

BARE BASE DEVELOPMENT CONCEPTS

A collaborative design project
accomplished by Junior Architecture
and Industrial Design students,
College of Design, Architecture, and Art
University of Cincinnati
in cooperation with Tactical Air Command

Instructors: J. M. Alexander
G. C. Born
K. H. Merkel

Sponsored by: Support Techniques Branch
Air Force Aero Propulsion Laboratory, RTD
F. W. Forbes, Project Advisor
A. J. Zappanti, 1/Lt

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Karl H. Merkel, Professor of Architecture
James M. Alexander, Professor of Industrial Design
Gilbert C. Born, Instructor of Industrial Design
University of Cincinnati, Cincinnati, Ohio 45221

INTRODUCTION

The research and development papers presented at this conference deal primarily with expandable structures and their application as shelters, boats, antennas, solar collectors, aerospace crafts, space stations, etc. etc.. The project described in this paper, however, will include several other items not necessarily in the expandable structures classification.

The research projects here described are some of the results of an unfunded collaborative exercise in creative problem solving by nineteen students of the College of Design, Architecture, and Art of the University of Cincinnati. The students worked under the direction of James M. Alexander, Professor of Industrial Design, Gilbert C. Born, Instructor in Industrial Design, and Karl H. Merkel, Professor of Architecture, with the cooperation and assistance of the U.S.A.F. Aero Propulsion Laboratory, RTD, and Headquarters, Tactical Air Command.

BACKGROUND FOR THE PROJECT

Students of the DAA College in 1962 prepared a number of design concepts for lunar shelters* with the cooperation of the Flight Accessories Laboratory, ASD, USAF. Personnel of the Aero Propulsion Laboratory were impressed by the performance of the students and believed they were capable of attempting another unfunded short term design research project for the Air Force.

The subject suggested for the project was the "Development of Bare Bases" for the Tactical Air Command; a Bare Base being defined as an airfield having one or more runways, taxiways, and a ramp, but no support facilities. In most cases, the bare base is a commercial airport or an abandoned airfield. It is assumed that facilities such as maintenance, housing, administration, and hospital buildings, etc., are not available. However, any existing facilities are used to whatever extent possible. Facilities and equipment, when not available at the bare base, must be flown in by cargo planes on short notice.

The development of a Bare Base involves problems of town planning, design of buildings and equipment, packaging, and shipping. Problems such as these are typical for the architect and industrial designer. Architectural designers and industrial designers are trained to apply their knowledge of Art and Science toward satisfying the complex physical and psychological environments and facilities which modern man uses and needs. Many recently developed materials, methods, and knowledge have opened new perspectives for the designers in their search for solutions to problems of satisfying these needs.

*Lunar Shelter Concepts Univ. of Cin., F.A.L. A.S.D. 1962.

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The Bare Base and its facilities and equipment were proposed as being in need of some re-examination in light of some of the recent developments. Preliminary re-examination indicated a number of problems which as design exercises would stimulate the creative efforts of the student architects and industrial designers.

Nineteen selected fourth year students (ten architects and nine industrial designers) were organized into five design teams, each having two architects and industrial designers (except one team having only one industrial designer).

The DAA College conducts a Co-operative School-Work program in which the architectural and industrial design students are enrolled. The design project was scheduled for a seven week Co-operative school term. The problem was introduced to the students at the beginning of the first week when they received the "Bare Base Development Program.* The students were then briefed by personnel from Headquarters TAC on TAC's mission in limited warfare and on relative successes and/or failures of recent Bare Base exercises. Some items or operations needing improvement were pointed out during the briefing with the suggestion that the students make some proposals for more satisfactory solutions.

The design teams then researched the Bare Base operations and the various required subjects with the assistance of information and manuals furnished by TAC, and by personnel from A.P.L., The teams developed statements of their philosophy of Bare Base Approach and prepared design proposals for the specified items.

At the end of the seventh week of work each team submitted a twenty-minute slide presentation of their concepts at Wright-Patterson Air Force Base. This paper presents several illustrations and proposals selected from the students' work.

*Bare Base Development Concepts Univ. of Cin., A.P.L., RTD, U.S.A.F., 1965, pp. 3-8.

REQUIREMENTS OF THE "PROGRAM"

Personnel from Headquarters TAC, the Aero Propulsion Laboratory and faculty at U.C. prepared a Program outlining the requirements for the design projects, a brief summary of which follows.

TAC operations around the world depend upon suitable operating bases known as "Bare Bases". These bases must be equipped quickly from a rear Main Operating Base with all weapons systems and support facilities appropriate to meet a particular threat. To facilitate quick mobility the material and personnel have been arranged into "packages" of various items.

When the need arises, a bare base is selected in the critical area and a survey team inspects the site. The survey team recommends which "packages" are needed to make the base operational. These "packages" are flown in to the base in rapid succession according to a prearranged sequence of priorities of need. Units of the Combat Support Group arrive at the same time to begin development of the site and to ready the field for arrival of tactical forces.

Bare base operations are planned for a minimum of 30 days occupancy. The development of the bare base must be accomplished within certain prescribed time limits and according to predetermined sequences of events.

The base which the students were to develop was to provide for a total complement of 1100 men (including Tactical, Maintenance, and Support personnel and a Provisional Headquarters) together with necessary aircraft, shelters, and full support facilities and equipment.

Each team of students was assigned a site map chosen from a selection of TAC and SAC airfields in various parts of the world. The site maps were previously altered to eliminate certain existing facilities in order to simulate typical Bare Bases.

The students were required to research Bare Base operations and to propose a list of priorities for air lift items and erection of operational and support facilities, as well as to solve design problems in four specific categories.

The four design problems were:

1. A site development plan, in model form with movable components, showing shelters, vehicles, and equipment. A photographic record was

Contrails

to be made showing the sequential development of the base at meaningful stages and calibrated to a time schedule of events.

2. The design of a shelter system, showing in model form or drawings the procedures of packaging, handling, erecting and demounting the shelters.

3. The design of a multipurpose land vehicle to accomplish normal transportation and other functions around an airfield, and to present a model and drawings to demonstrate flexibility of use.

4. Survey equipment needs, and present drawings of new ideas for one or more items such as airstrip lighting, fuel handling equipment, personal equipment, etc..

RESULTS OF THE DESIGN RESEARCH PROJECT

The students recognized a number of items or procedures which appeared to be in need of restudy and new design proposals. Technology has moved so rapidly that it has made obsolete many of the items in present use which have not changed their design or materials of construction for years. Some of the concepts proposed by the students and presented in this paper are entirely within practical limits of today's materials and methods. Some of the proposals are based on predicting possible applications for ideas and materials which are still in the early experimental stages, or perhaps are just dreams of what may be.

The concepts which the students presented were published in February 1965 by the Air Force Aero Propulsion Laboratory in a booklet entitled "Bare Base Concepts". The publication does not necessarily indicate Air Force approval of the concepts. Whatever actual use any of the concepts may have, might be open for question, but it is hoped that the ideas presented in the following pages by a few illustrations and portions of the text from the booklet, may disseminate some of the information the students collected and may stimulate further research in these areas.

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TEAM 1

Duane Gordon	Arch. '66
Dale Harris	I.D. '65
John McKnight	Arch. '66
John Plut	I.D. '65

SHELTER CONCEPT

The shelter is a suspended structure with three basic units on a single fiberglass member in the center of the three-cluster unit. (Fig. 1)

Time required to erect this thirty-man shelter is forty minutes for six men.....

The exterior skin of the structure is fabricated from 1/4 inch polyurethane foam of the flexible type. Laminated on both sides of the polyurethane foam will be a layer of mylar and woven nylon fiber. It was found that the "k" (insulating) factor of this material was as low as .22 thus demonstrating the ability of this shelter material to be used in a variety of climates. It is also worth-while to note that the tent skin weighs approximately 0.1 pound per square foot.

One tent unit complete with a floor can be folded down and rolled into a package of thirteen (13) feet long by eighteen (18) inches in diameter with its mylar flooring rolled around the outside to protect the unit in shipping.

A conservative estimate of the weight per one ten man unit is approximately four hundred and fifty pounds.....

HANGAR

.....We decided that the most efficient way to support a hangar structure is to suspend the enclosing material with relatively light tension cables.....

The structure consists of six pylons and six tension cables from which is suspended the wall and roof of the hangar (Fig. 2). The pylons would be made from high strength fiberglass.....

This hangar has six sides forty-five (45) feet long. It will accommodate two F-4-C jet fighters (Fig. 3).....

The hangar has two doors for plane access located on opposite sides of the hangar. These doors are made of the same material as the walls

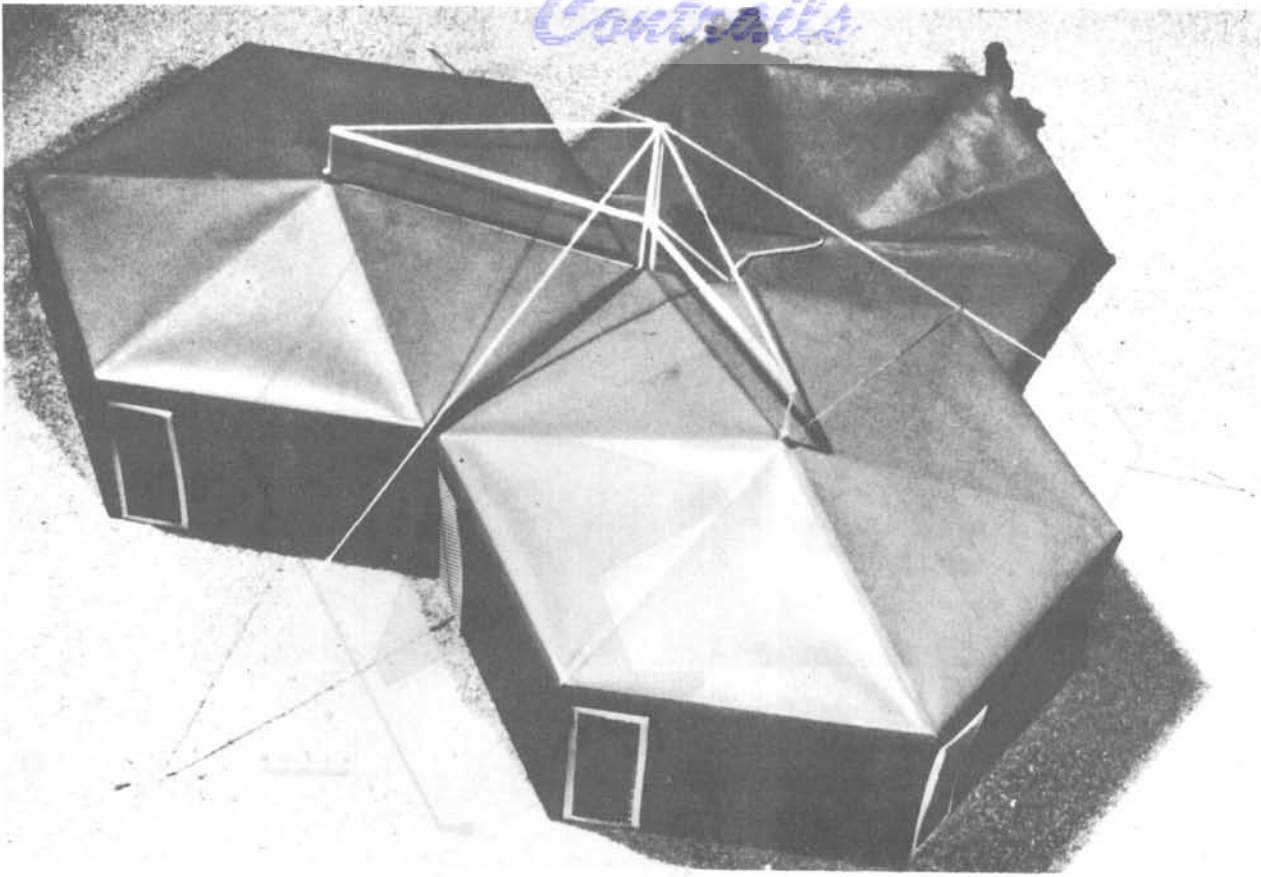


Fig. 1: Aerial View, placing last unit of shelter in place.

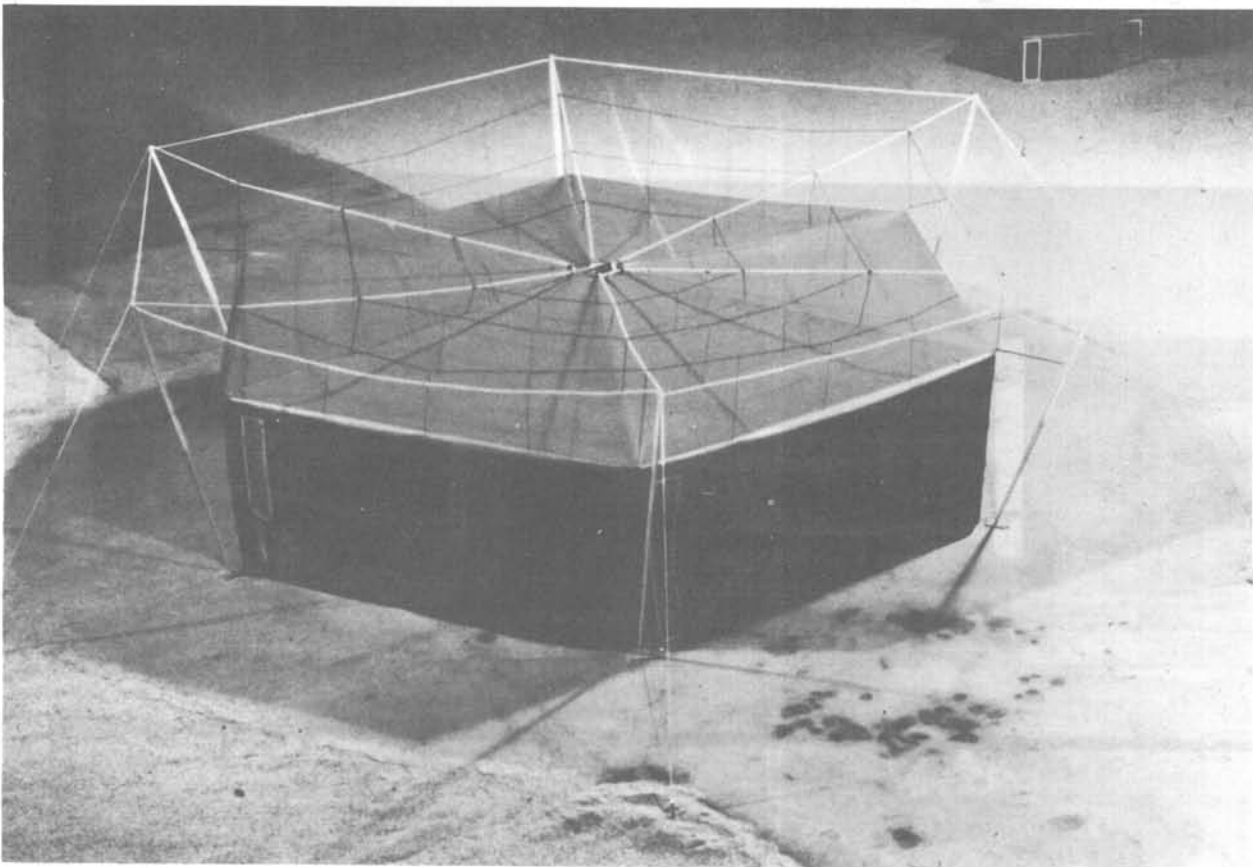


Fig. 2: Aerial view of hangar.

Contrails

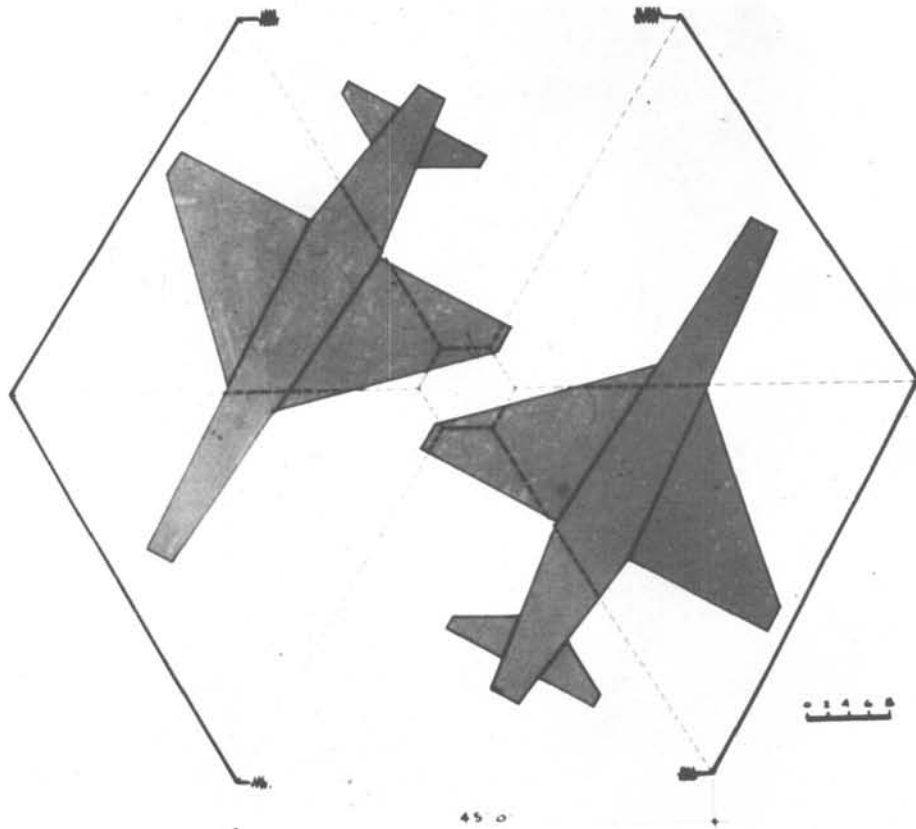


Fig. 3: Hangar plan, housing for two F-4C aircraft.

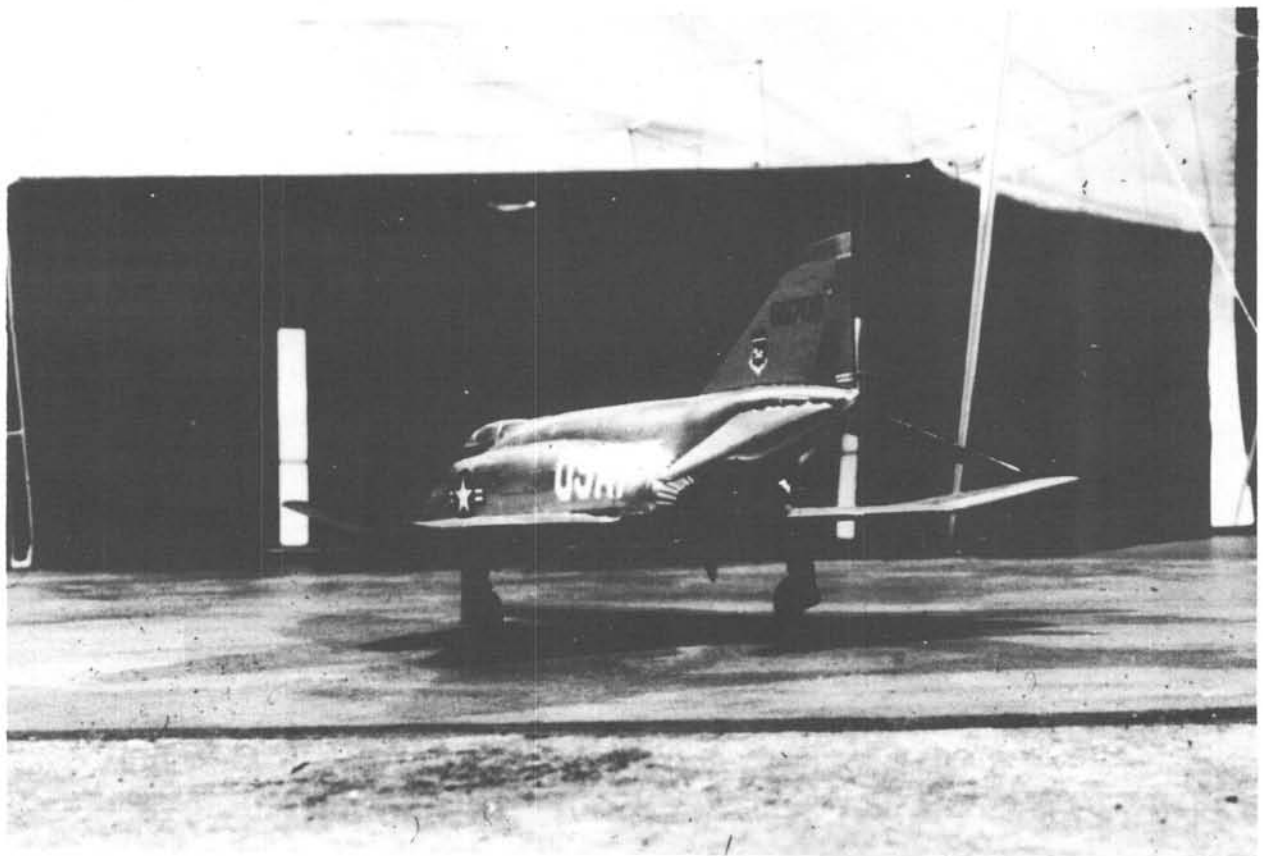


Fig. 4: F-4C fighter at hangar door.
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and ceiling which is the same as the smaller shelter. They fold (on overhead rollers) to the sides giving a forty-five foot clear opening. (Fig. 4).....

UTILITY VEHICLE SURVEY

.....According to TAC Manual 400-12 there are eighty-eight (88) vehicles allotted in the average bare base support group. These vehicles may be broken down into three categories: light, medium, and heavy duty in accordance with their own specific weight and the functions they perform.....It is felt that the light and medium duty function could be performed by a single vehicle type located somewhere between the two classes.....

VEHICULAR CONCEPT

In order to fulfill the required functions, the new vehicle must be flexible to adapt to the various situations which would include variations in terrain and climate (Fig. 5). A vehicle which would perform well on the hard, even surface of the runway system would not do well if the off-runway terrain was sand or mud.....A fluid-drive system was used to reduce moving and complex parts and transmit power from the engine to the wheels through flexible tubes rather than rigid drive shafts, universal joints, gear boxes, differentials, etc. Now that there are no rigid connections to the wheels, they can be made to rotate 360 degrees to allow the vehicle more flexibility. (Fig. 6)

The engine should be light for its power output, efficient in terms of fuel input, easy to maintain, and reliable. An engine has been developed which is particularly well suited to our fluid drive concept. The engine (Fig. 7) was designed by Harold Kosoff and consists of a tube with two pistons which come together in the center of the tube to form the combustion chamber.

Since the vehicle has the ability to raise or lower itself on its own suspension, the ground equipment for the fighter aircraft could be designed to allow the vehicle to back under the equipment, raise itself and the load, and carry the equipment to the job. (Fig.8)

The vehicle has the ability to operate at the same speed and with the same amount of maneuverability in any direction. This concept necessitates giving the driver seating and controlling facilities which will accommodate the multi-directional movements.....

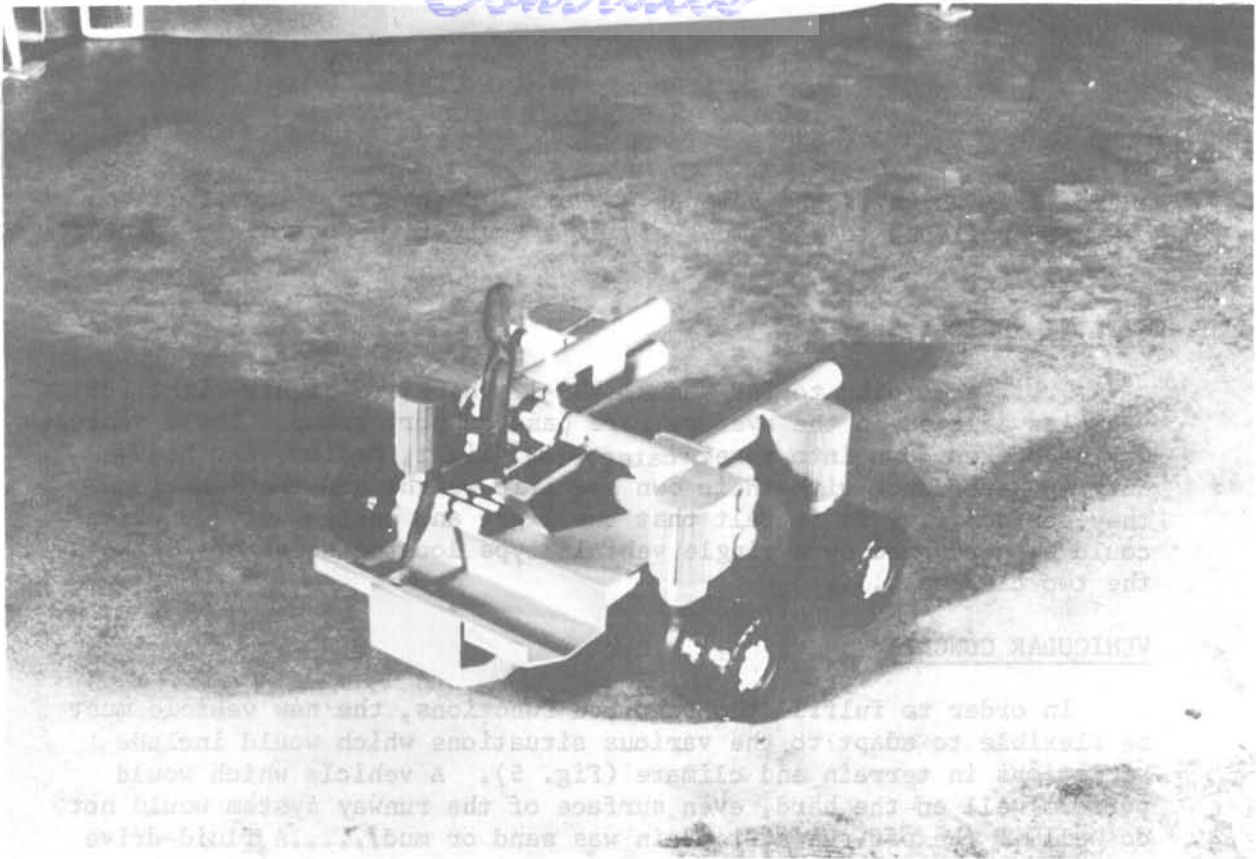


Fig. 5: Vehicle, showing open V-shaped frame.

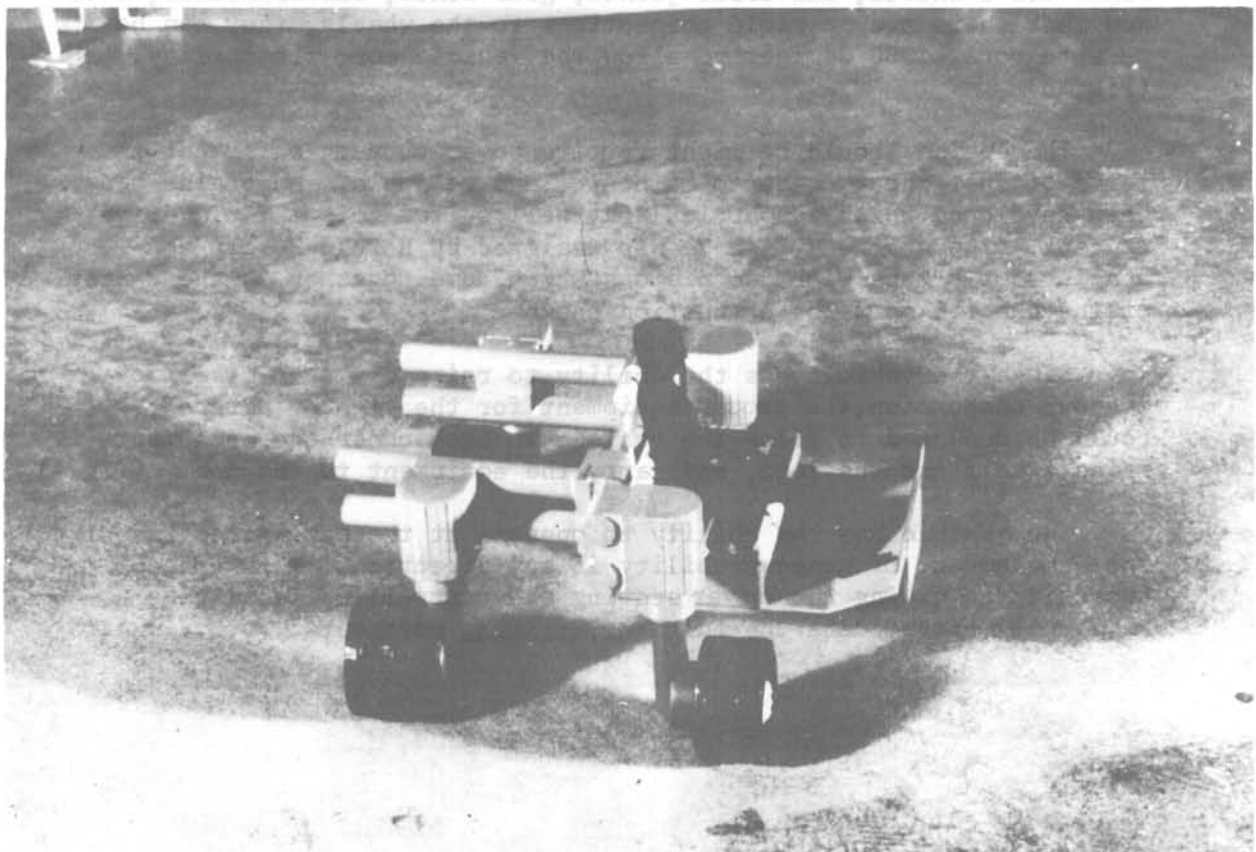


Fig. 6: Vehicle showing wheel rotation.

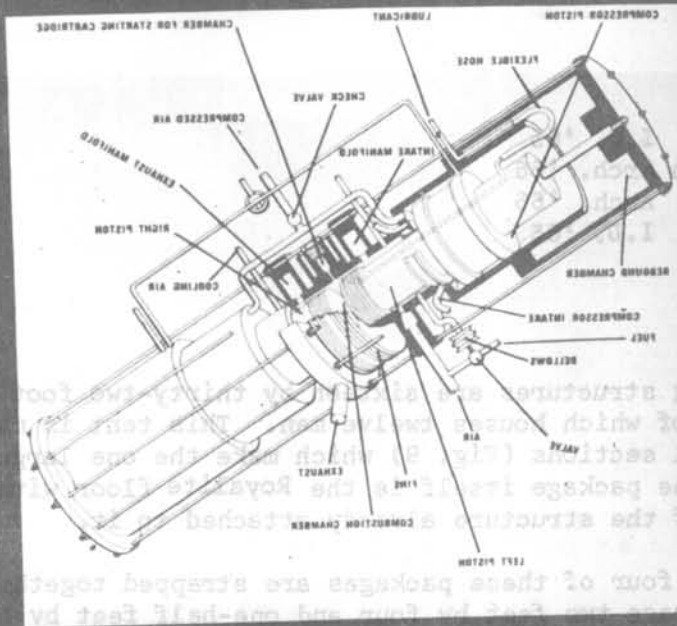


Fig. 7: Drawing of Kosloff engine.



Fig.8: Vehicle in raised position.

TEAM 2

Ruth H. Grad I.D. '65
Thomas C. McMullen Arch. '66
David R. Oldham Arch. '66
John W. Wissinger I.D. '65

TENTS

The billeting structures are sixteen by thirty-two foot inflatables each of which houses twelve men. This tent is made up of four individual sections (Fig. 9) which make the one large one. (Fig. 10)..... The package itself is the Royalite floor with the inflatable part of the structure already attached to it.

In shipping, four of these packages are strapped together to make a larger package two feet by four and one-half feet by eight feet.....The inflatable parts are zipped together, and the end panels are then zipped in.

A three-man team would most likely be used to erect this structure, and four of these teams could erect billeting for eleven hundred men in five hours.....

The messing structure and hospital are the same type of unit as our billeting structures. The difference is that the erected units are twenty-four feet by forty feet because of the need for extra space in both.....

HANGAR

Our hangar structure is also made of inflatable material but, due to its larger size, it is constructed in a somewhat different manner. It consists of a double layer of tubes with double zippers so that its three vaults can be supported properly. (Fig. 11)

The three vaults are twenty-five feet across and are twenty-eight feet above ground level at the highest point. The sides have sixteen foot vaulted openings to which can be attached smaller tents for utility or for light or ventilation (Fig. 12). The end panels are not inflated but are flat and roll up and down.....

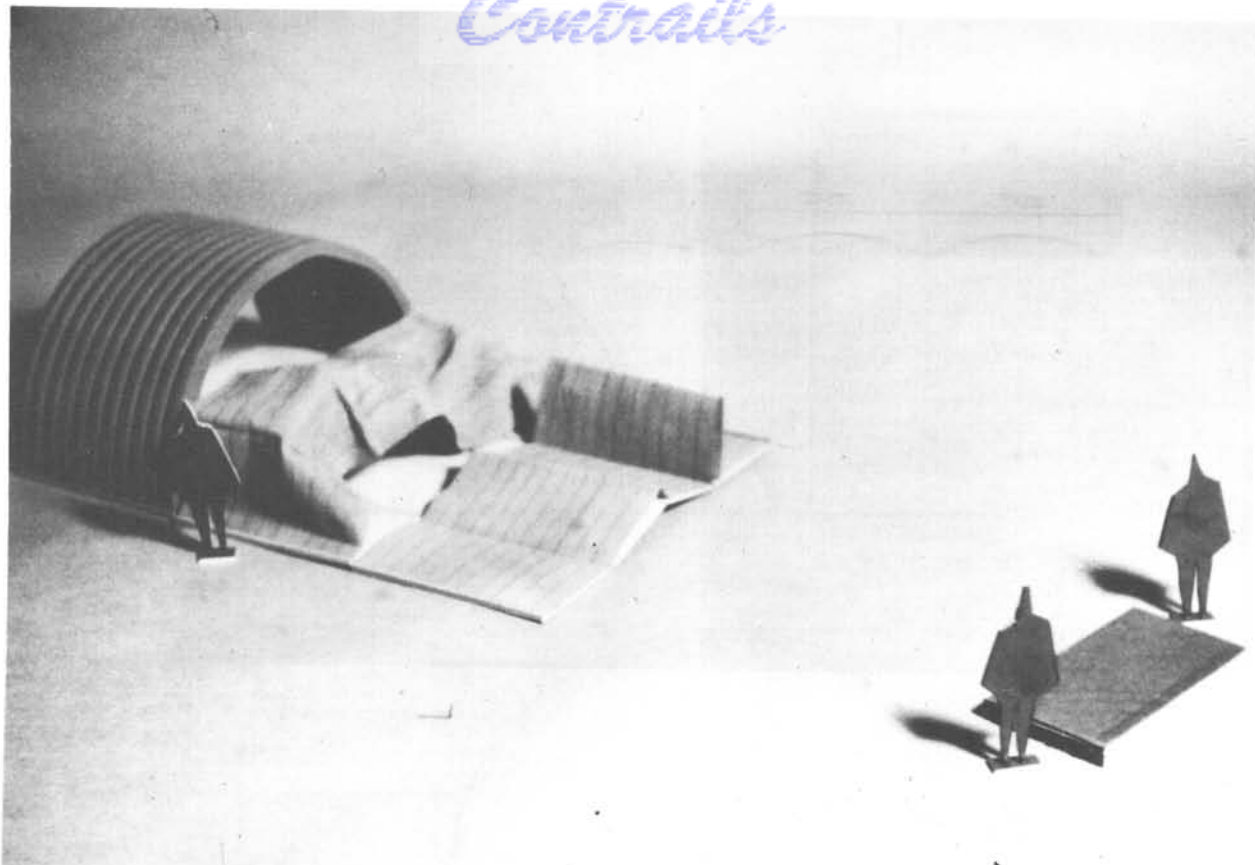


Fig. 9: Shelter in process of inflating section #2.

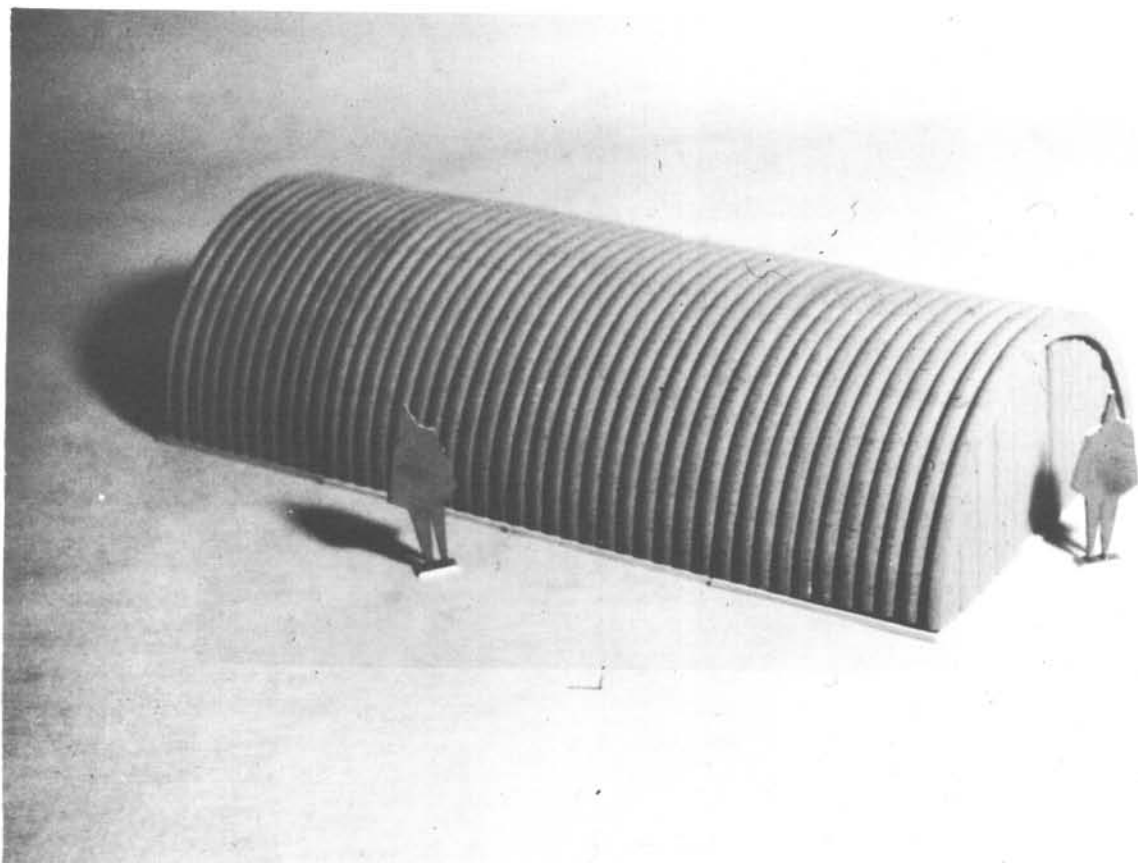


Fig. 10: Twelve-man inflatable shelter.

HANGAR

Contrails

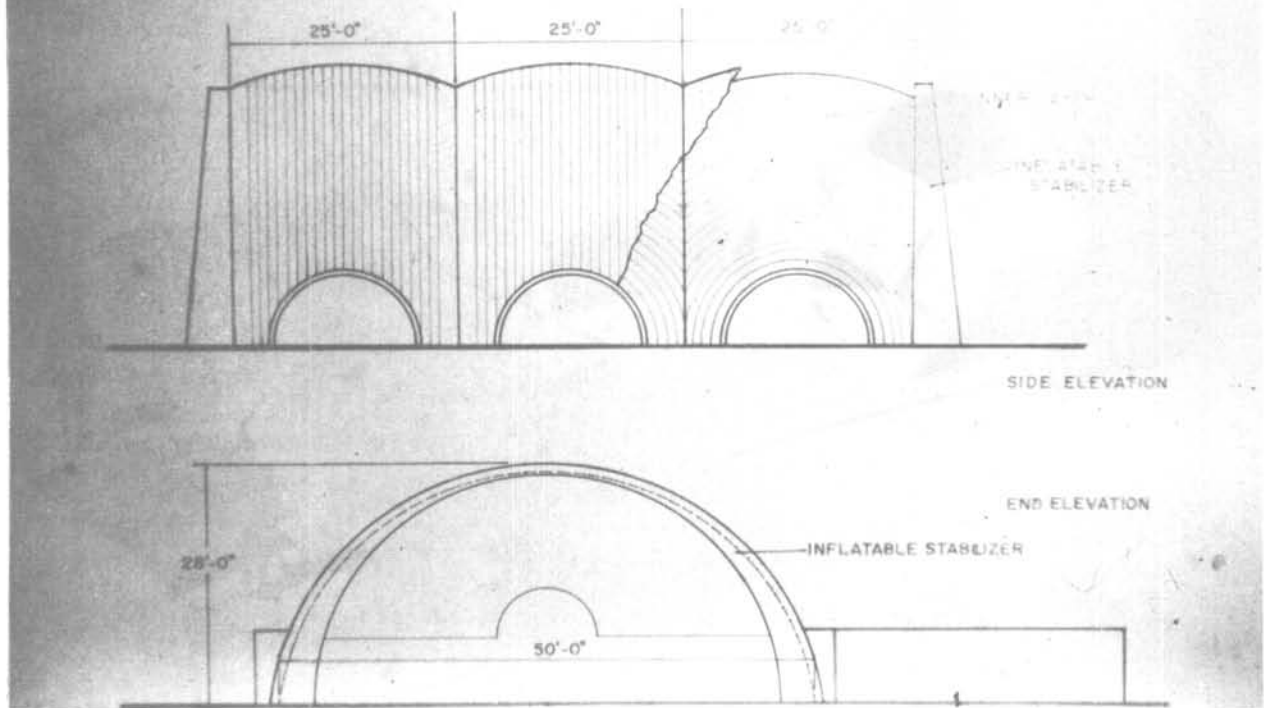


Fig. 11: Drawing of hangar.

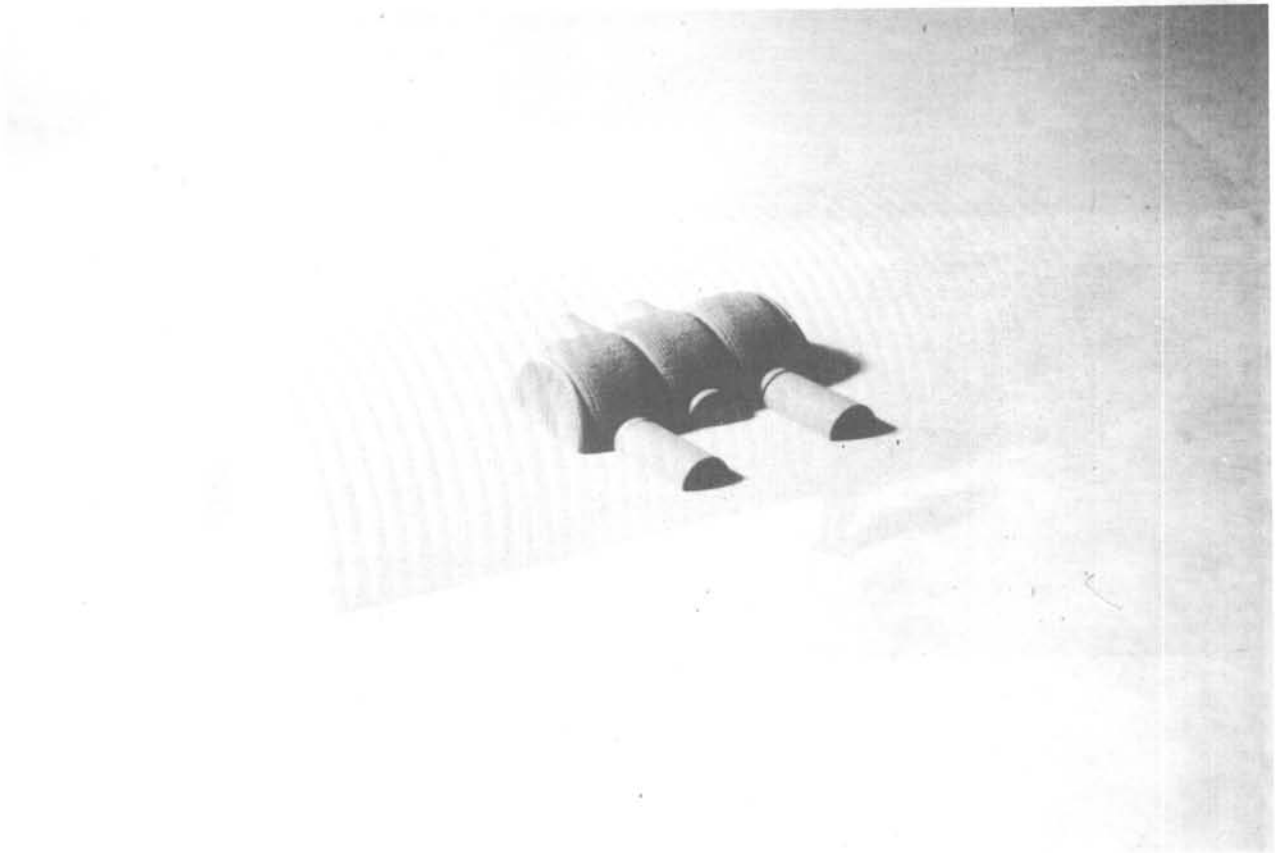


Fig. 12: View of hangar with attached wings.

VEHICULAR CONCEPT

.....The standard trucks now in use have too much dead weight. These trucks were designed for road use and are too general for this specific project. Also, the cabs have much unused space.

Our vehicle should be specifically for a Bare Base. We cut down on the unusable weight and have a cab to carry only the driver...
...

The two cabs we plan to use attach to a basic trailer with a posilock (Fig. 13).....

Both the cab and trailer use lightweight materials in their construction to lighten their shipping weight. The trailer has an expanded Royalite base floor over molded ribs to give it additional strength. The frame is made of lightweight aluminum alloy. The tires under the trailer are of the "air-sack" type and required very low pressure (7 psi). These provide an easy ride without regular suspension.....

A power take off at both front and rear operates many of the other attachments for the cab. A crane attachment on the front utilizes this as well as the same weight counter-balance that the fork lift uses. Other parts that can be worked in this manner include: grader blade, weed cutter, runway sweeper, ditch diggers and crane (Fig. 14).....

RUNWAY LIGHTING

Runway Lighting is to have radio operated lights which need no generator and wires along the airstrip.....

The individual light is a gas cylinder in a tubular housing which contains a pilot light and a radio control box. When the radio control receives its signal, the valve is opened to emit the gas which is then lighted by the pilot light. (Fig. 15)

The top has directional mirrors which receive the light from the parabolic mirror around the light. These directional mirrors cause the light to be at its strongest when looking directly down the runway.....The fuel would last approximately thirty hours. This is based on the theory that the lights are on for only about one hour per night. Thus, a unit would be a thirty day lighting supply. At one hundred fifty to two hundred foot spacing of the lights, the runway should be sufficiently illuminated.

Contrails

FUEL

Our plan for storing and transporting fuel is a semi-rigid plastic tank in a frame on wheels (Fig. 16). The tank has a thirty-six hundred gallon capacity. This enables it to fuel three F4C's.

The tanks would be stored until needed and then, with the same posi-lock our other vehicles have, would be driven from the storage area to the airstrip by one of the cabs.

The tank would be filled at the Main Operating Base and shipped to the Bare Base. As the fuel is used, the semi-rigid plastic tank begins to deflate down into the frame structure which is braced with steel ribs to hold the tank.

When the entire tank is emptied, it lies on this steel base. The side pieces, which are made of telescoping tubular metal, are then collapsed so as to make a compact unit to ship back to the starting base to receive more fuel.....

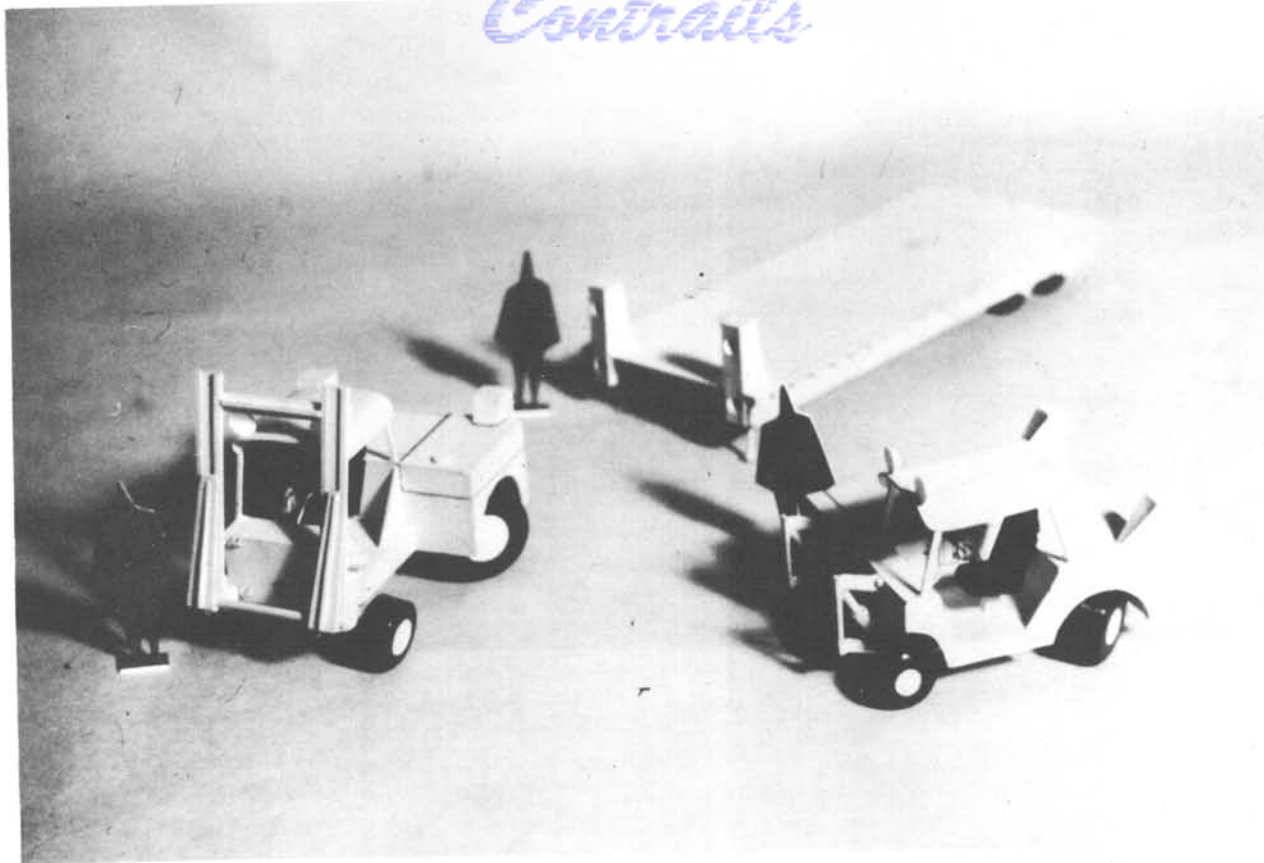


Fig. 13: Vehicle components (two cab units, one trailer).

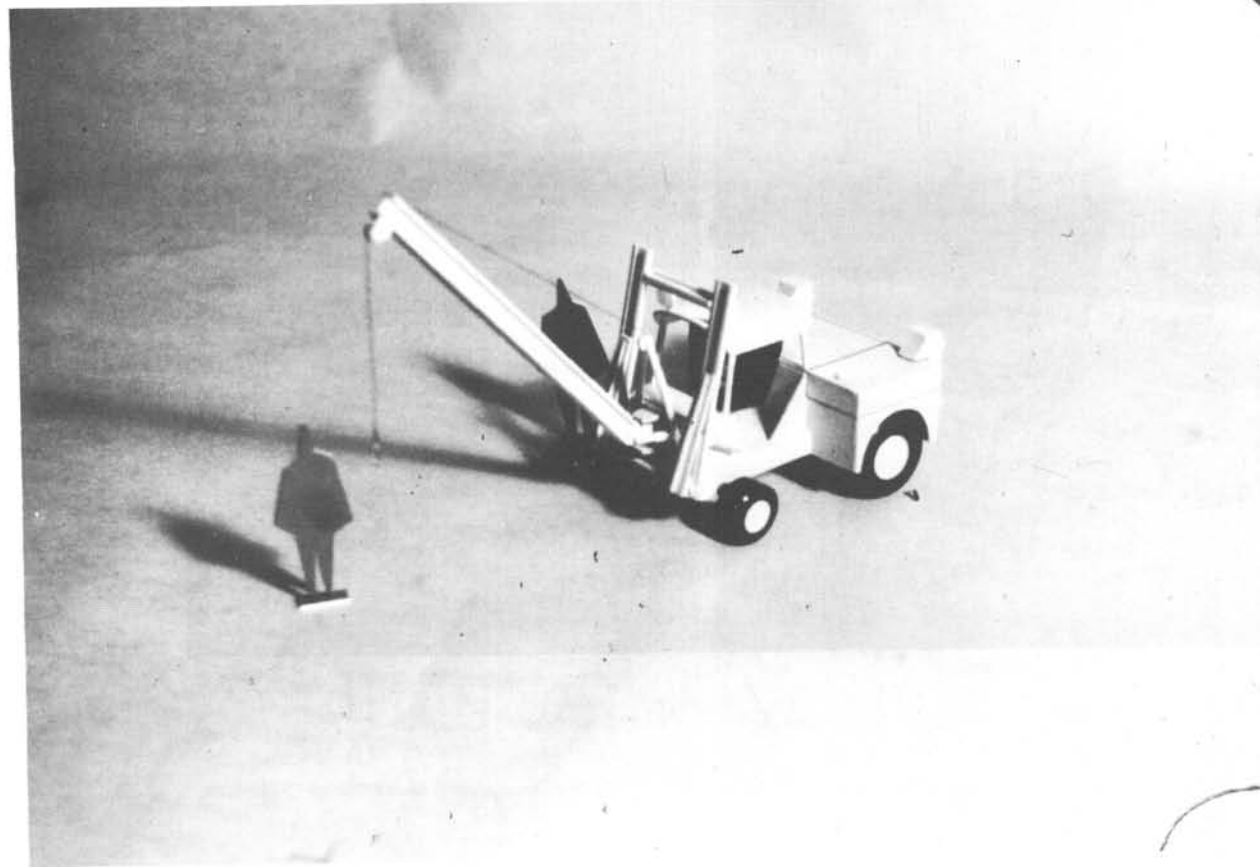


Fig. 14: Crane attached to cab unit.

RUNWAY LIGHTING.....

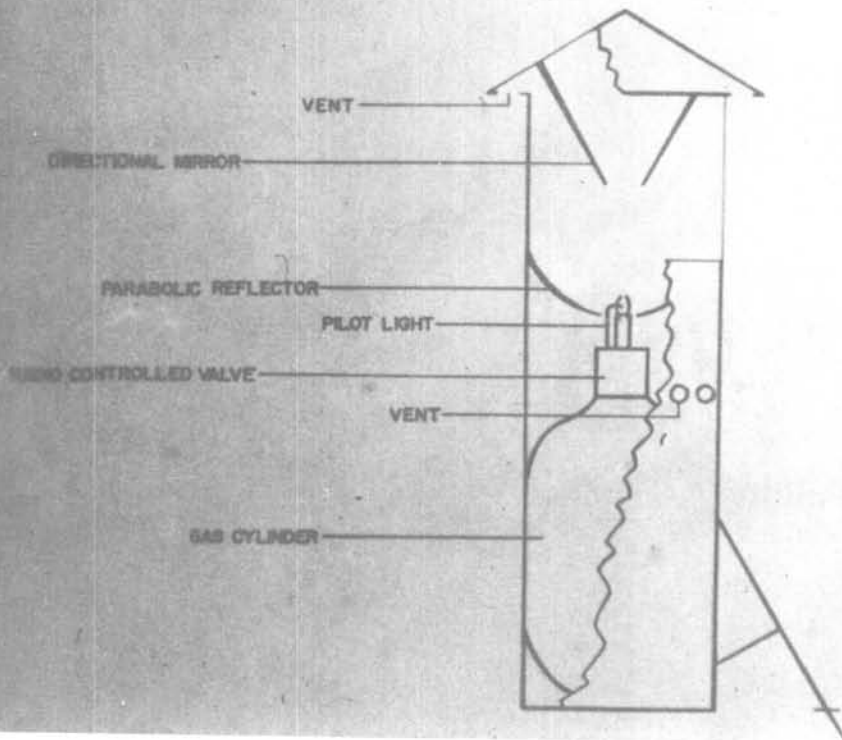


Fig. 15: Drawing of Runway Lighting Unit.

FUEL

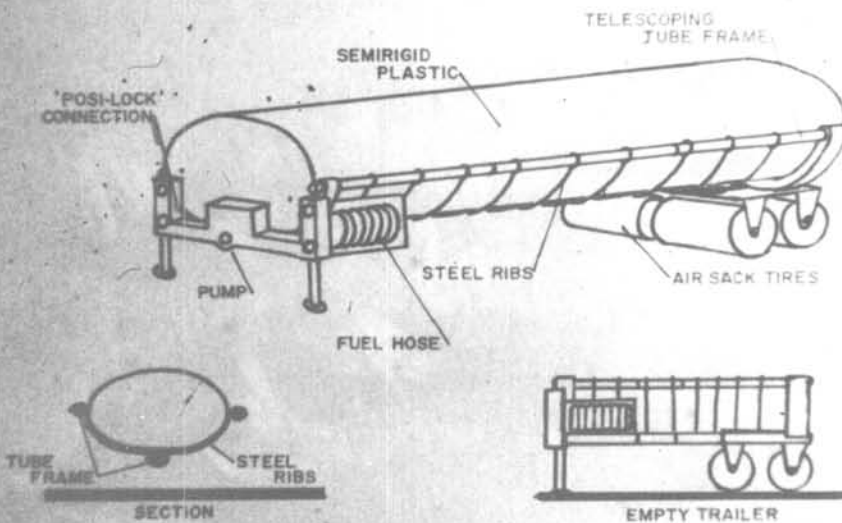


Fig. 16: Fuel Trailer.

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TEAM 3

Hans Bleiker	Arch. '66
Jerry Chuck	I.D. '65
Philip Joehnk	Arch. '66
Robert Wiesman	I.D. '65

SITE ANALYSIS

Our site is an elaborate airfield on the Atlantic Coast. In analysing the airfield we find that it would be best to use one major runway, one alternate and one for take off of TAC alert aircraft only. We would set aside 3 aircraft from each of the two squadrons to be designated and placed on an alert status at the northern end of the field.

The terrain of our site is very advantageous to the security of our base. Along the western coast there is a cliff rising 200 feet above the water. From the cliff running easterly there is a 2% slope. In locating the fuel storage areas, we use natural drainage to our advantage. In the event of fuel leakage it will not drain across the base. We designate two areas for fuel storage, thereby reducing the vulnerability of attack. In the same manner we designate two munitions dumps.

Special features of the site are a large, unbroken apron space and a small mound located centrally within the airfield complex. The latter lends itself quite readily for an air control center. The former will be used for a terminal area, TAC ready area, motor pool, run-up, hangars and maintenance of aircraft and vehicles. This allows all of the units to be located within close proximity of each other.

There is a main road running North and South to the east of the field with branches leading to the apron space, a taxi way and the southern fuel storage and munitions area. Access to the northern fuel storage area will require a minimum amount of paving. The northern munitions dump and liquid oxygen production and storage will be along the main road. Air police will set up check points at all intersections with main offices located at the junction of the branch that approaches the terminal area. Fire and Rescue units would be located between the main runway and the alert runway with easy access to both. Initial utilities for the entire base would be located just east of the terminal area. Billeting, messing, administration, the hospital and all special housing will be sited east of the main road away from the main operating areas. Larger support utilities will be located in this area. A small amount of grading and paving will be necessary in preparing this camp area (Fig. 17).

Contrails

PRIORITIES

In setting up priorities we vary from the Gray Eagle system by a different break down and sometimes by a different sequence. This system, like the present one, will work except when special circumstances prevail.

FIRST PRIORITY

- A. Air Police to set up security immediately for the base.
- B. Establish Terminal Area, Fire and Rescue, and Air Control to take care of the arrival of initial flights.

SECOND PRIORITY

- A. Initial utilities for operation of the airfield only.
- B. Motor Pool and Ground Equipment.
- C. Support utilities to be established for the arrival of additional personnel.
- D. Billeting and Messing.

THIRD PRIORITY

- A. Maintenance and Run-up Area.
- B. Initial fuel storage, munitions and liquid oxygen.
- C. Operations.
- D. Increased Billeting and Messing.

From the loading of the C-130's at the rear main operating base to the end of our Third Priority presently takes 72 to 96 hours. With the use of the equipment we have designed we believe this time will be cut down considerably.

FOURTH PRIORITY

- A. Arrival of Tactical Air Craft.

FIFTH PRIORITY

- A. Administration Building.
- B. Hospital.
- C. Special Housing.

SIXTH PRIORITY

- A. Hangars
- B. Erection of remainder of base and camp.

SEVENTH PRIORITY

- A. Improvements based on projected length of tenancy.

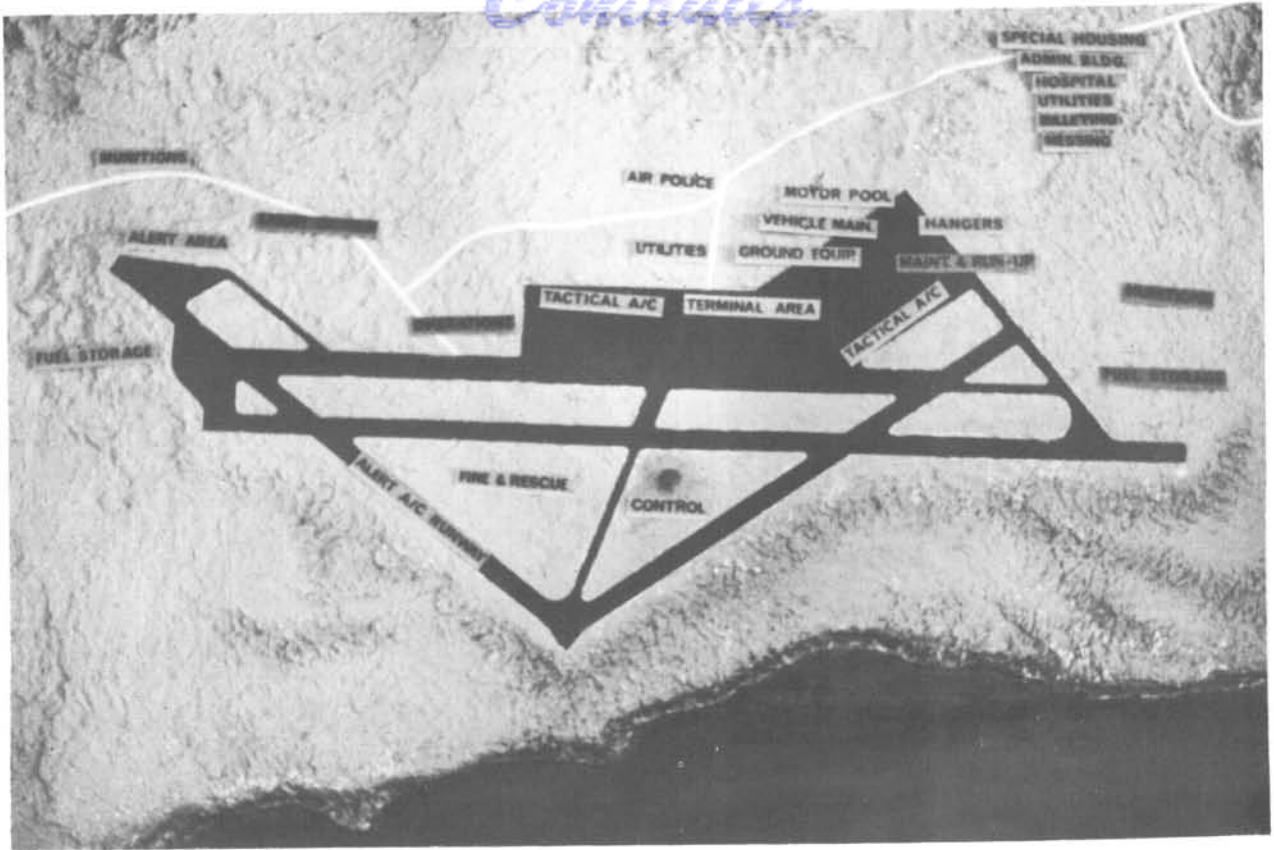


Fig. 17: Aerial view of Developed Site.

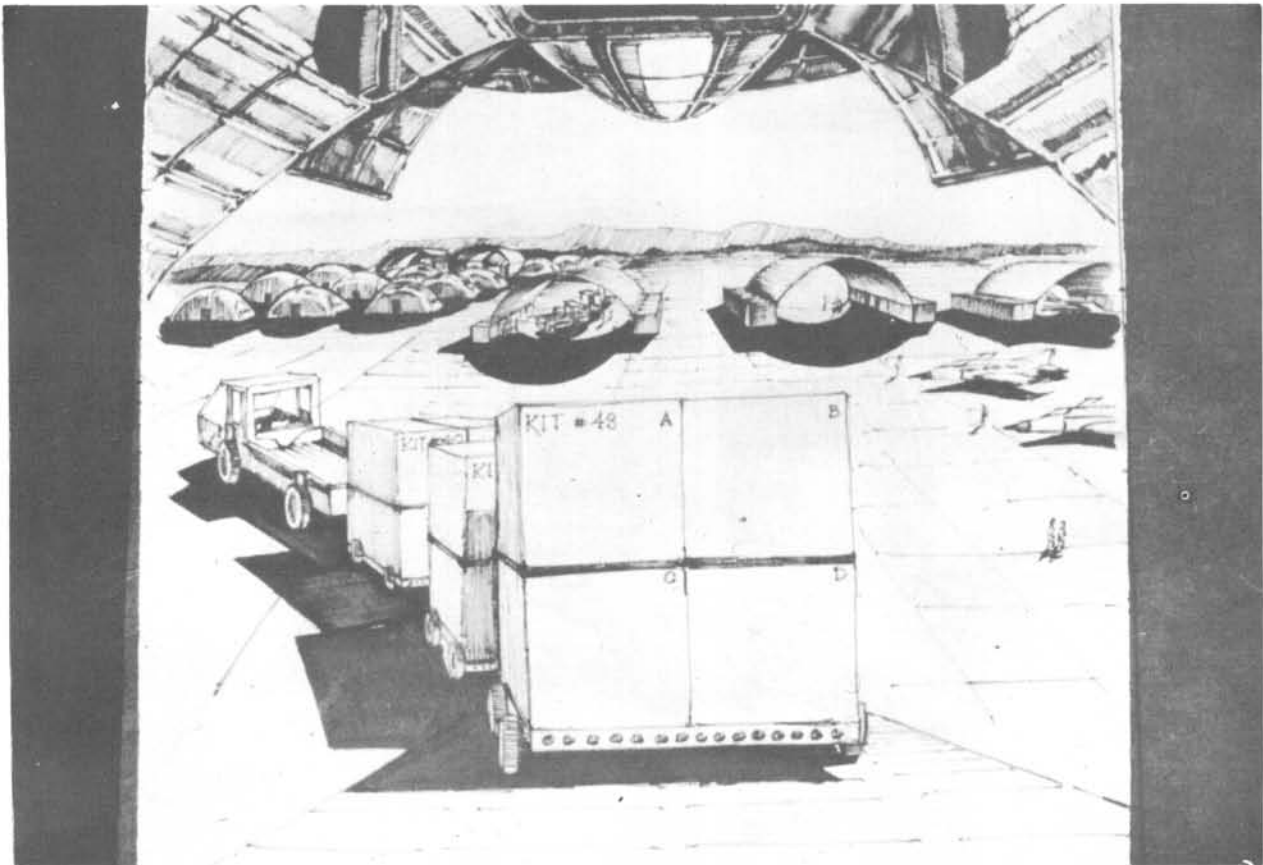


Fig. 18: Unloading a train of pallet-dollies from a C-130.

Contracts



Fig. 19: Aerial view of erected shelter.

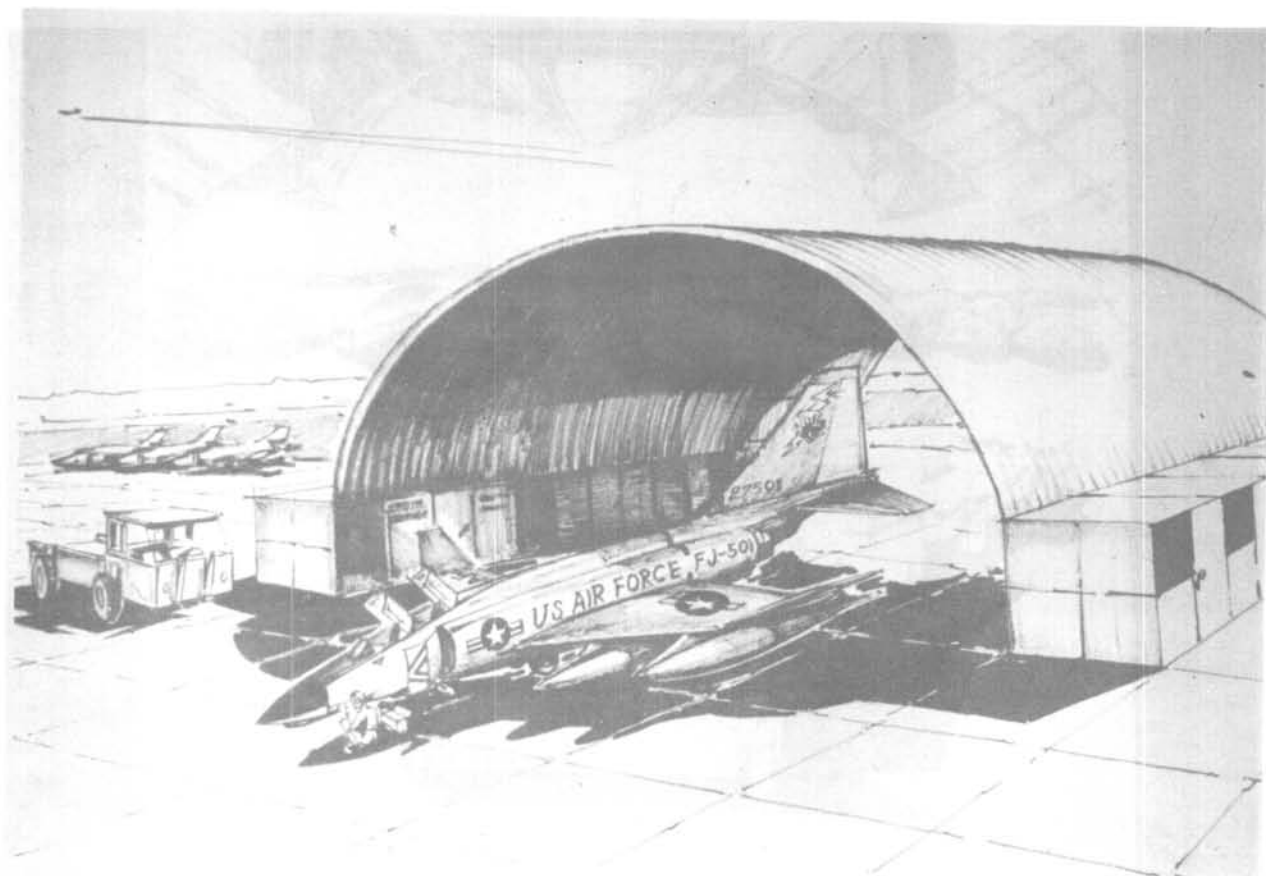


Fig. 20: Hangar with flanking service cubicles.

INTERPRETATION

We interpret this problem to consist of reducing the effort of making a base operational. This we have accomplished by pursuing the problem in two areas.

The first area of attention is aimed at reducing the number of required support flights; the second area of attention eliminates much of the labor on the base. Some of our designs are successful in one of the two areas, others in both.

The number of C-130 support flights can be reduced by making the required equipment lighter and/or making more than one use of that equipment.....

PALLET-DOLLY SYSTEM

To accomplish the unloading of the C-130's faster and with less effort than the present method, we have designed a pallet-dolly system (Fig. 18). All equipment is loaded on wheeled pallets of 8' - 0" x 8' - 0", and in the case of longer items on wheeled pallets of multiples of this module. Rather than having a forklift unit carry equipment from the plane, our dollies are pulled out of the aircraft either one by one by a small vehicle or en masse, depending on the weight of the contents. A C-130 will hold five dollies.

PERSONNEL SHELTER

The 26' - 0" x 26' - 0" tent, housing twelve men, is supported by four pneumatic main arches (Fig. 19). These arches are in turn braced from each other by two flatter pneumatic arches. One-cubic-foot compressed air bottle (4000 psi) is used to inflate the arches simultaneously to approximately 5 psi. The fabric skin is attached to the ribs and is self erecting when the structure is inflated.....

HANGARS, ETC.

.....The one-foot diameter hose from the fuel containers are purged with nitrogen and then used as structural members. The 400 feet of hose on one reel is made up of five 80' - 0" sections connected by 2-1/2" unions. Each of the sections becomes a pneumatic arch with a 50' - 0" span. As these arches stand side by side, one fuel rack accounts for five feet of the total 50' - 0" hangar space, one C-130 load--or five racks make 25 lineal feet of hangar. A 100' - 0" x 50' - 0" hangar would require the hose of four C-130 loads. Only a portion of the fuel containers are used in this way, the majority remaining in circulation.....

The hangar arches rest on the welded-pipe fuel racks rather than on the ground. A waterproof membrane is pulled over the entire arch system (Fig. 20). As this system does not use up hose and racks at the same rate, different combinations are illustrated for the messhall complex (Fig. 21).

MULTI-PURPOSE VEHICLE

In an effort to reduce the inventory of vehicles, we have designed a light multi-purpose vehicle which is capable of performing several of the less critical tasks. With attachment parts, it can be used for carrying personnel, light hauling, forklifting, heavy carrying, grading, and runway sweeping (Fig. 22).

A small turbine power plant located under the bed, drives the wheels and all other systems via hydraulic transfer of energy. The wheels are attached to the bottoms of four large hydraulic actuators which are capable of supporting the chassis at variable heights from two to six feet off the ground.....

FUEL CONTAINERS

Instead of shipping the fuel in 500 gallon rubber tanks, which have to be largely manhandled, we transport our fuel in 8' - 0" high rack which contains 2250 gallons and is carried on one of the 8' - 0" x 8' - 0" dollies. The rack holds a 400-foot spool of 1' - 0" diameter hose containing the JP-4 (Fig. 23).

COOK'S STOVE

The cook's stove (Fig. 24) takes advantage of the facts that heat can be reflected effectively and that JP-4, a high temperature fuel, is available on the base.

Individual burners provide direct heat for the hot plates and the griddle. A large vertical parabolic reflector directs the heat to the oven at the far end of the stove. This oven is based on the camper's reflector oven. The heat is thrown evenly, from the top and the bottom, onto the baking shelf by the two flat reflectors.....

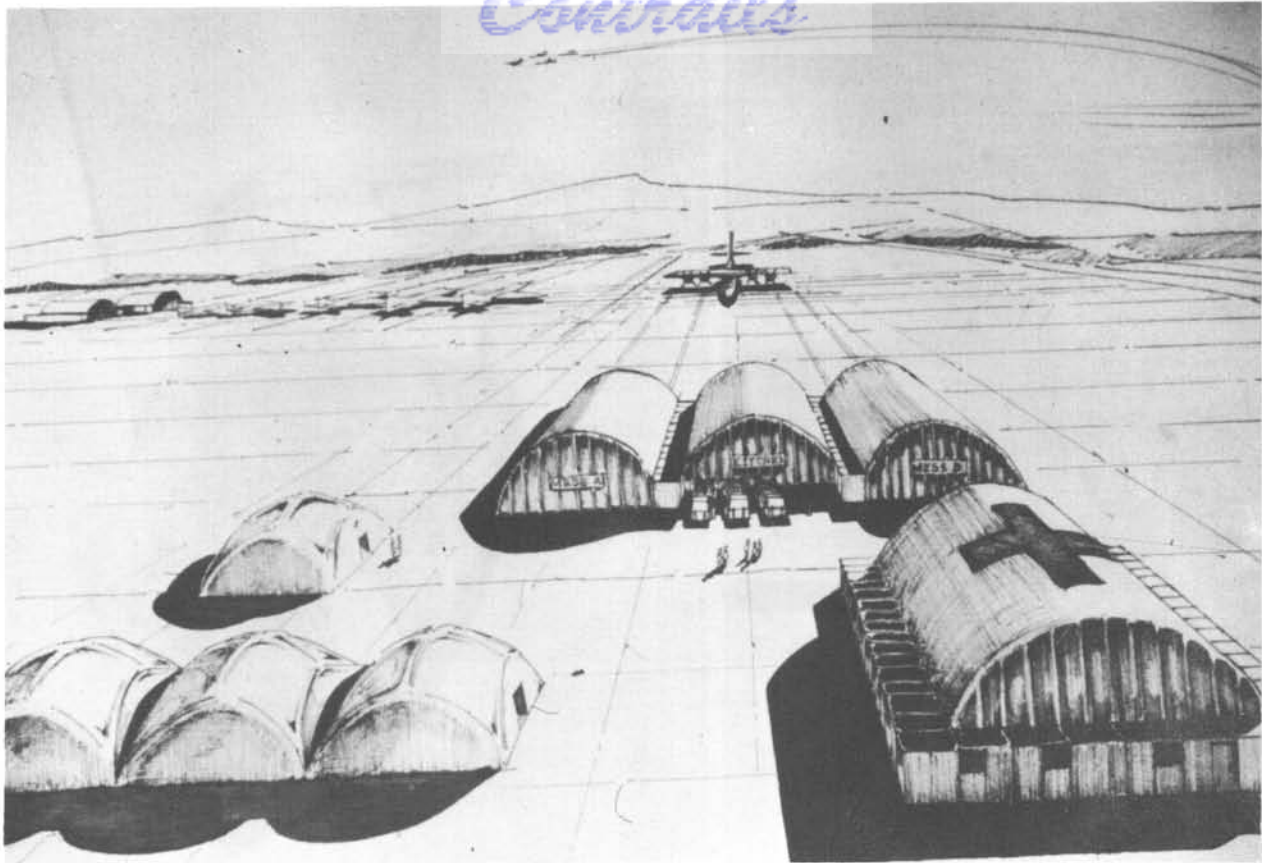


Fig. 21: Adaptations of shelters for billeting, mess halls, and hospital.



Fig. 22: Multi-purpose vehicle.

COOK'S STOVE

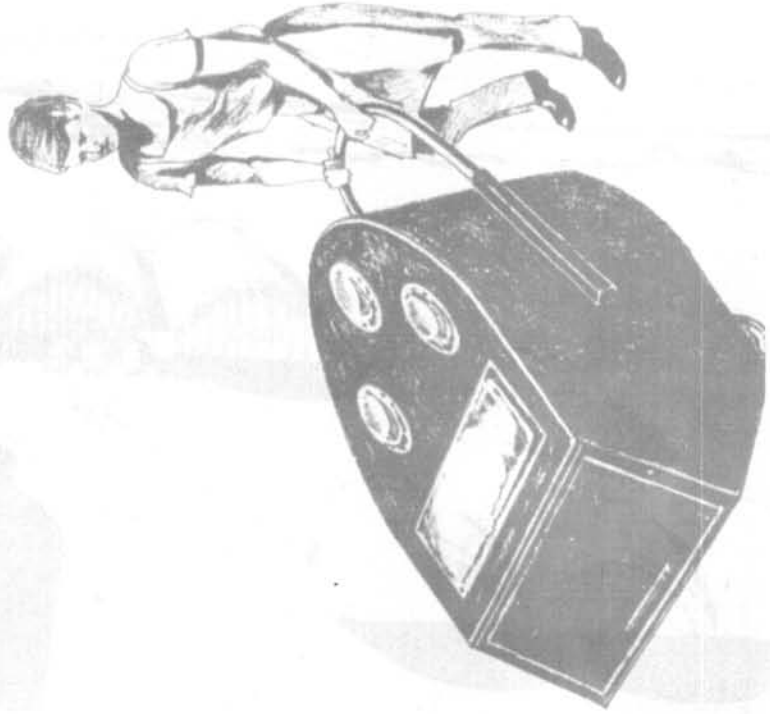


Fig. 24: Cook's Stove.

FUEL CARRIER

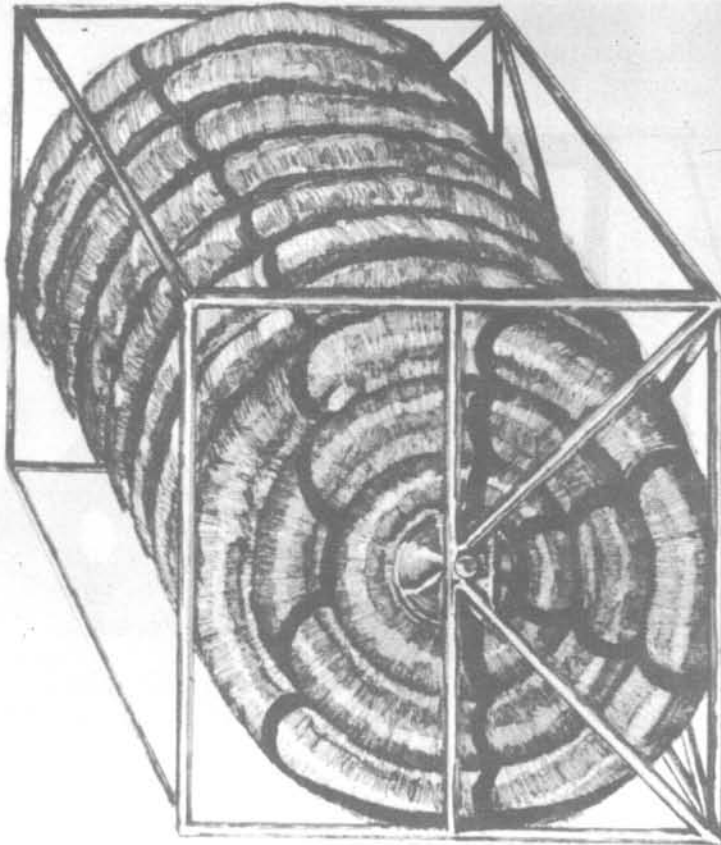


Fig. 23: Fuel Carrier.

Contrails

TEAM 4

Jeffrey Chambers	I.D. '65
John Coons	I.D. '65
Ronald Miller	Arch. '66
Rodney Lane	Arch. '66

SHELTER SYSTEM

Our concept makes use of a pallet in two ways. First, it is a carrying platform for materials brought to the Bare Base site. Second, it is used as a shelter system for Bare Base site.....

The pallet is made of honeycomb sandwich panels. The honeycomb material is aluminum with aluminum faces.

A housing unit designed for sixteen men is made up of two pallets and one end panel package.

The floor of the unit is brought together by tie rods mounted in the honeycomb (Fig. 25). At this point, one pallet would be unfolded into position and an end panel placed into it (Fig. 26). This would make the unit rigid. The second pallet which unfolds in the opposite direction is raised into position and connected to the first section, the second end panel is put into position. The unit is now complete (Fig. 27). Time allowed for one unit using three trained men for erection is 15 minutes.....

FLEXIBILITY-HANGAR

The hangar is constructed of the same pallets used for the smaller shelters. Their construction differs in that one joint is unhinged and the panels are extended to their full length (8' x 48'). Two pallets are butted end to end, making up one bay..... Structural ribs of honeycomb also stiffen the structure at interior points and on the ends (Figs. 28,29).....

TRANSPORTATION CONCEPT

The multi-purpose vehicle is a modular system consisting of a power unit and a trailer unit (Fig. 30). The unit is based on a tricycle arrangement, the larger wheels being used for power transfer and the smaller set, rigged to the steering mechanism. The unit is capable of working several take-off power units required for the operation of attachments such as the forklift (Fig. 31), runway sweeper, winch, bull dozer, and others. The vehicle is also adaptable for use as a passenger car (Fig. 32). Extreme maneuverability is facilitated

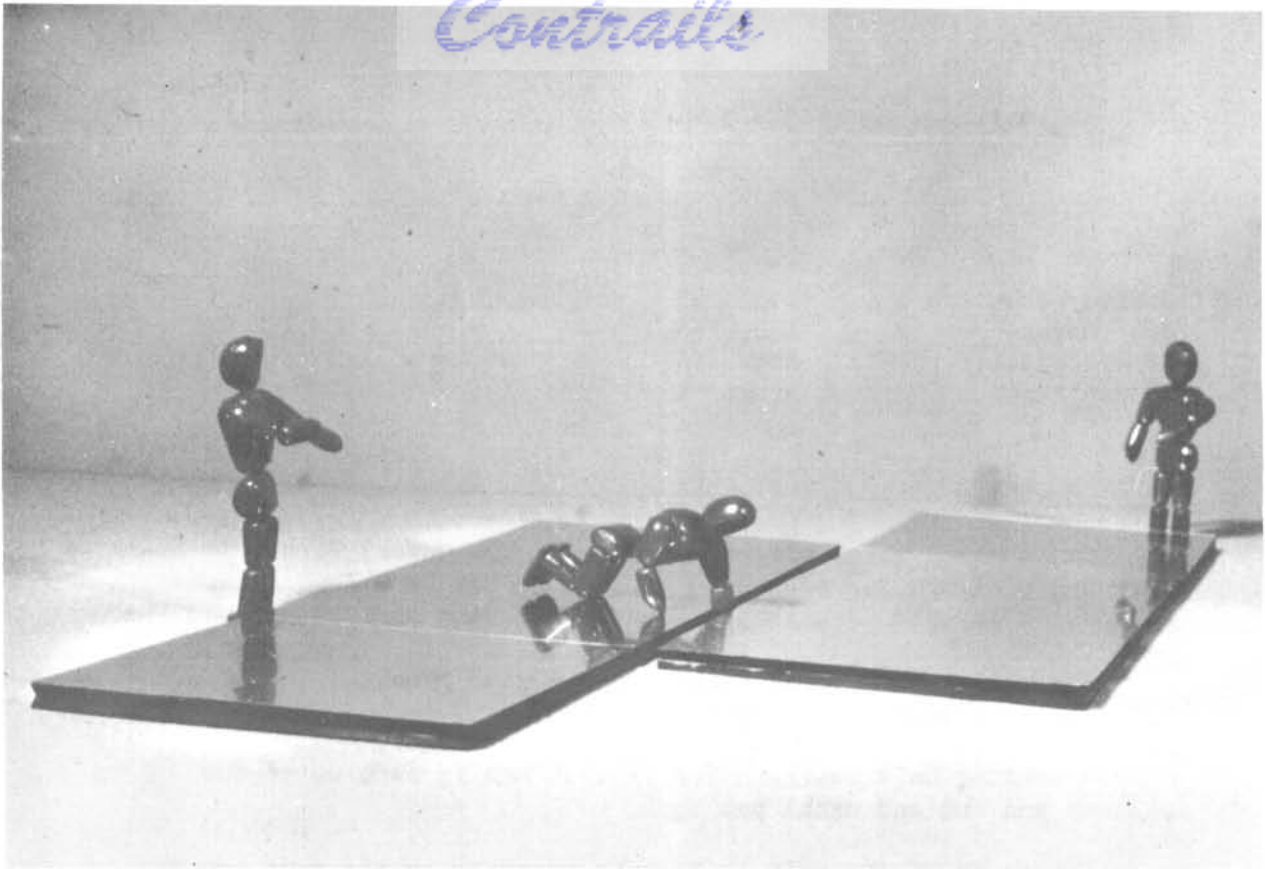


Fig. 25: Pallets laid alternately, floor panels tied together.

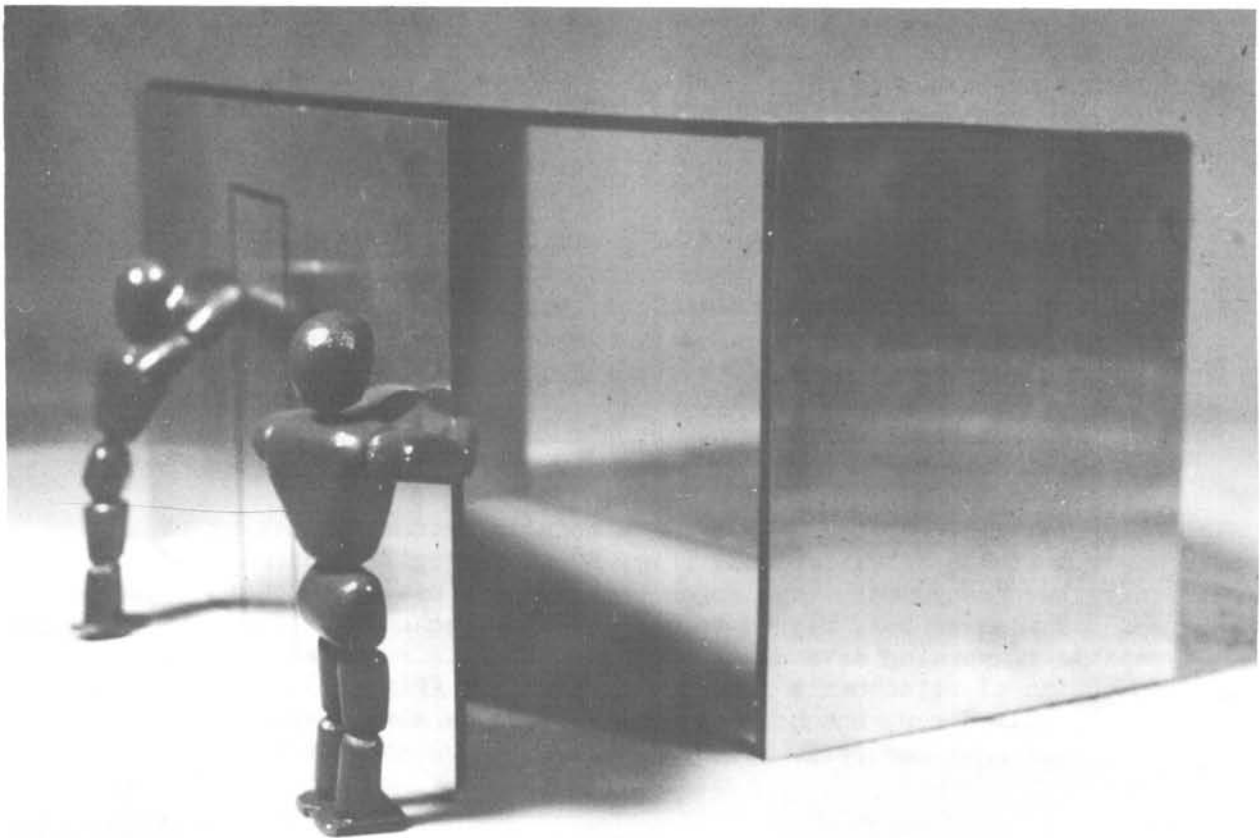


Fig. 26: First pallet unfolded, end panel being installed.

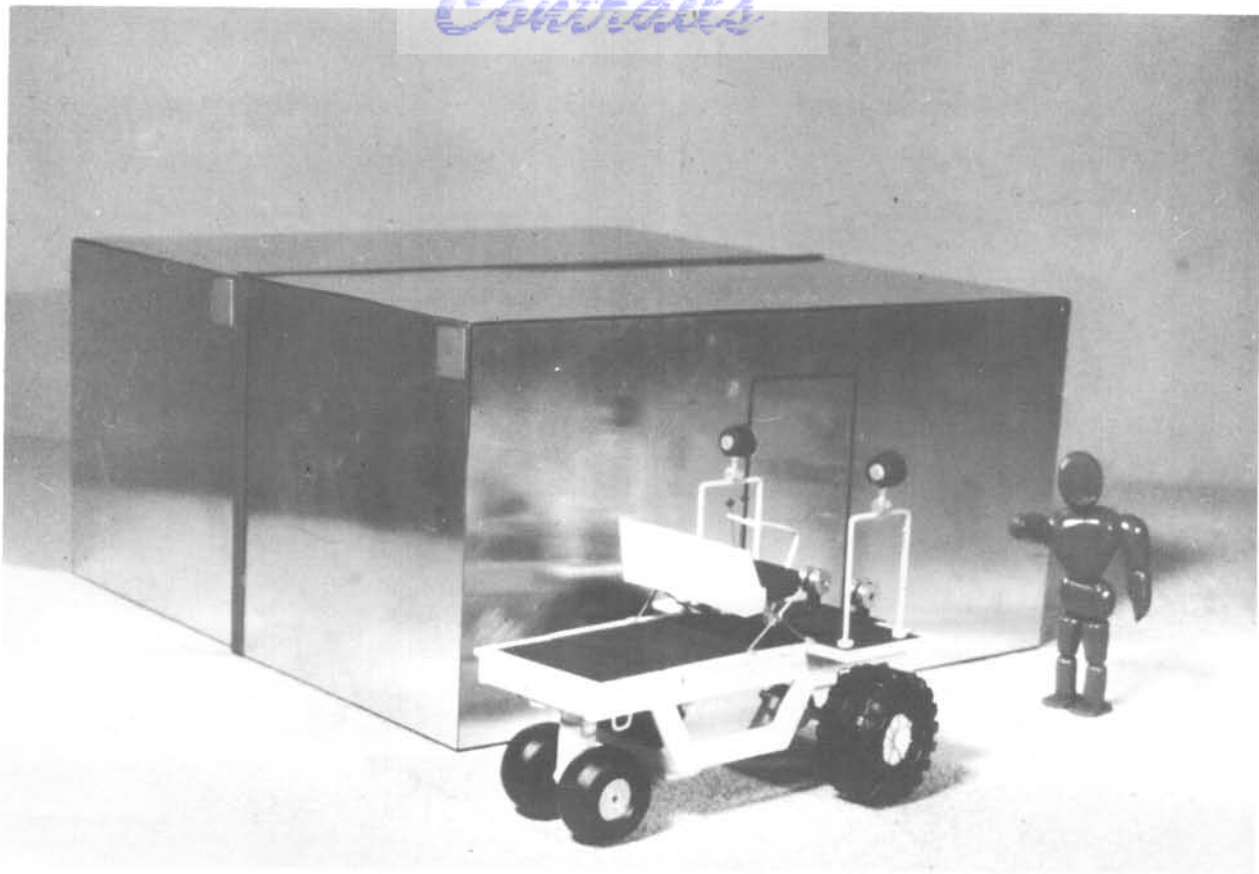


Fig. 27: Completed personnel shelter.

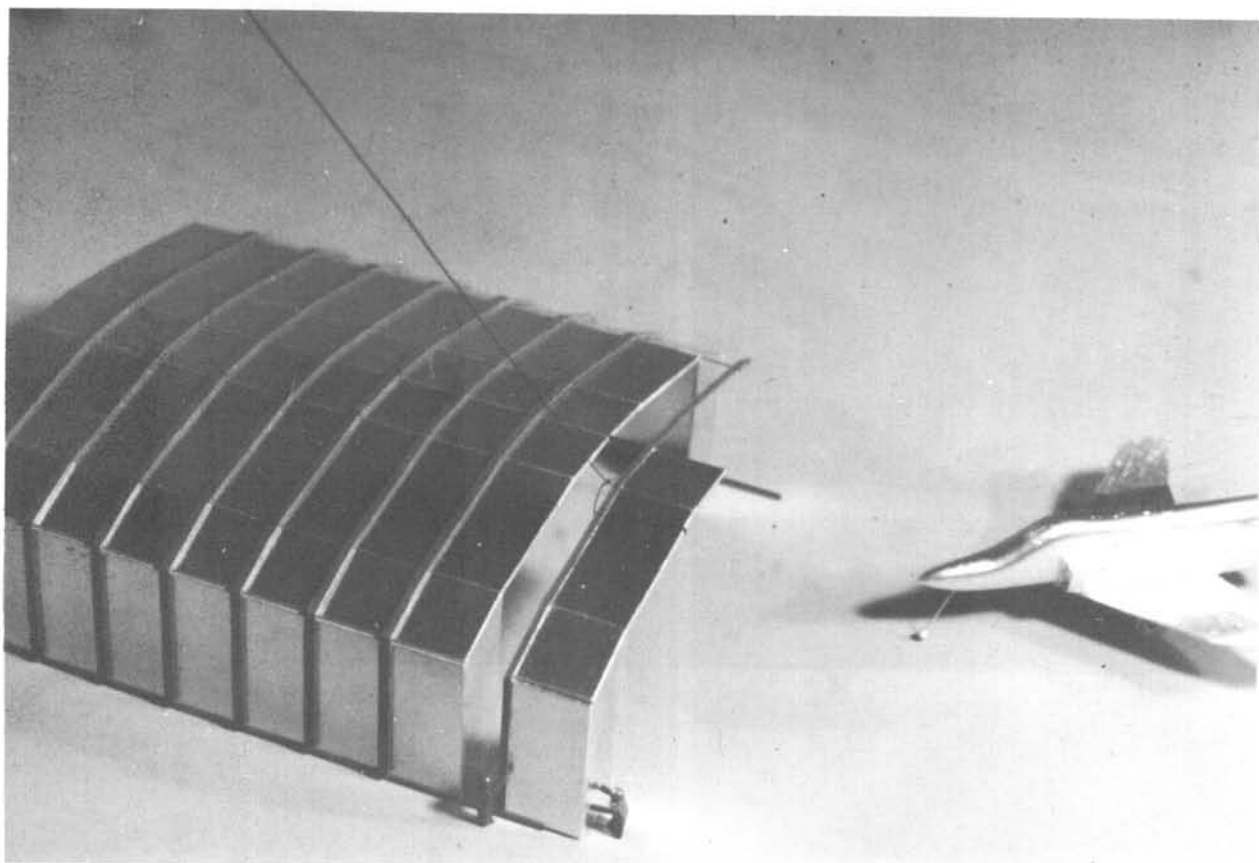


Fig. 28: Erecting panels and ribs of Hangar.

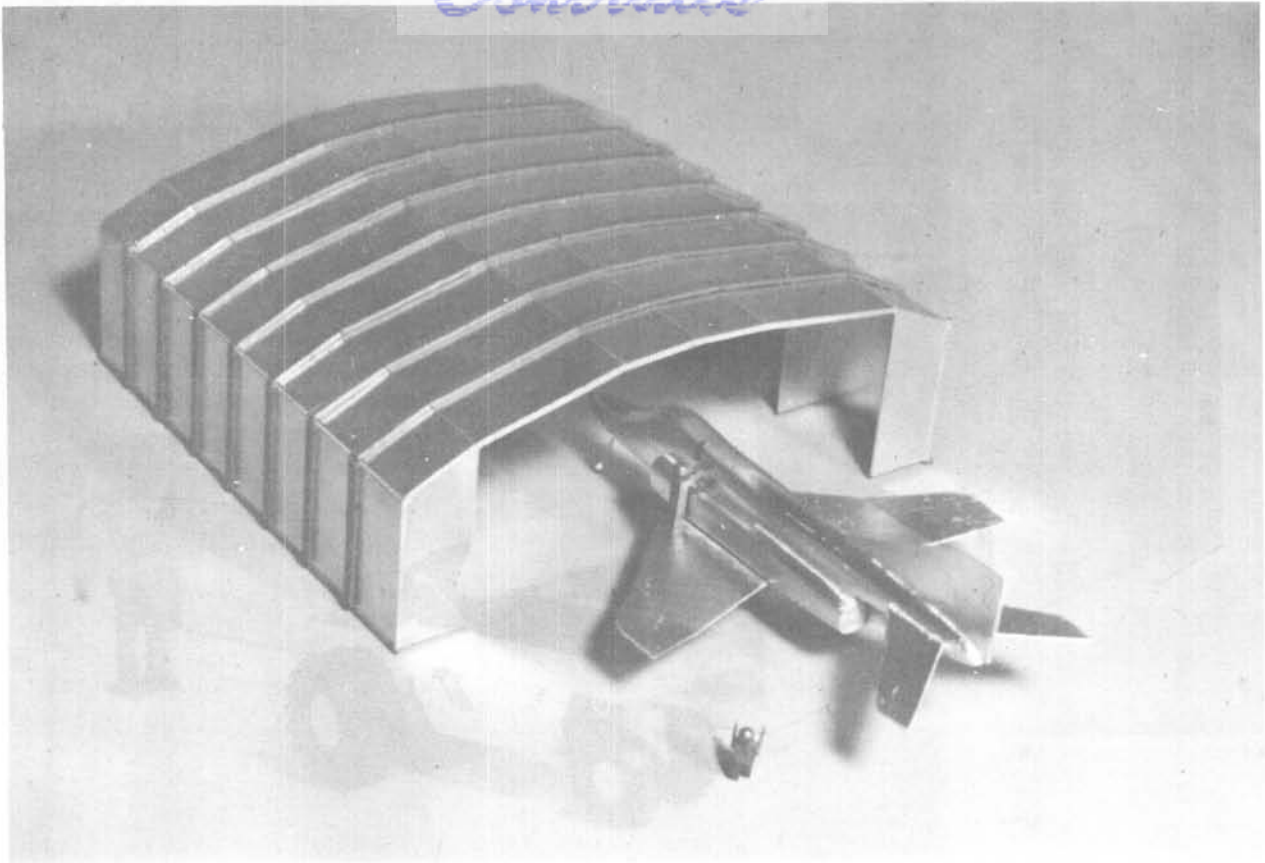


Fig. 29: Hangar showing stabilizing panels.

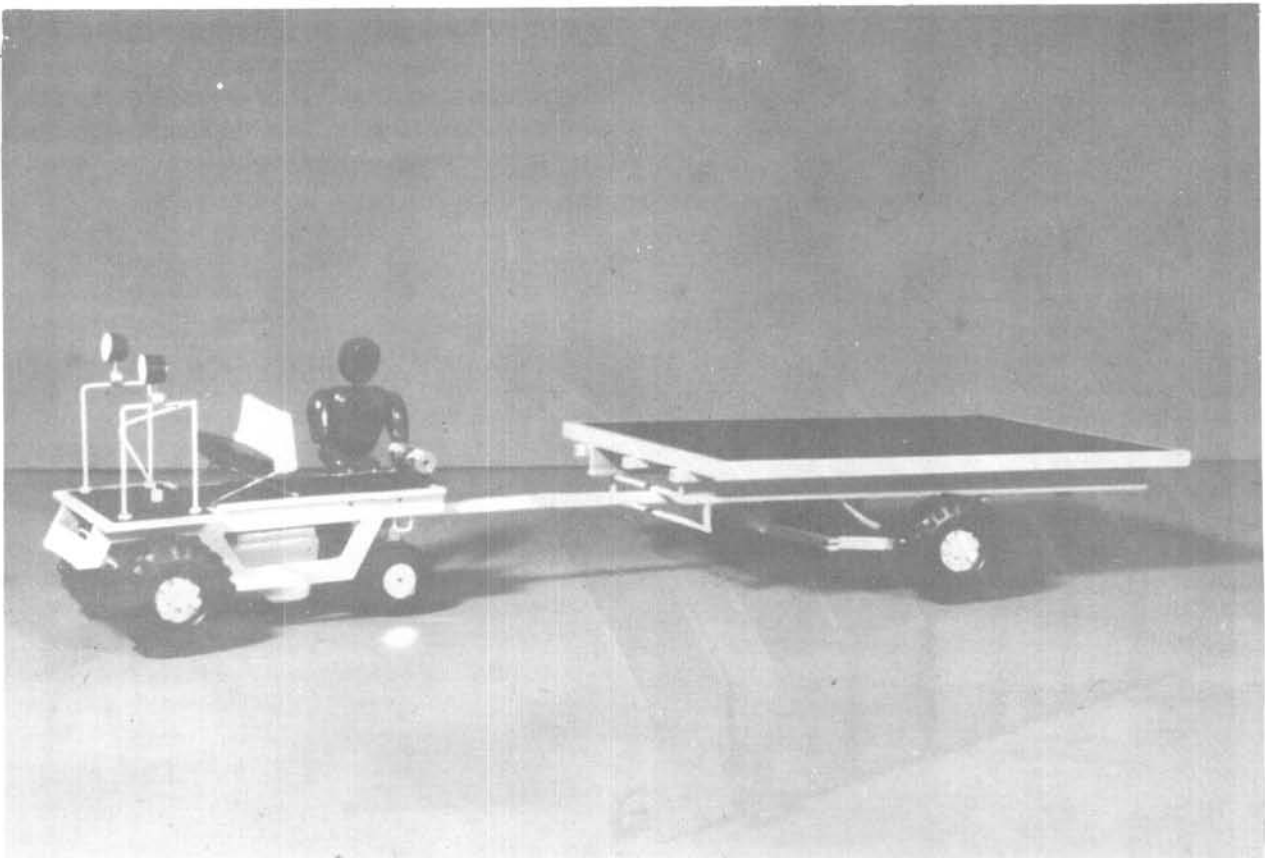


Fig. 30: Multi-purpose vehicle with trailer.

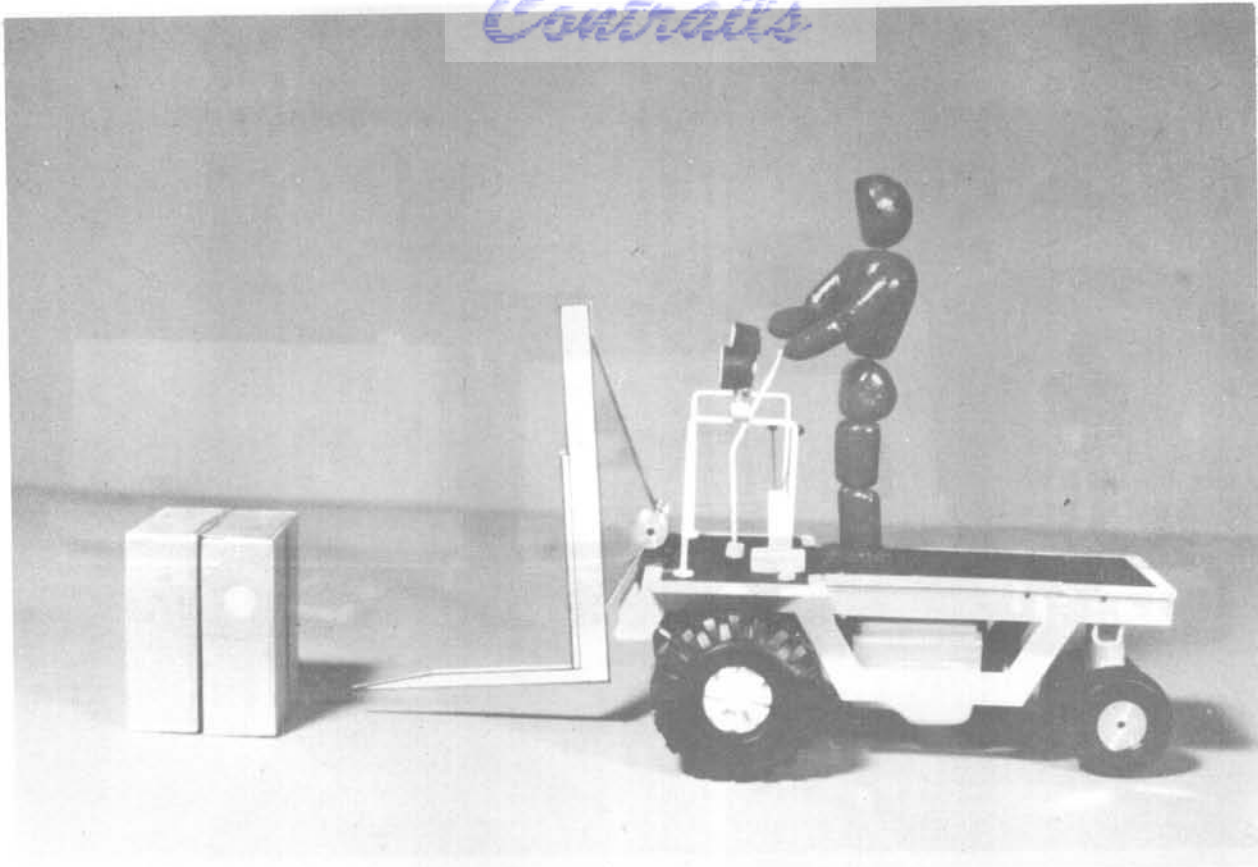


Fig. 31: Vehicle with fork-lift attachment.

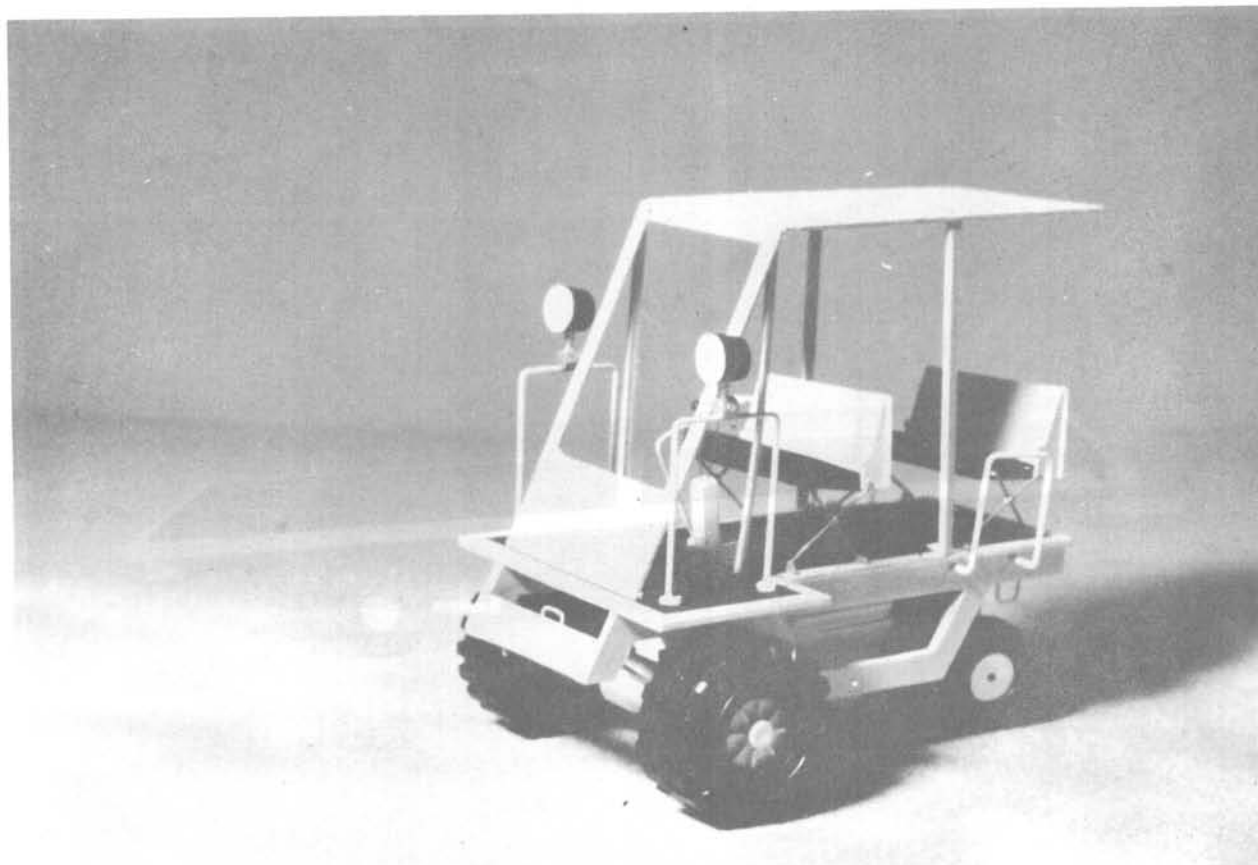


Fig. 32: Vehicle equipped as a personnel carrier.

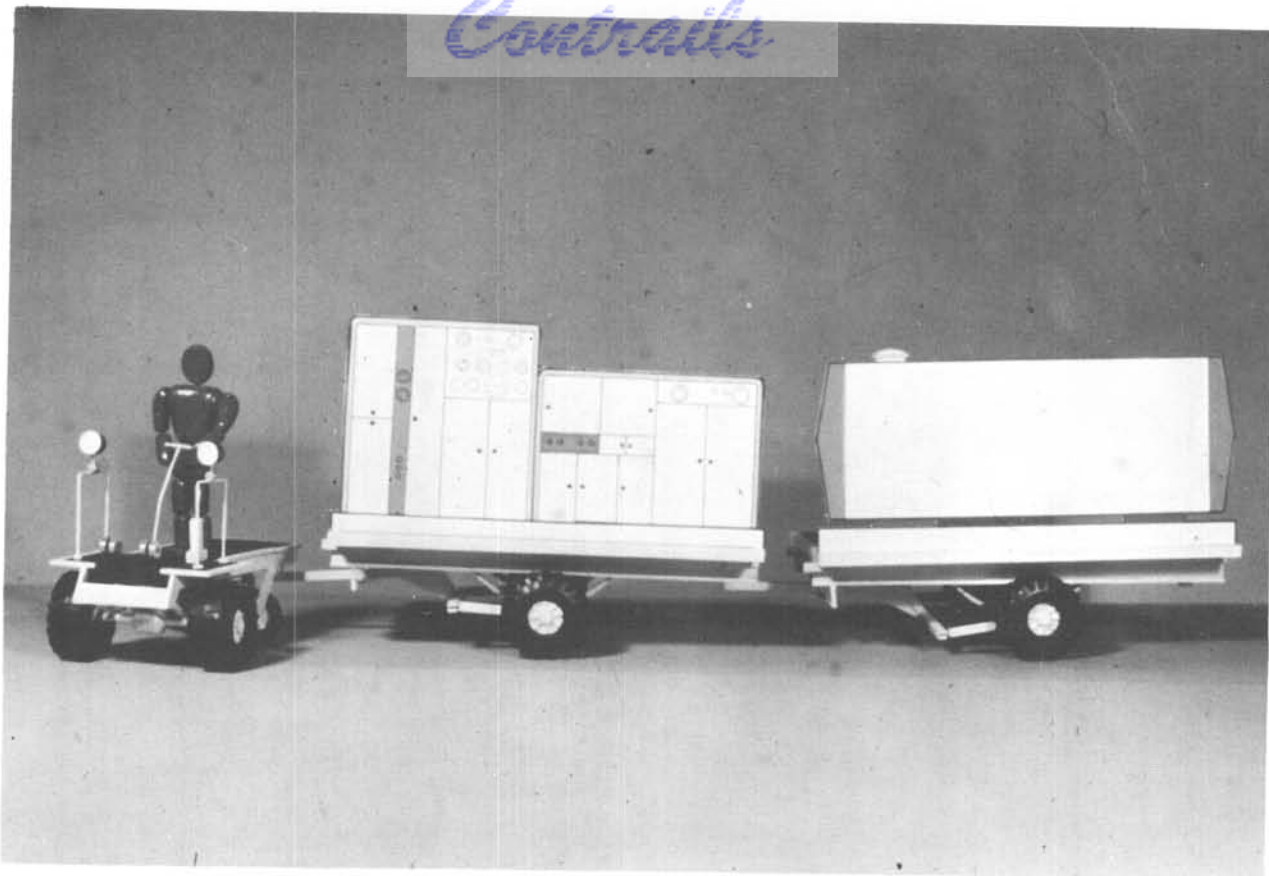


Fig. 33: Single trailers in tandem.

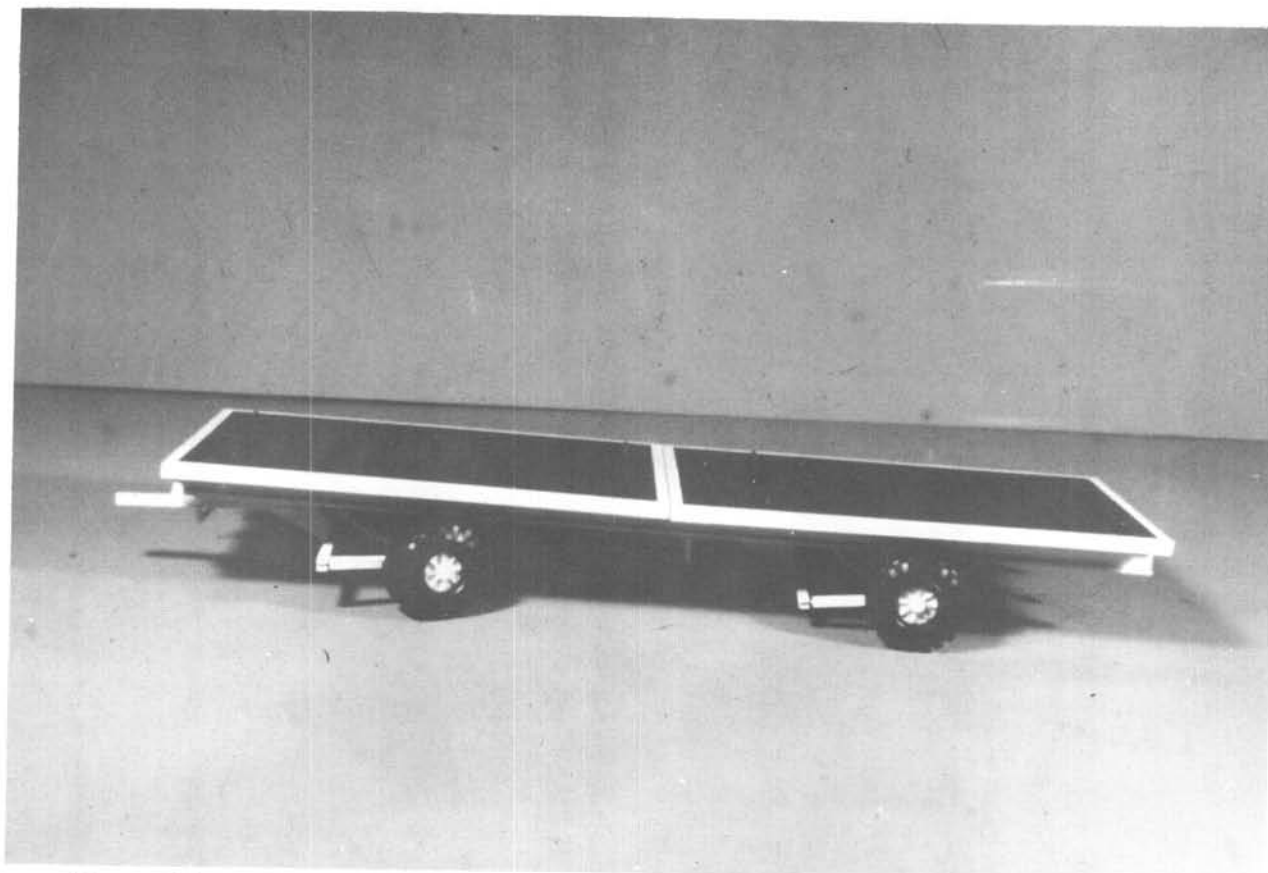


Fig. 34: Units joined to form large trailer.

Contrails

by enabling the vehicle to be driven in either direction at comparable speeds. Also, tiller steering has been included to allow driver to sit or stand and face either direction.

The trailers are designed as lightweight modular units. Each is basically a flat cargo bed mounted on a two-wheel suspension unit (Fig. 30). Each unit is equipped with tongue steering and a modular coupling system (Fig. 33). Its first application is as a hauling unit used to unload the C-130's. For this duty two units are joined rigidly to form a single four wheeled trailer (Fig. 34). The dimensions of this double cargo bed match those of the pallet.

TEAM 5

Stanley Hoelle Arch. '66
Raimonds Maculans Arch. '66
Robert Coulter I.D. '65

BASIC SHELTER

The shelter is an arched structure of light canvas over a skeleton frame. "Delrin" plastic rods form the frame structure for the shelter. These rods have a compressive stress of 18,000 psi and a tensile stress of 10,000 psi. They are resistive to heat, cold, acids and mildew. They can be painted, pigmented, cut or welded (Fig. 35).....

The rods are set in grade beams and are held in the arched form by cables under the removable canvas flooring.....

VEHICLE DESCRIPTION

The basic body shell of the vehicle is of unitbody construction, and.....has four-wheel drive and four-wheel steering to make it quite agile and maneuverable.....

Many standard jeep attachments can be used on this vehicle, which is equipped with a Power Take-Off front and rear..... A large vehicle of same basic lines but with caterpillar drive would be used for heavier jobs at the base. This vehicle could be fitted with grader blades, cranes, or other body units for specific work (Fig. 36).

RUNWAY LIGHTING

A very efficient type of lighting is neon. A single strip of light on both sides of the runway is sufficient for its location by the pilot.

The portable quality of the lighting is achieved by pumping the neon gas into flexible clear plastic tubing which can be wound onto reels that are mounted on a vehicle.

This single wire, cold cathode system can be powered by portable generators as needed.

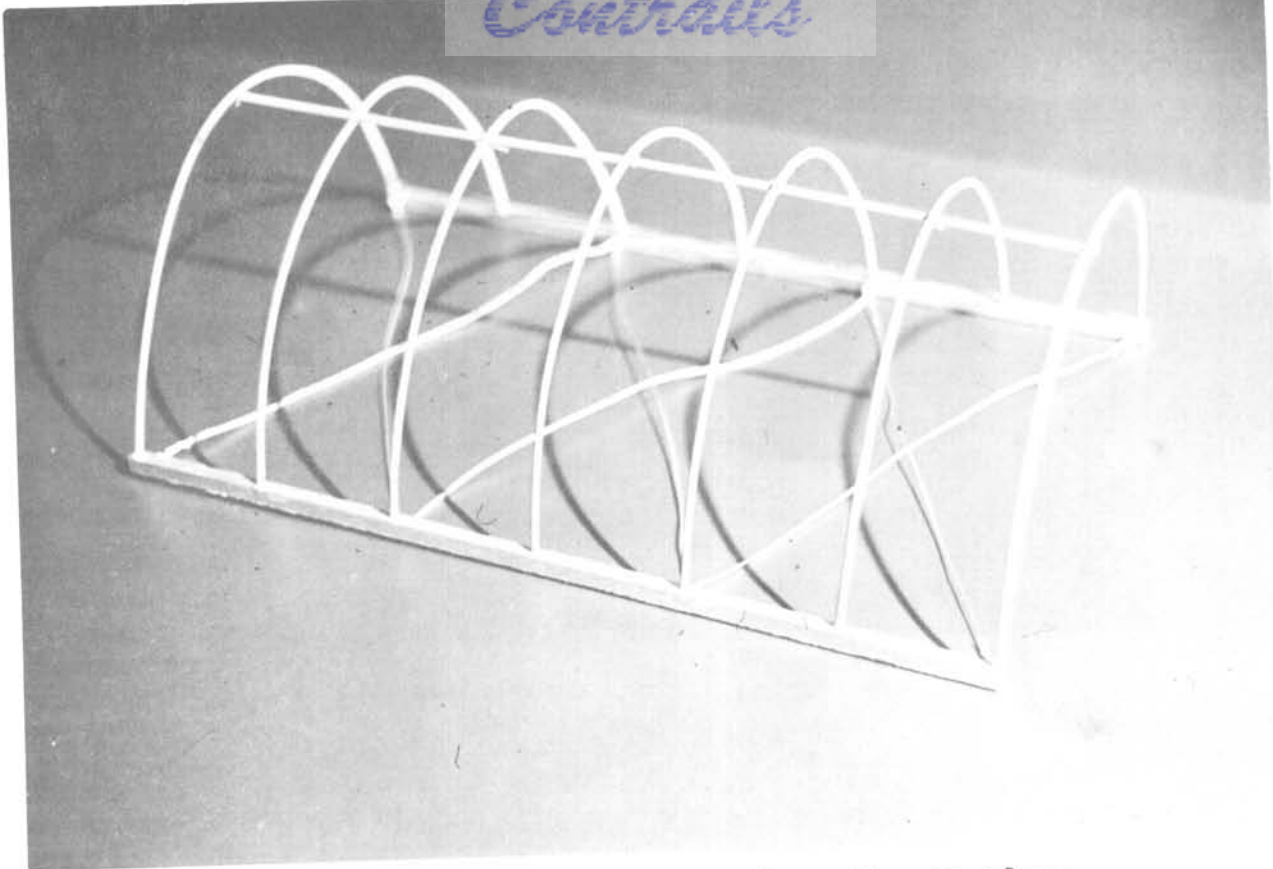


Fig. 35: Skeleton of shelter, showing ribs in place.

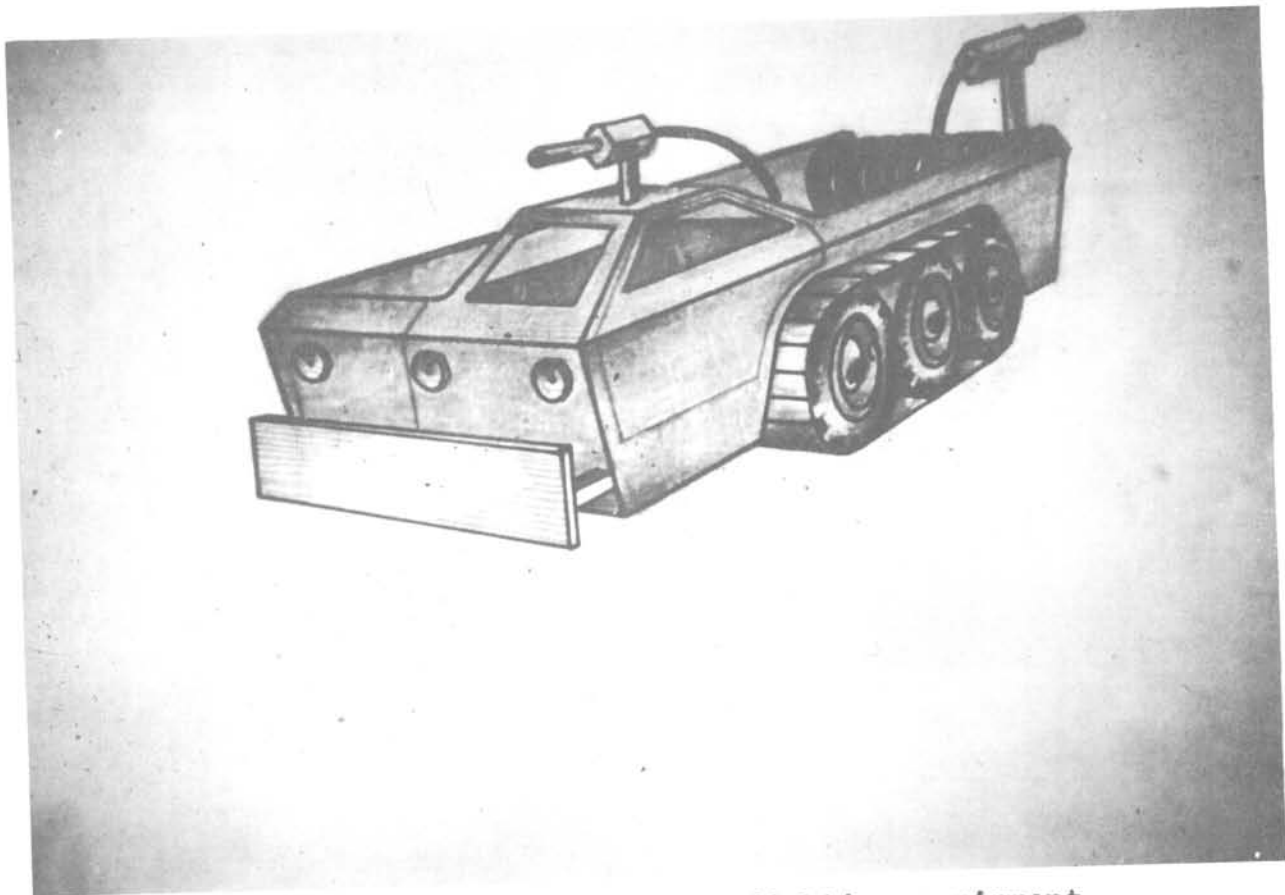


Fig. 36: Large vehicle with fire-fighting equipment.