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DEFENSE DOCUMENTATION CENTER

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SCIENTIFIC AND TECHNICAL INFORMATION

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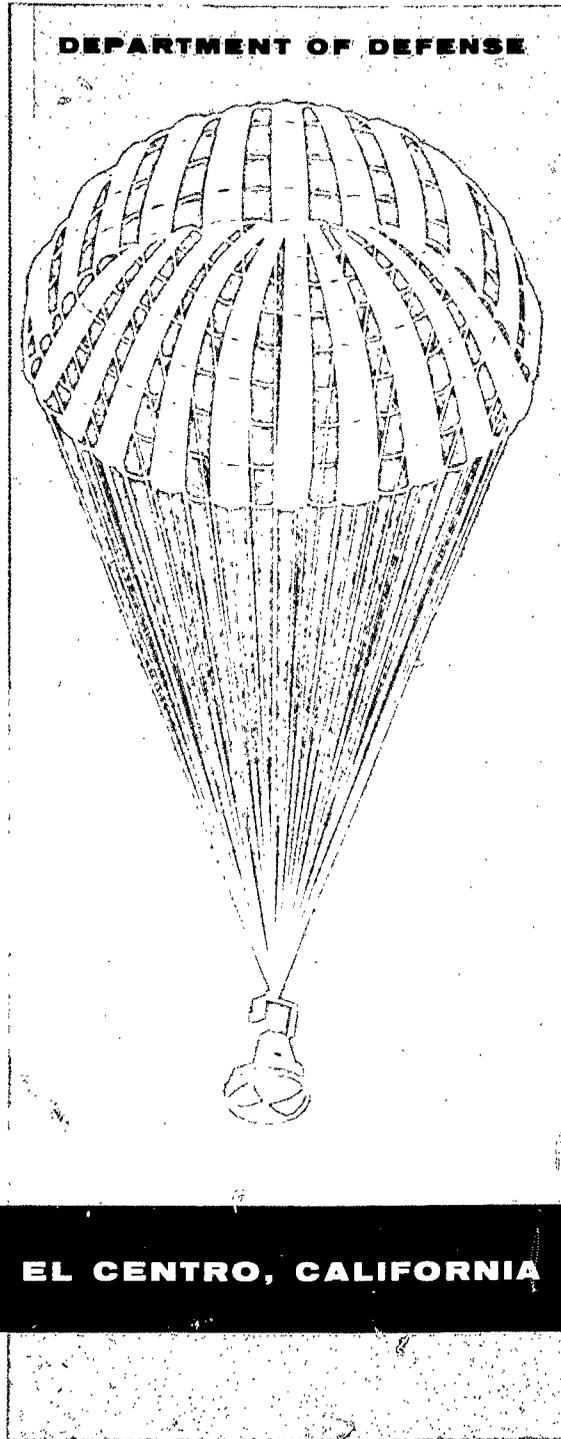
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# JOINT PARACHUTE TEST FACILITY

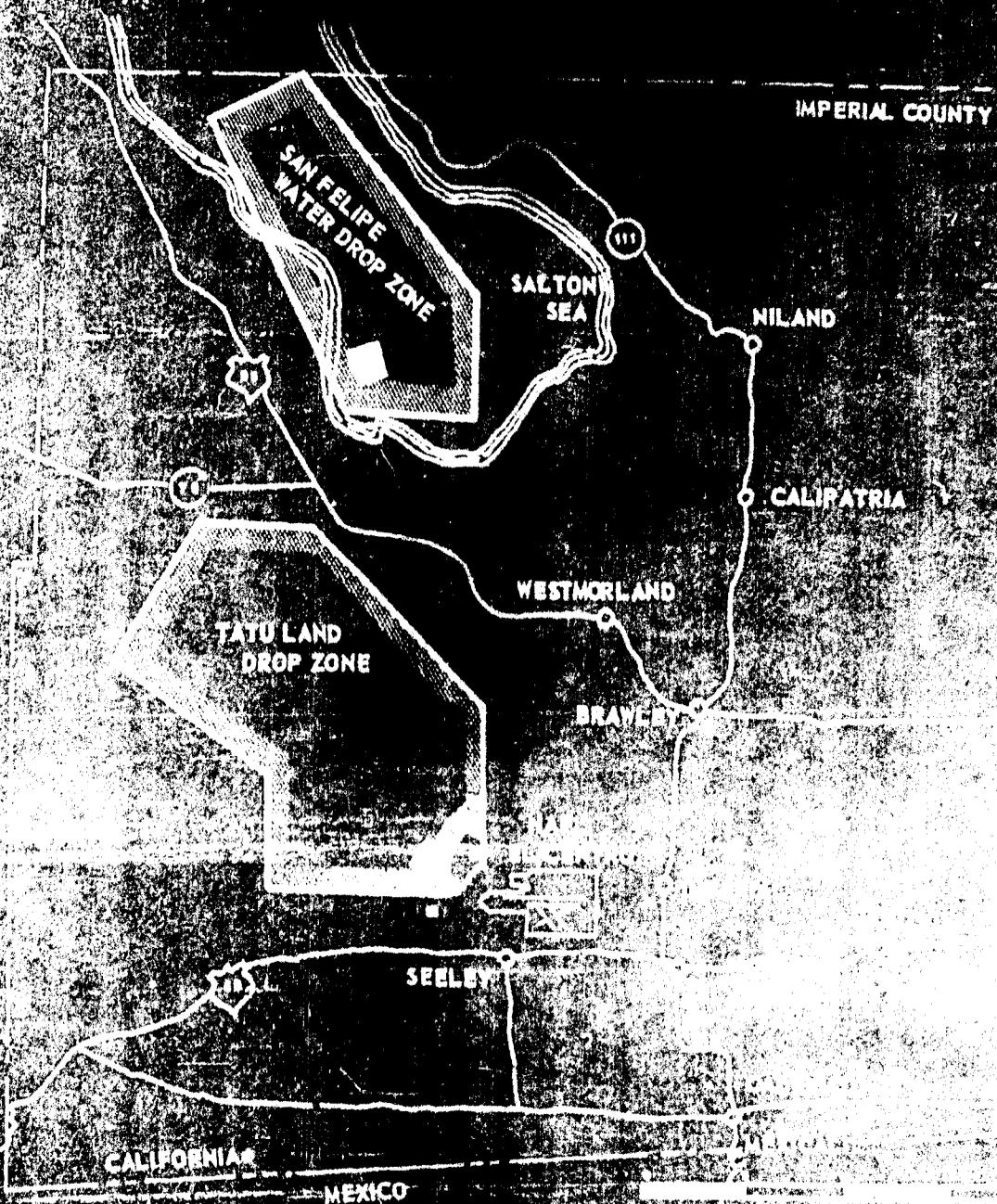
USAF 6511th  
TEST GROUP  
(PARACHUTE)

and

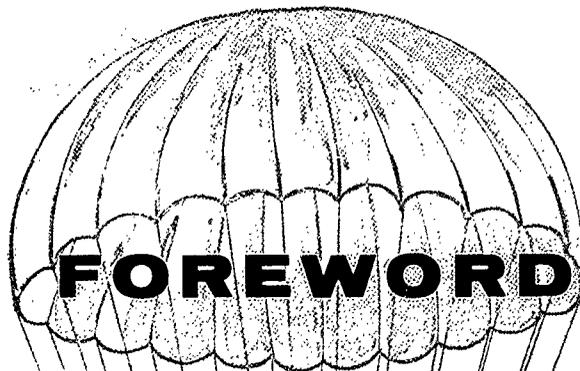
US NAVAL  
PARACHUTE  
FACILITY

REVISED-MAY 1963

DDC  
 RECEIVED  
 JUN 21 1963  
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THE JOINT PARACHUTE TEST FACILITY IS LOCATED AT THE NAVAL AIR FACILITY SEVEN MILES WEST OF THE CITY OF EL CENTRO, CALIFORNIA. EL CENTRO IS APPROXIMATELY 120 MILES EAST OF SAN DIEGO, CALIFORNIA, 60 MILES WEST OF YUMA, ARIZONA, AND IS GEOGRAPHICALLY LOCATED AT THE JUNCTION OF U.S. HIGHWAYS 90 AND 99.

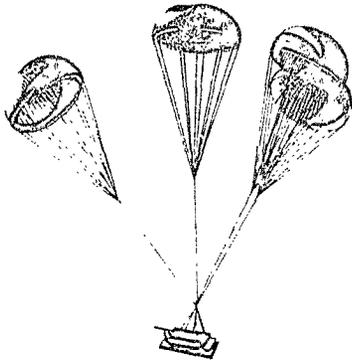


The purpose of this publication is to describe the Joint Parachute Test Facility operated by the United States Navy and the United States Air Force. The Naval Parachute Facility and the 6511th Parachute Test Group have joined together in the operation and utilization of one testing complex to achieve each service's specific objectives relative to the testing of retardation systems. The equipment and specialized experience available at this organization have been utilized in the solution of particular problems for all military services and also for many industrial organizations. Since improvements are constantly being accomplished, many of the latest and most current achievements cannot be reflected in this document. If additional information is required, it can be obtained from the Commander of either the Naval Parachute Facility or the 6511th Test Group (Parachute).



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# INTRODUCTION

The Joint Parachute Test Facility was established in 1951 by the Department of Defense to perform development; testing; and evaluation of parachutes and related assemblies, pilot escape parachute systems, aerial delivery systems for supply and cargo, parachute recovery systems for guided missiles, deceleration parachutes and related equipment for aircraft, and retardation devices performing functions of parachutes.

## NAVAL PARACHUTE FACILITY

The mission of the Naval Parachute Facility is to conduct research, development, test and evaluation of parachutes and related assemblies; pilot escape methods and systems; retardation and recovery systems; and rescue, survival and personnel-safety equipment as directed by the Chief of the Bureau of Naval Weapons.

The Technical Department, composed primarily of civilian engineers, provides the necessary technical guidance and supervision of the test programs which are generated under the assigned mission. All other departments have support task functions and are composed of military personnel. Constant direct liaison with fleet and shore aviation activities is utilized in order to keep abreast of the ever changing requirements and problems in the field of personnel-safety and survival equipment.

Project Directives in the form of WEPTASKS are evolved by the Airborne Equipment Division (RAAE-2) of the Bureau of Naval Weapons. Requirements of other agencies such as the Naval Ordnance Lab, National Aeronautics and Space Agency and the Naval Ordnance Test Station for RDT and E are subject to BuWeps approval and agency financing.

## 6511TH TEST GROUP (PARACHUTE)

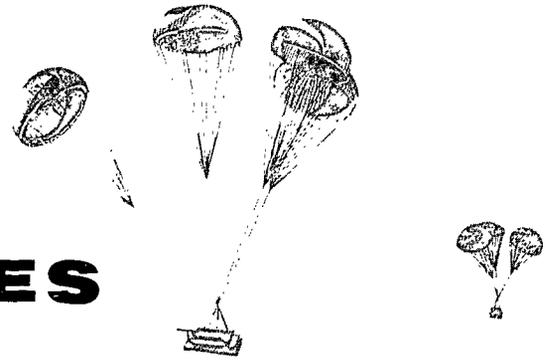
The mission of the 6511th Test Group (P) is to perform development testing of human escape parachutes and aerodynamic systems, supply and cargo aerial delivery systems, guided missile and re-entry vehicle parachute recovery systems, aircraft deceleration parachutes, and aerodynamic retardation devices performing functions similar to those of parachutes; and to accomplish the design, procurement, operations and maintenance of test equipment and facilities. The Group is responsible for performing research and development testing for the U. S. Army.

Test requirements are normally generated by: the Aeronautical Systems Division and the Space Systems Division of the Air Force Systems Command; the U. S. Army; and private industry. After completion of the required documentation in accordance with applicable Program Management Instructions, a test program is established. This test program determines the requirements for each of the testing activities. After completion of the tests, the evaluation of the results, including photographic evaluation, data reduction and engineering analysis is presented in a report.

Government agencies or industrial concerns desiring to use these facilities for conducting tests should contact the Commander, 6511th Test Group (Parachute) El Centro, California.



# JOINT SUPPORTING FACILITIES



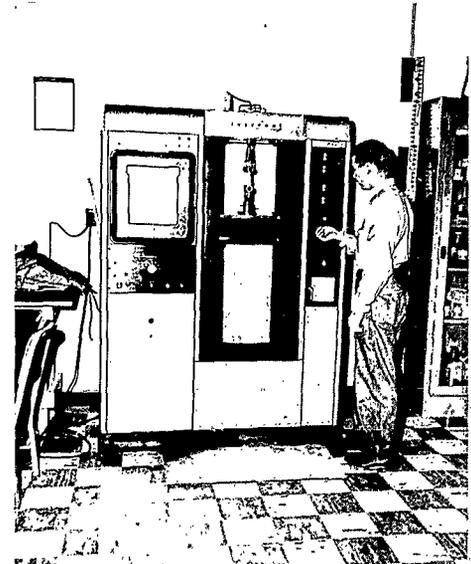
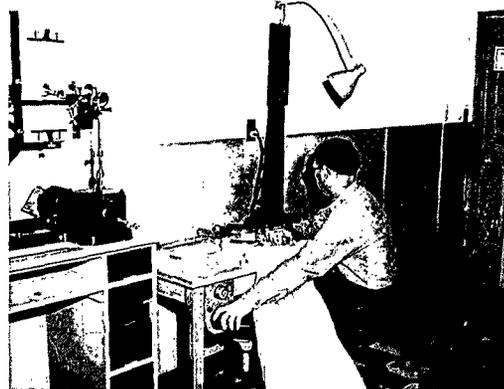
## MATERIALS LABORATORY

The Materials Laboratory is equipped with a full line of textile machines and equipment. Prominent among these are three tensile testing machines with capacities of 5,000, 20,000 and 125,000 pounds. The latter machine is designed especially for textile webbing in that it has the travel required for testing high elongation materials. Other equipment includes a Tinius-Olsen Tensile Tester, Elmendorf Tear Tester, Sheaffer Abrasion Machine, Air Permeability Machine, Weather-Ometer and an Altitude Temperature-Humidity Chamber.

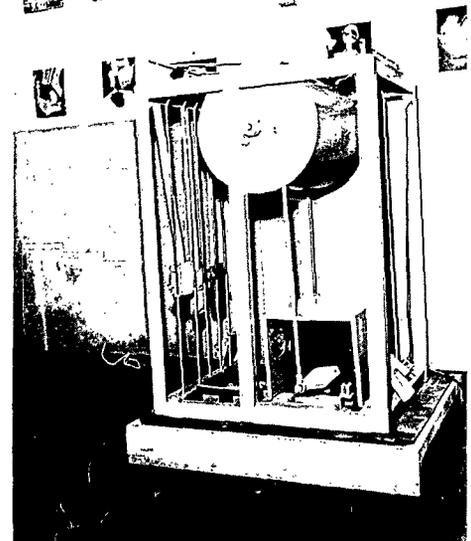
WEATHER CHAMBER AND SALT SPRAY



CHECKING POROSITY



INSTRO TENSILE TESTER



TESTING ABRASION QUALITIES OF WEBBING



AIR FORCE AND NAVY PERSONNEL PACKING A PARACHUTE

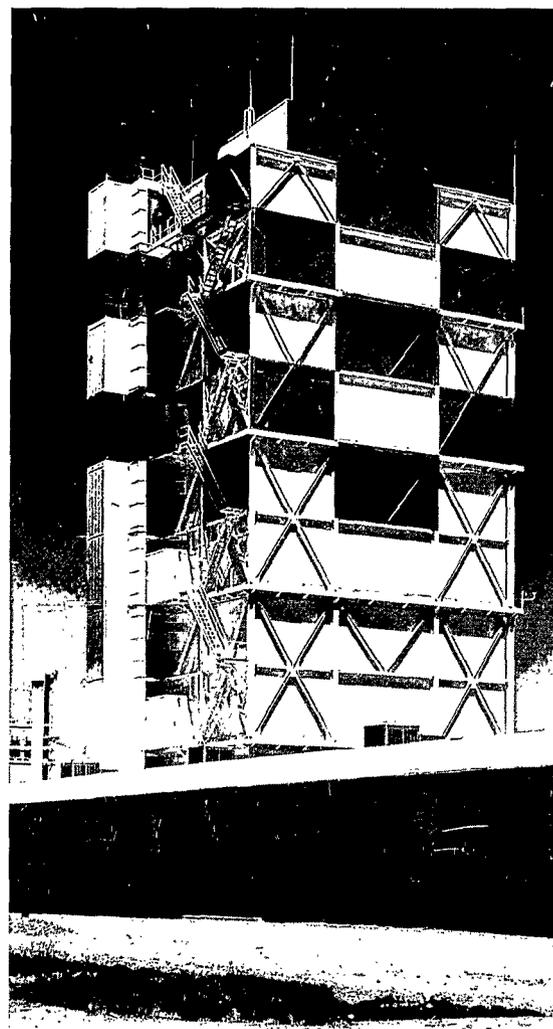
### PACKING AND FABRICATION

Here in the packing and fabrication section the parachutes are inspected, repaired, repacked and modified. Various types of sewing machines ranging in size from those for very fine material to those required for extra heavy webbing materials are available. Other special equipment such as electric cloth cutters, hot blade nylon cutters, stencil machines, and grommet setting machines are utilized. Facilities are also available to repair and calibrate the different types of automatic parachute opening devices.

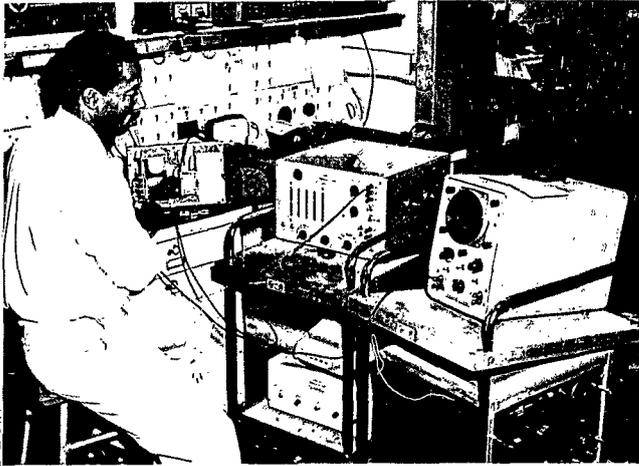


REPAIRING CARGO PARACHUTE

DRYING TOWER



CHECKING THE TELEMETER PACKAGE



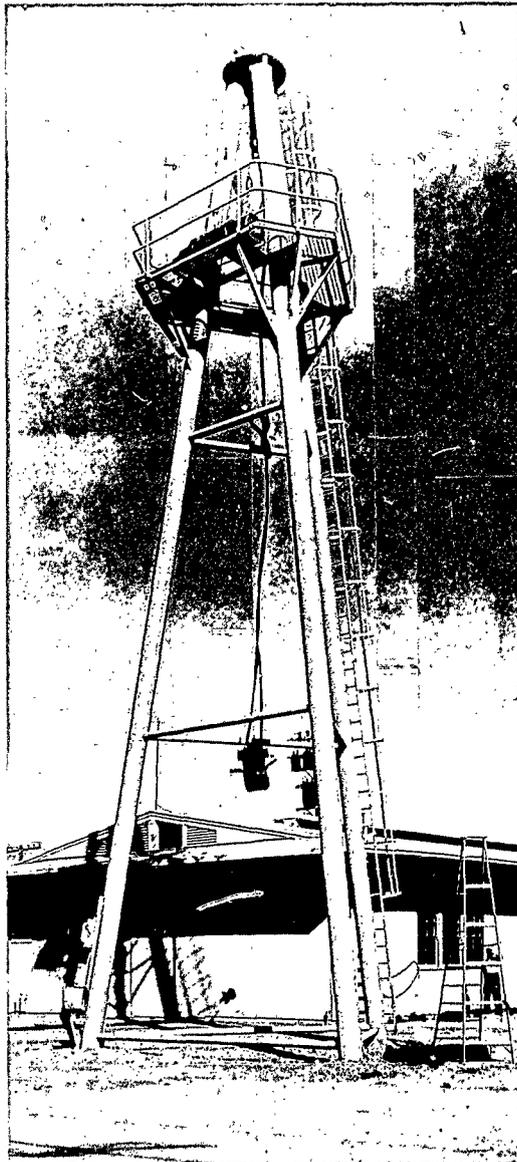
## INSTRUMENTATION

Instrumentation personnel translate the project engineers' requirements into the equipment necessary to measure and record the multitude of test parameters. Since each project presents peculiar problems, the experience and ingenuity of the instrumentation engineers and technicians play an important part in the acquisition of reliable data. Any special items required, but not readily available, are designed and fabricated by the laboratory personnel. Test items such as bombs, missiles and dummies are instrumented to telemeter vital parachute forces, accelerations, pressures and other data to the ground station. These telemetered data, transmitted by means of an FM/FM system, can be viewed immediately upon reception or stored on magnetic tape for future playback and data reduction.

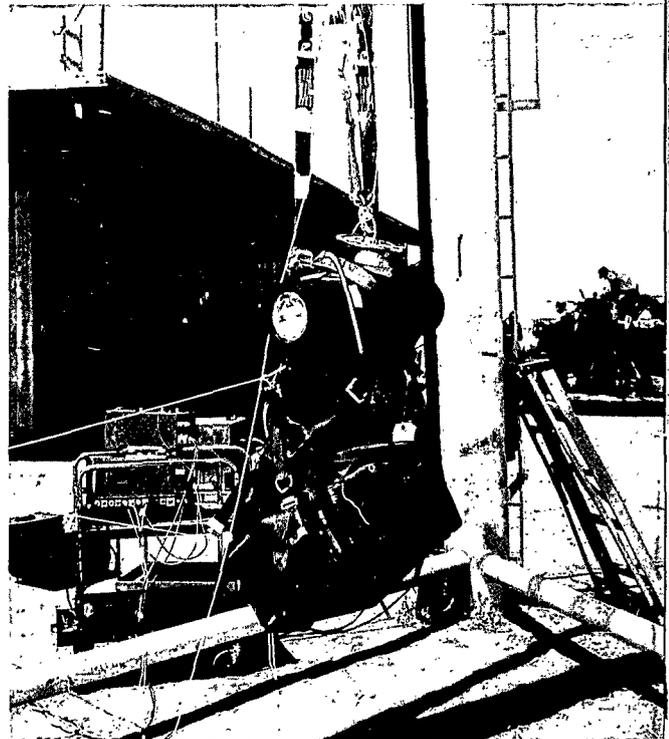
Mechanical type force recorders called tensiometers are also extensively used in recording parachute loads. These are available in 1500, 7500, and 15,000 pound ranges.

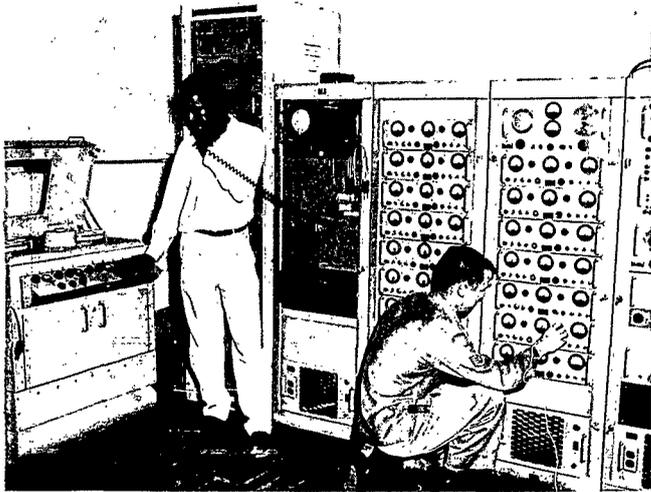
Further details on these facilities are available from the Commander, 6511th Test Group (Parachute) El Centro, California.

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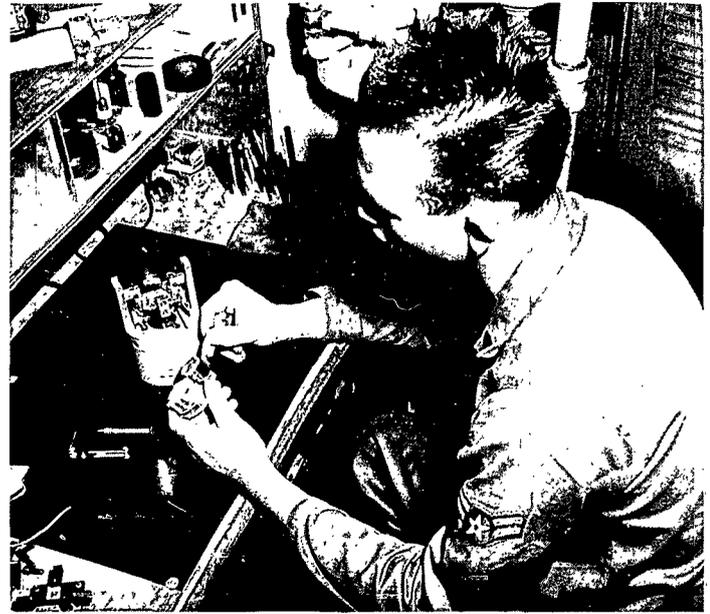


TESTING PARACHUTE HARNESSES ON THE DROP TEST TOWER





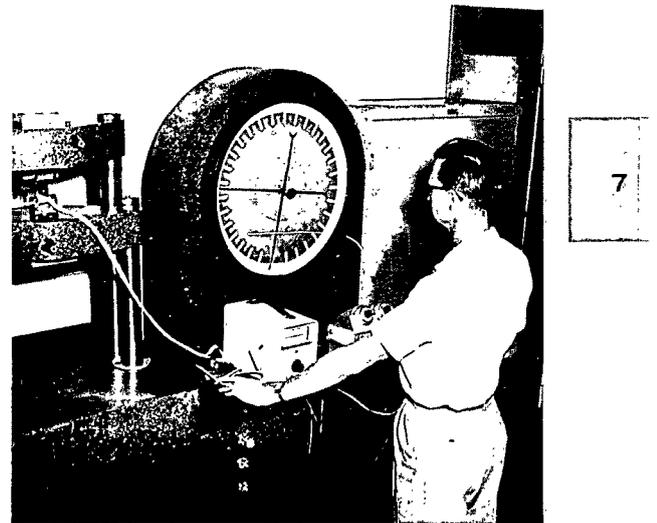
RECORDING A DROP



REMOVING RECORD FROM TENSIOMETER



RECORDING DATA ON TAPE



CALIBRATING STRAIN LINKS



ALIGNING GALVOS

MAKING SURE DUMMY WILL TALK



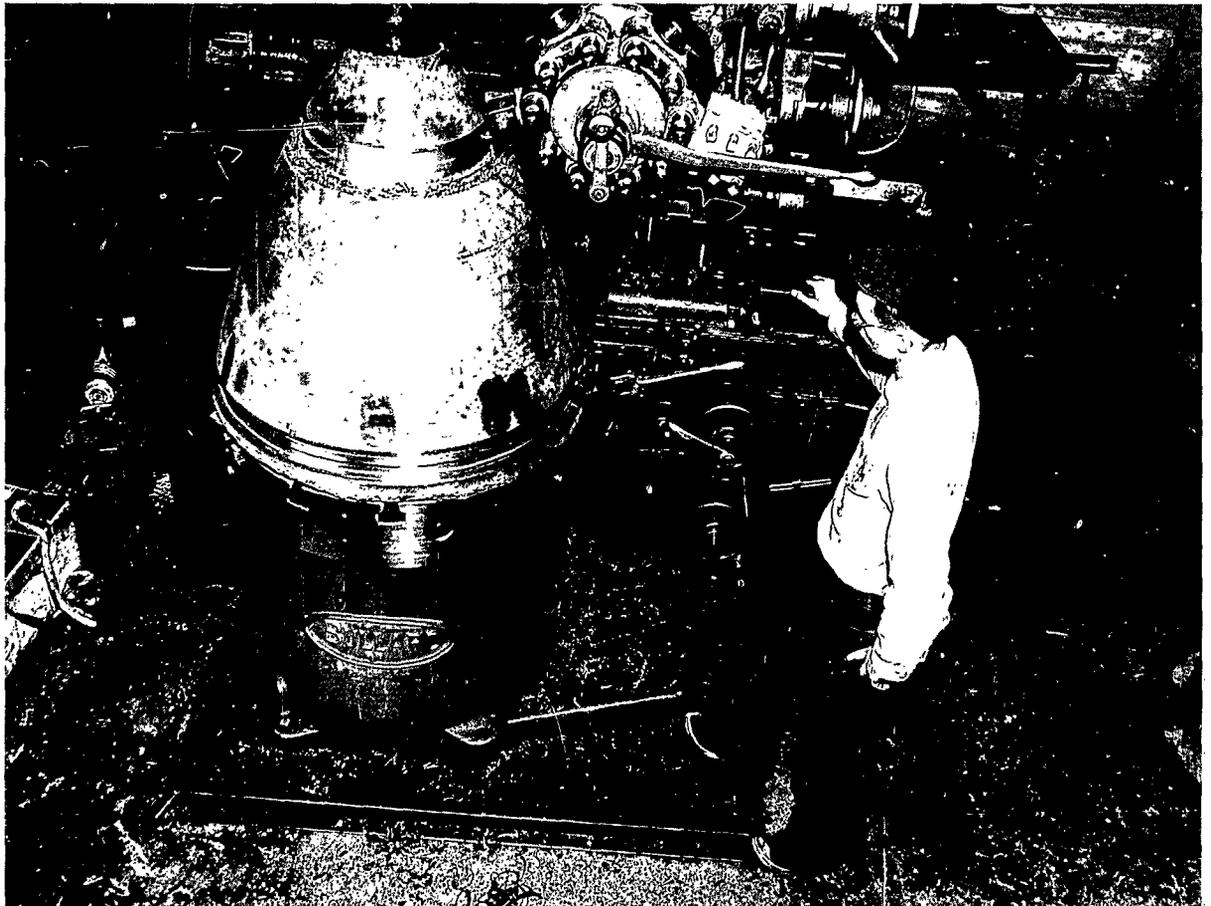
PREPARING PROJECT MERCURY CAPSULE



WELDING A NEWLY DESIGNED TEST VEHICLE



VERTICAL TURRET LATHE

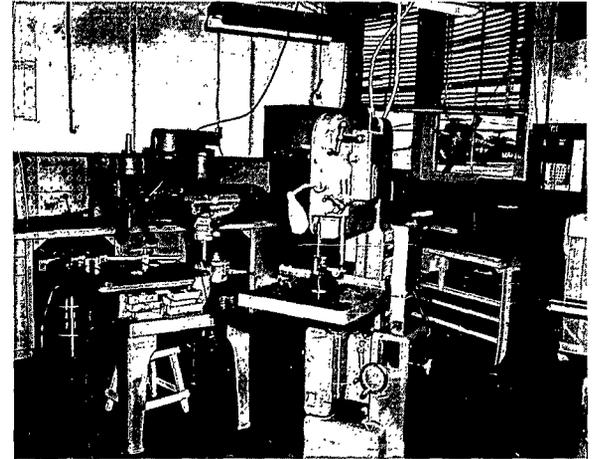


## SHOP FACILITIES

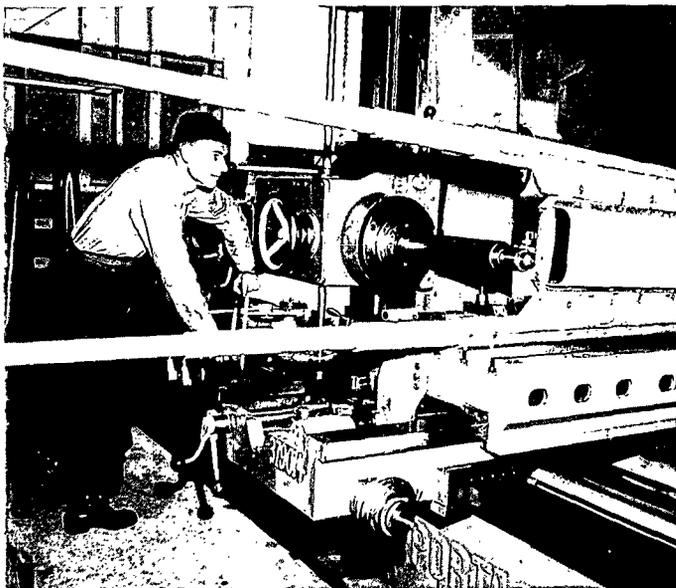
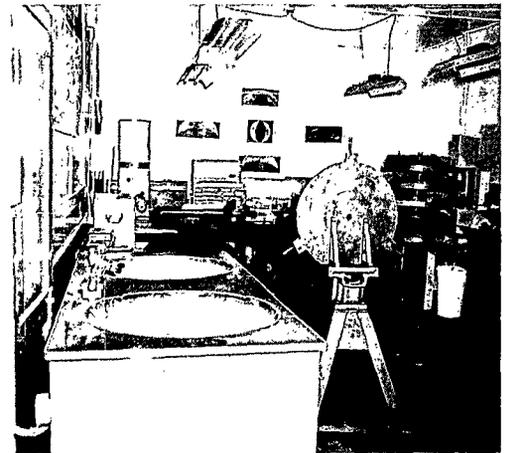
The machine shops and metal shops are equipped with a large battery of power lathes, milling machines and machine tools, and metal working machinery required for the diversity of assigned tasks.

As well as providing the necessary daily support, the shops are constantly striving to improve the testing facilities. This is evidenced by the collaboration of all the shops in the construction of a power driven tracking scope equipped with a 100 inch focal length mirror.

Fully equipped shops support the many Navy and Air Force projects. The capability of these shops ranges from the fabrication of precision parts for cameras and instrumentation to the modification and fabrication of heavy weight test vehicles. In the shops, priority is given to the project work load, resulting in rapid and efficient completion of test programs. The shops further support the other functioning divisions of the Joint Parachute Test Facility such as aircraft operation, instrumentation, etc.

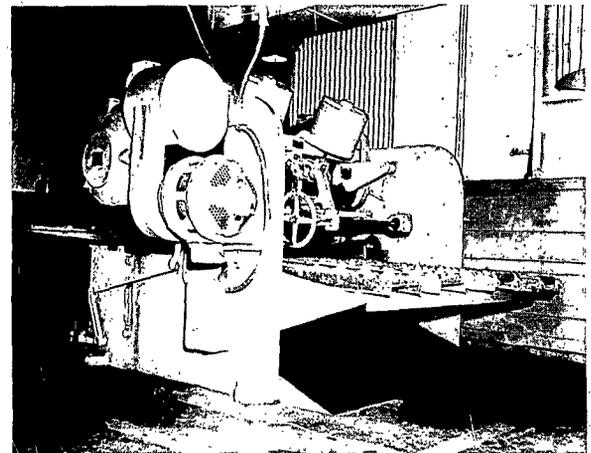


OPTICAL SHOP FACILITIES



HORIZONTAL BORING MILL

METAL SHEAR



## DATA REDUCTION

The Data Reduction Facility provides the project engineers with completely processed data within forty-eight hours after a drop test on a routine basis, and within twenty-four hours on a priority basis. This short time delay between drop test and finished test data results in rapid and economical accomplishment of test projects.

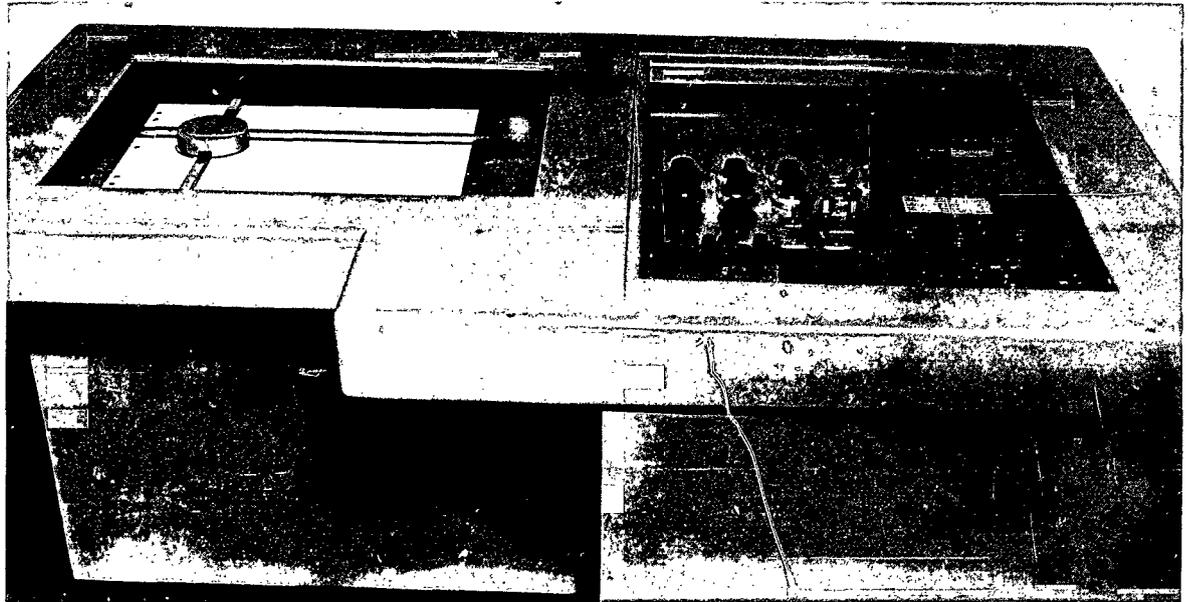
For the reduction of cinetheodolite data Telereadex machines are used to read the film. The Telecordex machines used in conjunction with these machines provide a tabulated readout of the film angle data and also operate IBM card punch machines to obtain cards with the data in punched form. These IBM cards are transmitted electrically to the IBM

7090 computer at Edwards AFB for computation of the desired trajectory and oscillation data. The results are then electrically transmitted back to El Centro for plotting and delivery to the project engineer. A feasibility study is being conducted to evaluate application of a medium size digital computer to the space position problem.

For the reduction of telemetry data, the equipment employed includes the Oscar D Oscillograph Reader, the Digital Converter E, and the Electroplotter E. This equipment permits one operator to read oscillograph records, record the data in tabulated form and simultaneously plot the data in graphic form. An IBM Card Punch permits storage of data for subsequent processing, if desired.

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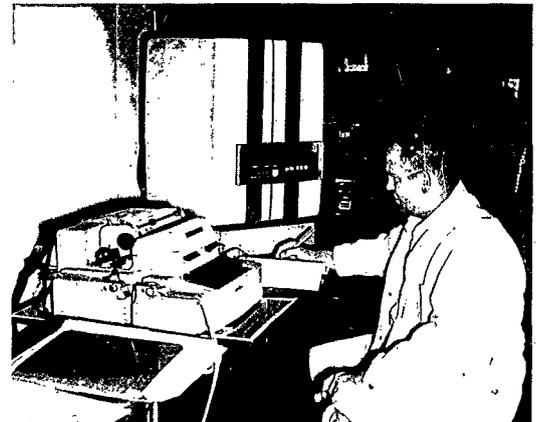
BENSON-LEHNER PLOTTER



AUTODIN SYSTEM

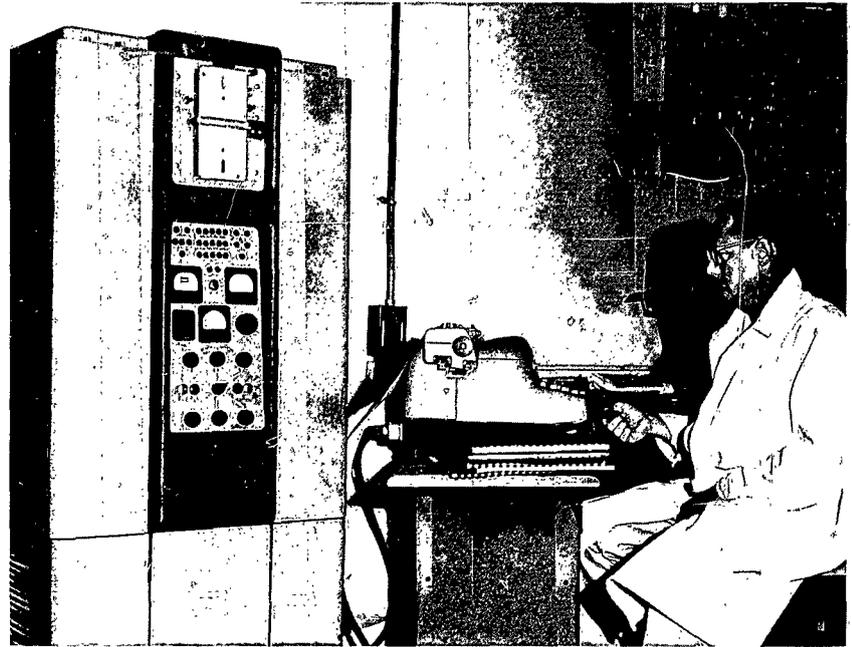


PACKARD-BELL 250 DIGITAL COMPUTER

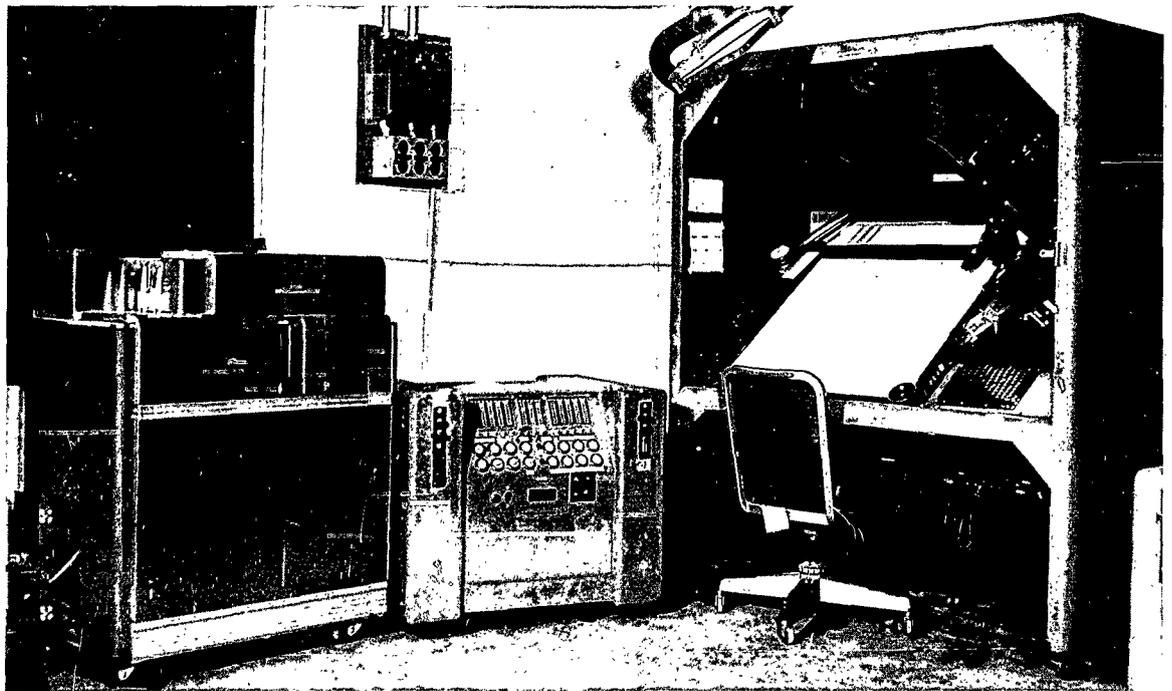




SCANNING CINETHEODOLITE FILM



BENDIX G-15 DIGITAL COMPUTER



CINETHEODOLITE FILM READER



PREPARING FOR PHOTO MISSION

DESERT PHOTOGRAPHIC CREW



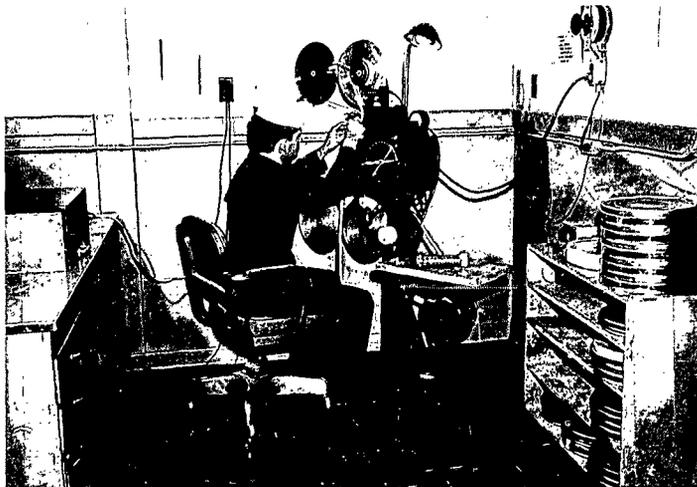
PROJECTION PRINTING ROOM



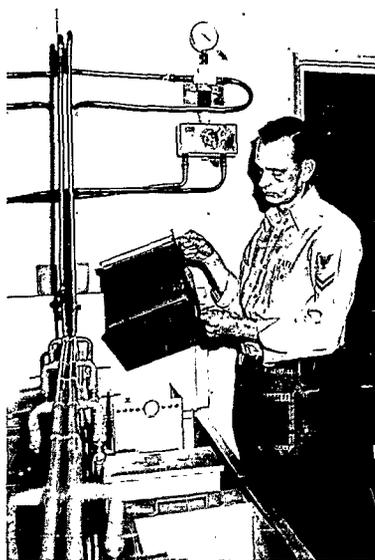
12



COLOR MOTION PICTURE PROCESSING



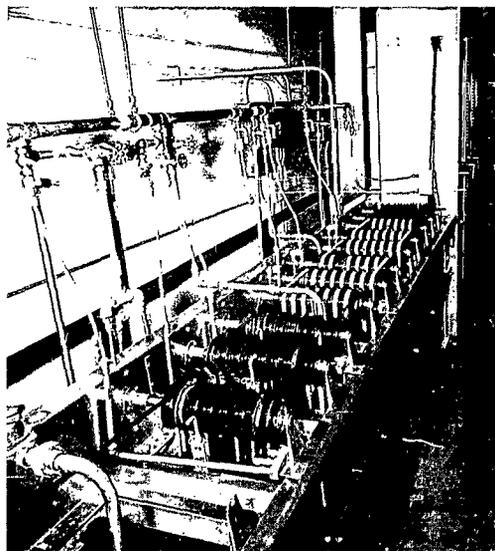
MOTION PICTURE PRINTING



EKTACOLOR PROCESSING

## PHOTOGRAPHIC LABORATORY

The Naval Class "G" Photographic Laboratory has tasks that encompass a diversified field of photographic coverage. This coverage varies from black and white and color still photography of small items, air to ground and air to air photography using BW and color high speed motion picture cameras. Support includes copying and portraiture in the laboratory studio, as well as stills, sequence stills and medium to high speed motion picture photography for all test projects. The photo department developed and utilizes long focal length tracking mounts for ground coverage of high speed, high altitude tests.



16 AND 35 MM COLOR PROCESSING

## WHIRL TOWER

The Whirl Tower was designed and built to provide an economical method for testing large numbers of parachutes. Parachutes can be tested as rapidly as one every 20 minutes. Since many new parachute designs require more than 200 tests before live jumps are initiated, this method saves considerable time and money as compared to aircraft drop tests. After the parachutes are tested from the Whirl Tower, each personnel type chute is tested by live jumpers.

The Whirl Tower is basically a tripod structure 120 feet high with a boom attached to a rotating shaft at the top of the tower structure. A cable 114 feet long is attached to the outer end of the 56 foot boom. The gondola attached to the lower end of the cable provides space to attach dummies fitted with the parachute being tested. When the boom begins to rotate, the gondola gradually increases velocity until the desired launching speed is attained, at which time

the operator releases the dummy and the parachute is automatically deployed.

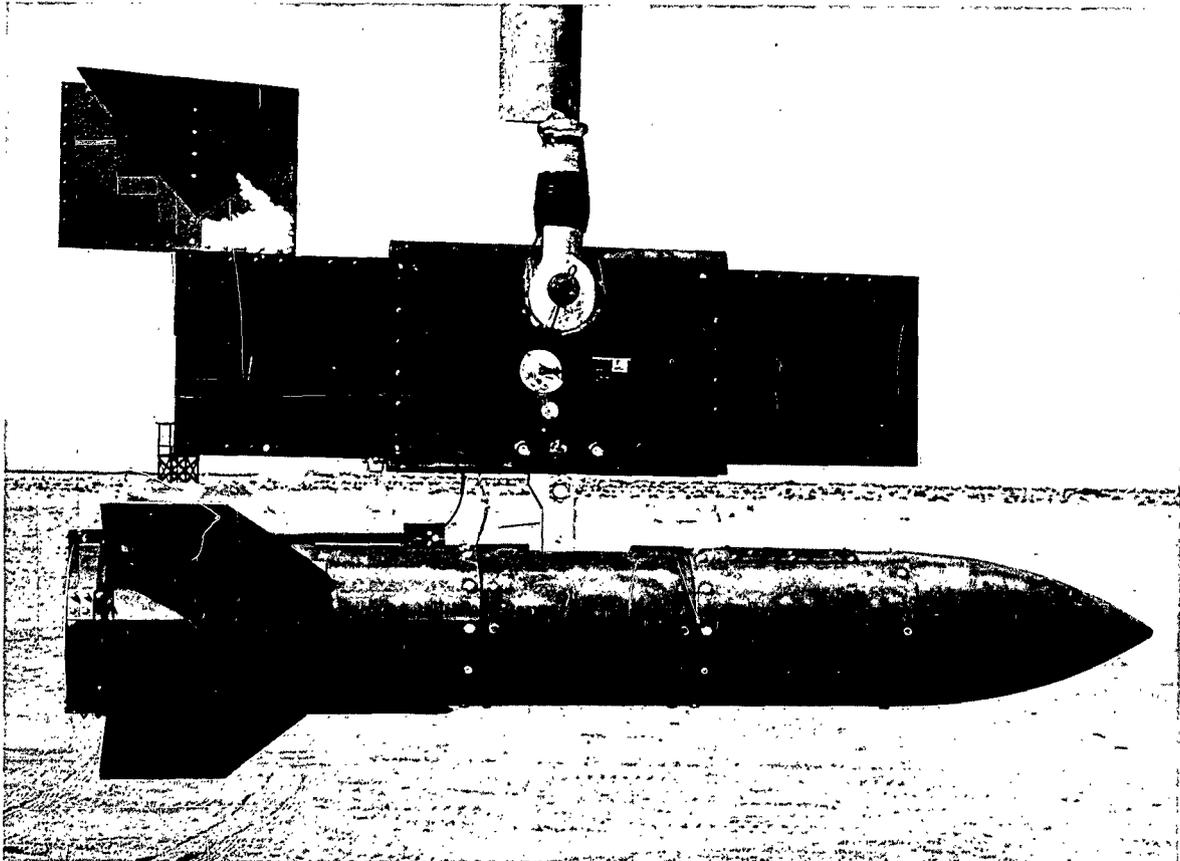
Testing velocities up to 400 knots are attained with the Whirl Tower. At this velocity all parts and equipment in the gondola are subjected to almost 100 g's or one hundred times their own weight. With this giant centrifuge, complex missile parts weighing hundreds of pounds can be subjected to high "g" forces.

A General Purpose Test Vehicle, which provides a cylindrical volume for housing test parachutes and auxiliary equipment, is available for use on the whirl tower. This vehicle eliminates the requirement for using a dummy and permits different types of parachutes to be tested with loads from 250 to 550 pounds. Large and heavy components which must be tested at high g forces can be installed in this vehicle and subjected to forces up to 100 g's.

A brochure is available describing this facility in more detail.

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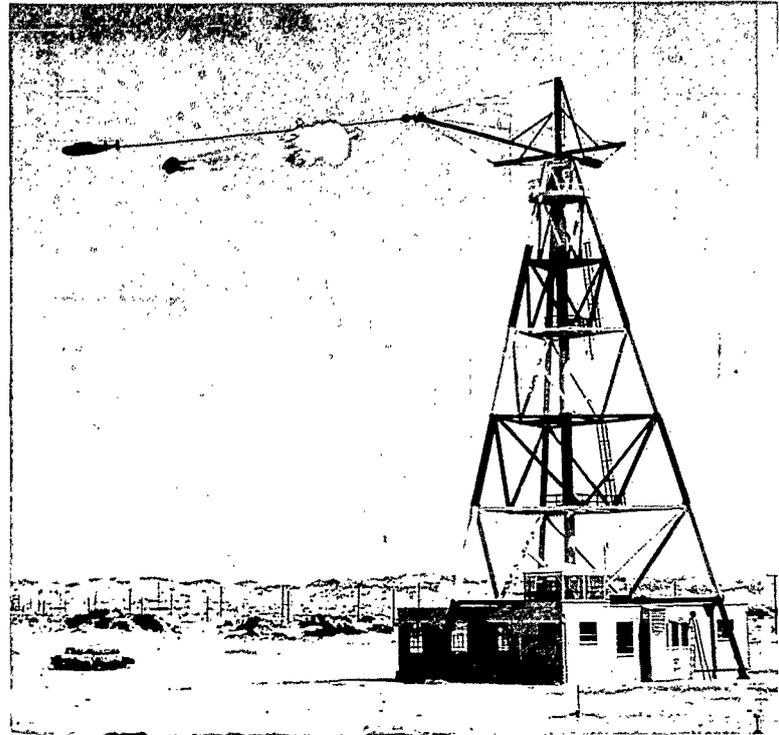
GENERAL PURPOSE TEST VEHICLE PRIOR TO DEPLOYMENT





WHIRL TOWER CONTROLS

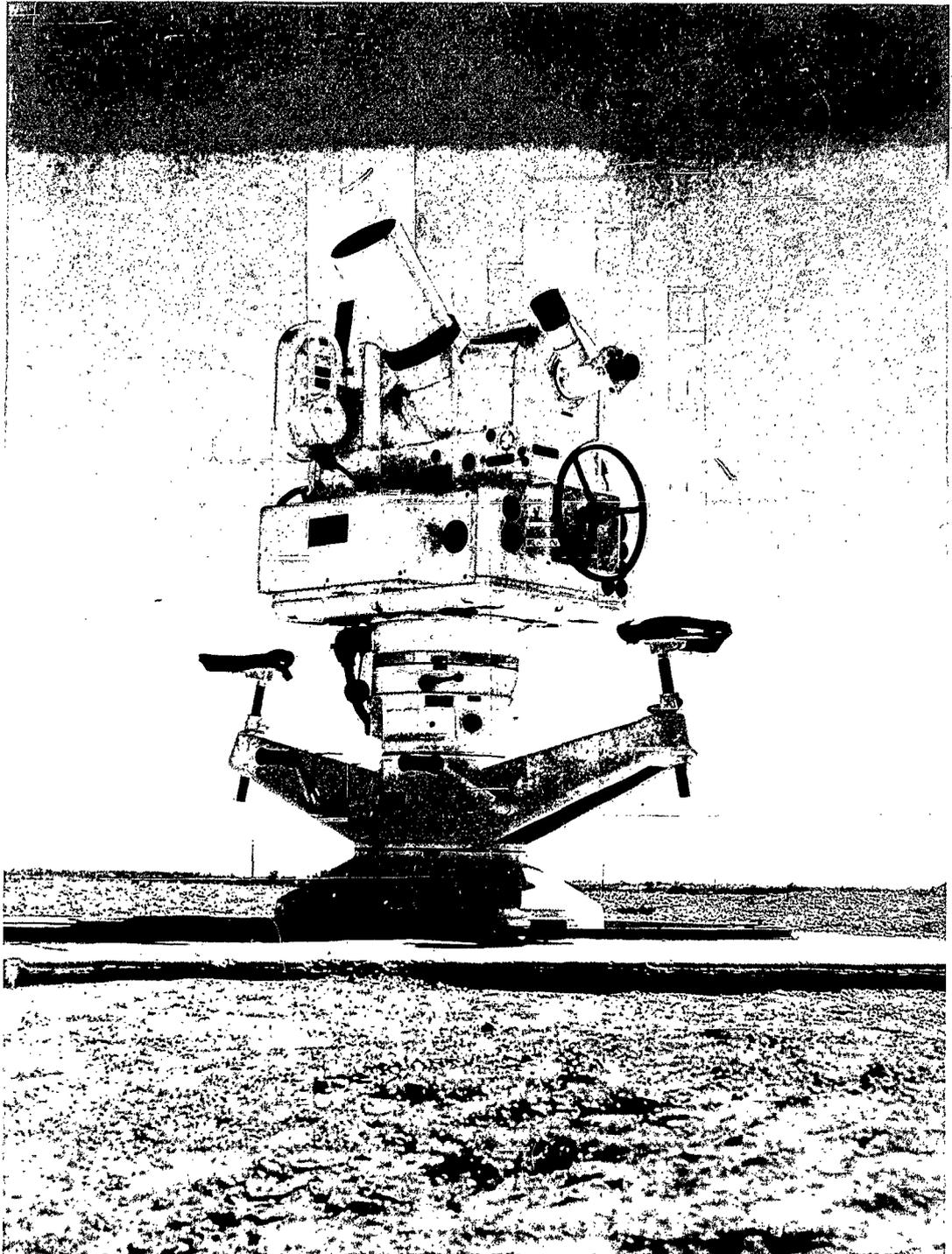
TESTING A PARACHUTE FROM THE WHIRL TOWER



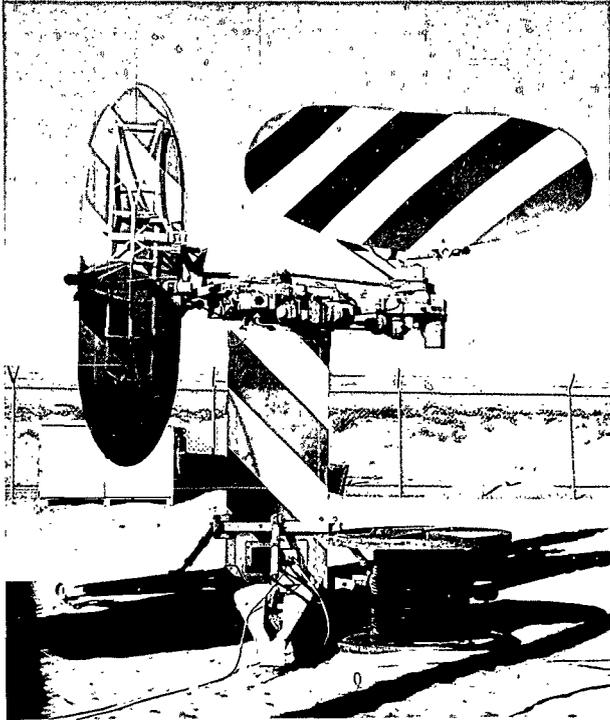
DUMMY IS RIGGED FOR TELEMETRY AND INSTALLED IN GONDOLA



16



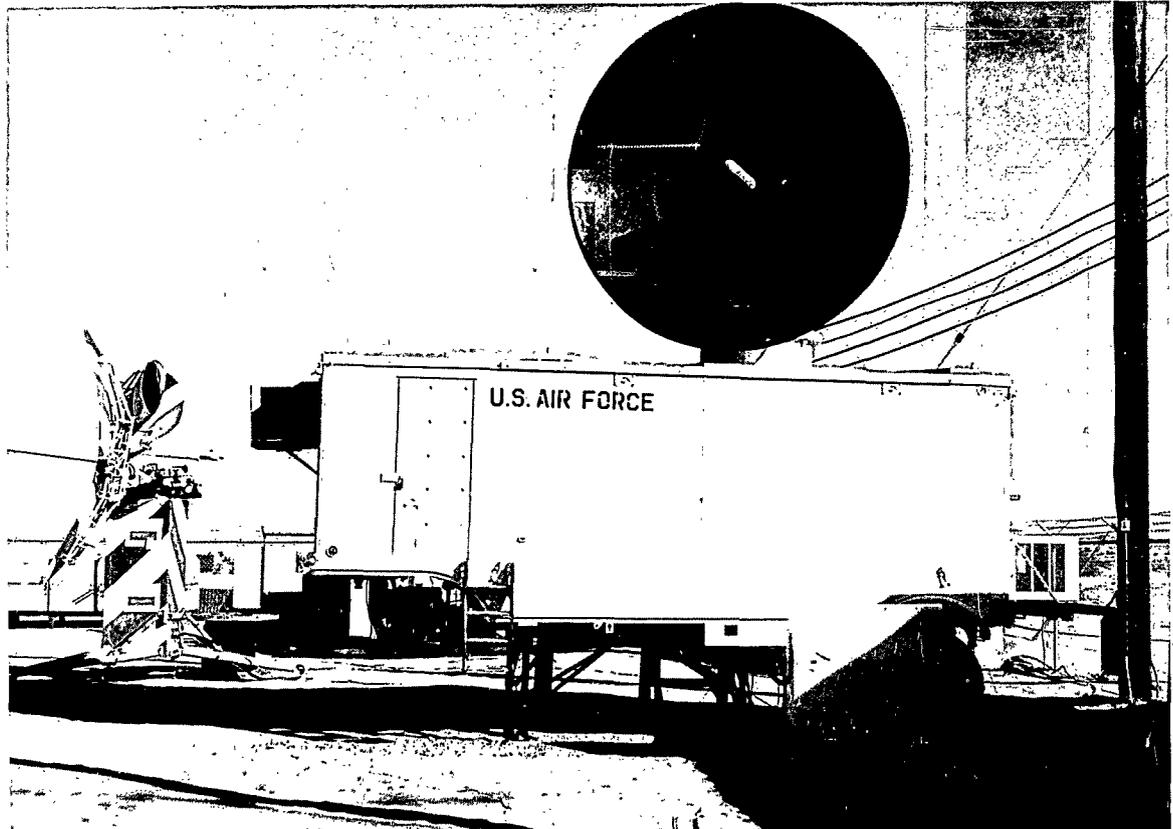
CONTRAVES CINETHEODOLITE INSTALLATION



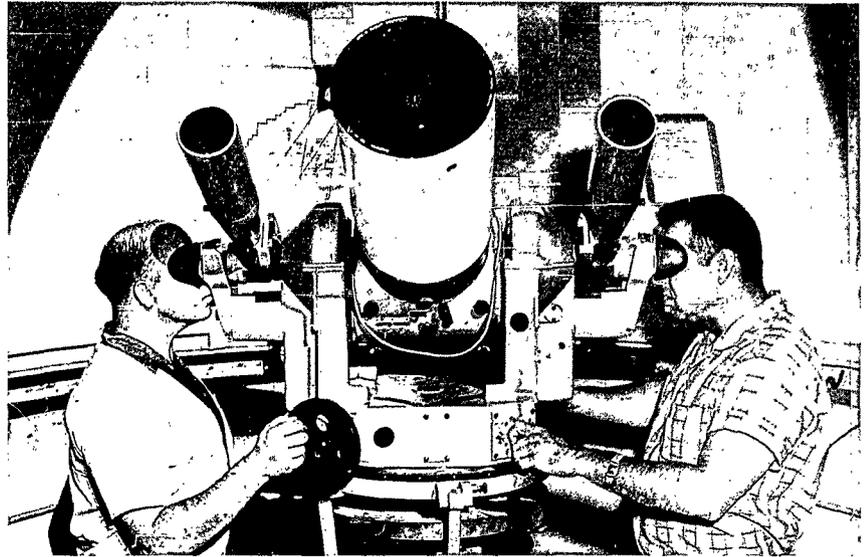
**SURVEILLANCE RADAR**

### **SPACE POSITIONING RANGE**

The El Centro Space Positioning Range consists of two drop zones. Both drop zones are radar controlled and equipped with cinetheodolites for space positioning and telescopic tracking cameras to insure complete photographic coverage of the test item from the moment of release to impact. The cinetheodolites are radio controlled from the master timing station which transmits the shutter pulse, flash pulse, time of day code and binary frame count code. The TATU land drop zone is located approximately 9 miles northwest of El Centro NAF. The San Felipe water drop zone is located in the Salton Sea about 30 miles north of NAF.



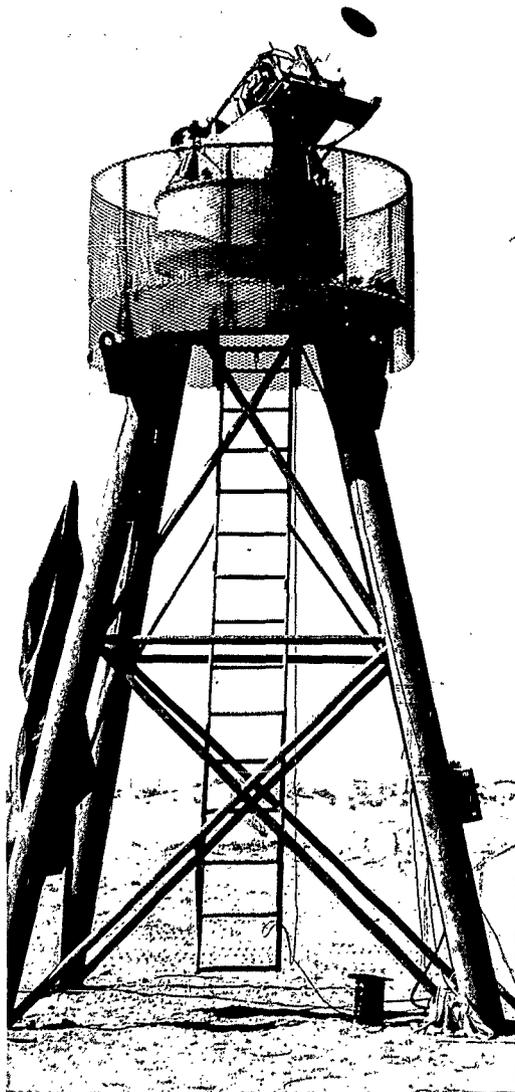
**SPACE POSITIONING RADAR**



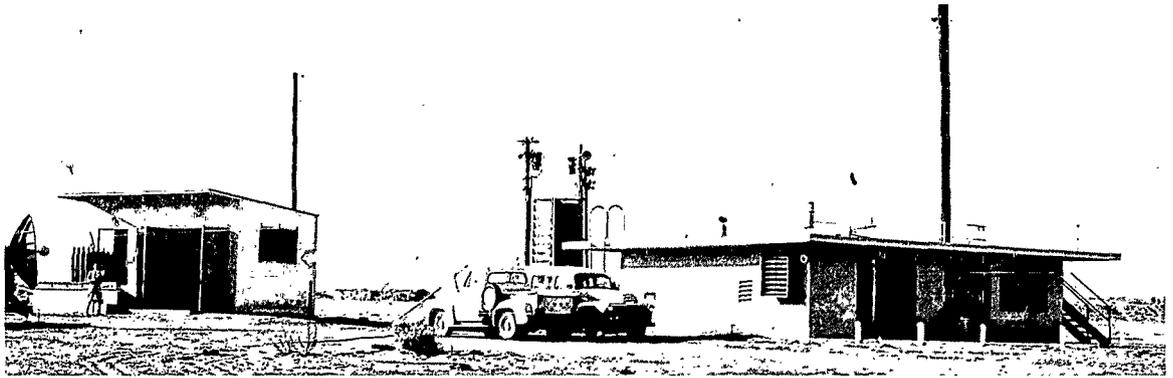
HIGH SPEED CAMERA WITH TELEPHOTO LENS

TRACKING WITH THE ASKANIA KTH 53

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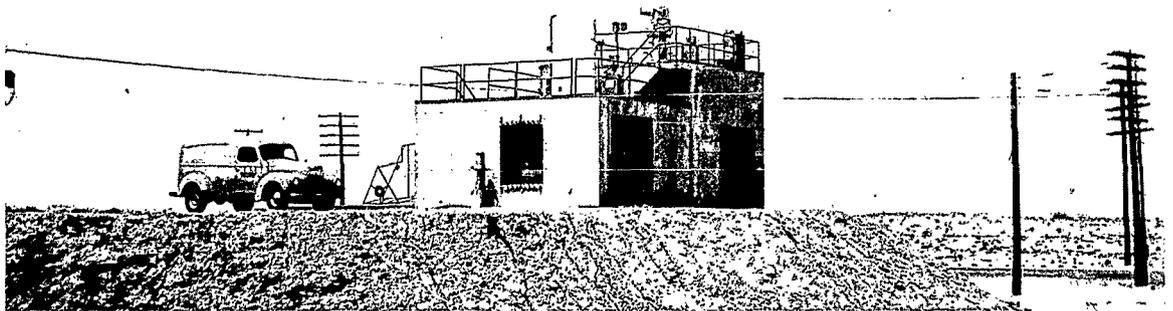


RADAR VECTORS AIRCRAFT TO RELEASE POINT



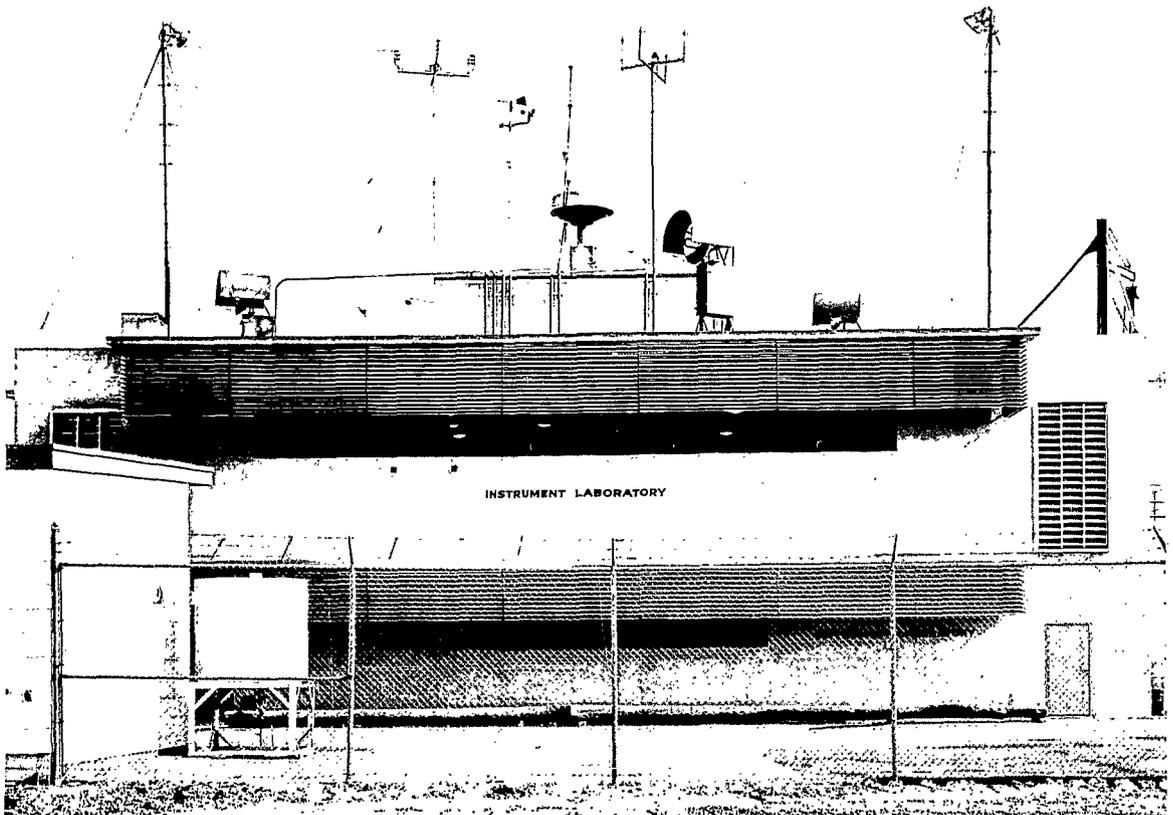
**RADAR SITE**

**TYPICAL CINETHEODOLITE STATION**



**SALTON SEA FACILITIES**

**INSTRUMENT LABORATORY**



## TESTING PERSONNEL RETREIVER



## TESTING

Personnel parachutes and related accessories are tested extensively to insure reliable and safe operation. Before a personnel parachute can be considered safe for live-jumping, it is drop-tested hundreds of times at various altitudes, speeds and suspended load conditions using dummies in place of men. After successfully completing the dummy drops the test parachute is live-jumped several hundred times by experienced test jumpers.

Besides the testing of parachutes, a test jumper is often required to test such related equipment as ejection seat systems, survival kits, exposure suits and methods of aircraft exit. The primary aircraft used for dummy tests and live jumps are the B-66, C-130, H-21, C-47, A3A. Parachutes have been successfully tested at speeds of 40 to 550 knots and at altitudes of 200 to 40,000 feet.

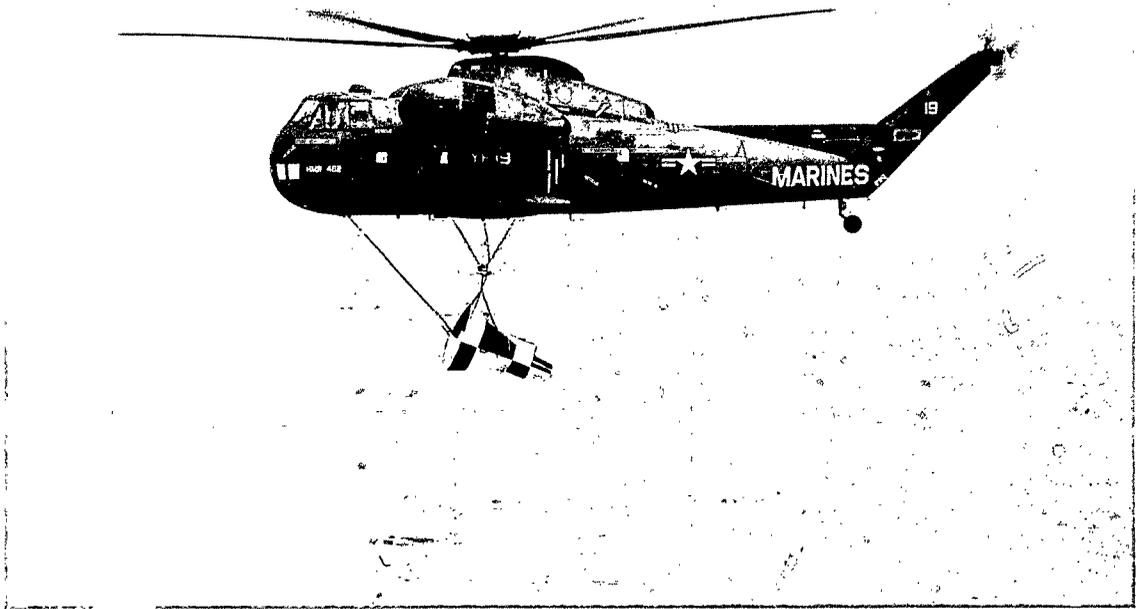
20



TESTING MODEL 'B' EJECTION SEAT

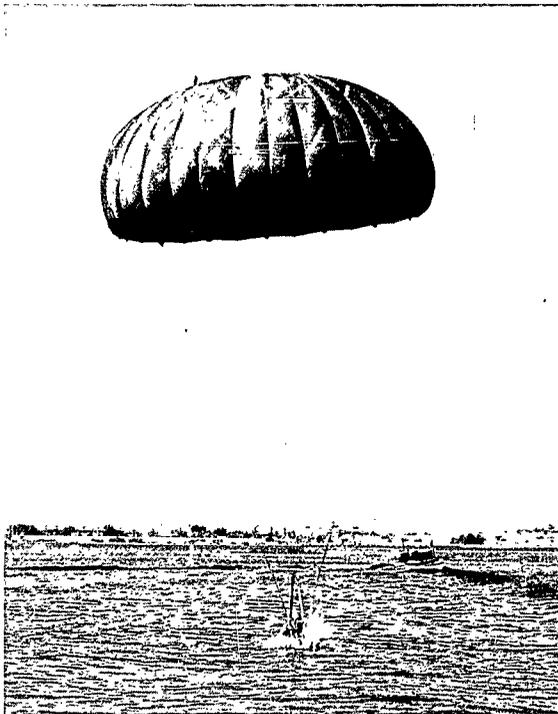


TEST JUMPERS

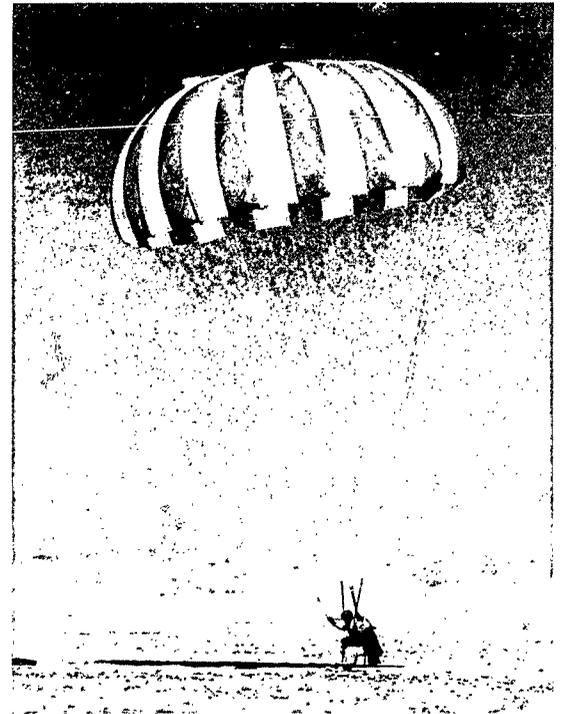


LOW SPEED, LOW ALTITUDE  
MERCURY CAPSULE TEST

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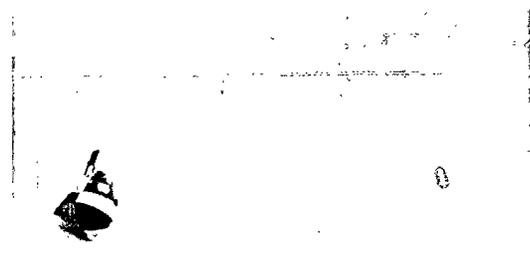
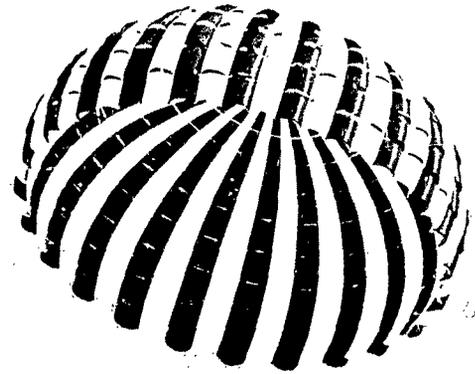


WATER ENTRY ESCAPE SYSTEM TEST



SUCCESSFUL TEST OF MULTISTAGE PARACHUTE

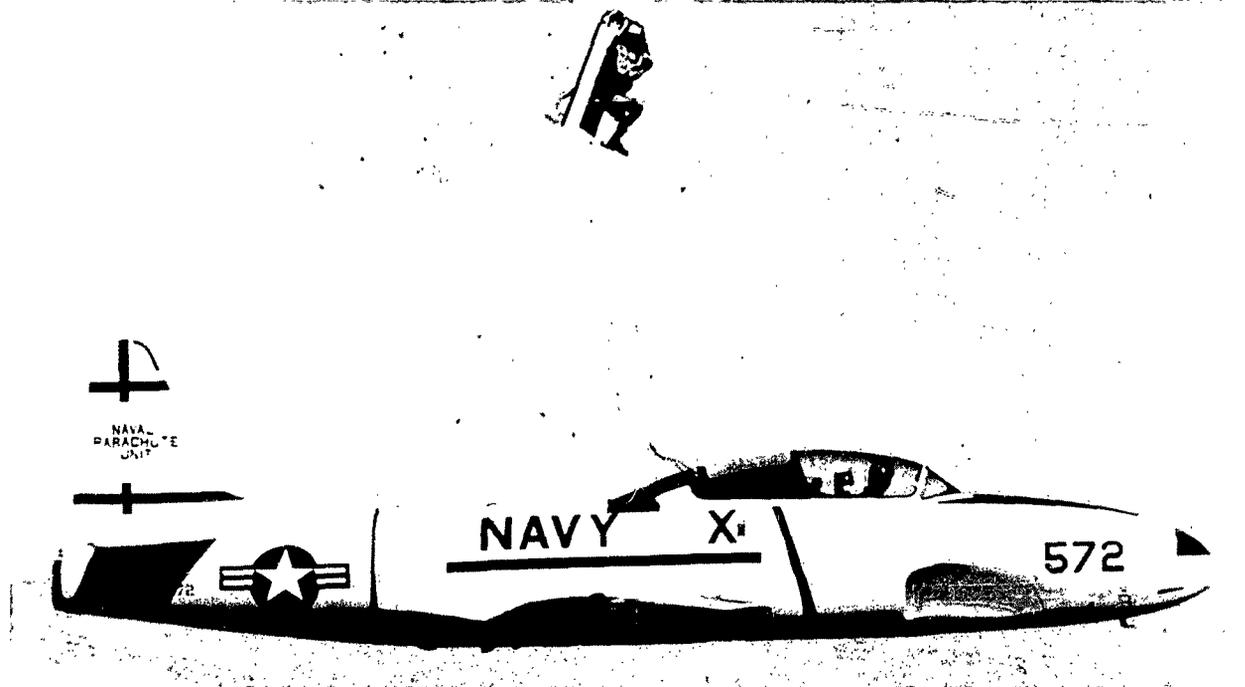
Recovery systems for many missiles, drones, escape capsules and satellites are tested to insure that these items are recovered successfully under actual conditions. Tests of deceleration chutes have been made in excess of Mach 2.0 by rocket boosted vehicles. Final descent parachutes singly or in clusters have been tested with weight ranges from 500 pounds to 12,500 pounds, airspeeds of 25 knots IAS to 550 knots IAS and altitudes ranging from 400 feet to 50,000 feet. Full scale models of missile nose cones, drones, escape capsules and satellites have been dropped from aircraft to test the complete stabilization, recovery and landing shock attenuation systems.



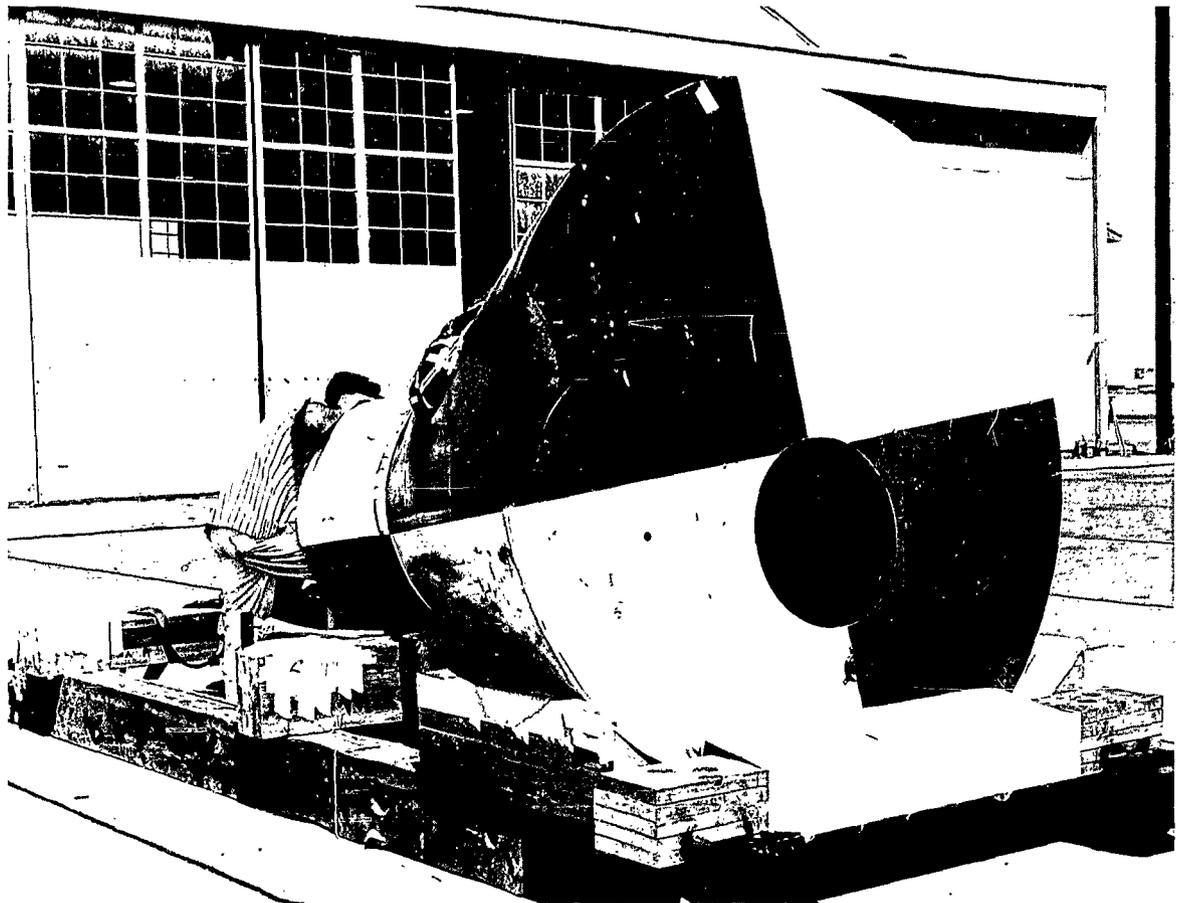
23

RECOVERY TEST OF MERCURY CAPSULE

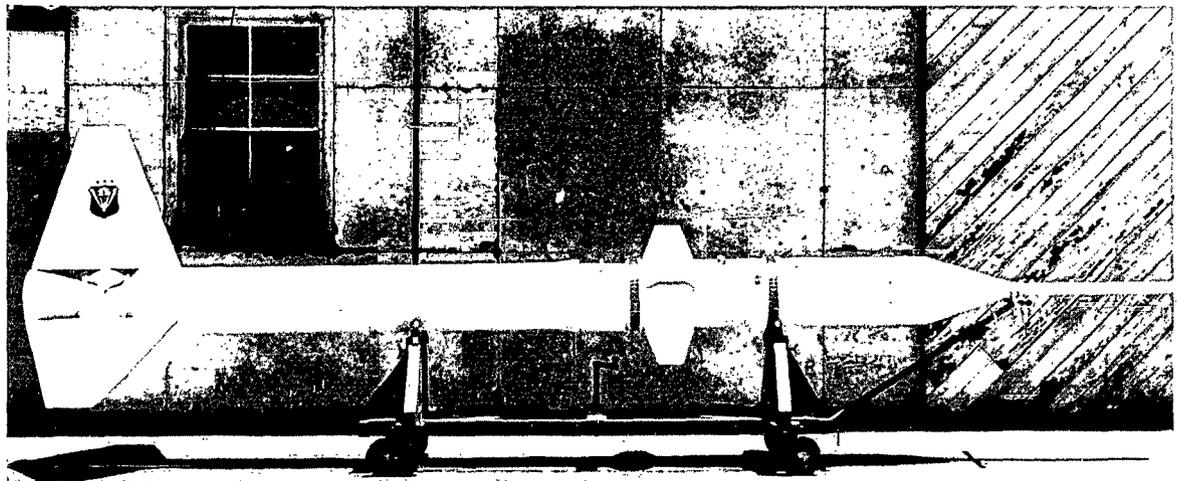
LIVE TESTING OF AN EJECTION SEAT



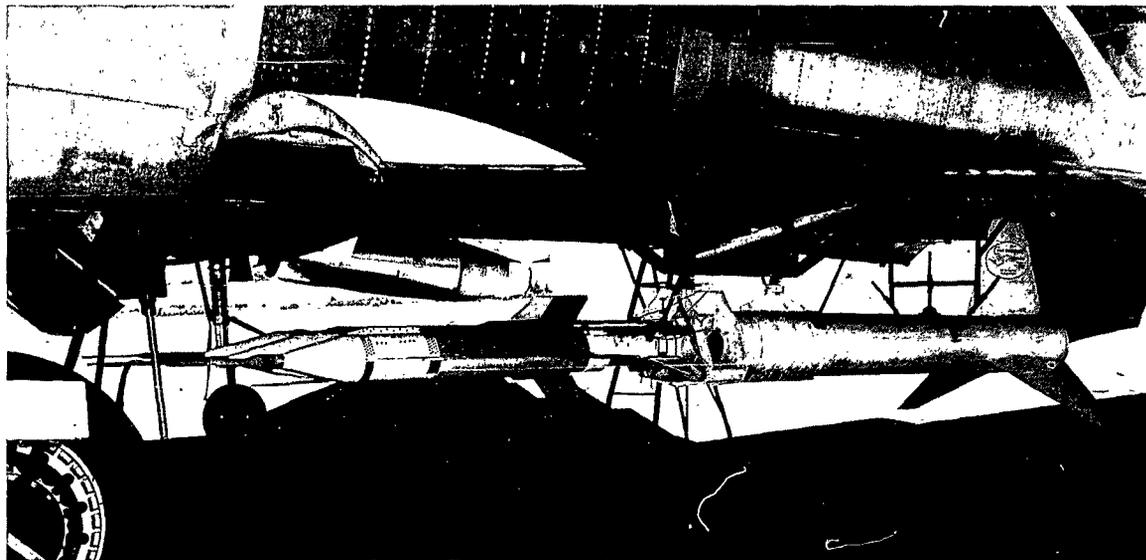
24



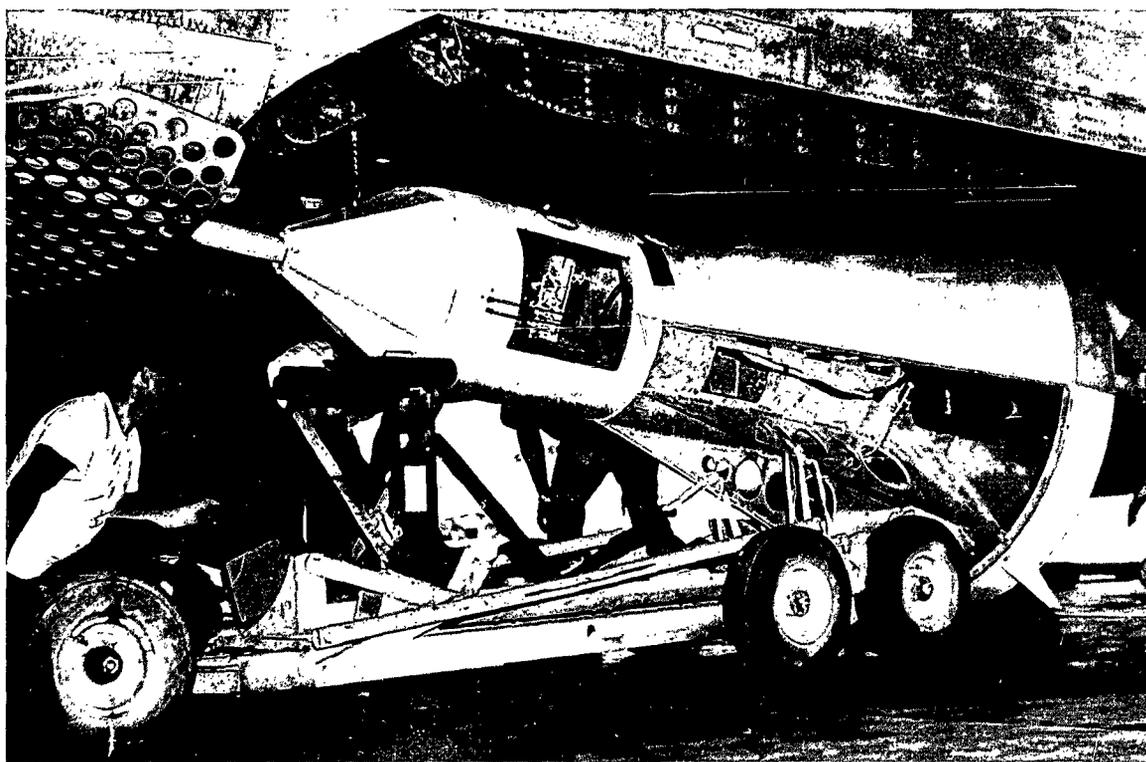
GEMINI BOILER PLATE MOCKUP BEING PREPARED FOR DROP



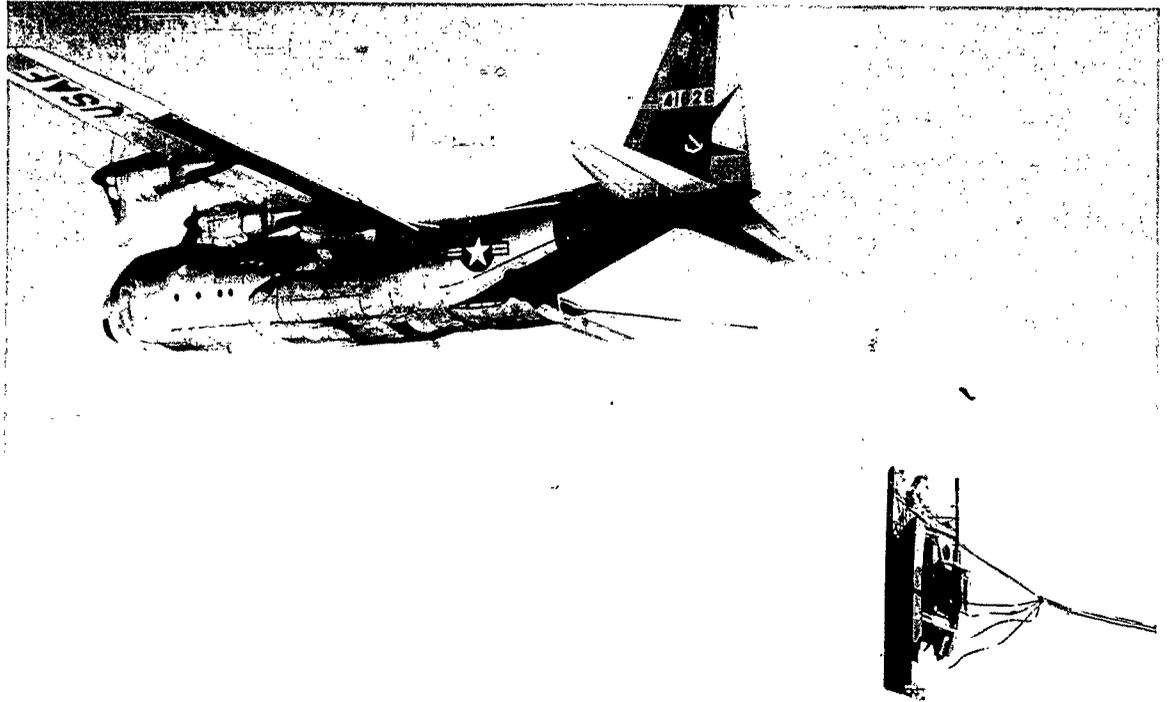
SUP ERSONIC II VEHICLE BEING DEVELOPED TO TEST HIGH SPEED PARACHUTES



CREE MISSILE IN B-47 WILL TEST HIGH MACH PARACHUTES



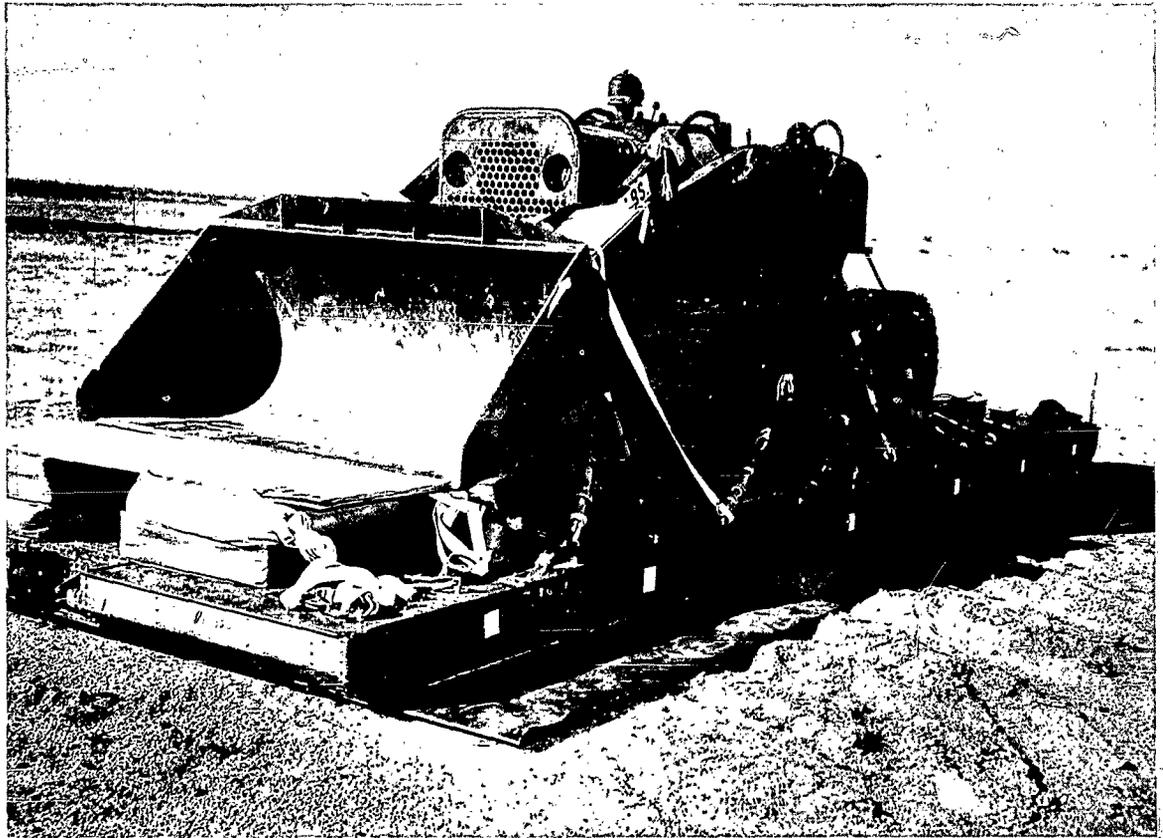
LOADING SPECIAL CAPSULE IN B-66 AIRCRAFT



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C-130 DROPS 25,000 POUNDS - AN ANTI TANK GUN AND ¼ TON TRUCK

The testing and evaluation of cargo parachutes, aircraft installation, rail guidance systems and related components is another phase of the testing performed by the Joint Parachute Test Facility. Development testing is currently in progress to increase the present standard 25,000-lb. maximum single unit load drop capability on the C-130 cargo aircraft for the support of future space, missile and Army type programs. A maximum of 41,740 pounds has been successfully extracted from a C-130 aircraft to date. Tests are presently being conducted on an Air Force and Army supported program for final evaluation of an 108-inch width restraint and release guide rail system, with two types of semi-expendable platforms. The tests will simulate dropping a new type Army vehicle with a maximum weight of 35,000 pounds.



SUCCESSFUL RECOVERY OF 16,000 POUND BUCKET LOADER

27

SUCCESSFUL RECOVERY OF 105 MM HOWITZER WITH TRUCK AND TRAILER





28

**SOME OF THE AIRCRAFT UTILIZED BY THE NAVY AND AIR FORCE FOR TESTING PURPOSES**



## AIRCRAFT PERFORMANCE

<u>Aircraft</u>	<u>Max. Drop Altitude</u> Ft.	<u>Max. Single Drop Weight</u> Lb.	<u>Min. Drop Speed</u> KIAS	<u>Maximum 5,000 Ft. Alt.</u> KIAS	<u>Drop Speed 20,000 Ft. Alt.</u> KIAS	<u>(Level) Max. Alt.</u> KIAS
C-130	40,000	35,000	105	150	150	130
F-100	45,000	3,500	190	550	460	275
F-106	DROP CAPABILITY AWAITING MODIFICATION					
B-47	45,000	20,000	160	310	310	220
B-52D	54,800	50,000	136	300	300	300
B-57	50,000	4,000	120	500	380	180
B-66	45,000	12,000	150	550	420	225
U-2	CLASSIFIED	1,000	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED
T-28						
(PHOTO)	20,000	-	70	200	145	145
T-33						
(PHOTO)	42,000	-	130	430	335	220
(DROP)	40,000	1,000	130	390	300	220
H-21	10,000	3,500	0	100	-	100
C-47H	15,000	300	90	150	-	110
A1E	30,000	2,000	100	220	180	140
A3A	45,000	12,000	150	550	420	225
TF10B	40,000	2,000	115	375	300	225
TF9J*	42,000	1,200	130	460	365	230
A4A	40,000	3,500	130	560	510	330

\*Has in-flight ejection seat test capability.



## **EL CENTRO PARACHUTE RANGE TECHNICAL DATA**

### Range Capability

Ground-launched Vehicle (Basic Guidance) - Altitude 150,000 feet - Mach 5.0  
Air-launched Boosted Vehicle - Altitude 80,000 feet - Mach 3.0

### Range Instrumentation

Radar Space Positioning Systems  
Cinetheodolites (to 30 frames per second)  
Telescopic cameras  
T/M Receiving stations (fixed and mobile)  
Radio communications (UHF, VHF, FM)  
Surveillance Radar

### Test Vehicle Instrumentation

FM/FM telemetry  
Mechanical tensiometers  
Attitude and oscillation sensors

### Photography

Ground-to-air  
Air-to-air  
Plane-to-air  
Vehicle-to-air

### Parachute Handling

Drying, repair and fabrication to 200-foot diameter

### Runway

9,500 feet, hard surface, lighted, -42' elevation

### Data Processing

Boscar N cinetheodolite film reader  
Telereadex cinetheodolite film readers and associated card punch equipment  
(punches, sorters, and listing)  
G-15 Digital Computing System  
Packard Bell 250 Computer  
Elecom 125 Digital Computer  
Oscar II  
Electronic Associates Plotter No 3300

Test Vehicles

Vehicle	Weight range		Max "G"	Max. speed	Diameter in.	Parachute compartment cu. ft.
	min. lb.	max. lb.				
<u>Weight Bomb Test Vehicles</u>						
General Purpose 500	200	1000	15	150 kt	14	None
General Purpose 1000	500	3000	10	150 kt	18.5	None
General Purpose 2000	2500	5000	8	150 kt	23	None
Light Case 4000	4000	10000	5	150 kt	35	None
<u>Cylindrical Test Vehicles</u>						
General Purpose 500	400	750	20	500 kt	14	3.8
General Purpose 1000	650	2400	20	500 kt	18.5	9.3
General Purpose 2000	1500	4000	15	500 kt	23	17.7
Light Case 4000	4000	10000	10	500 kt	35	53.3
T-10	7000	36000	7	290 kt (B-47) 570 kt (B-66)	37.5	60.0
<u>Transonic Test Vehicles</u>						
Mark 83	800	1500	25	M 1 - 1	14	2.3
Transonic III	2000	6000	10	M 1 - 0	24.5	7.0
<u>Supersonic Test Vehicles</u>						
Rocket Boosted Bomb	2250*	2350	10	M 1 - 5	22.2 x 32.4 (aft) 14.0 (forward)	
Cree Missile (3 missiles)	2390*	2350*	60	M 2 - 0	9	
Supersonic II	2200*	3200*	30	M 2 - 0	18	1.0
Supersonic III**	2000	5000	25	M 3 - 0	25	4.0

\* The weight indicated is total launch weight.

\*\* Supersonic III test vehicle is in the final design stage.