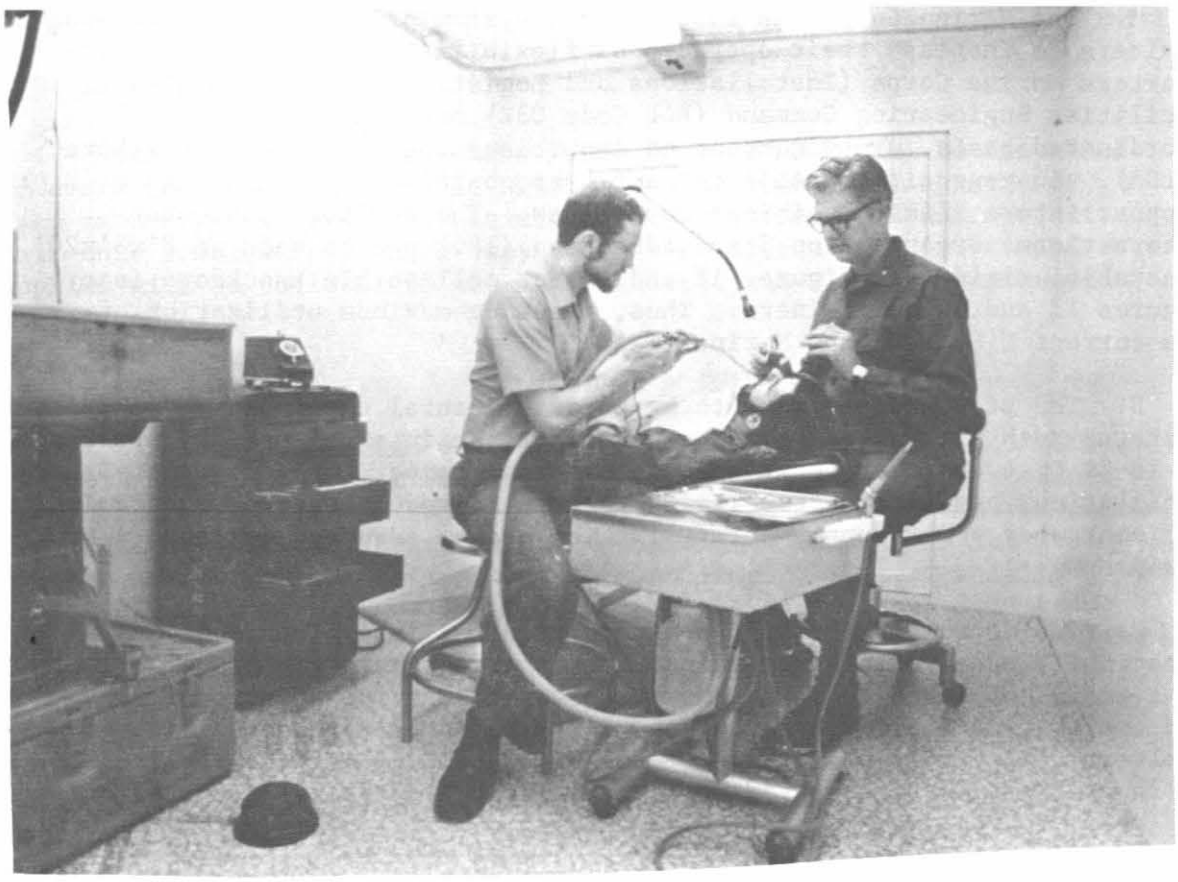


Figure 10. Field equipment of the Marine Corps' authorized dental allowance list (ADAL) being used inside a MCESS container. (Courtesy of Naval Dental Research Institute)

The Marine Corps Expeditionary Dental Shelter (MCEDS)

I. Introduction

A. The Marine Corps has instituted a system of rigid and knockdown shelters to increase their operational flexibility and mobility. Headquarters Marine Corps (Installations and Logistics, Code LM) and Naval Facilities Engineering Command (R&D Code 032) have developed, on a coordinated basis, a new concept of Amphibious Logistics Support Ashore (ALSA). In general, the ALSA concept uses containerized shipping to support future fleet amphibious operations. The shelters must meet International Organization Standardization (ISO) and be made of 8'x8'x20' stackable, rigid (see Figures 11 and 12) or collapsible knockdown (see Figures 13 and 14) containers. Thus, assuring maximum utilization of the current U.S. Merchant Marine fleet.

B. The standard shelters to be used for dental care require additional features such as: a controlled environment; an internal temperature range of 18-30 C, even in the most extreme external temperatures; adequate ventilation; positive internal air pressure to reduce external contaminants; and emergency power supply permitting the use of advanced designed dental equipment.

C. Two dental operatories would be required in a given shelter location. These would be contained in either a single rigid shelter, or a rigid complexed to a knockdown shelter to provide additional room and comfort. A shelter has the capability of complexing to adjoining shelters (side-to-side and end-to end) without modification, requires no foundation, is highly transportable and can be made fully operational and ready to receive patients in 45 minutes.

D. Additional applications for the shelters use are aboard ships, in overseas areas where permanent construction is not desired, or to increase the capability of current dental facilities during periods of emergency.

II. Shelter Facilities for Field Dental Care

Phase 1

A. A controlled-environment Marine Corps Expeditionary Dental Shelter (MCEDS) is being developed by the Naval Dental Research Institute (NDRI) to provide general dental support in combat areas. The two-operatory, 8'x8'x20', rigid shelter utilizes selected portable field equipment designed to provide adequate dental health care for combat-area Marine Corps personnel.

B. The dental equipment provided from the current authorized dental allowance list (ADAL) has generally been shown to be durable, light weight, and relatively maintenance-free. Notable modifications to this equipment have been to replace that which is obsolete, unadaptable, or no longer obtainable, and to engineer the necessary innovations.

C. Clinical trials were accomplished in a wooden mock-up using naval dental officers and technicians. The trials were successful and the system is now ready for field trials.

D. Future Plans:

Phase 2

Standard stock replacement items for the ADAL will be installed and evaluated in the mock-up at NDRI. The new items will consist of fixed cabinetry, an over-the-patient delivery system with an innovative chair-unit combination, and a tray instrument system. Equipment and supplies will be tailored to the MCESS shelter and will be recommended as a 662 ADAL.

Phase 3

Clinical evaluation will begin on a new generation of commercially available dental equipment for future replacement of ADAL and standard stock components of the MCEDS. Clinical performance standards for each item shall be written. Criteria for equipment to be used in the field shall be identified and defined in the standards. All commercially available equipment will be indexed against the standards. The items that most closely meet the set requirements will be procured for testing and evaluation in the mock-up.

In the out years new equipment developments will be continually evaluated in the wooden mock-up. A 30-day resupply module shall be developed for the dental shelters that are involved in extended operations. Methods for control of the shelter environment, involving the collection and elimination of particulate, water and exhaust contamination generated by dental treatment will be developed and evaluated.

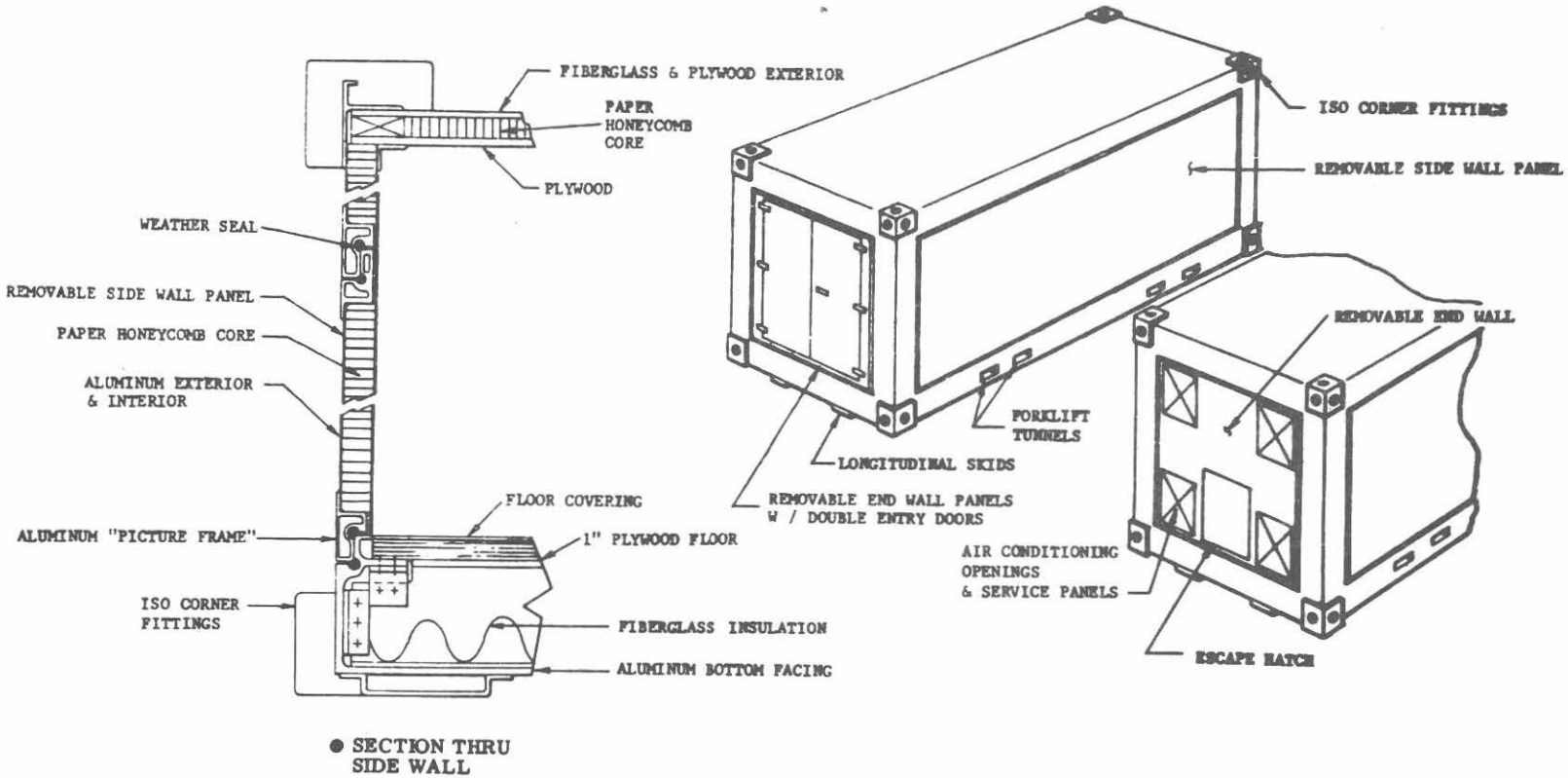
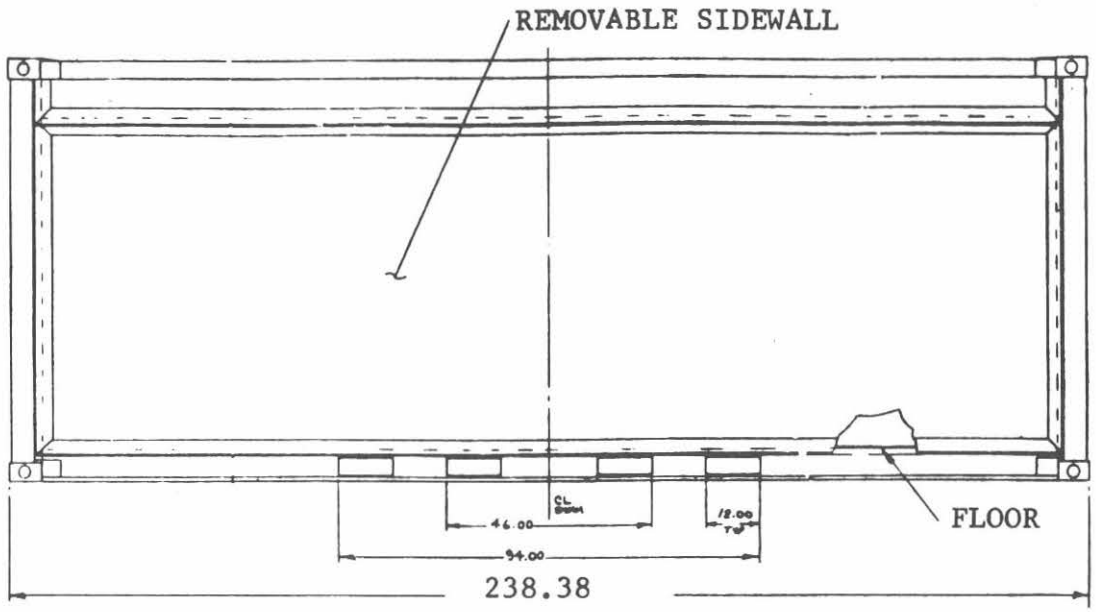


Figure 11. Rigid Shelter Design



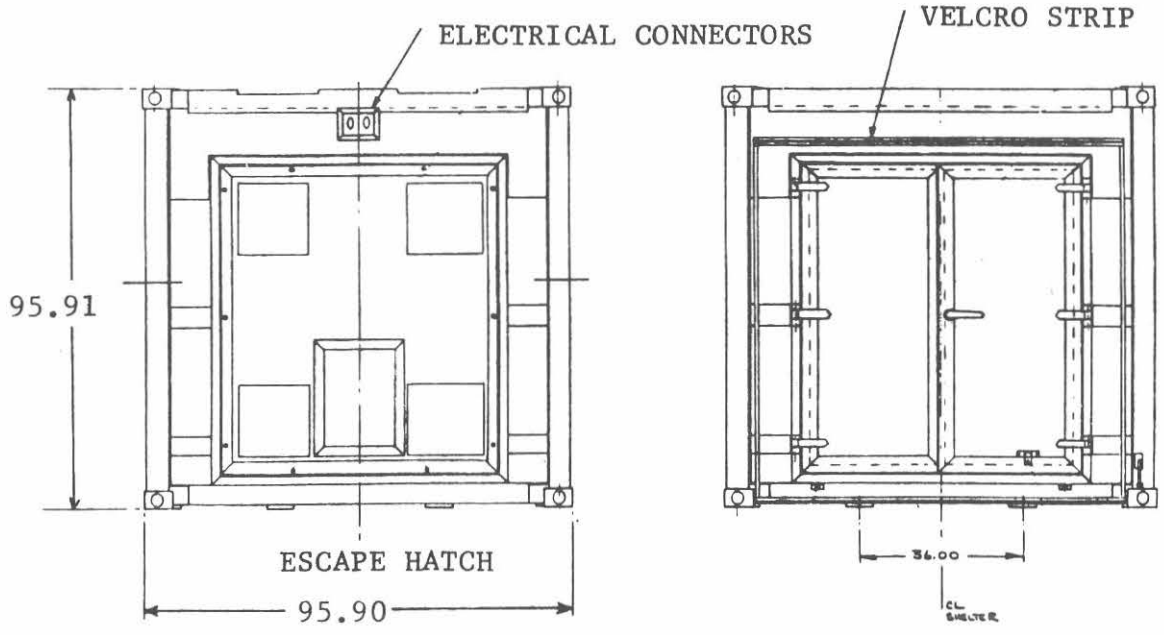


Figure 12. Rigid Shelter Envelope Drawing

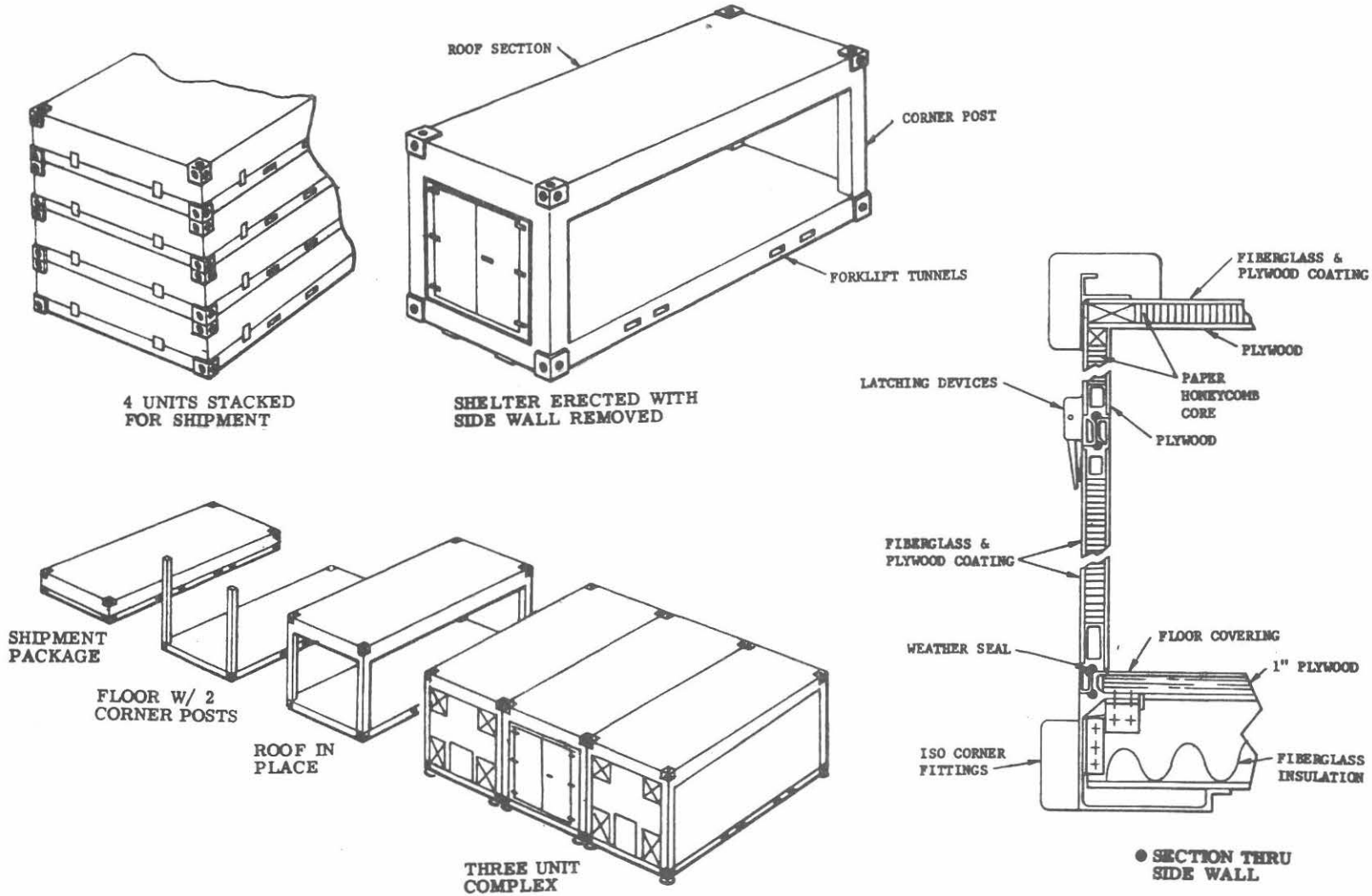


Figure 13. Knock-down Shelter Design

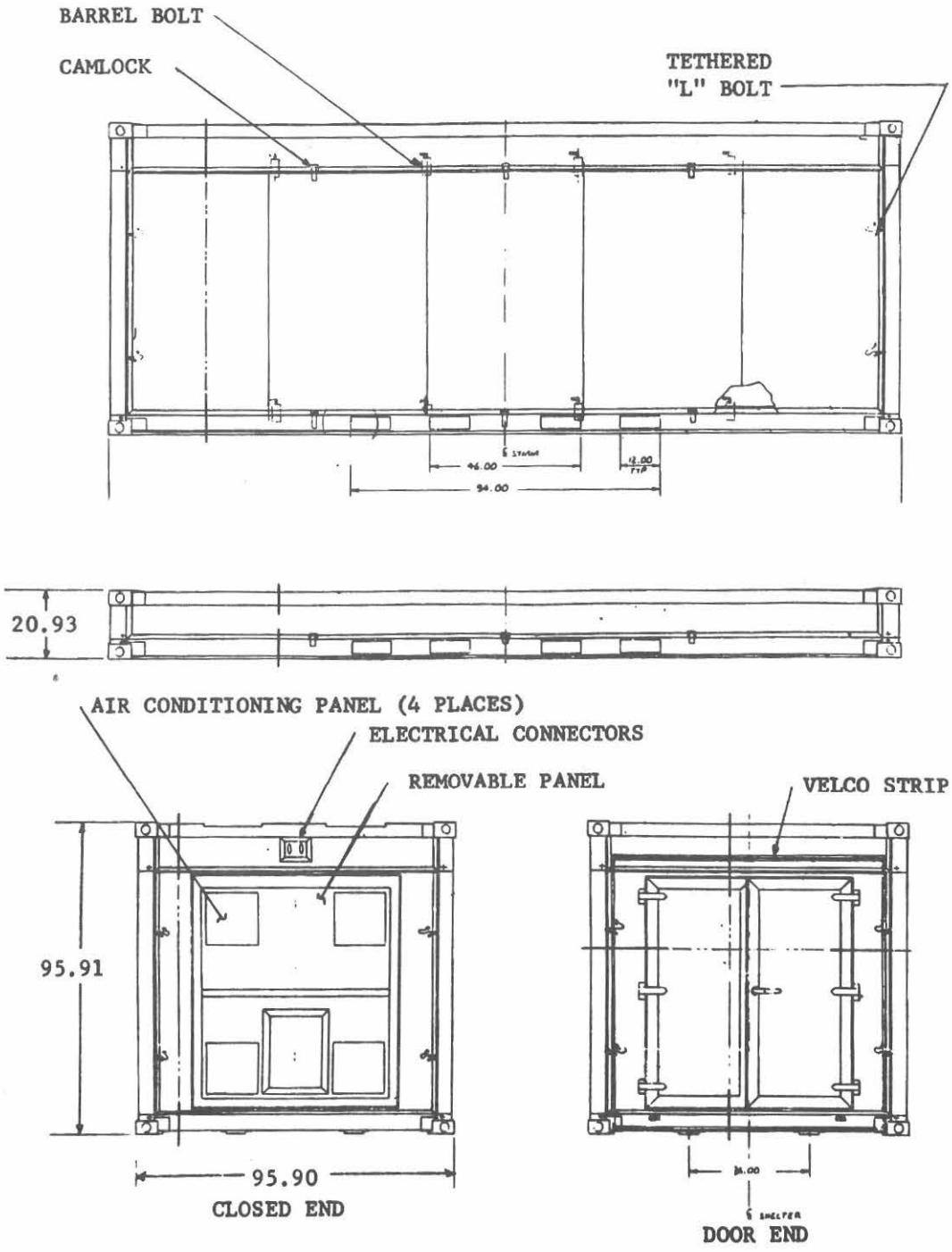


Figure 14. Knock-down Shelter Envelope Drawing

III. Shelter Electrical Status

A. The original shelter electrical specifications are not sufficient to support the electrical requirements of the current Authorized Dental Allowance List.

B. Electrical provisions of the original shelter specifications.
1. Equipped with built-in fluorescent lighting that consists of 16-48" tubes of 40 watts each.
2. One 115 volt 60 hertz convenience outlet in each 8 foot wall section with a total of 8 grounded outlets.
3. Provisions for a 120 or 240 volt power source.
4. Interconnecting cables to electrically join side panels of adjoining shelters.

C. Electrical components of the original shelter specifications.
1. Load center (generator output) is 60 amps 120 volt.
2. Breakers in the junction box are 15 amp each.
3. Rigid conduit (wire housing) of galvanized steel, 0.50 outside diameter.
4. Wire is 14 gauge single strand insulated wire.

D. Proposed changes to electrical components.
1. Change the load center to 60 amp 208-220 volts.
2. Change the 15 amp breakers to 60 amp.
3. Power source will require 208-220 volts 60 hertz single phase with a neutral.
4. The wire used for the outlets and lights will be changed to 8 gauge single strand insulated wire.

E. Amperege requirements of ADAL equipment.

Compressor	13-15.0
Sink	7.4
X-ray unit	7.0
Developer	5.0
Sterilizer	10.0
Amalgamator	1.5

F. Amperege requirements of other equipment.

Overhead lights	5.0
Fiber optic light	1.2
Heater	10.0
Air conditioner	7.5
Battle lantern	.2
Dehydrator	.2

G. Suggested electrical distribution.
See Figures 15 through 17.

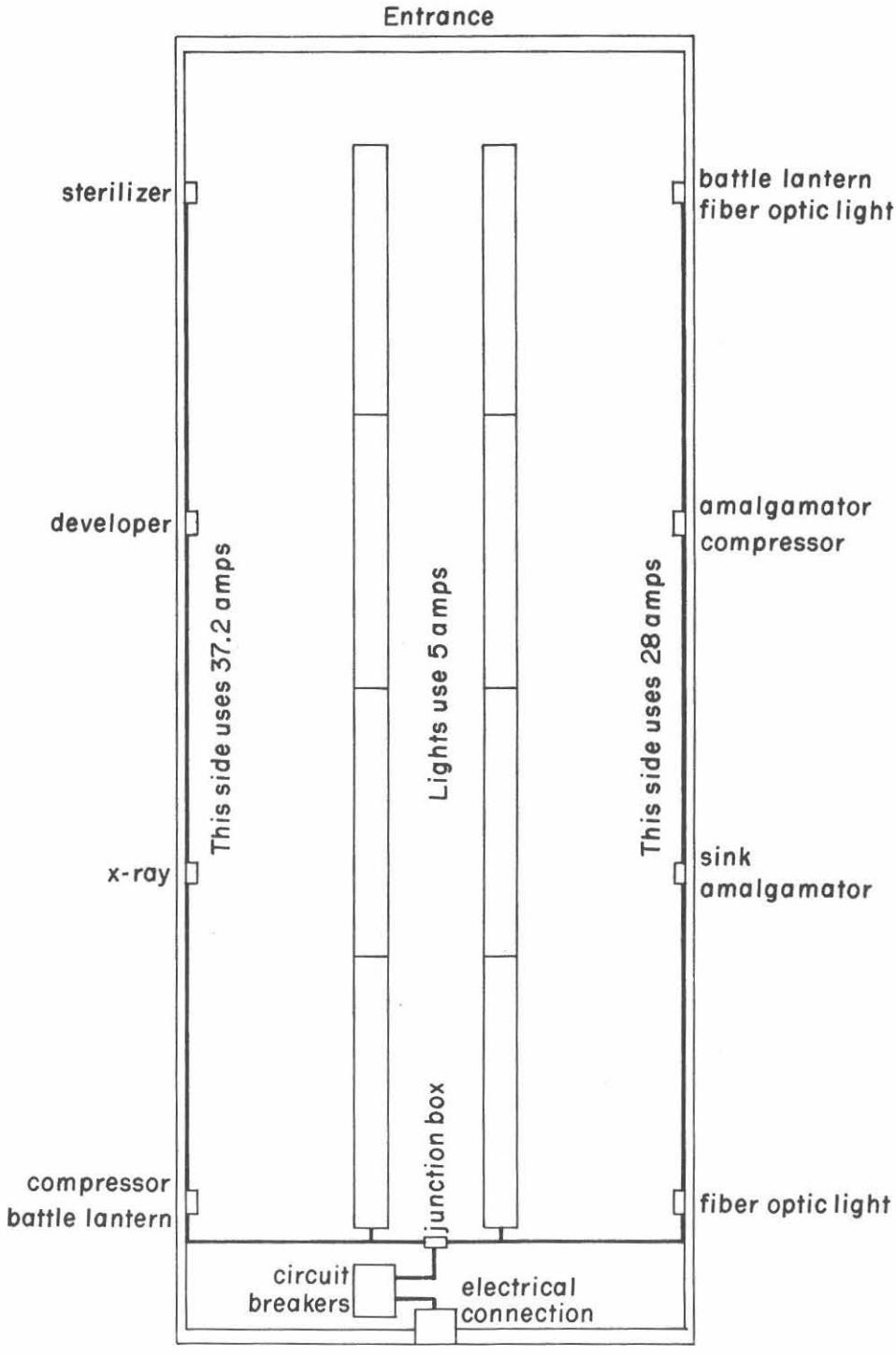


Figure 15. Standard electrical distribution (70.2 amps).. The two side walls are able to accept up to 60 amps each.

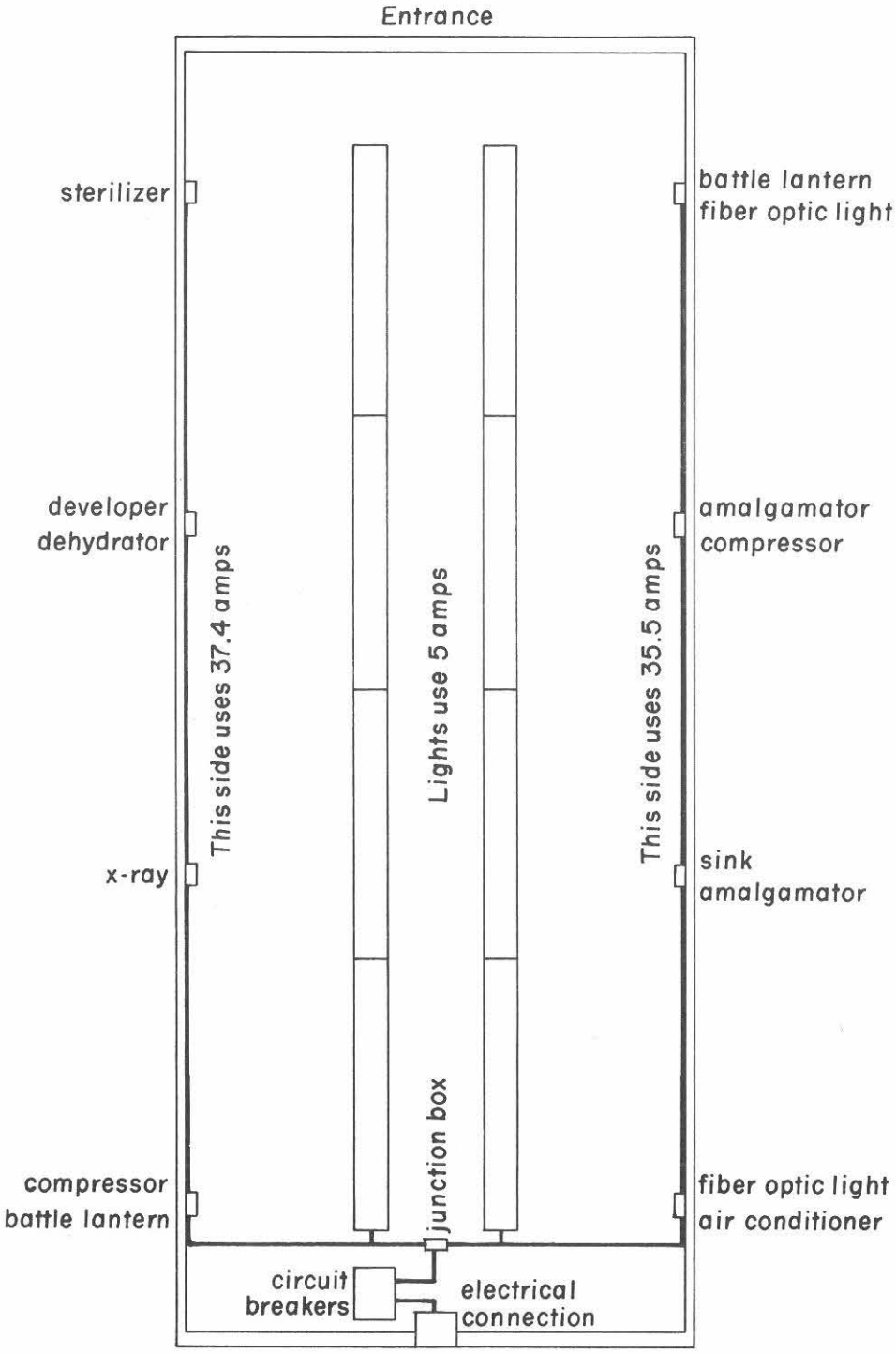


Figure 16. Hot Weather Set Up (77.9 amps)

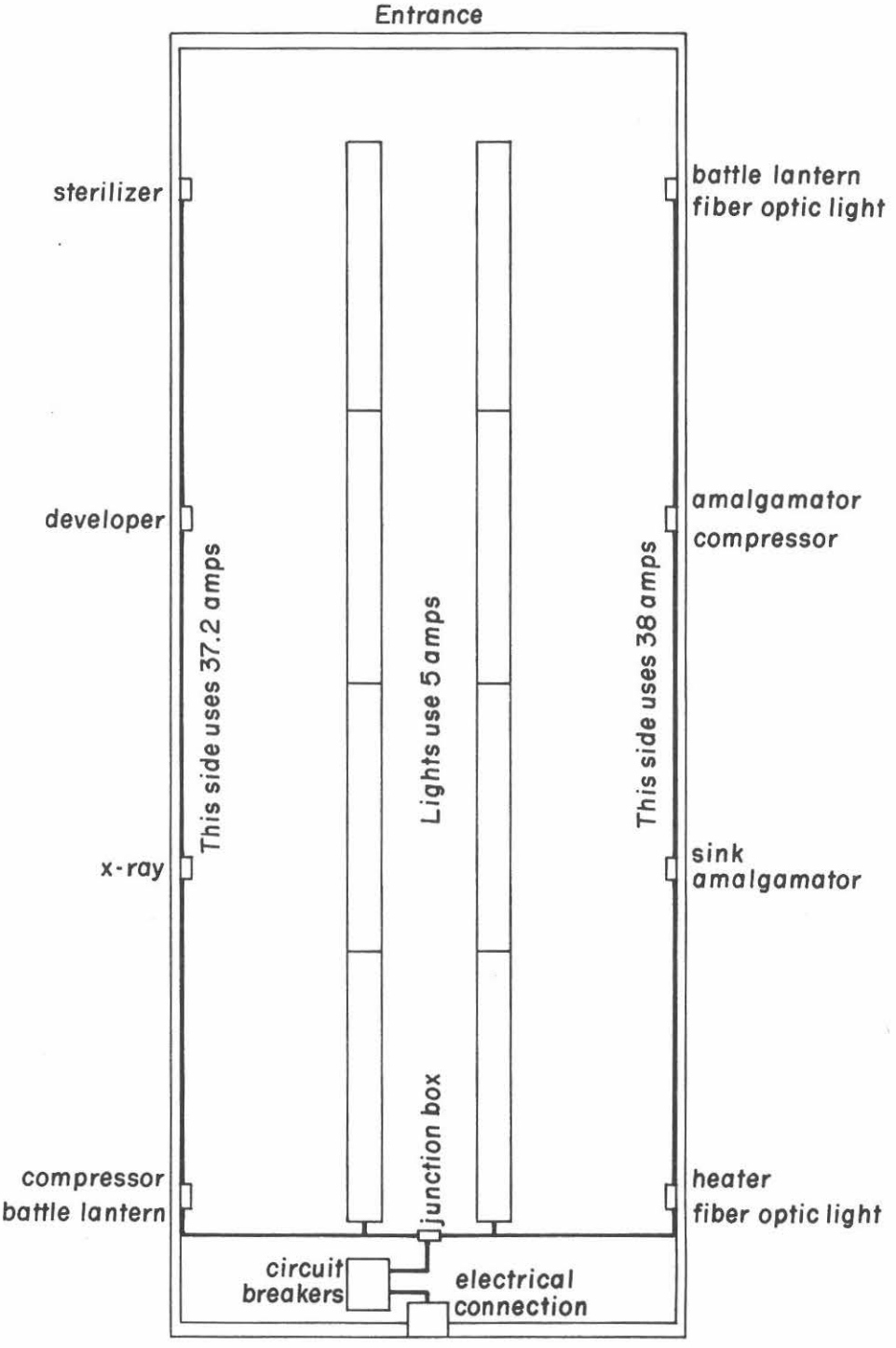


Figure 17. Cold Weather Set Up (80.2 amps)

IV. Authorized Dental Allowance List (ADAL)

A. The ADAL is composed of two components; the 660 which represents the supplies to equip one dental operatory, and the 661 which represents the supplies to be shared by six dental operatories (see Figure 18).

B. 660 components:

compressor	6520-00-139-1246
oper. unit	6520-00-140-7763
chest no. 2	6545-00-914-3470
chest no. 6	6545-00-914-3510
chair, porta	open purchase, A-DEC model 3450 (to replace the Den-Tal-Ez chair no longer manufactured)
sterilizer	6530-00-782-6503
fiber optic light	open purchase, MDT (to replace the present field dental operating light 6520-00-074-4581)

C. 661 components:

sink	6545-00-935-4056
x-ray	6545-00-616-9404
developer	6525-00-763-4612

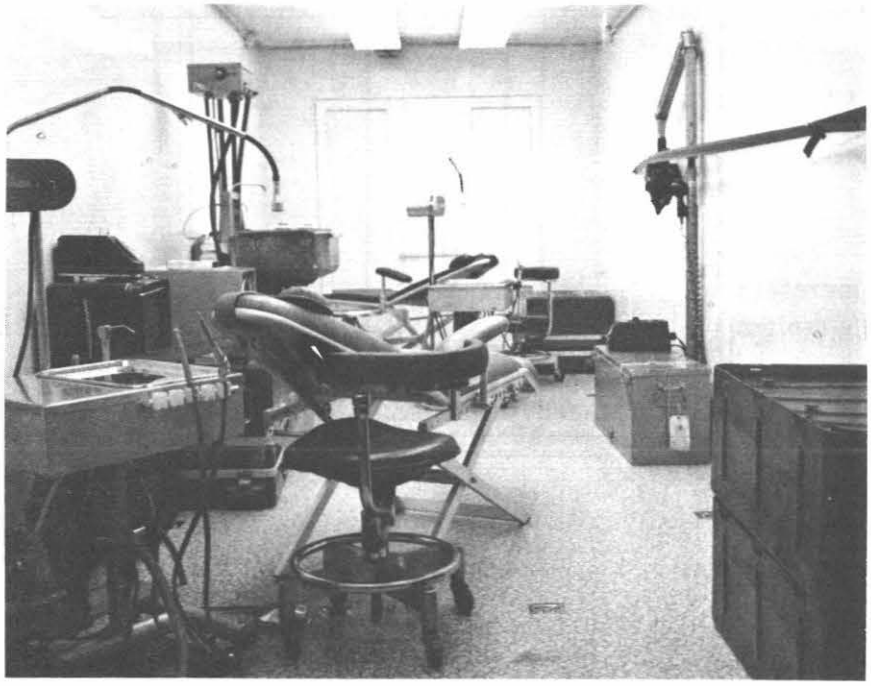


Figure 18a. View from the entrance of the MCEDS with the ADAL in place.

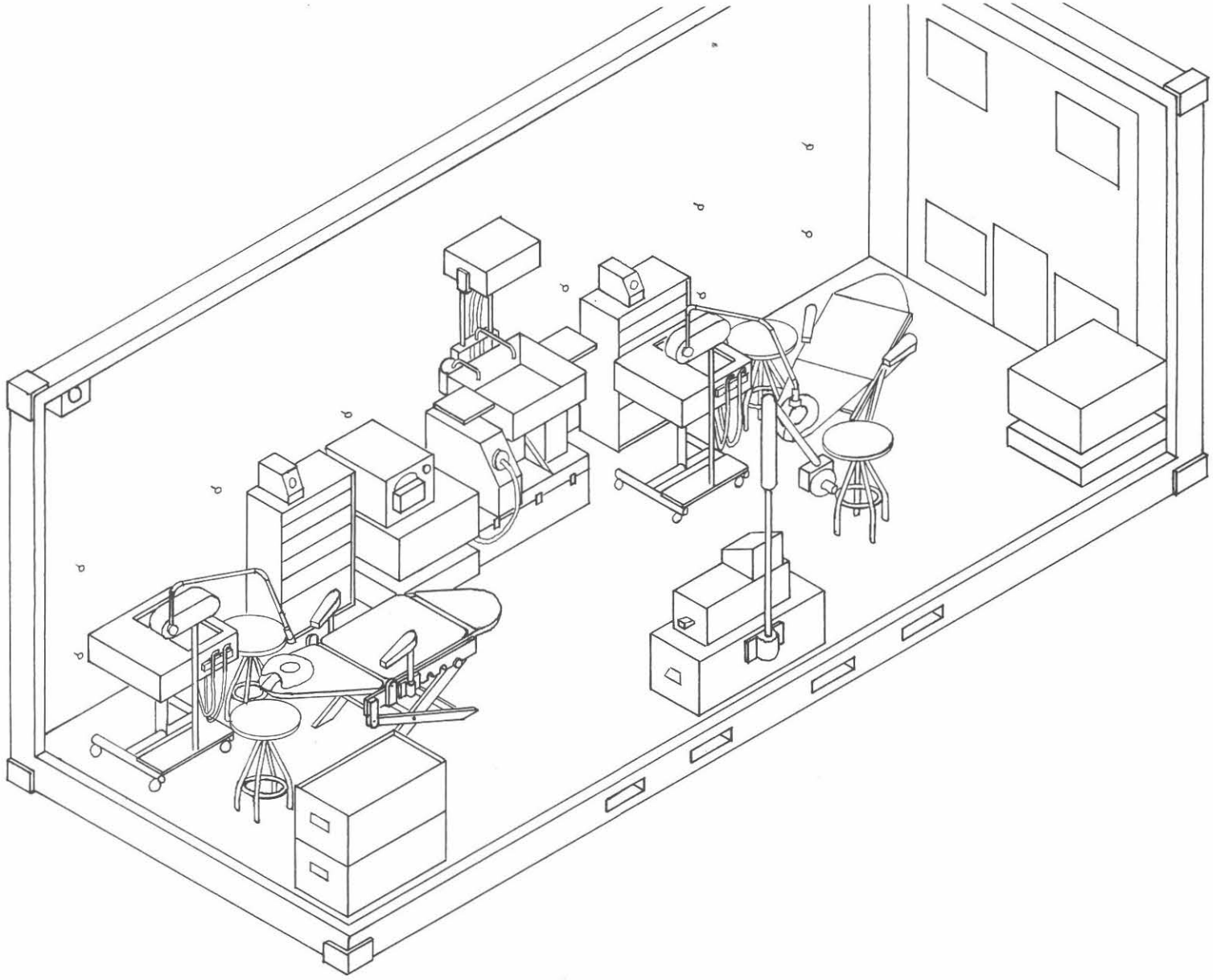


Figure 18b. Typical layout of field equipment inside an 8x8x20 rigid shelter.

D. Compressor modifications

Compressor - Dehydrator, Dental Equipment
(Compresso-Dri, Model M5)
FSN 6520-00-139-1246
Cost: $1,467.01
GS-005-64087
Air Techniques, Inc.
2020 Jericho Turnpike
New Hyde Park, New York 11040 Phone: (516) 775-1645

The compressor is a complete, portable unit with an integral air drying section switch which automatically regenerates the drying agent. The unit supplies compressed air, free of oil, moisture, and particulate matter, to power a dental operating unit. An integral part of the compressor is a transit case, the cover of which is designed to serve as sound suppressor and protective device during normal operation. The compressor can be rapidly placed into operation and is readily maintained. We have found that the Compressor-Dehydrator is adequate in running one field type dental operating unit. During our trials we found that we only used the compressor for short periods of time that average 12 minutes per hour. The operating instructions suggest that during emergencies, two dental units may be operated off the same compressor if used in alternating intermittent operation.

To start the compressor you must first remove any compressor head pressure by depressing the red colored unloader valve tab on the pressure switch, while setting the circuit breaker to the on position. Failure to depress the red tab will result in tripping of the circuit breaker. In order to depress the red tab and turn the circuit breaker on it is necessary to remove the cover of the compressor, which would require that the dental technician would have to remove the cover several times a day.

In order to save time and better utilize the dental technician an in-line switch was installed for the circuit breaker and a pull chain to depress the red tab relieving the head pressure to the air compressor. With these modifications, the dental technician is able to turn the compressor on and off without removing the cover each time the compressed air is needed (Figure 19).

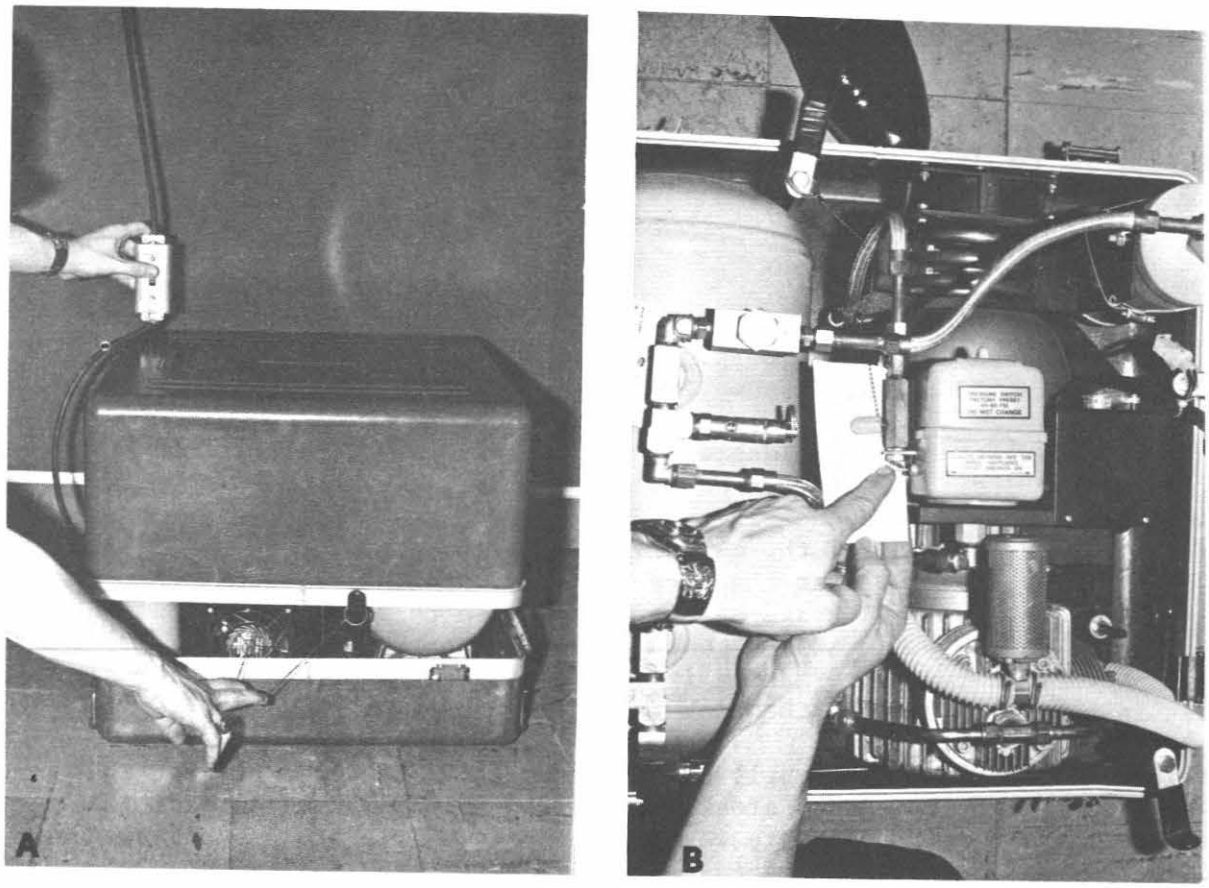


Figure 19. a) Photo showing in-line switch and pull chain modifications in use; b) chain connection to unloader valve tab.

E. Sink modification

Sink Unit Hospital Field
Model AH E001A1
FSN 6545-00-935-4056
Cost: $388.00
Atlas Hospital Equipment Co., Inc.
1000 Railroad Street
Windber, PA 15963

5 gallon water tank
7240-00-089-3827
Cost: $10.95
Canadian Commercial Corp.
Ottawa, Ontario, Canada

The sink consists of one foldable, portable scrub sink, capable of delivering either electrically heated, or unheated water. The sink unit is intended for the use of medical personnel in the field during pre-operative and post-operative scrubs, and for the cleaning of instruments as required. In our trials we have noticed that the knee operated water valve was difficult to reach for a person of average height. To revise this problem we put in a stop screw in the micro switch control to shorten the working range of the knee-operated water valve making it much easier for a person of over six feet in height to operate the sink (see Figure 20).

It is recommended that a supply of emergency stand-by water be kept in a 5 gallon water tank, standard stock number 7240-00-089-3827. An additional tank could also act as a waste water receptacle. This would avoid the use of the awkward metal shipping case that holds the sink (see Figure 21).

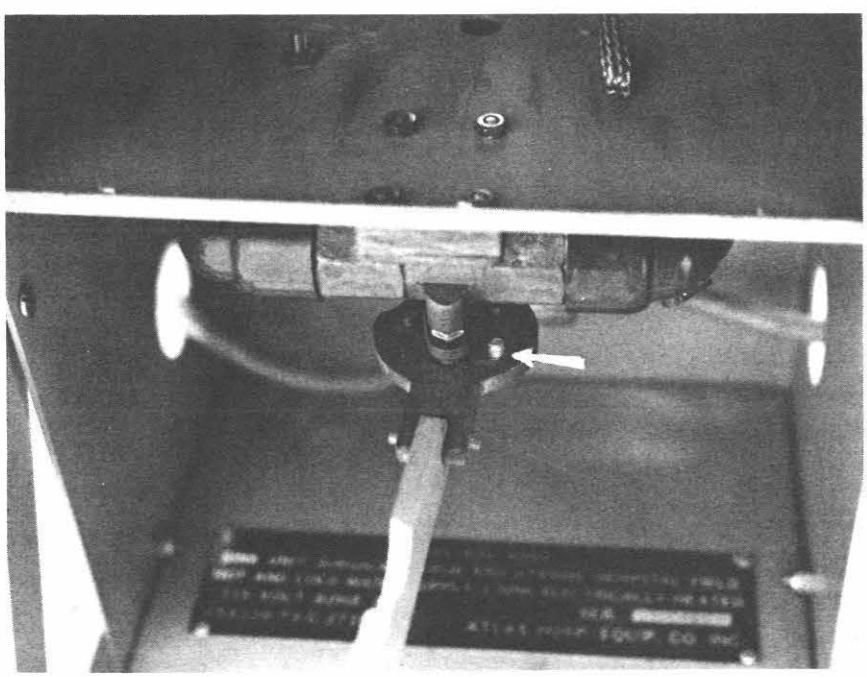


Figure 20. The arrow shows stop screw placement.

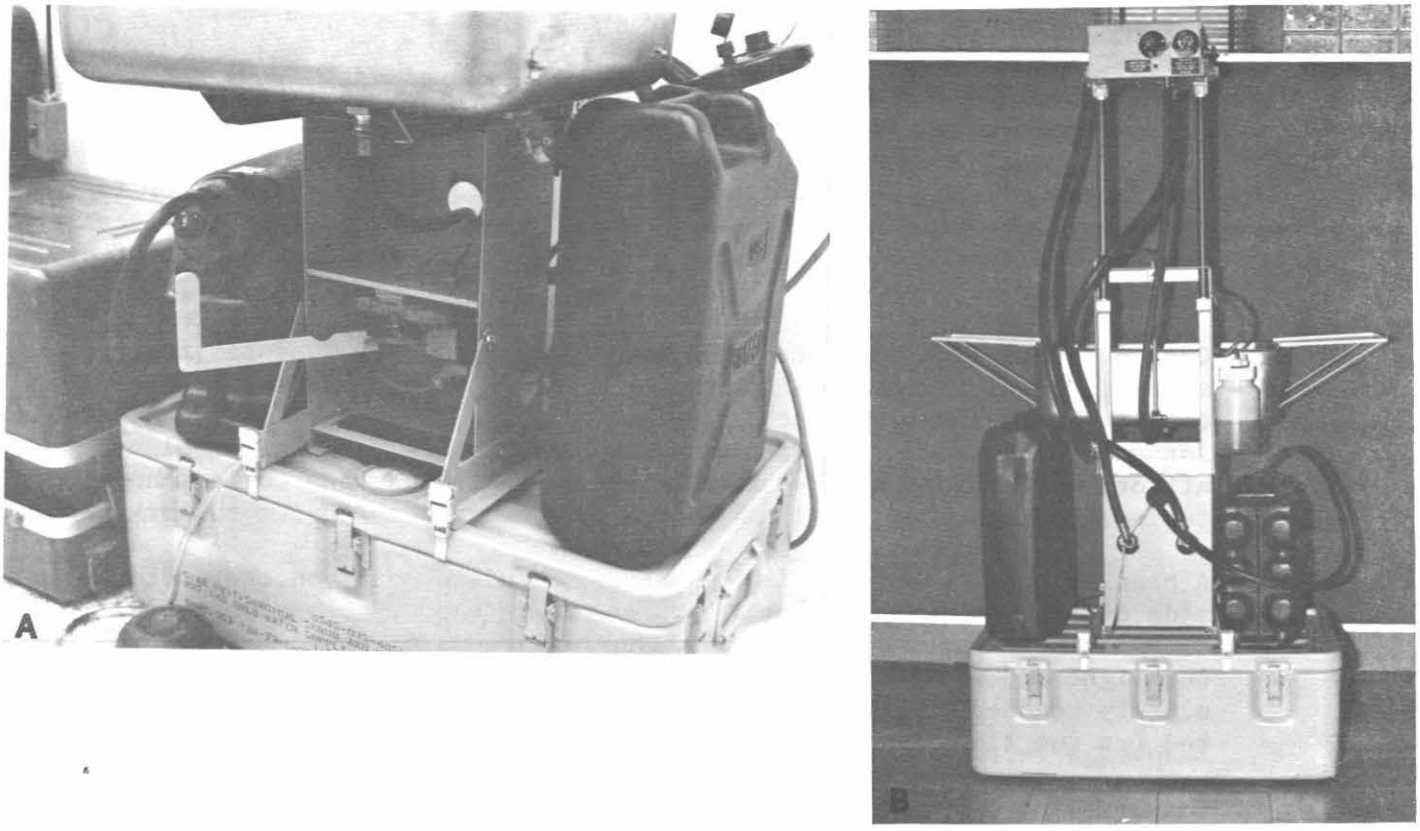


Figure 21. 5-gallon water tanks being utilized as emergency, stand-by water source and as a waste water receptacle. a) front view, b) rear view demonstrating hose distribution.

F. Dental operating unit modifications

Porta Cart
FSN 6520-00-140-7663
Cost: $1,856.90
GS-005-64220
A-Dec
2601 Crestview Drive
Newberg, Oregon 97132 Phone: (503) 538-9471

The Porta-Cart is a self-contained mobile dental unit designed for field operatory use. A pressurized water tank supplies water for handpiece coolant and syringe. Attaching the water supply line to a source of dry filtered air at 80-100 PSI is the only connection required.

Oral evacuation is provided by steril-vac. The control system features manual selection of two handpieces with air and water coolant. The water coolant and maximum dynamic drive air pressure are individually adjustable for each handpiece. The water coolant on-off toggle and air coolant affect both handpieces. We found in our trials that the coiled handpiece tubings tangled, but straight handpiece tubings were easier to work with.

A bracket and support bar has been fabricated to mount on the doctor's side of the Porta-Cart. Their purpose is to support the adjustable aluminum post which will mount the MDT fiber optic light. It removes the light and post from the doctor's way and allows the chair to be quickly readied to accept a stretcher during a casualty care situation, and for the light post to be used as an I.V. pole (see Figures 22 and 23).

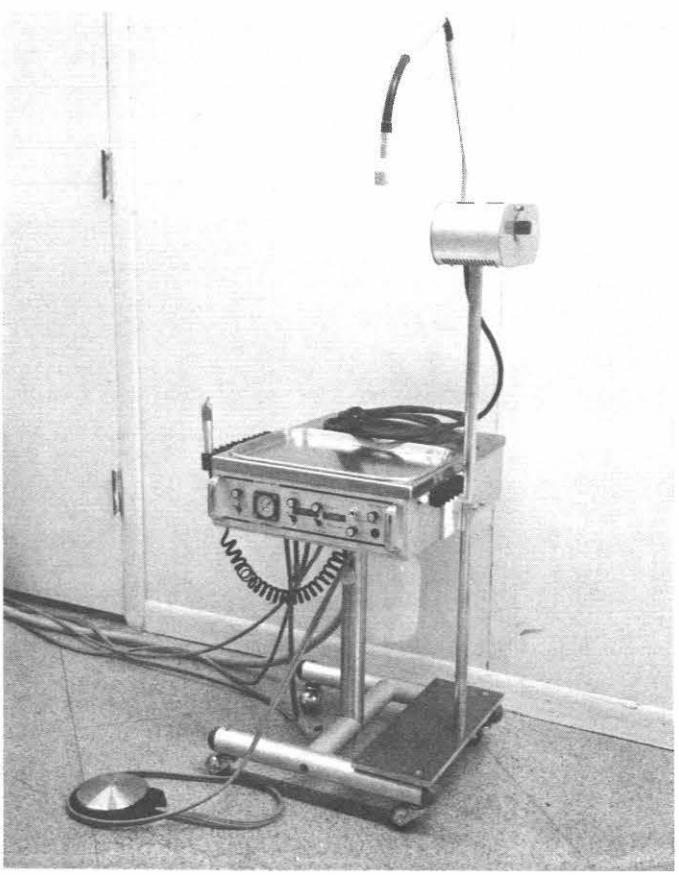


Figure 22. A Porta-Cart showing the bracket, support bar, aluminum post, and MDT fiber optic light.

Figure 23. Detail of the bracket, support bar, and aluminum post. A-Dec will be able to supply these items.

G. MDT Rolux fiber optic light substitution
Open purchase $510.00
GS-005-64418
MDT Corporation
19365 Southwest 89th Avenue
Tualatin, Oregon 97062 Phone: (503) 638-9631

Quartz Lamp
Quartz, 200 watt, 24 volt
Model EJL
Open purchase $14.30
General Electric
Dental Systems
Box 414
Milwaukee, Wisconsin 53201

The present field dental operating light 6520-00-074-4581 is tripod mounted and does not enable the dental officer in the field to place the light in any position that will provide a satisfactorily illumination of the oral cavity. The end result is an inability of the operator to view definitely posterior teeth rendering treatment extremely difficult. Additionally, the light is awkward, difficult to position properly, and subject to being easily turned over and broken. Parts are no longer available necessitating complete light replacement or cannibalization of existing lights.

A replacement 5 lb. fiber optic light has been selected for NDRI's shelter project. The light has an intensity selector that permits adjustment of from 1100 foot candles to 6,700 foot candles of power without the associated heat. The lamp may be quickly replaced without the use of any tools. The light source mounts on an aluminum pole which in turn is attached to the Porta-Cart by a simple bracket and support plate. The flexible arm is 42 inches long and may be positioned 360 degrees vertically and horizontally placing it out of the way. The lens is normally placed from four to twelve inches from the oral cavity minimizing time lost in reaching to adjust. All of the oral cavity is easily illuminated without the light spill-over into the patient's eyes (see Figure 24). The fiberoptic light is packed in the No. 6 aluminum storage chest.

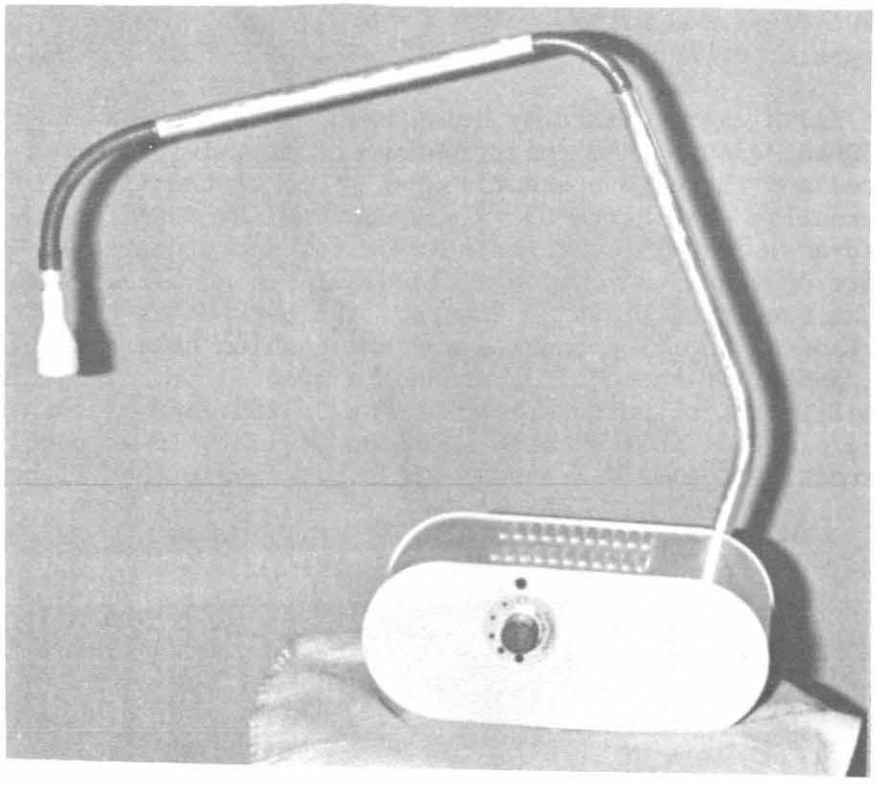


Figure 24. Detail of fiberoptic replacement dental operating light.

H. Porta-Chair substitution
Model 3450
Open purchase $666.50
GS-005-64220
A-Dec
2601 Crestview Drive
Newberg, Oregon 97132 Phone: (503) 538-9471

The dental field chair currently being used is the Den-Tal-Ez chair FSN 6520-00-181-7349. This chair, unfortunately, is no longer being manufactured and there is presently a shortage of them in the field. As an alternative, the Porta-Chair was selected by NDRI for use in the shelter project. The Porta-Chair is a sturdy and lightweight adjustable dental chair designed to survive field use. Its adjustment mechanism elevates the base from 22 to 33 inches. The back tilts up 70 degrees from a horizontal position and has movable cushion headrest. In the horizontal positions the chair arms can be removed to receive a stretcher during casulty care situations. It weighs 35 lbs. and is constructed of 7/8 inch aluminum tube with an anodized finish. It is upholstered with polyurethane foam and heavy weight vinyl fabric (see Figure 25).

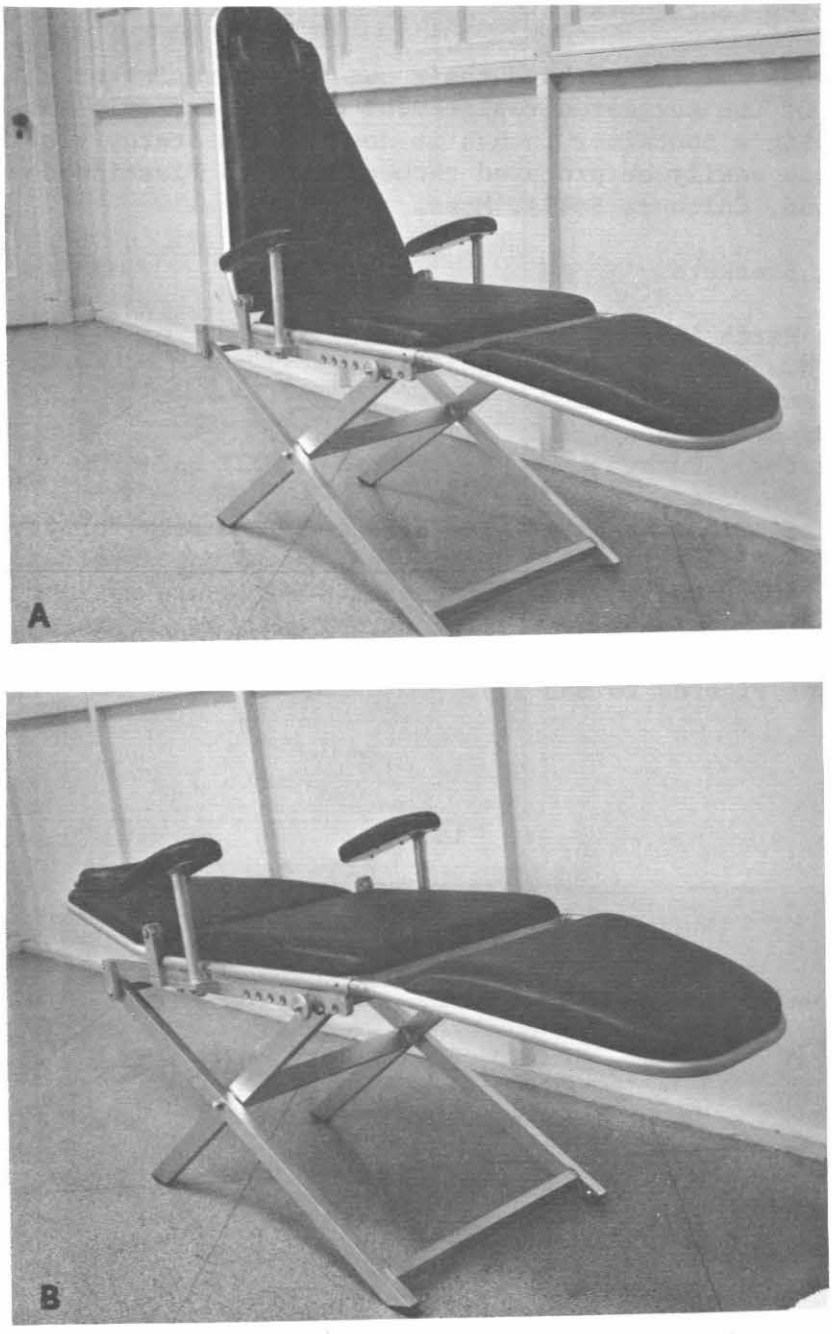


Figure 25. The Porta-Chair in the a) upright and b) horizontal positions. Note: That while the chair is in the horizontal position the arms can be removed to accommodate a stretcher.

V. Loading and Transport of the Authorized Dental Allowance List

A. Shipping Containers

The ADAL components have their own impact-resistant shipping containers. Of the suggested replacement components, only the Porta-Chair is lacking a container though it does have a sturdy vinyl bag. A container can easily be procured through Mercury Plastics Corporation, 672 Fuller Road, Chicopee Falls, Mass. 01020.

B. Floor Brackets

Flush Hatch Lifting Handles
Cat. No. H2236 Mfrs. No. 6030
Open purchase $15.45
Welcox Crittenden
Middletown, Conn. Phone: (203) 632-2600

Recessed floor brackets were selected primarily for strength. Another important feature was a design that would not interfere with normal foot traffic and equipment movement. To insure maximum use the floor brackets were placed over floor strong points. It is suggested that this or similar type floor brackets be installed by shelter contractor (see Figures 26 and 27).

Figure 26. Detail of floor bracket.

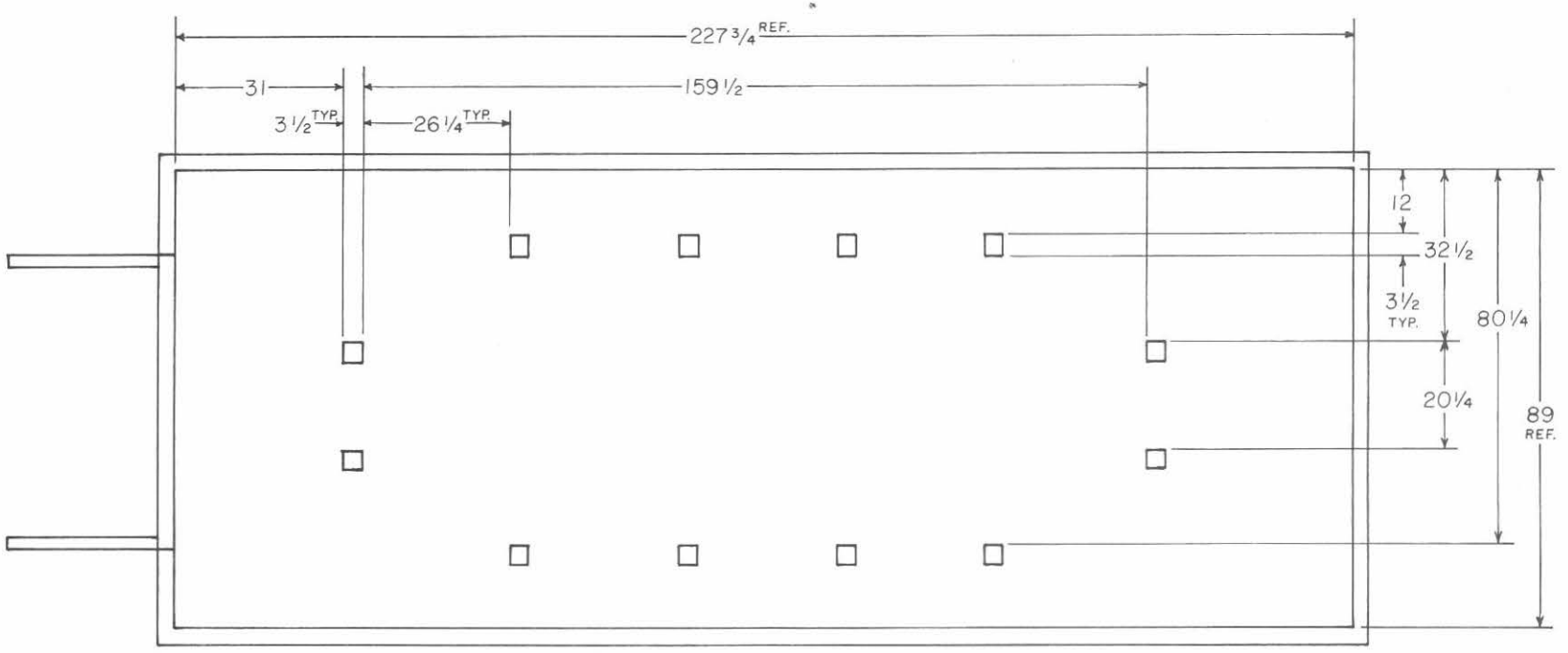


Figure 27. Location of floor brackets placed over strong points.

C. Cargo, HCU 15/c Top Net

FSN 1670-00-969-4103
Cost: $74.39
FLZ Warner Robbins Air Force Base, GA

The ADAL components are packed in their respective containers and stacked in two layers on the shelter floor. The first (bottom) layer, going from front to back, consists of a chair, compressor with stools, chest, chest, compressor with stools and x-ray. The second (top) layer consists of a chair, unit, sterilizer, sink, unit, and developer (see Figures 28 and 29). Four stools are added to the ADAL and placed on either side of the two compressors. A cargo top net is placed over the ADAL containers and secured to the floor brackets and its straps drawn tight (see Figure 30).

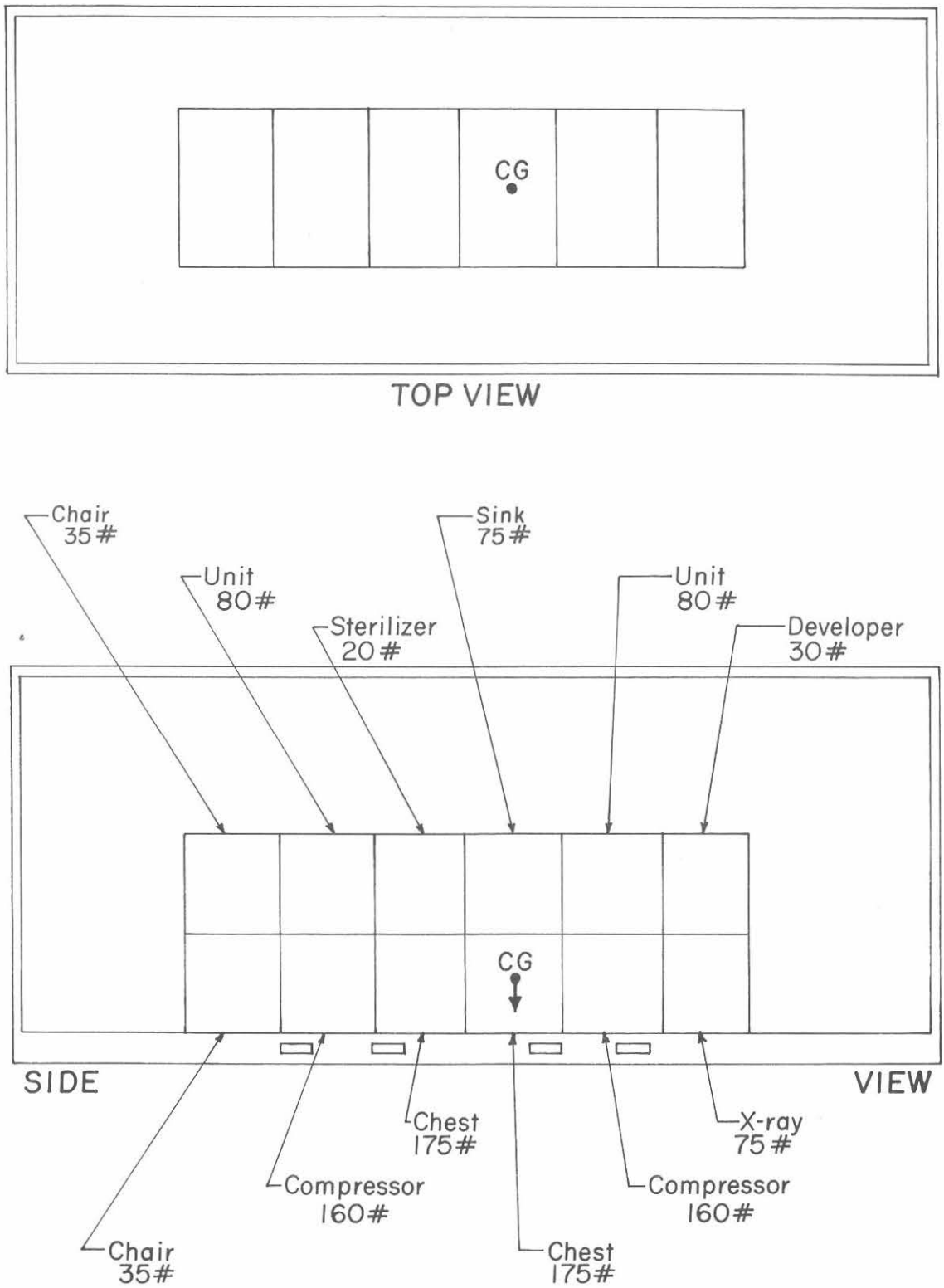


Figure 28. Diagram of recommended load plan for the 1100 lbs. of equipment. The load weight is 22 lbs/sq. ft.

CG = Center of Gravity

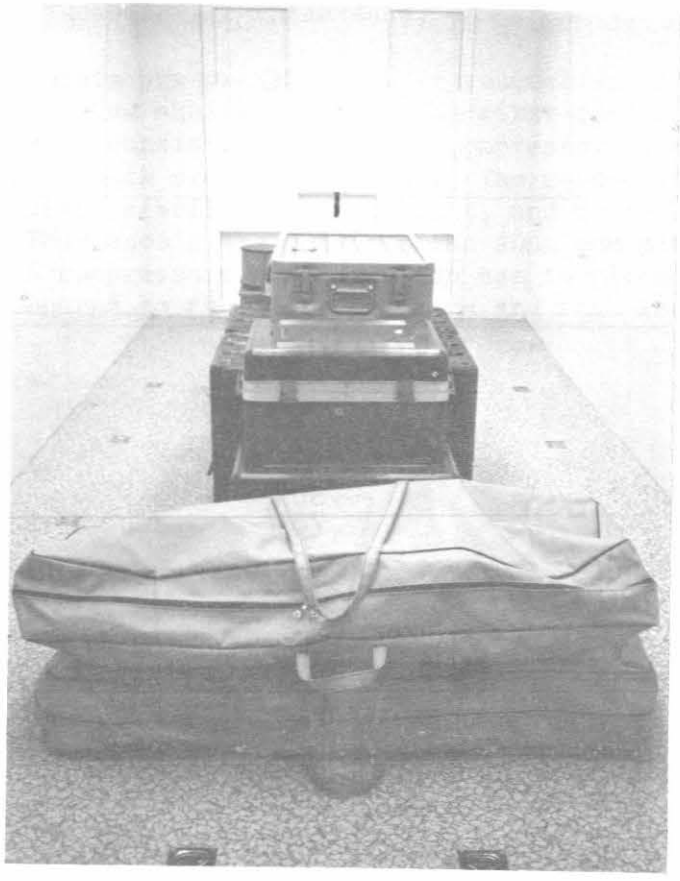


Figure 29. The ADAL component containers stacked in two layers, ready to be secured for transport.

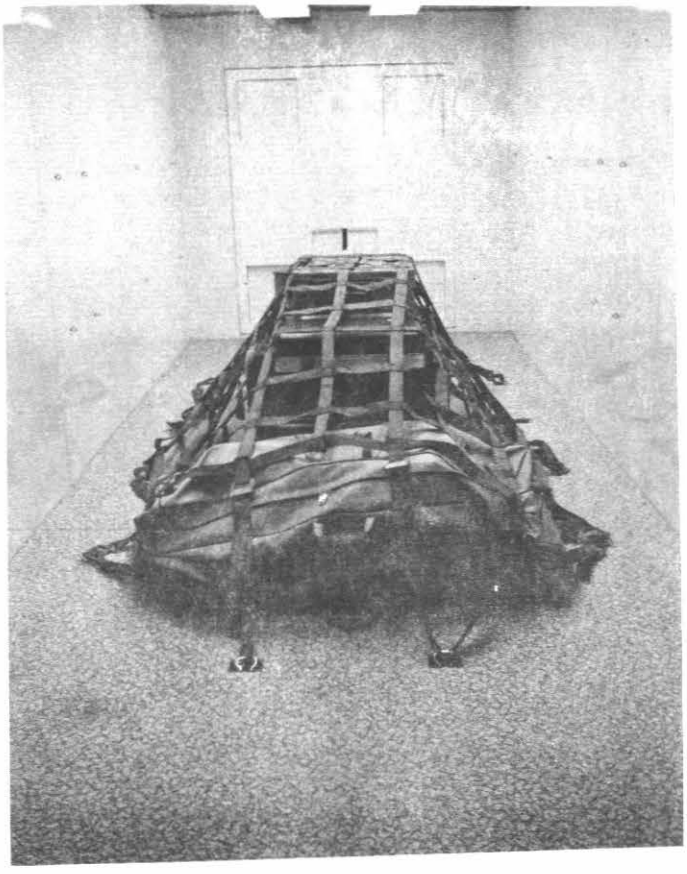


Figure 30. A cargo net is placed over the ADAL load and the clips attached to the floor brackets and tightened.

D. Nylon Straps

Long Cargo Straps - 17 1/2 foot x 2 inches
1670-00-554-5458
Cost: $12.00 each x 2
N32 Philadelphia, PA

Short Cargo Straps - 10 foot x 2 inches
1670-00-348-4137
Cost: $10.68 each x 4
FPZ Air Logistics Center
Kelly Air Force Base, Texas

To further insure the ADAL is secure, two long nylon straps are placed over the cargo top net length-wise and tightened down. Four short nylon straps are placed over the cargo top net width-wise and also tightened down. The ADAL is now secure to be transported (see Figure 31).

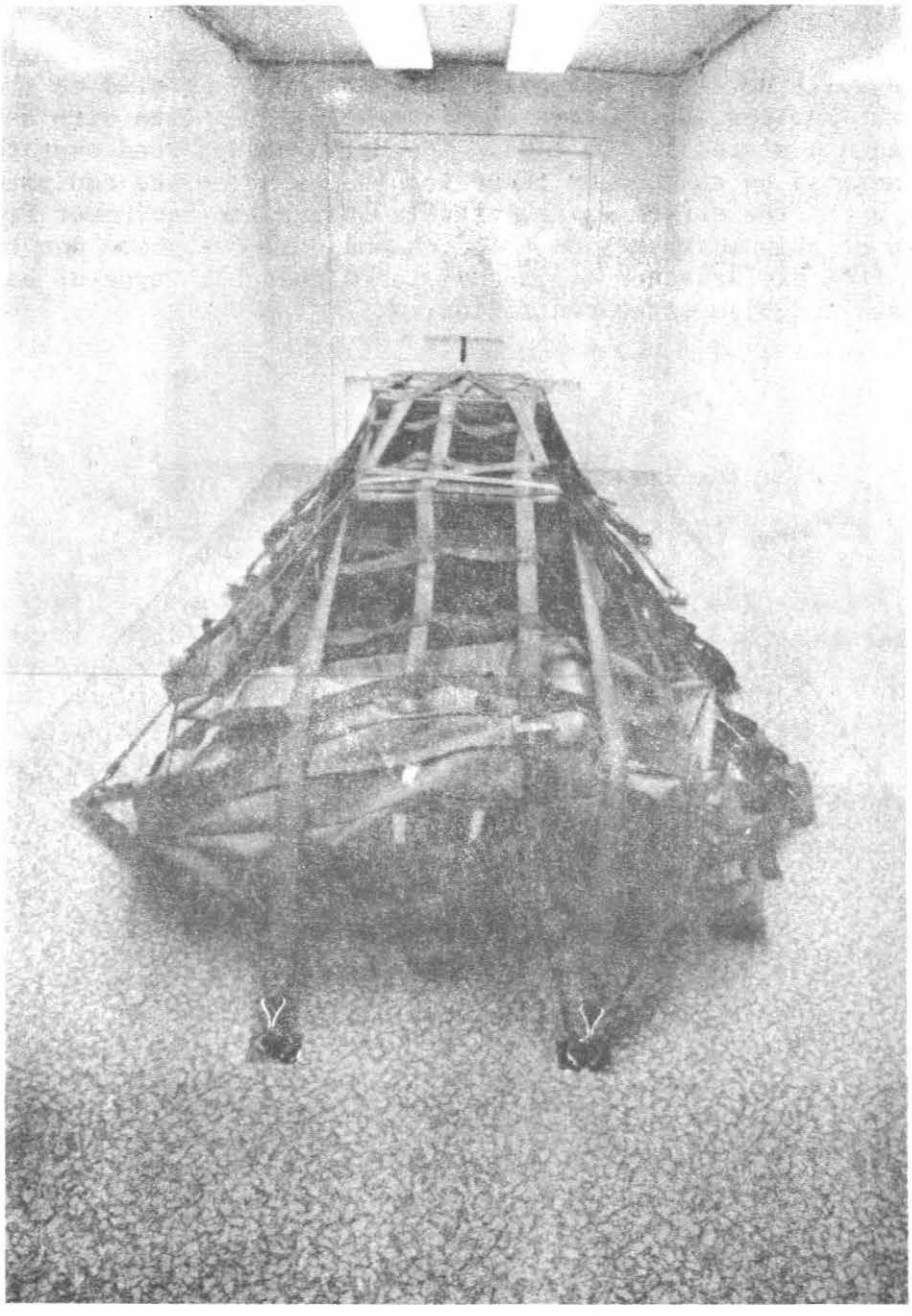


Figure 31. Nylon straps are placed over the cargo net and tightened down making the load secure for transport.

E. Wall Loop Bolts

The walls have taps for 5/16-1 1/4" NF bolts located on the strong points of the shelter in two rows of six taps each. Bolts with a loop for its head are placed in the taps. The nylon straps used over the cargo top net may be snapped on these loop bolts after the equipment is set up for use. The straps may be used to secure the equipment from the ill effects of ship movement due to pitch and roll or ashore due to the concussion from explosions. It is envisioned that this type of bolt will be installed by shelter contractor.

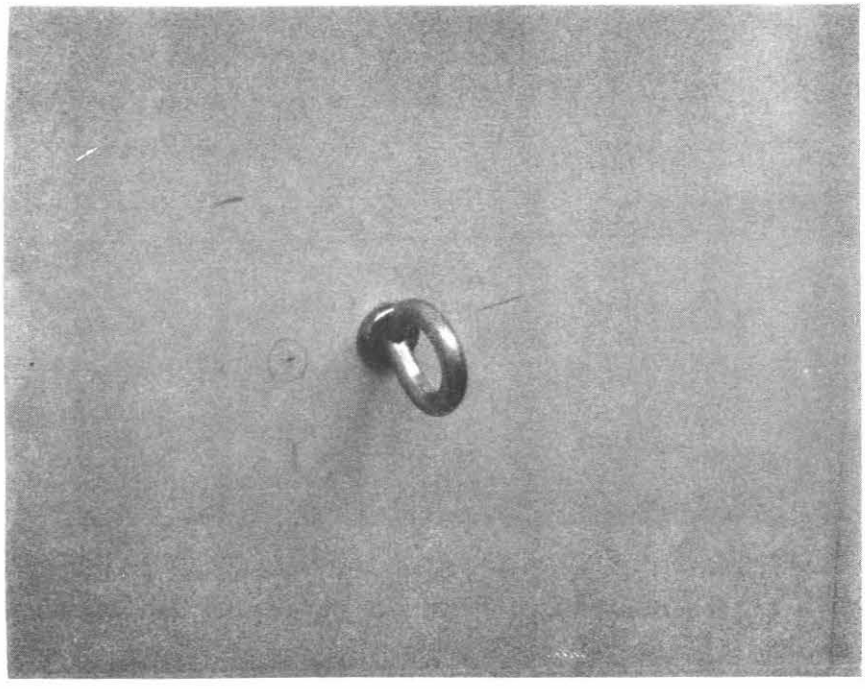


Figure 32. Detail of wall loop bolt.

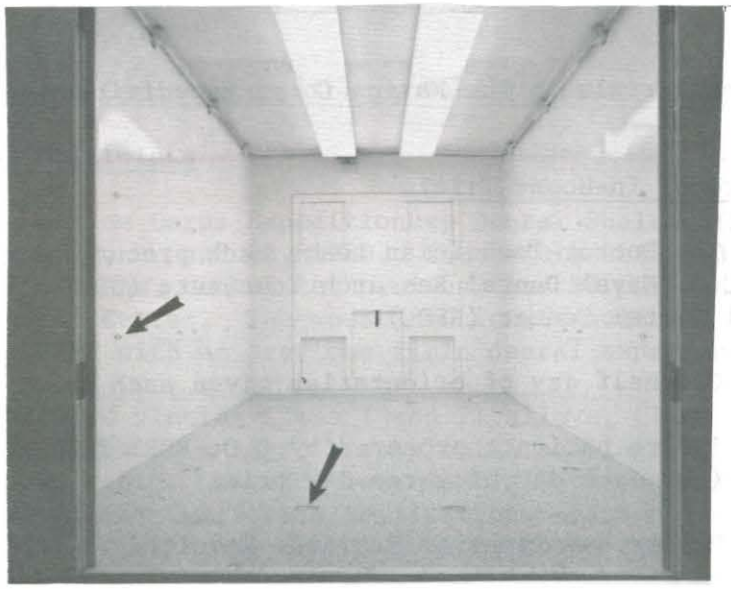


Figure 33. View of the inside of the shelter showing the floor brackets and wall loop bolts.

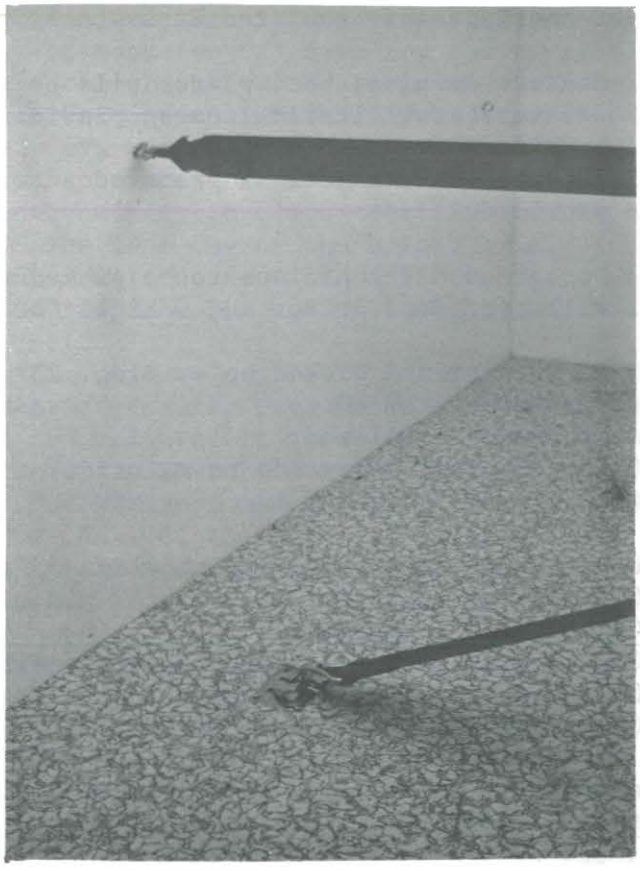


Figure 34. A close-up view of the floor brackets and wall loop bolts showing nylon straps attached.

Clinical Trials in the Marine Corps Expeditionary Dental Shelter

I. Protocol In-House Trials

A. Two Doctor-Technician teams each procured from NDRI volunteers and by C.O. Naval Dental Research Institute (NDRI) from C.O. Naval Regional Dental Center (NRDC).

B. One-half day of orientation given each team.

C. Twelve patients procured by C.O. NDRI from C.O. NRDC (for each day of three-day trial).

Number and Types of Patients Required:

2 patients requiring T-2 exams, bitewings, and prophys.
2 patients requiring simple, single tooth extractions (not impactions).
2 patients requiring scalings.
2 patients requiring Class III anterior restorations.
2 patients requiring Class I amalgam restorations.
2 patients requiring Class II amalgam restorations.

Number and Types of Simulated Cases to be provided by NDRI:

2 denture repairs; base plates will be provided.
2 fracture stabilization cases; plaster casts will be provided.
2 endodontic final fills; prepared anterior teeth will be provided.

D. 0730 Doctors and Technicians to be picked up at Bldg. 237. NDRI will provide a driver and vehicle for transportation.

E. 0800 First patients picked up at Bldg. 237.
0830 Treatment started.
1130 Treatment completed.
1200 Last patient delivered to mainside.
1200 DO and DT Teams eat lunch at NRMC.

F. 1300 First patients picked up at Bldg. 237.
1330 Treatment started.
1530 Treatment completed.
1530 Questionnaires given each Doctor and Technician.
1600 Last patient delivered to mainside.
1630 Doctors and Technicians delivered to mainside.

G. Trials will be constantly monitored with specific attention to equipment availability and performance.

H. Repeat the trial with the same Doctor-Technician teams but switch operatory spaces.

II. Results of the Marine Corps Expeditionary Dental Shelter Clinical Trials with Guest Clinicians

A. Trials of the Marine Corps Expeditionary Dental Shelter (MCEDS) were conducted on March 19, 24, and 25, 1980. The trials utilized both in-house and guest clinicians, dental technicians, and 37 patients from the Naval Regional Dental Center. The guest clinicians selected for the trials were LT, DC, USNR with no previous field dental experience.

B. The trials included placing Class I and II alloys, Class III composites, T-2 exams, bitewing x-rays, prophylaxis, scalings, and extraction of unimpacted teeth. In addition, models were supplied to simulate situations requiring fracture stabilization, endodontic instrumentation and fill of anterior teeth and prosthetic repairs.

C. All participants were observed and interviewed as to their reaction to the MCED's operability. Trials of Phase I were judged as being successful in that they demonstrated that the prepositioned Authorized Dental Allowance List (ADAL) can be fitted to a rigid MCESS and accomplish the required range of dental procedures. Field tests will need to be conducted to determine the deployability of the MCEDS.

D. The guest clinicians and technicians were observed and debriefed at the end of each day. It took two (2) days for the guest clinicians and technicians to become comfortable with using the Porta-Cart rear delivery system and the fiber optic light. They had experienced only over-the-patient delivery systems prior to the trials. The clinicians described the hand dental instrument's physical sizes as being too large and in insufficient quantity to allow sterilization to handle the patient load given. The last day of the clinic trials went smoothly with only one significant complaint from the doctor working near the entrance who was bumped during the removal of tooth by an exiting patient from the other chair.

E. Patients were debriefed after treatment. They were all satisfied with treatment received and believed it to be of the same quality received in a fixed clinic environment. The crowding of the work space and compressor noise was noted but were not perceived by them as being a significant problem. Over half of the patients remarked that the Adec Porta-Chair used in the trials was more comfortable than other dental chairs of their experience.

F. Many of the suggestions and lessons learned from the trials, although not applicable to the current ADAL, will be evaluated in the Phase II portion of the MCEDS project.

III. Field Trials

A. Protocol will be designed based upon information received from the in-house tests, questionnaires, and observations.

Figure 35. Successful clinical trials were conducted in the MCEDS mock-up located at NDRI, Great Lakes.

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A wooden mock-up of the Marine Corps Expeditionary Shelter System was built, outfitted with field dental equipment, and modifications made to improve its operability.

Clinical trials were accomplished using Navy dental officers and technicians, and the system is ready for field trials.

DEPARTMENT OF THE NAVY

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