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Page 21. - Salzwerke, Tarthun, Egeln, near Magdeburg.

Para. 1 - salt mine where final assembly operations are carried out on Me 262, Ju 88 and FW 190. 14 large chambers, inter-connected by corridors of considerable length -- total operations floor space is 200,000 sq. ft.
2,400 employees
1,600 feet below surface
Average space per employee 83 sq. ft. (dense 100 sq. ft. USA)

Para. 2 - "All of the corridors and chambers were lined with pure salt and when question was asked of the manager as to whether or not any difficulties occurred, he replied in the negative, saying the forced ventilation used, coupled with moisture absorption qualities of salt, made atmospheric difficulties impossible. Workmanship appeared good, stock rooms well placed, and all in all we were impressed by the efficiency and orderliness of this particular factory which, incidentally, was not the case at several others we inspected".

Para. 3. - "One difficulty in connection with these dispersed area operations is the length of time that it takes to get people in and out. Access to these particular works was through two shafts, the smaller of which is shown in photograph. This elevator accommodated only six or eight persons at a time. The larger one would accommodate sixty. Because of the length of time, therefore, in moving people through 1600 ft. elevation, shifts had to be consistently on the move, as it would take some four to six hours to move 2400 people by this means. This factor would undoubtedly make good production very difficult and would decrease the standard of efficiency of the operations."

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Page 23 - Notes on conference with Herr Werner (a leading figure in the aircraft engine industry) Bad Nauheim.

#6 - "He emphasized the attendant difficulties of dispersed operations, venturing the opinion that 75% efficiency held in comparison with undispersed manufacturing. He claimed considerable hardship in working in quarries and salt mines and mentioned that temperatures of 100C were encountered, so that it was necessary to work short shifts in order to maintain even the above relatively low efficiency."

#7. "He indicated that flow time in motor manufacture was eight weeks, consisting of 4 weeks from raw material to finished engine and an additional 4 weeks from finished engine to aircraft delivery."

Page 24, #10. "He stated that bombing of ball bearing plants did not set back engine production at all and that very few plain bearing substitutions were made in engine designs as a result of ball bearing plants bombed".

NOTES ON NATURAL COOLER STORAGE, ATCHISON, KANSAS

File

LOCATION

Approximately two miles east of Atchison, Kansas.

SITE

Approximately 22 acres of land.

TYPE OF FACILITY

Gallery-type limestone quarry.

TEMPERATURE

An average of 54°F. is maintained the year around.

SIZE OF CAVE

Outside perimeter 6,000 lin. ft.
Height of ceiling from floor level 12 ft.
Gross Floor area 621,000 sq. ft.
Net floor area 501,000 sq. ft. (columns deducted)
Net storage space 400,000 sq. ft. (aisles deducted)

CAPACITY

3,000 railroad cars.

DISTANCE

Portal to extreme end of cave 1,600 ft. (by aisles).
Portal to loading dock 300 ft.

LOADING DOCK

500 ft. in length x 18 ft. wide.

LEASE DATA

Entered into and accepted by R. W. Maycock, Vice President of CCC, 5/3/45.
Rent - $20,000 per year payable semi-annually on 1/10 and 7/10.
Left of Lease - 5 years beginning 7/10/44 - ending 7/9/49.
Beginning of operations - Sept. 1, 1945.
Renewal Option - on a yearly period but not to extend beyond 7/9/55 unless agreed upon in writing by both parties to the lease.

Assignment or sub-leasing - lease may be assigned or transferred by CCC to any other agency of the Government but to no one else except with written permission of the Quarry Co.

STORAGE DATA

Commodities in storage for 1946 include dried beans and peas, refined lard, concentrated juices, whole dried eggs, salted meat, cured horse meat, canned salmon, potatoes and alfalfa meal. Of the above, 35% were stored in connection with CCC's General Commodity Programs, 38% for Price Support Programs, 19% for General Supply Programs and 8% in connection with alfalfa meal contracts.

33

SECRET

SPECIAL REPORT

Hawaiian Underground Air Depot

1. The Hawaiian Underground Air Depot Building was constructed for the Air Corps during 1942 and 1943. The development of the need for the building and the variations of intent for its specific use are best described in a publication of the U.S. Army Forces, Middle Pacific, entitled: "History of Engineer Section," Volume I, page 492. The pertinent excerpt concerning this project is quoted here, "Hawaiian Air Depot Underground Facilities. Early in 1941 preliminary studies and estimates for a bombproof underground airplane repair shop were made in the Office of the District Engineer in coordination with representatives of the Hawaiian Air Depot. Based on these studies a request by the Commanding General Hawaiian Dept., dated 10 September 1941, was forwarded to the Adjutant General, Washington D. C., for an allotment of funds to be used in the construction of such a repair shop at Wheeler Field. This request was subsequently disapproved by the Adjutant General and the construction of a splinterproof structure recommended. A cut and cover bombproof structure was considered in the preliminary studies and consisted of a large assembly and disassembly shop surrounded by smaller repair shops and storage rooms. The main shop area was laid out to provide space for two B-17 planes without wings and one B-17 with wings and an overhead bridge crane was provided to serve this entire shop. Access to the structures was provided by a ramp large enough to accommodate a B-17 and laid out on a curve thru a 90 degree bend to provide protection for the entrance to the shop.

"On 9 December 1941 Job Order 104-W was written for the Hawaiian Constructors to authorize construction of a bombproof repair shop at a site selected by Lieutenant General Short. The site selected was a relatively level pineapple field approximately 1200 feet from the side of Waiele Gulch and 2400 feet from the end of Waiele Gulch Air Strip. The preparation of plans for the structure was begun, based on the requirements set up for the preliminary studies with some rearrangement of the smaller shops and storage areas to simplify construction and to provide for the increased size of the planes to be accommodated. When plans were started, a shortage of reinforcing steel existed and the use of street car rails for reinforcing in the heavy walls and roof of the structure was incorporated into this design. Immediately after floor plans and the overall height of the structure had been determined, an excavation plan was prepared and excavation operations were started.

"After a portion of the plans for the structure had been prepared on the basis described above and a large part of the excavation had been accomplished, a restudy of the problem was made by the Air Force and report dated 28 February 1942 was written in which an entirely different layout was proposed. The scheme of construction proposed in the report by the Air Force was approved by the Commanding General, Hawaiian Department, with the exception of the proposed housing, and on 14 April 1942 a directive to proceed with construction was issued to the Department Engineer by the Commanding General, Hawaiian Department.

"On Approval of the revised project the Design Division immediately proceeded with the preparation of plans for the construction. The design was closely coordinated with the Hawaiian Air Depot thru Colonel Tibbets and Mr. Head, Warrant Officer of that agency. The project consisted of the following:

SECRET

Incl #1

a. Bombproof Cut and Cover Shop. This structure was to protect the vital repair equipment and personnel and designed to occupy the site excavated for the previously approved bombproof repair shop. The main structure has three floors of 67,000 sq. ft. floor area each level, for shop space, and in an adjoining two story wing, 13,000 sq. ft. floor area each for standby power and air conditioning equipment. Bombproofing was provided by reinforced concrete walls 3'-9" thick and roof 12'-0" thick. The roof slab was extended 15'-0" beyond the outside face of the walls to give added wall protection. Access to the structure was provided by a cut and cover structure, 20' wide and 1176' long, connecting the first floor of the bombproof with Waiele Gulch. A second entrance connecting the structure to Waiele Runway, 20' wide tunnel 3700' long, with 15,500 sq. ft. added floor area for additional working space and storage area in side drifts was proposed but not constructed. Construction of tunnels for shops and storage was approved by the Commanding General but approval of the second entrance was not obtained. To make possible the transportation of bulky plane parts to the second and third floors of the structure a hydraulic elevator with a 20' x 34' platform and 10 tons capacity was provided. Standby electric power, (4200 KW) for the entire project was provided in the bombproof structure and a 300,000 gal. underground reinforced concrete diesel fuel storage tank was provided to supply the engine generators. The entire shop area was air conditioned, requiring 1500 tons of refrigeration. A five foot layer of earth was provided over the structure which is a sufficient depth to allow the cultivation of pineapples, and thus camouflage the structure. The portal of the entrance structure was located on a steep cliff in Waiele Gulch in order that it would attract as little attention as possible from the air and the only other openings to the structure, air intake and exhaust, were constructed to resemble warehouses served by a railroad spur. The spur was specified for the dual purpose of camouflage and service to the fuel storage tank.

b. Shops of Wood Frame Construction. These shops were provided to house less vital repair facilities and were located in Waiele Gulch near the entrance of the underground shop so that the repair work could be coordinated throughout all of the shop facilities. Ten 30' x 100' wood frame shops were included and were located in benches cut into the sides of the gulch to provide a maximum of protection from air attack.

c. Repair Bunkers. On the basis that provision for bombproof protection of assembly and disassembly operations of large bombers was not worth the expenditure of money and materials required, paved bunkers for these operations were provided adjacent to Waiele Gulch runway. Three bunkers 100' x 200' with paved working areas were provided for this purpose and also the use of other bunkers previously constructed was contemplated. Pockets were laid out in the cliffs at the side of the runway with earth side slopes as steep as practical to provide maximum protection from the strafing of enemy aircraft. The bunkers were excavated in conjunction with the construction of the air field.

d. Water Supply System. The two systems in the project (1) potable water and (2) cooling water and fire protection, included one 100,000 gal. concrete reservoir, one 200,000 gal. concrete storage tank, a pumping plant and 5000' of 6" and 20,000' of 10" transite pipe.

e. Sewage Disposal System. A 3000 man capacity sewage disposal plant was included in the project.

f. Access Roads. A road system was laid out to provide access to the underground structure and the shops of frame construction, in all, approximately 3700' of roads were required.

"Soon after preliminary layouts for the revised bombproof structure had been approved, construction was again given the highest priority. Upon the completion of a preliminary design for a portion of the structure an excavation drawing was prepared on which details of typical wall and column footings were added. With three drawings, which included the excavation drawing and floor plans, out of a final set of approximately 180 drawings, construction operations were started. Considerable difficulty was encountered throughout the preparation of plans because construction was in progress on the first floor of the structure before designs had been completed for the upper floor, standby power plant, power distribution, ventilation, or plumbing and water supply. As each required revision to the preliminary layout was found it was necessary to hurriedly revise previously issued plans in order not to delay construction. At one stage in construction a portion of the roof slab at one end of the structure had been placed before information necessary in the design of foundations in the power room had been received from the engine manufacturers. The depth of concrete required to provide bombproof protection was determined by methods and charts presented in the English publication "Civil Protection" by Felix J. Samuely and Conrad W. Hamann, published in 1939 by the Architectural Press. The preliminary designs indicated a 10' thick concrete roof slab, and the use of concrete developing 3000 lbs. per sq. in. strength was contemplated. This design would provide protection against a 500 lb. armor piercing bomb or a 1500 general purpose bomb. In September 1942, it was decided by the Commanding General that the structure should be designed to resist a 2000 lb. armor piercing bomb. However, at that time the concrete in a large number of column footings had already been placed and column forms and reinforcing had been fabricated. It was determined by this office that a 12' thick roof slab was the maximum that could be used and still salvage the construction already completed. The bearing capacity of the soil in addition to the load carrying capacity of the footings was the factor that limited the addition of weight in the roof slab. By the use of a 12' roof thickness and 5200 lb. per sq. in. concrete, it was found that defense against a 1000 lb. armor piercing bomb had been provided, and this design was approved on 2 October 1942. To obtain concrete that will develop 5200 lb. strength, it is necessary to add large amounts of cement to the mix, which in turn causes the generation of a large amount of heat in the setting up of the concrete. To prevent the forming of an excessive number of contraction cracks in the roof, it was necessary to place the slab in 2' lifts and to develop bond between the layers, sand blasting of the top of each successive layer was required.

"The necessity for a 1176' long cut and cover entrance structure was due to the location of the bombproof shop on the site selected for an entirely different type structure. A large amount of money could have been saved if a new site had been selected nearer Waiele Gulch to shorten the entrance and the original excavation abandoned. Probably no delay in construction would have resulted from this procedure, because with a reasonably complete set of plans available prior to the first concrete placing, construction operations could have been better organized and greater production obtained.

"Air conditioning to provide humidity control for several instrument repair shops in the underground structure was requested by the Air Corps. The remainder of the structure required only adequate ventilation. However, in making designs for the forced draft ventilation system it was found that such large volumes of air were required that it would be necessary to increase the depth of the structure and also the floor area to obtain proper distribution of the fresh air. In addition it would be practically impossible to prevent an increase in relative humidity in the structure, and with high humidities in the outside air, sizeable increase would result in poor working conditions for the personnel of the shop. Consequently, air conditioning and humidity control was specified for the entire shop. The air conditioning system is of 1500 tons capacity, and it employs 3-500 HP centrifugal compressors using Freon 11 for refrigerant. Chilled water and hot water are circulated thru 53 air conditioning units which accomplish the necessary cooling and dehumidification. This is the largest installation of its kind on the Hawaiian Islands. Trouble was experienced with sludge forming in the evaporative condensers which was overcome by chemically treating and filtering the water. Bad surface dust conditions make the air cleaning a problem, however, additional filter capacity is now on order to better clean the air. The entrance structure provided another ventilation problem. The use of gasoline powered vehicles in this portion of the structure was contemplated, and to prevent the accumulation of noxious gases it was necessary to provide a forced draft ventilation system with air supply and exhaust ports throughout the length of the structure.

"The problems involved in designs of the standby power plant, water supply and sewage disposal systems, wood frame shop building, and road construction have been covered in other portions of the history.

"All statements not specifically documented in the above Section (A-2) are based on information obtained from Francis J. Sauer of the Design Division, Oahu Engineer Service, USAFMIDPAC, Fort Armstrong, Oahu, T. H."

2. Other items of description requested in the basis correspondence directing this report will be covered herein with letter references corresponding to letter items of basic letter, paragraph 2.

a. The size of the structure and the usable area are described in the excerpt above.

(1) The geological formation of the site of the building is lateritic. The soil structure is produced by disintegration in place of the original lava rock, to form a reddish soil which readily supports agriculture. Within the land mass may be found isolated boulders of varying size which are said to be remnants in place of the hardest centers of the original lava, the softer cindery portions having been completely disintegrated. In the lower portions of the excavation for the building, certain areas are covered with solid work, whereas, certain other areas are in variation stages of disintegration approaching the upper lateritic soil.

(2) As noted in descriptive text of excerpt there was but one entrance to the structure. Emergency escape channels were provided by the outlet & intake air tunnels. The second entrance was provided for in the planning, but the tunnel was not built. The method of entrance as mentioned above was by 2-lane road through a tunnel 1176' long leading from the adjacent gulch.

(3) No camouflage was attempted during construction. After completion of the structure the entire area was replanted with pineapple as it had been prior to excavation. The tunnel entrance was not camouflaged. No cover as placed over the entrance to the tunnel. The road leads directly to the entrance. However, at this stage of completion the War had moved into the far Western Pacific and danger of attack was extremely remote. The intake and outlet air structures were camouflaged by the construction of terminal structures resembling warehouses, serviced by a rail line.

b. A portion of the supporting operations were placed underground within the same structure.

(1) Transportation facilities, consisting of a 2-lane paved road, were brought up to the structure and into it by tunnel as indicated above. A platform elevator was provided within the building for transportation of heavy units from the lowest floor, or road level, to the other two floors.

(2) Normal power was supplied by the HECo by pole lines to the ventilation shaft and underground through that. A standby power plant, diesel powered, for the entire required capacity of the underground depot was provided. This had a capacity of 4200 K.W. These were later removed and sent to Saipan for use there. The present standby of 300 K.W. provides only for emergency lighing for removal of personnel.

(3) The water supply was obtained from the adjacent post with a separate tank storage provided a short distance from the structure. The water supply was not protected except that the lines were underground and thus hidden from view.

(4) Personnel housing was not provided underground.

c. The air conditioning system provided is a 1500 ton capacity zone system using Freon eleven as primary refrigerant with water as the distributing medium. Controls are actuated by compressed air. The system provides eight changes of air per hour in a space of 3,000,000 cubic feet introducing approximately 80,000 cubic feet per minute of fresh air. Air for working space is approximately 400,000 cubic feet per minute, 20% fresh, 80% recirculated. All of this air is filtered through viscous type, manually cleanable filters. Three centrifugal compressors, chiller, evaporative cooler balanced circuits of 500 tons each compose the principal parts of the cooling plant. Each of three evaporative condenser requires 147,000 cubic feet per minute of air at full load, approximately 440,000 cubic feet per minute total. Because the structure has never had the full equipment or the manpower allotment for which it was originally designed, one third of installed capacity has been sufficient to maintain temperatures of 76° F continuously in the structure. A determination of overall plant efficiency has never been made because there has never been available more than 30% of design load. The air intake and the air exhaust were covered by warehouse structures matching nearby warehouses to act as camouflage. Much trouble has arisen from red dust getting into the ventilation system. This dust originates in the many square miles of surrounding pineapple fields on the side from which the trade wind blows. Automatic self-cleaning filers

were requisitioned which were to be installed at the air intake in the pseudo warehouse covering it. Cancellation of above requisition occurred on 27 Aug 45 and no attempt has been made to reinstate it. The cooling of the power room and its engines before they were removed for use on Saipan, required an additional 340,000 cubic feet per minute of air, therefore the above filters were ordered so as to clean 1,000,000 cubic feet per minute of air with 97% efficiency. Considerable difficulty was experienced with water for evaporative condensers having a great deal of sludge forming impurities in it. It was found that a connection not shown on plans had been made which diverted water from a nearby irrigation ditch into this part of the system. When connections were corrected to agree with plans, to use water from the Schofield system no further difficulty was experienced. Scale formation in evaporative condensers is characteristic throughout the Hawaiian Islands - water treatment is necessary.

d. The entire underground plant was constructed in a new excavation started for an underground hangar which evolved into the underground shop structure. The tunnel entrance to the building opens into an adjacent gulch.

e. Construction methods used were those normally used for sub-surface dry construction.

(1) The batching plant was located near the structure and transit mixer trucks were used for the mixing operation. They were enable to load at grade into concrete buckets and hoppers for crane or buggy placing. The excavation and ventilation for entrance tunnel were used as temporary access roads. The outside walls were constructed in one-story lifts and were brought up concurrently with the interior column and floor construction. The required 12' thick reinforced buster course and roof slab of 5200 lb. concrete required rather high cement contents for mass concrete, approximately seven sacks per cubic yard. To prevent excessive accumulation of heat of hydration, it was necessary to place the concrete in 2' lifts. The surface of each lift was then sand-blasted, or water jetted at an early age, to provide good bond characteristics. Resistance thermometers and strain gages were used to follow closely heat and strain phenomena in the structure during construction.

(2) The total cost p.s. ft. reflected in the cost accounting records for this structure was $27.20 p.s. ft. of floor area. Included in the cost but not in the floor area are the ventilation and entrance tunnels. The estimated cost to buil such a depot at this time is approximately $40 per square foot. The estimated cost to build an air depot of this size above ground without splinterproofing and without burster roof slab would be approximately $18 per square foot.

f. The estimated time of completion of this project was 1½ years using an average of 200 men per shift, three 8-hour shift per day, or approximately 317,000 man days. The time required to construct a similar installation without splinterproofing and burster course above grade would have been approximately one year, using an average of 200 men per shift, three 8-hour shift per day, or approximately 212,000 man days.

g. The need for an underground air depot appeared to diminish soon after completion of this structure, consequently, only a portion of the shop equipment was moved into this structure. It has never been used, therefore, as an air depot shop. It now houses the 30th Engineer Topo Battalion's activities.

h. There are no noticeable unusual effects on the people working therein. No lost of efficiency or speed of operations has been reported, and no known psychoses have developed.

i. Because of diminishing need for the plant as a location for an air depot, and because of the reduced liability of the Hawaiian Islands to attack, the standby power units mentioned above were removed from the structure and transported to Saipan to provide power there.

9	Radio Tunnel	Mt Kaala Oahu	Tunnel - concrete floor and reinforced gunite lining	1330	10'	18'5"	7'	3'6"	6600 -	110/220					
10	Pump House	Waiawa Gulch Oahu	Cut and cover - concrete floor, walls and roof	780	9'	20'	6'6"	4'6"	11,000	110/220	no	yes	yes		x
11	Radar Tunnel	Koko Crater Oahu	Tunnel - concrete floor gunite lining	840	10'	14'	6'6"	4'6"	4160	110/220	yes	no	no		x
12	Repair Depot	Wheeler Fld Oahu	Cut and cover - concrete - 3 stories deep	236,800	12'	250'	15'	2'	4160	110/220	yes	yes	yes		x
13	Storage Tunnels	Wheeler Fld Oahu	31 tunnels - concrete floors and lining	77,400	12'	10'	6'6"	4'6"	6900	110/220	no	no	no	x	x
14	Telephone Exch	Gen Lyman Fld Hawaii	Cut and cover - concrete floors, walls and roof	1300	18'6"	25'	6'	4'	440	110/220	yes	yes	yes		x
15	Radar Tunnel	Kokee, Kauai	Tunnel - concrete floor, gunite lining	840	10'	14'	6'6"	4'6"	2300	110/220	yes	no	no		x
16	Telephone Exch.	Barking Sands, Kauai	Cut & cover - concrete floor, walls & roof	784	8'	28'	6'	4'	440	110/220	yes	yes	yes		x
17	Storage Tunnels	Barking Sands Fld Kauai	Tunnels - concrete floors gunite lining. 19 tunnels total as follows: 6	7200 (1200 ea)	12'	15'	9'	9'	2300	110/220	no	no	no		x
			4	3300 (825 ea)	12'	15'	6'6"	4'6"	2300	110/220	no	no	no	x	

aala Oahu	Tunnel - concrete floor and reinforced gunite lining	1330	10'	13'5"	7'	3'6"	6600	110/220	yes	yes	yes	x		Rock	Existing tunnel presently being enlarged. W be used as a VHF Stat Tunnel to have a heat unit. Estimated comp date - 1 June 1948
wa Gulch u	Cut and cover - concrete floor, walls and roof	780	9'	20'	6'6"	4'6"	11,000	110/220	no	yes	yes		x	Dirt	Booster pump house, on War Reserve AvGas pipeline. Used only occasionally.
Crater Oahu	Tunnel - concrete floor gunite lining	840	10'	14'	6'6"	4'6"	4160	110/220	yes	no	no		x	Rock	Power & transmitter room
ler Fld Oahu	Cut and cover - concrete - 3 stories deep	236,800	12'	250'	15'	28'	4160	110/220	yes	yes	yes		x	Dirt	1st floor is used by USARPAC, 2d floorby 30th Engr Topo Bn, & 3d floor by PacAirCom Air Mechanic School and storage. Structure has a reinforced concrete roof slab 12' thick.
ler Fld Oahu	31 tunnels - concrete floors and lining	77,400	12'	10'	6'6"	4'6"	6000	110/220	no	no	no	x	x	Rock	Ammo Storage
Lyman Fld ii	Cut and cover - concrete floors, walls and roof	1300	19'6"	25'	6'	4'	440	110/220	yes	yes	yes		x	Rock	Telephone Exchage
e, Kauai	Tunnel - concrete floor, gunite lining	840	10'	14'	6'6"	4'6"	2300	110/220	yes	no	no		x	Rock	Tunnel is presently not in use due to cave-in of tunnel. Future planning contemplates enlarging & concrete lining the tunnel & using it as a combined receiver & transmitter sta.
ing Sands, uai	Cut & cover - concrete floor, walls & roof	734	8'	28'	6'	4'	440	110/220	yes	yes	yes		x	Sand	Installation is on a standby basis
ing Sands Fld Kauai	Tunnels - concrete floors gunite lining. 19 tunnels total as follows:	6	7200 (1200 ea)	12'	15'	9'	9'	2300	110/220	no	no	no		x	Rock	Bomb storage
		4	3300	12'	15'	6'6"	4'6"	2300	110/220	no	no	no	x			

DGSP-144

TION	TYPE	DIMENSIONS					UTILITIES								COVER	USE AND REMARKS
		MAIN AREA		ENTRANCE			ELECTRIC POWER			VENTILATION						
		Floor Area Square Feet	Minimum height	Minimum width	Minimum height	Minimum width	Primary	Secondary	Stand-by	Water	Sewer	Natural	Mechanical	Air conditioned		
)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Field,	Tunnel - concret e Floor and lining	68 35	13'3"	17'	7'	4'	230 0	110/220	ne	ne	ne		x		Dirt	AvGas fuel storage. Six 50,000 gal. tanks set on cradles.
Fld Oahu	2 tunnels - concrete Floors and linin g	3000 (1500 each)	9'	10'	6'6"	4'6"	2300	110/220	no	no	ne		x		Dirt	Bomb Storage
Field	Tunnel and cut-and-cover-concrete Floors, wall and lining	1450	12'	17'	7'	3'	440	110/220	yes	yes	yes			x	Dirt	Telephone Exchange, installation is on a standby basis
hua Gulch	Tunnel - concrete floor concrete lining	3660	12'	15'	6'8"	4'	4160	110/220	yes	yes	yes			x	Dirt	ACS Transmitter tunnel
hua Gulch	Tunnel - concrete floor concrete lining	2775	12'	15'	6'8"	4'	4160	110/220	yes	yes	yes			x	Dirt	ACS Receiver tunnel
ter Oahu	Tunnel - concrete floor unlined walls and ceiling	630	10'	14'	6'6"	4'6"	4000	110/220	no	no	no		x		Dirt	Radar radio receiver tunnel. Tunnel is presently abandoned due to cave-ins. Future planning contemplates lining with concrete throughout. Installation is known as "Little Eddy"
te * 1	Tunnels - concrete floors and lining	8000	12'	12'	7'	4'	4160	110/220	yes	yes	yes			x	Rock	
ld ak		59,900	16'	20'	12'	10'	4160	110/220	no	yes	no		x		Dirt	Tire and tube storage

Reports Control Symbol: WDGSP-144

	INSTALLATION	LOCATION	TYPE	DIMENSIONS: MAIN AREA: Floor Area Square Feet	MAIN AREA: Minimum height	MAIN AREA: Minimum width	ENTRANCE: Minimum height	ENTRANCE: Minimum width	UTILITIES: ELECTRIC POWER: Primary	ELECTRIC POWER: Secondary	Stand-by	Water	Sewer	VENTILATION: Natural	VENTILATION: Mechanical	VENTILATION: Air conditioned	COVER	U
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
1	Storage Tunnel	Bellows Field, Oahu	Tunnel - concrete Floor and lining	68 35	13'3"	17'	7'	4'	230 0	110/220	no	no	no		x		Dirt	Av 50 cr
2.	Storage Tunnels	Bellows Fld Oahu	2 tunnels - concrete Floors and linin g	3000 (1500 each)	9'	10'	6'6"	4'6"	2300	110/220	no	no	no		x		Dirt	Be
	Telephone Exch	Bellows Field Oahu	Tunnel and cut-and-cover-concrete Floors, wall and lining	1450	12'	17'	7'	3'	440	110/220	yes	yes	yes			x	Dirt	Te st st.
	Radio Tunnel	Kaukonahua Gulch Oahu	Tunnel - concrete floor concrete lining	3660	12'	15'	6'8"	4'	4166	110/220	yes	yes	yes			x	Dirt	AC ne
	Radio Tunnel	Kaukonahua Gulch Oahu	Tunnel - concrete floor concrete lining	2775	12'	15'	6'8"	4'	4160	110/220	yes	yes	yes			x	Dirt	AC
	Radar Tunnel	Ft Shafter Oahu	Tunnel - concrete floor unlined walls and ceiling	630	10'	14'	6'6"	4'6"	4000	110/220	no	no	no		x		Dirt	Ra tunn sent cave cont conc stal "Lit
7	Defense Control Center	Ft Shafter Oahu	Tunnels - concrete floors and lining	8000	12'	12'	7'	4'	4160	110/220	yes	yes	yes			x	Rock	
	Bs[illegible] t	[illegible]ist	Two intersecting tunnels - concrete floors and lining	59,900	16'	20'	12'	10'	4160	110/220	no	yes	no		x		Dirt	Ti

Reports Control Symbol: WDGSP-144

	INSTALLATION	LOCATION	TYPE	DIMENSIONS			
				MAIN AREA			EN
				Floor Area Square Feet	Minimum height	Minimum width	Minimum height
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Storage Tunnel	Bellows Field, Oahu	Tunnel - concrete Floor and lining	68 35	13'3"	17'	7'
2.	Storage Tunnels	Bellows Fld Oahu	2 tunnels - concrete Floors and linin g	3000 (1500 each)	9'	10'	6'6
3	Telephone Exch	Bellows Field Oahu	Tunnel and cut-and-cover-concrete Floors, wall and lining	1450	12'	17'	7'
4	Radio Tunnel	Kaukonahua Gulch Oahu	Tunnel - concrete floor concrete lining	3660	12'	15'	6'8
5	Radio Tunnel	Kaukonahua Gulch Oahu	Tunnel - concrete floor concrete lining	2775	12'	15'	6'8
6	Radar Tunnel	Ft Shafter Oahu	Tunnel - concrete floor unlined walls and ceiling	630	10'	14'	6'6
7	Air Defense Control Center	Ft Shafter Oahu	Tunnels - concrete floors and lining	8000	12'	12'	7'
8	Sub-assembly depot	Schofield East Range Oahu	Two intersecting tunnels - concrete floors and lining	59,900	16'	26'	12'

SECRET

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D. C.

30 April 1948

MEMORANDUM FOR: THE UNDER SECRETARY OF THE AIR FORCE
ATTENTION: Brigadier General W. D. Eckert

SUBJECT: Report of Project Officer on War Department Mission to European Underground Factories

1. Inclosed are copies of the reference report and memorandum to the Chairman, Munitions Board setting forth the comments of the Department of the Army on the recommendations set forth in the reference report.

2. This report is forwarded for whatever action your office may consider advisable.

G. K. HEISS
Colonel, G.S.C.
Executive

2 Incls.
1. Memo to MB
2. Rpt of Project Officer (in dup)

SECRET

SECRET

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D. C.

MEMORANDUM FOR:

SUBJECT: Underground Manufacture of Aircraft

1. Reference is made to the attached "Report of Project Officer on W.D. Mission - European Underground Factories." This report was submitted to the Under Secretary of the Army in accordance with an Air Force commitment. Aside from its value for reference purposes, no action is required.

2. The mission referred to comprised Air Force (W.D.) representatives and representatives of J. Gordon Turnbull Inc., which firm has a study contract in connection with an Air Force pilot underground jet engine facility. The technical and engineering data obtained and lessons learned by the Mission are being incorporated in the Air Force study contract.

3. The underground project is divided into three Phases. Phase I concerns the study aspects of the program. Phase II concerns the construction of the pilot plant, and Phase III concerns the operation of the facility. Phase I (study aspects) is further broken down as follows:-

Item I, Site and Comparative Cost Investigation
Item II, Technical Studies - Manufacturing Equipment, Related Services and Drawings
Item III, Reports - Summary, Analytical and Pictorial

4. It is planned to use the facility as a laboratory to develop technical data and experience in recognizing, segregating and solving problems incident to underground manufacture of aircraft and related equipment.

5. The Air Force contractor has recommended a site at Greer, West Virginia as his first choice. The site is a limestone mine having an overburden of from 200 to 500 feet, a ceiling height of 35 feet, and a total potential usable area of 1,200,000 square feet.

6. The contractor has estimated that a pilot underground plant at the Greer location, comprising approximately 400,000 square feet, will cost $7,056,743. The item for construction of the

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plant is currently carried in the Fiscal Year 1949 Engineers Budget in the amount of $5,400,000, which includes funds for the acquisition of land.

7. It is believed that the study will prove invaluable to the Air Force, the Munitions Board, and other Government agencies concerned with passive defense. Provision has been made to allow for expansion of the pilot facility for stepped up manufacturing should the need arise. The facility could also be used as a command and control center.

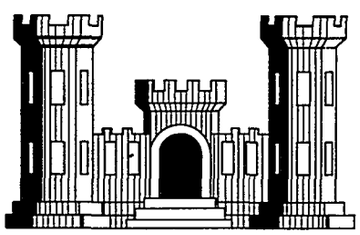
Incl:
Report

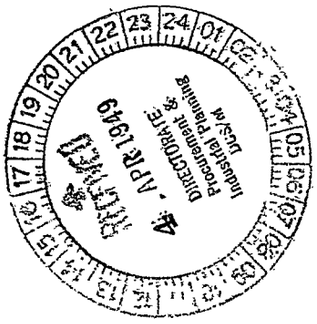
20

CONFIDENTIAL

PROGRESS REPORT . . . . . NO. 8

UNDERGROUND INSTALLATIONS PROGRAM





31 DECEMBER 1948

CONFIDENTIAL

DEPARTMENT OF THE ARMY
WASHINGTON, D. C.

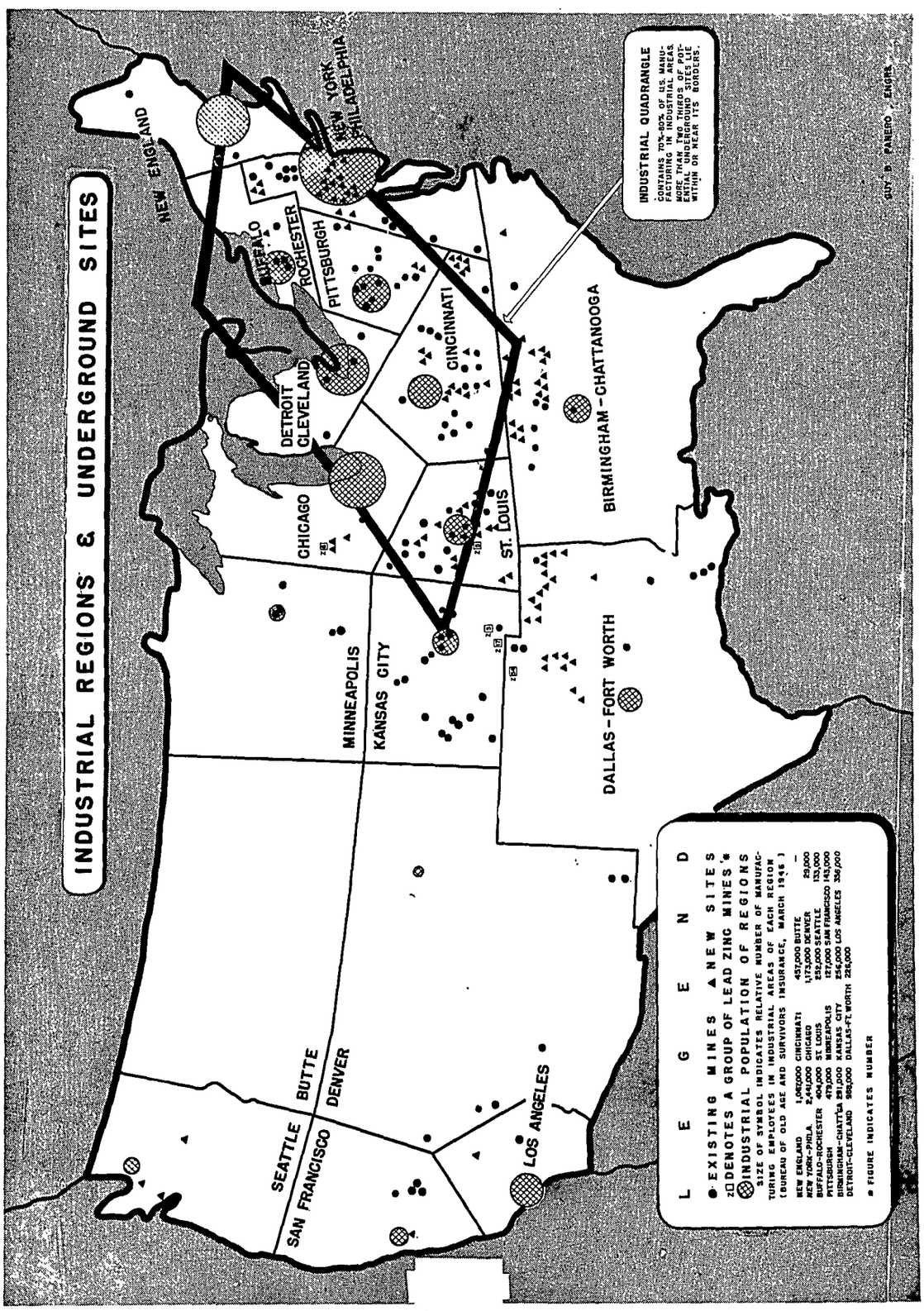


Figure 1

ADDRESS REPLY TO
THE BUREAU OF YARDS AND DOCKS

AND REFER TO
SC N12-3/A16-3
D-6A/aak
Y&D Serial 003691

NAVY DEPARTMENT

WASHINGTON 25, D. C.

SECRET

6-5-47

From: Chief of the Bureau of Yards and Docks
To : The Army and Navy Munitions Board

Subj: Caves and Underground Sites in Antilles Department - Report on

Ref : (a) ComGenAAF Secret ltr AFDRP-3, TGB/evb dtd 16 May 1947 to BuDocks

1. Reference (a) and the enclosure therewith entitled "Report on Investigation of Caves and Underground Sites, Antilles Department" were received and reviewed with interest. An appropriate record has been made of this material for future reference.

2. In accordance with the request of paragraph 4, reference (a), the report is forwarded herewith, together with a copy of the reference, for filing.

W. H. Smith
By direction of Chief

Encl. (HW)
1. Subject Report and copy of ref. (a)

cc: wo/encl.
Commanding General, Army Air Forces
Washington 25, D. C.

SECRET

ADDRESS REPLY TO
THE BUREAU OF YARDS AND DOCKS

AND REFER TO
. SC N12-3/A16-3
D-6A/aak
Y&D Serial 003691

NAVY DEPARTMENT

WASHINGTON 25, D. C.

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W H Smith
By direction of Chief of Bureau

Encl. (HW)
1. Subject Report and
copy of ref. (a)

cc: wo/encl.
Commanding General, Army Air Forces
Washington 25, D. C.

DRAFT

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CAVES AND UNDERGROUND SITES

(PUERTO RICO)

Information Available

I. Sources of Information.

A. As will be noted, the information compiled and presented in this study has been based largely on personal investigation, and on exploration of cave sites themselves. During this project the Department was assisted in its preliminary studies by the following persons:

(a) Former Head, Bureau of Mines, P.R.
(b) Former Assistant Head, Bureau of Mines, P.R.
(c) Commissioner of Agriculture of P.R.
(d) Head of Soils, P.R.
(e) Engineering Geology Professor, Agriculture and Mining College, Mayaguez, P.R.

B. In addition to preliminary information gleaned from the aforementioned persons, various technical publications* were consulted which dealt with insular geological information. Another fruitful source of information on the subject of underground caves and sites in Puerto Rico was the records and archives of the late Mr. J.H. Fallon, who in 1915 made an extensive study of the subject, with a view of determining the extent and richness of the guano deposits present in the caves of the island. Mr. Fallon's records disclose the existence of 106 caves in Puerto Rico proper. Unfortunately the preliminary investigation disclosed the fact that the records containing detailed data on each of the 106 caves had been destroyed.

II. Actual Investigation.

A. Attached Map (Incl.1) indicates the location of caves on which information was gathered. Those caves nearest to existing military facilities are shown by ◎ , and those which are not particularly close to existing facilities, or which are more or less inaccessible are shown by ⊖ . Only those caves were explored which were deemed to be conveniently close to existing Ground Force and Naval facilities to warrant consideration for usage as underground shelters. Thus, the caves near the westerly end of the Island were not investigated, although they might be suitable for use as underground shelters by the 24th Composite Wing (Borinquen Field).

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* "The Geology of Puerto Rico", H.A. Meyerhoff
"Scientific Survey of Puerto Rico", N.Y. Academy of Science
"Bat Guanos of Puerto Rico and their Fertilizing Value" (Bulletin No.25)

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B. On the basis of the information secured during the preliminary investigation, two localities were selected as suitable, from a tactical viewpoint. The first location, indicated as No.1 and shown by ◎ on the attached map is located in the vicinity of the town of Juana Diaz, located along Insular Highway No.1, approximately six miles north of Losey Field. Although there are four caves in this area, only one was explored. The second location, indicated as No.6 on the attached map, and shown by ◎ , is located in the vicinity of the town of Aguas Buenas, about 13 miles south of Fort Buchanan. The latter caves are located about two miles from the nearest public highway. Access to these caves is by a footpath over rather rugged hills.

C. Juana Diaz Cave.

The investigation party, following the route shown by the broken line on the attached map, proceeded from San Juan to Juana Diaz along Insular Highway No.1, and, branching off at the latter town, advanced to within 3/4 of a mile of the entrance of the cave. The path from the nearest highway was slightly upgraded until directly below the mouth of the cave, where it was necessary to ascend to an elevation of 300 feet above the footpath to reach the cave entrance. The entrance was only 4 feet in diameter. After entering the cave, the party traveled on a level flooring for about 100 feet through a narrow, low passageway. Subsequently, the cave opened up into a large cavern, shown on attached photograph, Incl 2. This cavern was found unsuitable for an underground site inasmuch as the floor slopes approximately 20°, and there is a circular hole approximately 20 feet in diameter in the roof. The party proceeded to the next cavern, as indicated in photograph, Incl 3. This cavern also is on an incline and would be unsuitable for use as a permanent place of protection, since extensive work would be required to fit it for occupancy. This cavern is infested with bats, cockroaches, and spiders. Several large spiders of the tarantula species were found on the walls of the caves. It was reported by the natives that these spiders were poisonous, but upon submitting a specimen to the local laboratories, no trace of any poison was found in them. Their size varies from 6 inches to 16 inches, when measured diagonally across the body and from the tip of one leg to the tip of the other leg.

D. Aguas Buenas Caves.

The investigating party proceeded by automobile from San Juan to Aguas Buenas via the route indicated by the broken line on the attached map, advancing to within two miles of the entrance to the cave. The remaining distance was covered on foot over rather rugged terrain.

The Aguas Buenas Caves consist in general of two seperate sets of caverns, the entrances to which face each other (see Incl 4, plan and profile sketches). The first cave was entered from the south (see plan sketch, Incl 4) traveling generally in a north-easterly direction. Photograph, Incl 5, shows this cavern near its entrance. This part of the cave continues on approximately 400 feet and outcrops over a small stream.

The other series of caverns was then entered, (see plan sketch, Incl 4) and the exploring party traveled through a passageway about 10 feet wide and 15 feet high for approximately 600 feet. This passageway opened into a large cavern (No.1) as shown in Incl 4. As the party progressed, caverns No's 2, 3 & 4 were reached (see photograph, Incl 6). The party continued from cavern No.4, ascending along a gentle grade, passed through a small opening and then descended to a floor of lower elevation than that of cavern No.4, where a water fall was reached. The capacity of the underground stream was estimated at approximately 100 gallons per minute (see photograph, Incl 7).

The guide employed at the site, who professed to know the entire cave, stated that there were additional caverns which would require a week to explore. As indicated on the attached plan and profile sketches, the available space is extensive. The cave, in general, is dry, the floor is level, and the geological formation is sound and is composed of a soft limestone. Ventilation in the cave was very good, the temperature was estimated at approximately 74° with relatively high humidity. It is thought, however, that if any living quarters or offices are set up in this cave, air conditioning will be required. The overburden of the cave is rather difficult to estimate. It is believed that the overburden in most instances is not less than 100 feet. The only accurate method of determining this overburden would be by establishing a system of levels inside the cave and on the surface.

III. Conclusions.

A. From the information available and the sites investigated it would appear that the Aguas Buenas Caves are much more suitable for use as underground shelters and Joint Command posts by virtue of their location and adaptability, than are any other caves in the Island of Puerto Rico.

Plans Under Consideration.

Due to budgetary restrictions at the present time, it is not contemplated that any steps will be taken in the immediate future towards developing or exploring further any of the underground sites mentioned herein. However, it is felt that, at a later date, consideration should be given to exploring the Aguas Buenas Caves, and possibly others, in greater detail with a view of converting them, if feasible, into a Joint Army-Navy Command Post, or into other military uses.

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CAVES AND UNDERGROUND SITES

(TRINIDAD BWI)

Information Available

A. General

1. There are two known caves in Trinidad BWI neither of which, however, appears suitable for development or adaptation into the site of a military installation by reason of the expense which such adaptation would involve.

2. Throughout this study the two caves will be referred to hereafter as Cave "A" and Cave "B".

B. Discussion

1. A discussion of the two caves follow:

a. Cave "A". (See Incl 8, which is not to scale, and Map, Incl 9).

(1) The exploring party approached the cave from the south. It was noted that for about 120 feet from the entrance to the cave the ground sloped upward to a 90 foot entrance at an angle of about 30 degrees to the horizontal. There was a rocky projection extending outward (south) for about 90 feet over the entrance to the cave and estimated to be about 70 feet thick. The exploring party also noted before entering the cave that it appeared to be about the 2900 foot level of a 3014 foot peak located in Aripo Heights.

(2) Upon entering the cave it was noted that the floor of the cave sloped downward at about a 60 degree angle for about 150 feet; at this point the floor assumed a steeper slope downward at an angle of about 75 degrees extending for an unknown depth. It was estimated by the exploring party that the depth might be about 1400 feet. It was further noted that from the floor to the top of the cave was about 90 feet, and the width about 60 feet, extending for about the first 250 feet; the dimensions then become roughly circular, about 50 feet in diameter.

(3) It was stated by the guide who accompanied the party that only a few people have gone down below the 200 foot level in this cave.

(4) The party observed that the sides of the cave were weathered and weak, leaving evidence of sulphuric encrustation. There were also outcroppings in the vicinity of the shaft, shaly in nature, stratified and weak.

b. Cave "B".

The exploring party did not actually explore this cave but talked to a guide who stated that the cave was roughly 30 feet square and 150 feet deep and located in an area inaccessible without

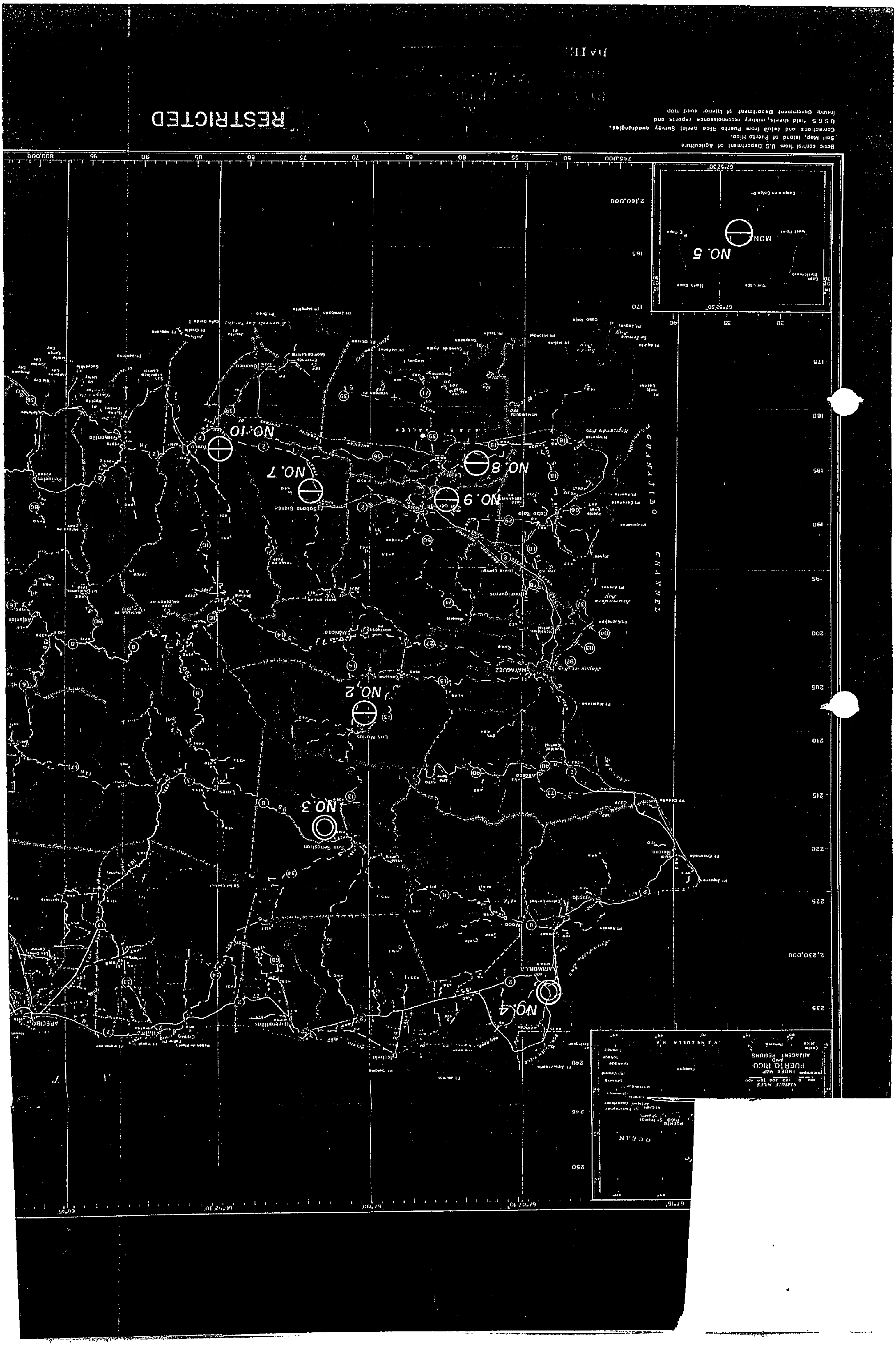
C. Conclusions:

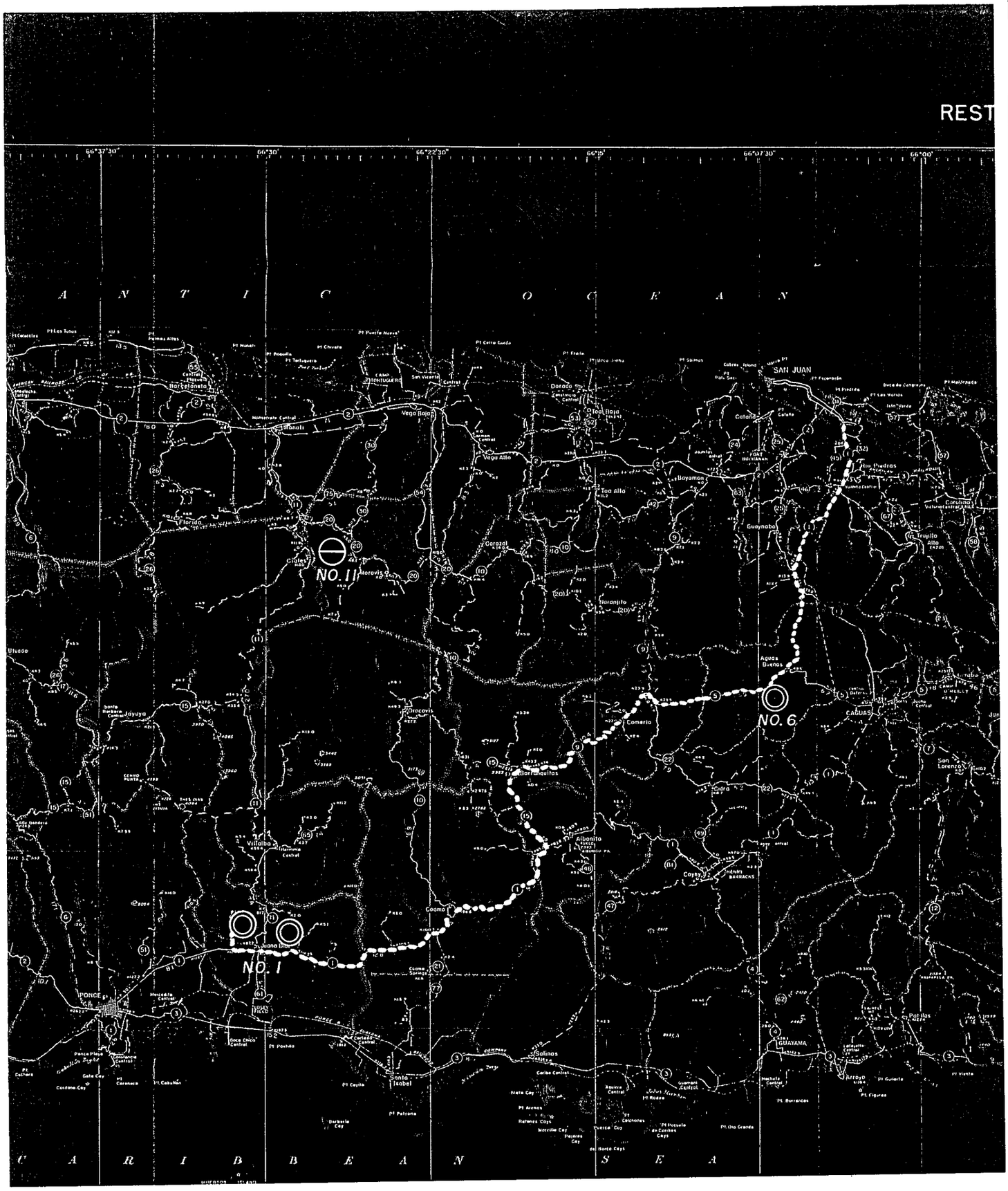
1. That neither cave is suitable for development into a military installation.

Plans Under Consideration.

1. Because no suitable cave has been found in Trinidad, no plans for the utilization of underground sites in that island are contemplated.

2. Should Trinidad be developed as a major U.S. base, further plans should be developed for an underground headquarters and other underground installations, in accordance with current directives.





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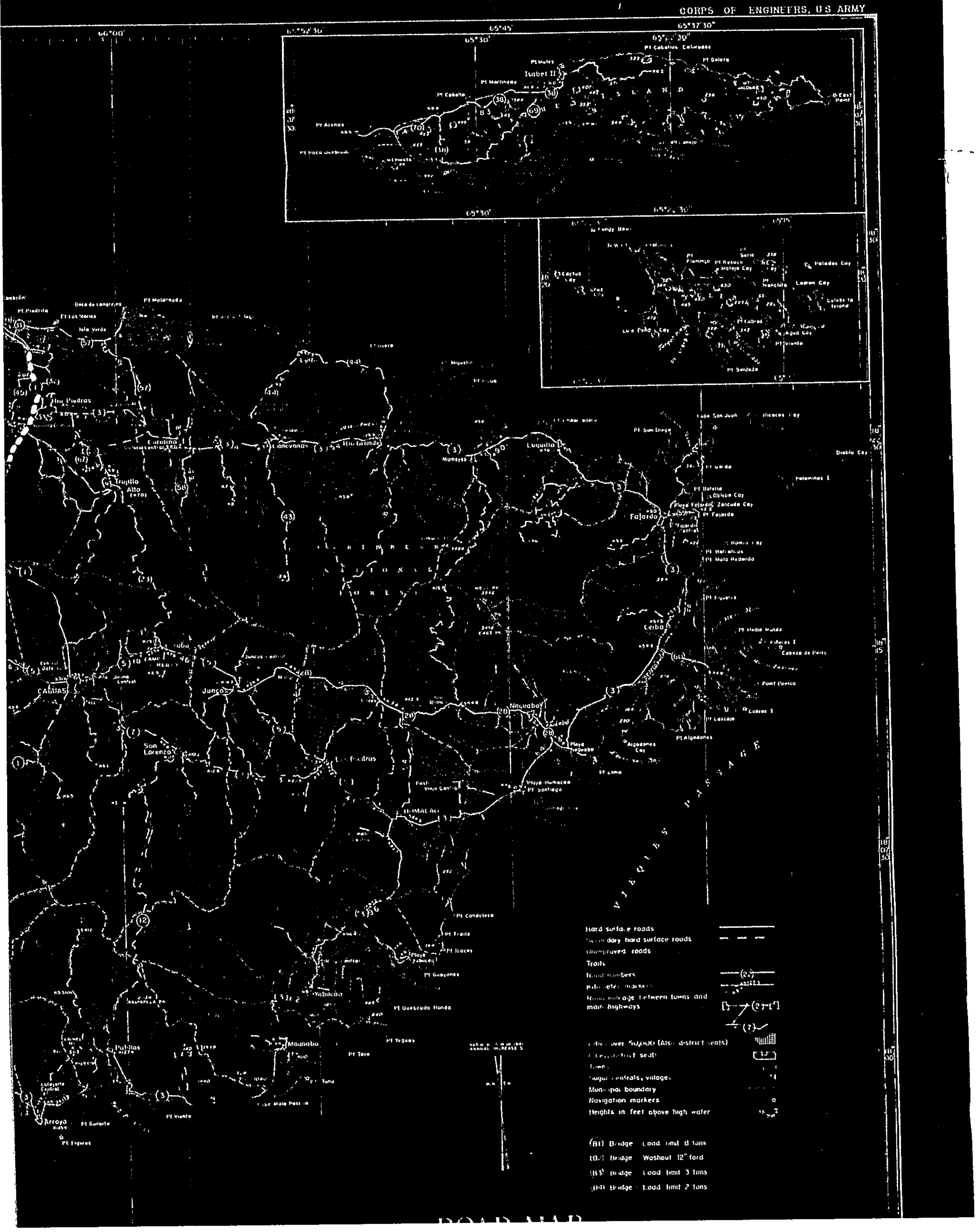

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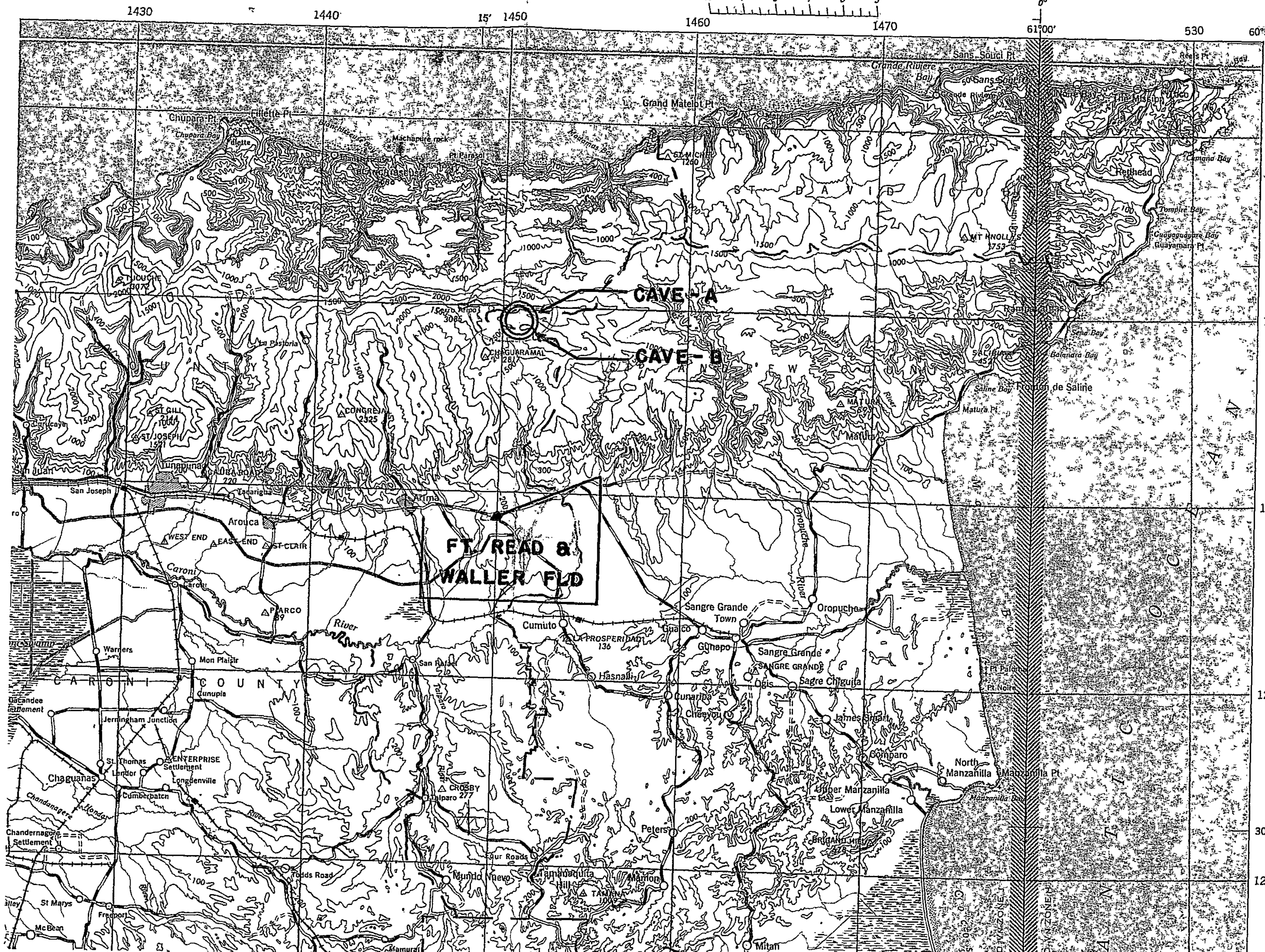
RINIDAD

FIRST EDITION-AMS 1



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MCPIXPI/JVW/ewa

MCPIXPI 6 July 1948

Pilot Underground Plant

Chief of Staff
United States Air Force
Washington 25, D. C.
Attn: Mr. T. G. Baptist

1. Reference is made to wire No. A-189, 29 June 1948 from AMPL, requesting report covering the second quarter 1948 on the progress of the Industrial Planning Division with respect to underground installations.

2. On 25 May 1948, the J. Gordon Turnbull Inc., the consulting engineers engaged by the Air Force to develop preliminary design criteria and cost data for an aircraft pilot underground plant, completed its final summary report. Previously the following reports had been submitted:

a. Phase I - Report Concerning Study of Underground Sites in Continental Europe.

b. Phase I - Item I - Report concerning Site and Comparative Cost Investigation.

c. Phase I - Item I - Supplement to Report Concerning Site and Comparative Cost Investigation.

d. Phase I - Item II - Report Concerning Technical Studies - Manufacturing Equipment, Related Services, and Drawings.

3. In its final report the company concluded that "... an underground plant presents no insurmountable engineering or construction problems, and that an underground program for the protection of vital industry is not only essential but practical and economical, considering the protection afforded.

4. "Prior to engaging in a broad scale underground program, it is advisable to determine the problems of underground construction, plant operations, and production processes. The results of our studies indicate that the exploration and solution of these problems through the medium

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of a Pilot Underground Plant is the most effective approach."

5. The specific site finally selected by the J. Gordon Turnbull Inc., for construction of the Air Force Pilot Underground Plant is the limestone mine at Greer, West Virginia. This mine possesses adequate over-burden and contains rooms of suitable width and ceiling height. It is located in rugged country that can be easily camouflaged and is economically well situated from the point of view of jet engine suppliers. The J. Gordon Turnbull, Inc. submitted specific plant layouts and production flow charts for a plant of 428,000 square feet, to be used for the purpose of manufacturing parts of the jet engine and for assembling completed engines.

6. The cost of constructing and equipping this plant was placed at approximately $10 million.

7. Copies of the summary report were distributed to interested personnel within the Air Materiel Command, the Air Defense Command, and a number of copies were submitted to Hq. USAF for further redistribution.

8. On 14 May 1948 a representative of the Industrial Planning Division, Air Materiel Command made a formal presentation on the pilot underground plant program to the Commanding General of the Air Materiel Command and his Staff. Authorization was received to include the pilot plant program in the Command construction budget and to present the program to higher authority.

9. On 8 June 1948, a similar presentation was made in Washington to members of the Munitions Board and to the Assistant Secretary of the Air Force. At the presentation the full scope of the Air Force underground program was described.

10. On 10 June 1948, Mr. Arthur S. Barrows, Under Secretary, Department of the Air Force, forwarded a memorandum to the Deputy Chief of Staff, Materiel, requesting further analyses of the need for an Air Force installation in view of the plans of the Corps of Engineers to construct a pilot underground plant for the manufacture of instruments. The requested analysis was forwarded to Hq. USAF 2 July 1948. It was pointed out that the Air Force underground plant was primarily established as a production experimental facility and that the quantities of end items manufactured are of secondary consideration. It was further emphasized that should the Munitions Board

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decide to authorize only one pilot underground plant at this time, it is imperative that adequate room and opportunity be provided for the testing of the full range of aeronautical manufacturing processes.

11. The Department of Intelligence of the Air Material Command is continuing to explore the measures adopted by foreign countries to protect aeronautical industries from enemy attack. Included in these studies are an evaluation of the underground programs of Germany, Great Britain, Japan, Sweden, and Russia. This report will be used as a portion of the industry defense program being conducted by the Air Material Command.

FOR THE COMMANDING GENERAL:

FREDERICK M. HOPKINS, JR.
Major General, USAF
Chief, Industrial Planning
Division

SECRET

T-41069

RG 341
Entry 464
Box 34

(1)
1/96/S

ACCESS RESTRICTED

The item identified below has been withdrawn from this file:

File Designation: Underground Installations — CW, BW, & RW
Rpt.
Date: 1947
From: Corps of Engineers
To: —

In the review of this file this item was removed because access to it is restricted. Restrictions on records in the National Archives are stated in general and specific record group restriction statements which are available for examination. The item identified above has been withdrawn because it contains:

☒ Security-Classified Information

☐ Otherwise Restricted Information

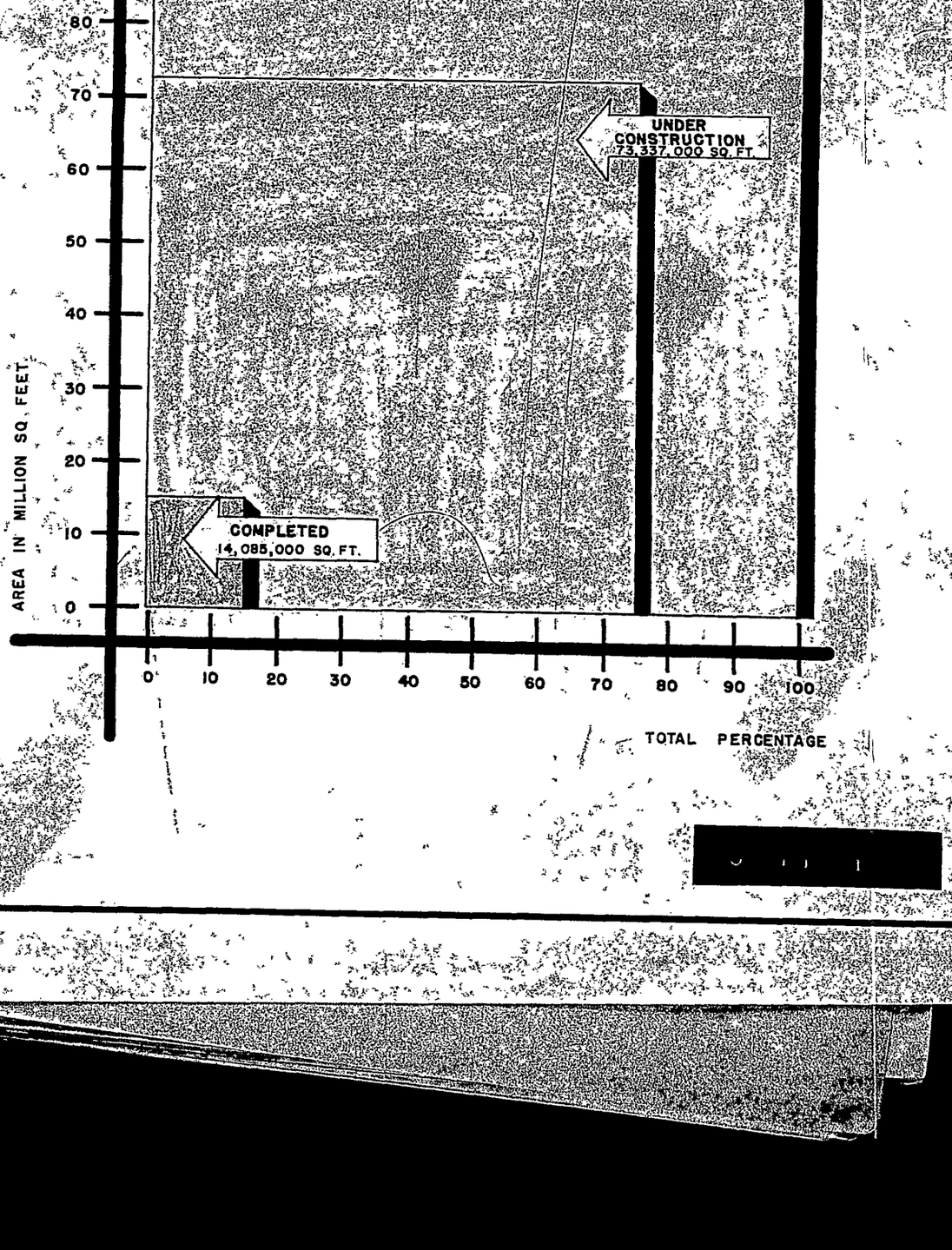
NND 913021 — Authority
2-22-91 — Date

WITHDRAWAL NOTICE

36

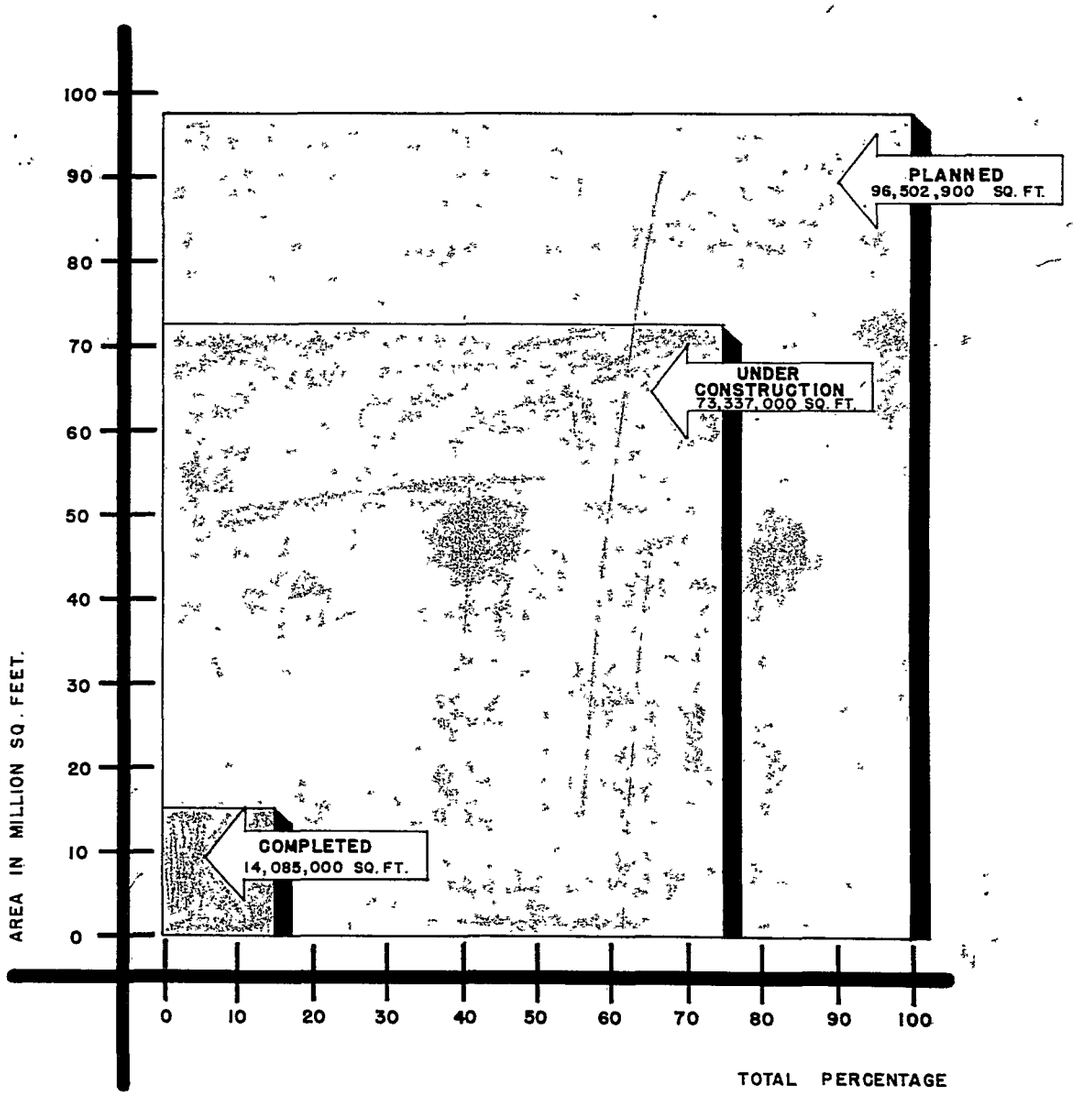
STATUS OF UNDERGROUND INDUSTRIAL PROGRAM IN GREATER GERMANY

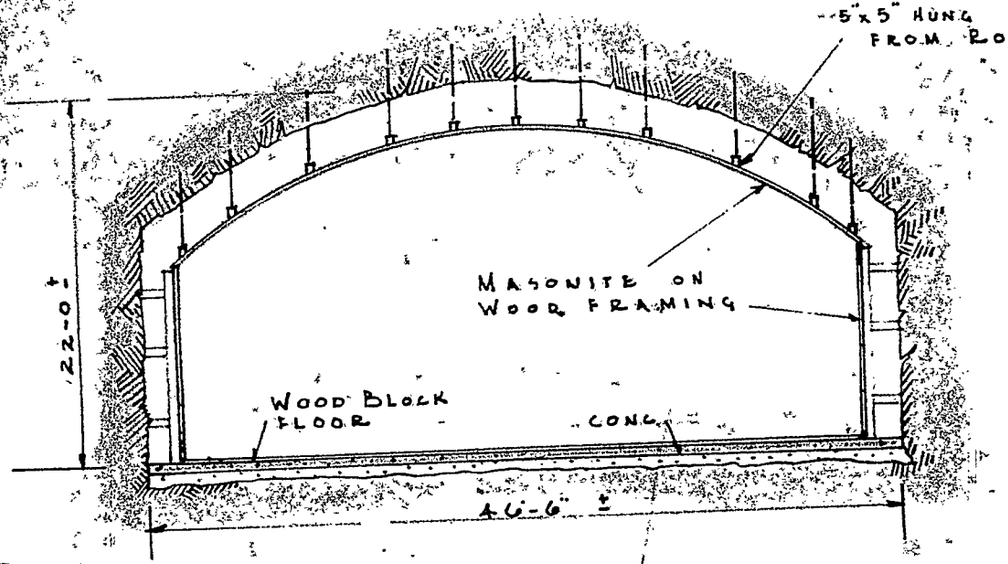
AS OF NOV. 1944



STATUS OF UNDERGROUND INDUSTRIAL PROGRAM IN GREATER GERMANY

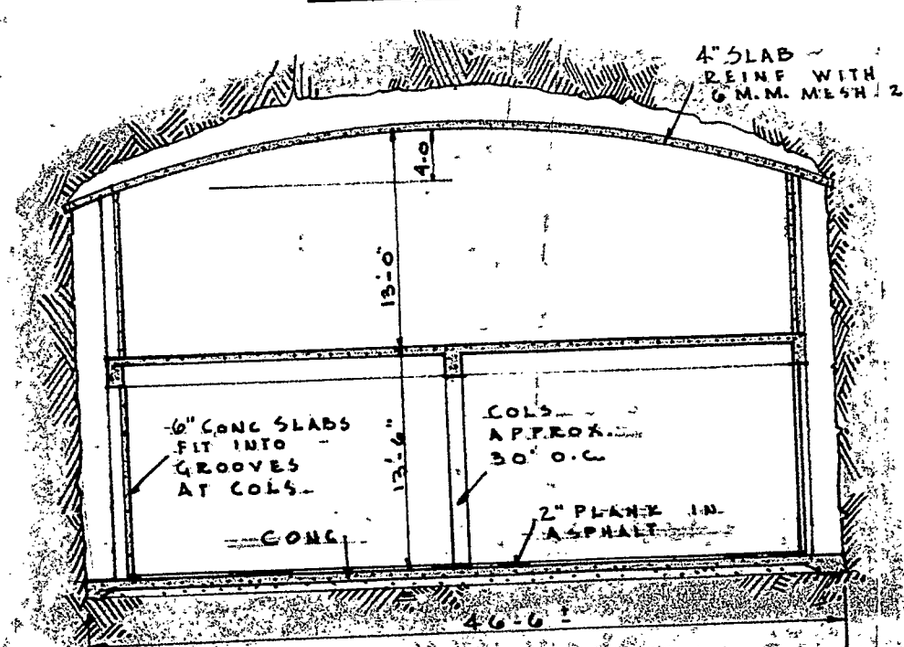
AS OF NOV. 1944





TYPICAL SECTION THRU BOLINDER - MUNKTELL PLANT - SWEDEN

FIGURE 10



TYPICAL SECT. THRU SAAB PLANT - SWEDEN

FIGURE 11

SCALE 3/32" = 1-0

4. NARA_RG334_Rea_2002.pdf

Original start page:	111	**Inserted note page:**	114	**Archive starts after note:**	115

Why it belongs in this release

Only document in the batch with a direct Roswell/Oak Ridge/autopsy lead. It is not official proof, but it is a clear investigative lead involving Charles Rea, Oak Ridge medical personnel, and a possible military doctor autopsy.

Complete release-note text from UAP 4

4. Rea 2002 / Oak Ridge / Farrell lead.

This is the most directly UFO-related document in the set, but it should be released with a clear evidentiary caveat: it is an investigative lead, not an official confirmation. The file includes an email stating that Paul Farrell worked with a civilian arm of the U.S. Government from 1947 to 1964, did liaison work at Oak Ridge, and had a story possibly linked to Roswell; a follow-up says the autopsy was allegedly done by a military doctor. Another email identifies Oak Ridge doctors in a photo, including Charles Rea. Congress and NARA should subpoena or request Oak Ridge personnel rosters, medical research files, contractor records, travel records, military medical assignments, pathology/autopsy logs, and CIA/OSS personnel files for Farrell and related names. This is a good public-release item because it gives investigators names, locations, dates, and a specific hypothesis to test.

Source: UAP 4 - Archives Release Notes(2).docx. This note page was inserted immediately before the archive file.

Boards (334) → 350.05/350.09

5. NARA_RG_227_Reports_to_President_1941-46.pdf

Original start page:	120	**Inserted note page:**	124	**Archive starts after note:**	125

Why it belongs in this release

Shows the formal wartime/postwar science secrecy model: the President asked how to release scientific information, and OSRD/NAS considered a board to control release and publication of sensitive scientific information.

Complete release-note text from UAP 4

5. Reports to the President, 1941-46.

This is valuable because it shows the official theory and practice of controlling scientific information after major wartime discoveries. The President asked OSRD what could be made known “consistent with military security,” while OSRD discussed declassification, dissemination, and a proposed National Academy mechanism to control release and publication of scientific information. That does not prove UFO secrecy, but it establishes a precedent: revolutionary science was explicitly subject to centralized control, staged release, and national-security filtering. Congress and NARA should use this as the policy starting point and trace successor bodies: OSRD, National Academy boards, RDB, JCS, CIA, Atomic Energy Commission, Air Force Scientific Advisory Board, and any special-access or unacknowledged compartments that inherited release-control authority for anomalous aerospace materials.

Source: UAP 4 - Archives Release Notes(2).docx. This note page was inserted immediately before the archive file.

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5 bxs

REFERENCE SERVICE SLIP

DATE	NO.
23 JAN 2006	

NAME OF REQUESTOR	AGENCY OR ADDRESS
Wood/Winn, Robert	068427

UNITS OF SERVICE

INFORMATION SERVICE (Number of replies) WRITTEN	ORAL	RECORDS FURNISHED (Number of items)	TEXTUAL, STILL PICTURES, ETC. (Number of pages)	MOTION PICTURES (Number of feet)	SOUND RECORDINGS (Number of feet)

SOURCE OF REQUEST (Check)

- NA Administrative Use
- Agency of Origin
- Other Government
- Nongovernment

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RECORD IDENTIFICATION

"Correspondence Re Reports to President, 1941-1946"

boxes 1-5 ENTRY 2

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REFERENCE SERVICE SLIP 20 bxs					DATE 23 Jan 06	NO. 9602
NAME OF REQUESTOR WOOD / DOLAN			AGENCY OR ADDRESS 06842 6			

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INFORMATION SERVICE *(Number of replies)* WRITTEN	ORAL	RECORDS FURNISHED *(Number of items)*	TEXTUAL, STILL PICTURES, ETC. *(Number of pages)*	MOTION PICTURES *(Number of feet)*	SOUND RECORDINGS *(Number of feet)*	NA Administrative Use / Agency of Origin / Other Government / Nongovernment
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RG NO.	STACK AREA	ROW	COMPARTMENT	SHELF	OUTCARD NO.
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RECORD IDENTIFICATION

E 3008 D Scientific Technological Affairs
Box 1-20

RECEIVED BY	DATE	RETURNED TO	DATE

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REFERENCE SERVICE SLIP

DATE: 2 JAN 04 | NO.: 7002

NAME OF REQUESTOR: WOOD / DOLAN

AGENCY OR ADDRESS: 06926

UNITS OF SERVICE						SOURCE OF REQUEST *(Check)*
INFORMATION SERVICE *(Number of replies)*		RECORDS FURNISHED *(Number of items)*	TEXTUAL, STILL PICTURES, ETC. *(Number of pages)*	MOTION PICTURES *(Number of feet)*	SOUND RECORDINGS *(Number of feet)*	
WRITTEN	ORAL					
		20				NA Administrative Use Agency of Origin Other Government Nongovernment

REQUEST HANDLED BY: CF

RG NO.	STACK AREA	ROW	COMPARTMENT	SHELF	OUTCARD NO.
59	150	69	20	01	

RECORD IDENTIFICATION

E300SD Aircraft - Technology - Alter
Box L-20

RECEIVED BY	DATE	RETURNED TO	DATE

NATIONAL ARCHIVES AND RECORDS ADMINISTRATION — **DO NOT REMOVE FROM RECORDS** — NA FORM 14001 (11-85)

UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY

DEC 20 1963

MEMORANDUM TO: STATE/SCI - Mr. Arthur Pardee

FROM : ACDA/ST - Dr. Herbert Scoville HS

SUBJECT : Request for ACDA Support - Atmospheric Science Research

We appreciate your calling the Agency's attention to the research program on the atmospheric sciences. ACDA is especially interested in the weapons implications associated with control of weather, and in the international cooperative features of the program. Nevertheless, the present shortage of contract funds severely limits ACDA's ability to transfer funds to other Agencies. This constraint is particularly binding in this case where the research is not directly relevant to ACDA activities. Though we regretfully cannot use ACDA contract funds to support atmospheric research, we shall follow the research program with great interest.

ACDA/ST:HAFeiveson:bjm

DEPARTMENT OF STATE
THE DIRECTOR
OFFICE OF INTERNATIONAL SCIENTIFIC AFFAIRS

MEMORANDUM

September 27, 1963

TO: SCI - Dr. R. Rollefson

FROM: SCI - J. Wallace Joyce

SUBJECT: Objectives and programs for an analysis of atmospheric science research

In a memorandum dated August 19 the Chairman of the Interdepartmental Committee of Atmospheric Sciences (ICAS) assigned to the Department of State member committee the following task:

> To make an analysis of how the national research program in atmospheric sciences can through international cooperation contribute to the aims of our foreign policy and actions.

It was suggested that a counter question also be studied namely:

> What political and legal issues might arise as the result of an international program in atmospheric sciences?

In a reply to the Chairman of ICAS dated September 9 a preliminary outline describing in very general terms a proposed Departmental approach to the problem was presented. This report was given at the ICAS meeting of September 16 and was accepted with minor comments. At the same meeting the other agencies holding membership in ICAS who had been given comparable assignments in connection with the atmospheric sciences program presented proposals as to how they would deal with their respective problems. Plans varied considerably from an in-house committee in the case of Defense to high level commission proposed by the National Science Foundation.

Subsequently, I had a conversation on September 25 with Dr. Thomas Malone the Chairman and Mr. John Sievers the Executive

Secretary

Secretary of the National Academy's Committee on Atmospheric Sciences. We discussed possible committee structures that might respond to the State Department's task. It is my own feeling that SCI has in this assignment a unique opportunity to give real leadership in developing policies which relate international scientific activities to foreign policy objectives. Accordingly, we deemed it important to convene a high level, high powered committee to look at this problem. It seems clear the group should include a variety of competences including political, economic, legal and scientific aspects and that the members should be persons who have exhibited a high degree of interest in problems of the kind with which we are dealing. Furthermore, I believe it important, to establish the committee under the auspices of the National Academy of Sciences. Neither Malone nor Sievers could see any basic objection to this procedure although the matter would have to be discussed with Dr. Seitz and possibly others at the Academy.

We attempted to suggest the names of persons who might serve on the committee. These included the following:

Professor Hans J. Morgenthau - Political Science and Law, University of Chicago.

Professor Myres S. McDougal - Yale Institute of Law.

Professor Paul A. Samuelson - MIT (Economist)

Professor Bruno Rossi - MIT or

Professor John Bardeen - Illinois or

Professor Frederich Seitz - National Academy of Sciences.

Professor Gordon J. MacDonald - UCLA Atmospheric Sciences.

Dr. Thomas Malone - National Academy of Sciences Atmospheric Sciences.

Professor Robert G. Fleagle - OST Atmospheric Sciences and Oceanography.

Dr. Robert M. White - Chief, U.S. Weather Bureau.

In addition to the committee itself there may be some usefulness in bringing in consultants on specific points, particularly

in scientific areas. Several names were discussed in this category including Dr. Suomi, Dr. Batten, Dr. Revelle and Dr. Islin.

Whether a majority of the persons named could be persuaded to serve on the committee is still undetermined. We hope that the time that they would have to devote to the report could be arranged to minimize disruptions to their normal affairs. As a preliminary suggestion it was thought that a series of possibly four 2-day meetings extending over a period of three to four months might be sufficient. These would be largely discussion sessions preferably located in isolated areas such as Williamsburg.

In order to draft the report it would be desirable to retain the services of a good writer. This person would serve as a full-time employee for a period of possibly four to six months. Hopefully, the services of such a person could be borrowed from one of the Government agencies. As an upper limit for the cost of convening the proposed group including consultant fees, travel and other administrative items we arrived at a figure of about $40,000.

Obviously, the key to this plan is the availability of funds. If the money can be obtained and if the Academy agrees to sponsor the committee we can, I believe, develop a first class document which may well serve as a pattern for similar studies in other areas. If funds are not available we will have to back track, although I would still recommend an Academy Committee if at all possible.

Department inputs would be made by representatives from SCI, S/P, IO and possibly L.

REQUESTED ACTION: That you concur in the recommended procedure, and authorize an informal approach to the National Academy of Sciences to discuss in greater detail the establishment of the proposed Committee. Upon receipt of an informal concurrence from NAS, a formal letter requesting the Committee will be prepared.

Seen 9/27/63

SCI #5156 (revised) 5156
OR

DEPARTMENT OF STATE
OFFICE OF INTERNATIONAL SCIENTIFIC AFFAIRS

April 7, 1964

SCI file

SR/16

CONFIDENTIAL

MEMORANDUM FOR THE SECRETARY

THROUGH: G - Mr. Johnson
S/S

FROM: SCI - R. Rollefson, Director

SUBJECT: Reentry and Impact of Large U.S. Space Vehicles - INFORMATION MEMORANDUM

REF: My memorandum to you on this subject of March 19, 1964

DISCUSSION

In my memorandum to you of March 19 I informed you of two imminent space launchings by NASA which will result in the uncontrolled reentry and impact of a large amount of material on the surface of the earth within a few days after launch, i.e.: the first orbital flight of a GEMINI spacecraft (GT-1) and the second orbital flight of a SATURN launch vehicle (SA-6) which are scheduled to be launched this week and in late May respectively. The first orbital launching of a SATURN vehicle (SA-5) took place on January 29 and involved similar risks, but the vehicle is not expected to reenter until mid-1965.

In that memorandum I recommended that the Department not raise objection to this GEMINI launch as scheduled, since it is the only flight in the GEMINI program which will involve uncontrolled reentry of the spacecraft as well as booster fragments. NASA has prepared contingency public statements for use in connection with this launching which are similar to those agreed between the Department and NASA for the SA-5 launching. The Department's part will be to refer inquiries to NASA.

The SATURN launching is the second of several launchings in the SATURN-APOLLO program which will involve risks of similar proportion. I had proposed, therefore, that we consider

the SA-6 launching in terms of the overall impact problem from all of NASA's planned programs which might result in a significant amount of material impacting on the earth, and had asked that NASA provide information on which to base that consideration. Specifically, I requested data as to (1) the total probability of casualty for all planned launchings of this sort and (2) the cost in time and derogation of mission performance which would be involved if NASA were requested to take the steps required to assure controlled reentry in each case.

I am now informed that from each orbital GEMINI and SATURN-APOLLO flight some portion of the launch vehicle and, in the case of some APOLLO test flights, the spacecraft as well will reenter and may impact on an uncontrolled basis. An analysis of the 39 launchings now planned for these programs indicates the probability of one injury in every 40,000 flights. (This means that there is one chance in 1,000 of injury during the course of these programs.) There is no estimate as to the probability of property damage. A requirement to install a retro system for the SA-6 launching would involve a delay of $1\frac{1}{2}$ to 2 years to design, produce, test and install the system, an estimated weight penalty of 2500 pounds and a cost of $3 to $6 million. On SATURN-APOLLO flights after SA-6 there is insufficient weight margin to permit incorporation of a retro system. There are no other programs now planned which involve an impact problem of these proportions.

CONCLUSIONS

I feel that these risks appear acceptable at this time and have, therefore, neither interposed objection to the SA-6 flight now scheduled for late May nor requested NASA to reorient or change presently planned programs at this time so as to assure controlled reentry in all cases. My office will consider each subsequent GEMINI and SATURN-APOLLO launch on a case-by-case basis in the light of program performance, new technical information developed as these programs proceed and the political circumstances at the time.

cc: L - Mr. Chayes
P - Mr. Manning
IO - Mr. Cleveland
INR - Mr. Hughes
ACDA - Dr. Scoville

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~~RECOMMENDATIONS~~ CONCLUSIONS

I feel that these risks appear acceptable at this time and ~~recommend therefore that the Department:~~ have, therefore, neither ~~1. Not interpose~~ objection to the SA-6 flight now scheduled for late May / nor requested by

APPROVED _____

DISAPPROVED _____

~~2. Not request~~ NASA to reorient or change presently planned programs so as to assure controlled reentry / in all cases. At the time

3. We will consider each subsequent GEMINI and SATURN-APOLLO launch on a case-by-case basis in the light of ~~political circumstances at the time,~~ program performance, ~~and~~ new technical information developed as the ~~program~~ proceeds and the political circumstances at the time.

APPROVED _____

DISAPPROVED _____

cc:

L - Mr. Chayes
P - Mr. Manning
IO - Mr. Cleveland
INR - Mr. Hughes
ACDA - Dr. Scoville

SCI:RFPackard/CEDillery:br
4/6/64

CONFIDENTIAL

NASA CONFIDENTIAL

AF X

MANNED SPACECRAFT CENTER — ATTN: DR. GILRUTH

MARSHALL SPACE FLIGHT CENTER — ATTN: DR. VON BRAUN

NASA JOHN F. KENNEDY SPACE CENTER — ATTN: DR. DEBUS

UNTIL FURTHER NOTICE, THE FOLLOWING IS THE RESPONSE TO QUERIES ON POSSIBLE EARTH IMPACTS OF FRAGMENTS FROM ORBITING MANNED SPACE FLIGHT LAUNCH VEHICLES AND SPACECRAFT. NO QUERIES HAVE BEEN RECEIVED AT THIS TIME. NO INFORMATION IS BEING VOLUNTEERED. THIS HAS BEEN COORDINATED BY OUR INTERNATIONAL PROGRAMS OFFICE WITH THE STATE DEPARTMENT. ALL ADDITIONAL RESPONSE OVER AND ABOVE THE FOLLOWING WILL BE ONLY BY THE ADMINISTRATOR, THE DEPUTY ADMINISTRATOR OR THE ASSOCIATE ADMINISTRATOR. QUERIES REQUIRING SUCH ADDITIONAL RESPONSES SHOULD BE REFERRED TO THEM.

"A. PRIOR TO ANY IMPACT: THIS PROBLEM HAS BEEN VERY CAREFULLY STUDIED. THE POSSIBILITY OF A FRAGMENT FROM ANY SPACE VEHICLE ENDANGERING HUMAN LIFE OR

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NASA

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PROPERTY IS QUITE REMOTE. ANY DISCUSSION OF SUCH AN IMPROBABLE INCIDENT WOULD BE HEAVILY CONJECTURAL.

"B. AFTER A REPORTED IMPACT: UNDER NO CIRCUMSTANCES DOES THIS AGENCY (GOVERNMENT) CONJECTURE ON THE ORIGIN OF AN OBJECT. RATHER, IT DESIRES TO OBTAIN, ANALYZE, AND ATTEMPT TO ESTABLISH THE ORIGIN OF SUCH AN OBJECT.

"C. AFTER IT IS KNOWN THAT A FRAGMENT IS TO BE DELIVERED TO US. THE OBJECT WILL BE SUBJECTED TO STUDY AND PROMPT PUBLIC ANNOUNCEMENT WILL BE MADE WHEN ANALYSIS HAS BEEN COMPLETED."

SGD - JULIAN SCHEER
ASSISTANT ADMINISTRATOR
FOR PUBLIC AFFAIRS

cc: A/Mr. Webb
AD/Dr. Dryden
AA/Dr. Seamans
M/Dr. Mueller
AFP/Mr. Lloyd
AI/Mr. Frutkin
AC/Mr. Callaghan

2 2

Julian Scheer, Asst. Administrator 35302 10:30 am. 7 Apr 64

RESPONSE TO QUERY April 8, 1964

(B) FOR USE AFTER REPORTS OF FRAGMENT IMPACT.

1. What comment do you have on the injury or damage reported in _____?

Any injury (or death or damage) from any cause is much to be regretted. It is not possible to comment on the possibility that the accident is to be ascribed to rocket debris until we are given an opportunity to examine the object said to be responsible. It may then be possible to determine whether the object is natural or man-made and, if man-made, whether it is a fragment of a US or other space vehicle.

2. Will the U.S. meet the damages in this case?

It is premature to discuss damages or liability until responsibility is determined. The U.S. is not likely to avoid its demonstrated responsibilities.

3. What are you doing to resolve these questions in this case?

We have requested the State Department to arrange for us to examine the piece(s) in question. If this can be done, it will be subject to laboratory analysis. We will not have further comment until this analysis is completed.

4. Have other pieces from other rockets been recovered?

Yes. A number have been returned from various parts of the world at various times in the past and have been identified as of both U.S. and Soviet origin. There have been no casualties.

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA GEN. REG. NO. 27

5010-107

UNITED STATES GOVERNMENT

SECRET

"Unclassified when enclosures detached"

NASA HEADQUARTERS
Washington, D.C. 20546

SP-16

RR
EMP
RR
IA
OSR
SCI file

Memorandum

TO : Mr. Robert F. Packard, Chief, Outer Space Affairs Section, SCI, Department of State

DATE: APR 8 1964

FROM : Assistant Administrator for International Programs

SUBJECT: Queries on fragment return from NASA spacecraft or space vehicles

The attached response to queries, classified SECRET, updates the RTQ's concerning the SA-5 vehicle forwarded to you on January 27. This information is intended for the sole use of the Administrator, Deputy Administrator and Associate Administrator of NASA.

As with the information provided to you earlier, these RTQ's are provided for limited distribution to the concerned senior officers of the Department of State. It is understood that the Department will refer inquiries to NASA.

There is also attached a copy of a CONFIDENTIAL teletype message which has been given wide distribution in NASA to permit responses to queries to the degree indicated.

Arnold W. Frutkin

Attachments

SECRET

GROUP 3
Downgraded at 12 year intervals; not automatically declassified

RESPONSE TO QUERY

April 8, 1964

RE: Queries on Fragment Return from NASA Spacecraft or Space Vehicles

A much abbreviated guideline for RTQ has been provided by Mr. Scheer to various NASA officials who might be queried on this subject. The following more extensive responses are provided as background information to be used by the Administrator, Deputy Administrator, or Associate Administrator of NASA, in their judgment, in event of queries on the return of space vehicle fragments to the earth. It is suggested that the minimum information be used to satisfy a given query.

(A) FOR USE PRIOR TO AND AFTER A PARTICULAR LAUNCH BUT BEFORE ANY KNOWN IMPACT OF RETURNING FRAGMENTS:

1. Do fragments from (satellite X) pose a threat to life or property?

The probability that fragments from (satellite X) may cause damage or injury is remote. The probability of injury from natural meteorites is far greater.

2. a. What is the probability of impact?

There are many factors (e.g., time in orbit, atmospheric conditions, how the vehicle breaks up, dispersal pattern, etc.) involved and the calculations are extremely complex. We have assured ourselves, however, that the hazard is far less than many hazards encountered in everyday living.

b. What is the numerical probability that NASA has placed on this?

In the case of SA-5, it is one in 50,000 launches.
In the case of GT-1, it is one in 27,500 launches.

3. Has NASA taken steps to lessen the fragment problem?

Yes. NASA is actively engaged in minimizing it. For example, on the SA-5 satellite, NASA used 13,000 lbs. of harmless sand as ballast and roughed up the nosecone so that it would burn on reentry. On the GT-1 spacecraft, NASA bored large holes in the heat shield to assist burning during reentry. In addition to specific steps such as these, studies are underway to assist NASA in further coping with the overall reentry problem.

ANY INFORMATION IN THIS DOCUMENT USED IN RESPONSE TO QUERIES IS AUTOMATICALLY DECLASSIFIED.

SECRET GROUP 3 "This document consists of

4. How many fragments may be expected to survive

From SA-5 - About 30
From GR-1 - About 55

5. If any fragments come down, where are they most likely to impact?

The small number of fragments surviving from any satellite will be dispersed over an area of thousands of square miles, most of which are likely to be oceans, seas, or other water surface.

6. Can the fragment problem be further decreased by exploding the orbiting element?

Explosion or destruct of the orbiting element could produce more fragments and, hence, increase the possibility of fragment impact.

7. If one were to be hit by a fragment, would it be lethal?

In the remote possibility that one were to be struck by a fragment, it might, depending upon area of body struck, be lethal. However, this is also true of being struck by a meteorite, and the possibility of being struck by a meteorite is greater than the possibility of being struck by a fragment from (satellite X). In fact, based on data provided through the Smithsonian Astrophysical Observatory, the average number of meteorites over 2.2 lbs. which impact on the earth every year is estimated at 5628. This is many, many times greater than the total number of fragments to be expected from (satellite X). And, to date, there are no substantiated reports of injury from these meteorite impacts.

8. Meteorites are natural phenomena. Do you consider NASA justified in increasing the possibilities of a lethal impact, no matter how improbable?

Many human activities carry with them a demonstrable probability of casualty--flying, automobile driving, golfing during an electrical storm. But we do not stop driving, flying or golfing.

SECRET

9. Will this sort of thing be a continuing hazard?

In some degree, yes. In time, it should become possible to develop some solutions such as ensured return over water, but these will take a great deal of research and development as well as significant payload margin. It is a matter of constant attention.

10. How do reentry problems with GT-1 compare with those of other rockets?

Very roughly, about the same as with Atlas reentries, from which there have been no casualties.

June 28, 1941

SECRET

Contractor	Number of Contracts
Academic	
Brooklyn Polytechnic Institute	1
Brown University	1
California Institute of Technology	8
University of California	10
Carnegie Institute of Technology	3
Carnegie Institution of Washington	8
University of Chicago	9
College of the City of New York	1
Columbia University	5
Cornell University	1
Cornell University Medical College	1
University of Delaware	1
Drexel Institute of Technology	1
Franklin Institute of the State of Pennsylvania	2
Harvard University	13
University of Illinois	6
Iowa State College	4
Johns Hopkins University	3
Massachusetts Institute of Technology	20
University of Michigan	4
University of Minnesota	3

SECRET

SECRET

Contractors

Contractor	Number of Contracts
Academic	
University of Missouri	5
National Academy of Sciences	1
University of Nebraska	1
Brooklyn Polytechnic Institute	1
Brown University	1
California Institute of Technology	8
University of California	10
Carnegie Institute of Technology	3
Carnegie Institution of Washington	8
University of Chicago	9
College of the City of New York	1
Columbia University	5
Cornell University	1
Cornell University Medical College	1
University of Delaware	1
Drexel Institute of Technology	1
Franklin Institute of the State of Pennsylvania	2
Harvard University	13
University of Illinois	6
Iowa State College	4
Johns Hopkins University	3
Massachusetts Institute of Technology	20
University of Michigan	4
University of Minnesota	3

SECRET

Contractors	Number of Contracts
University of Missouri	1
National Academy of Sciences	3
University of Nebraska	1
University of New Mexico	1
Northwestern University	3
Ohio State University Research Foundation	3
Pennsylvania State College	5
University of Pennsylvania	3
Princeton University	10
Purdue Research Foundation	1
Rensselaer Polytechnic Institution	1
University of Rochester	2
Rockefeller Institute for Medical Research	1
University of Southern California	1
Stanford University	3
University of Virginia	2
Wesleyan University	1
University of Wisconsin	5
Woods Hole Oceanographic Institution	1
Yale University	2

41 Contractors - 155 Contracts

SECRET

Contractor	Number of Contracts
Industrial	
Air Reduction Company, Incorporated	1
American Locomotive Company	1
Bakelite Corporation	1
Carson & Carson	1
Central Scientific Company	1
Ethyl Gasoline Corporation	1
General Electric Company	1
General Radio Company	1
Gulf Research and Development Company	3
Hazeltine Service Corporation	5
Monsanto Chemical Company	1
National Cash Register Company	1
Polaroid Corporation	1
Precision Castings Company	1
Raytheon Production Corporation	2
RCA Manufacturing Company	7
Standard Oil Development Company	1
Edward Stern & Company, Incorporated	1
Union Switch & Signal Company	1
United Shoe Machinery Corporation	1
Western Electric Company	17
Westinghouse Electric and Manufacturing Co.	2

22 Contractors - 52 Contracts

SECRET

59

Academic	41 Contractors	155 Contracts
Industrial	22 Contractors	52 Contracts
Total	63	207

In addition to the signed contracts listed above, the Committee has authorized contracts covering approximately 100 additional items contracts covering which are now being negotiated.

These contracts cover the development of a variety of new equipment and reports upon a wide range of subjects related to mechanisms and devices of warfare. Among the more important subjects covered by the contracts are the following:

Microwave equipment
Anti-submarine devices
Fire control equipment
Uranium
Rockets
Terminal ballistics
Fuses
Explosives
War gases
Defense against war gases
Oxygen storage and measurement
Fuels
Communication devices
Improvements in tanks
Bridge designs
High intensity sounds
Recognition devices
Infra-red equipment
Night vision devices

SECRET 3/42

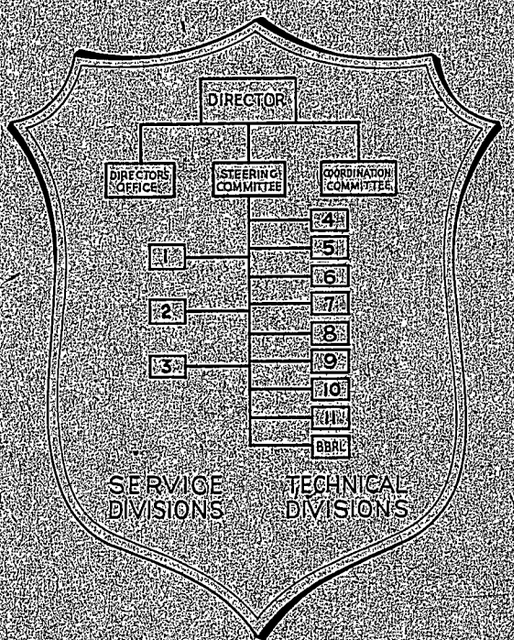
REPORT FOR THE PRESIDENT

RL
MAY 17 1945
#97

RESTRICTED

GROUP ORGANIZATION LIST

MAY 1, 1945



RADIATION LABORATORY

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

RESTRICTED

This list shows the personnel and organization of your division or group as it showed on our records of May 1, 1945. We should appreciate immediate notification on any of the following:

Change of group or division

Change of office room number

Change of office telephone number

Change of home address

Change of home telephone number

Change of marital status

Date of birth and name of a new child

Change of educational status

If there are any additions or corrections which should have been made on this list prior to issuance, please send a list of them immediately to Ruth Seibel, Room 24-111.

F. W. Loomis

Associate Director

[redacted]

Related Part of OSRD Organization

OSRD - V. Bush, Director

NDRC - J. B. Conant, Chairman
R. C. Tolman, Vice-Chairman
R. Adams
C. P. Coe
K. T. Compton
Col. L. A. Denson
F. B. Jewett
Rear Adm. J. A. Furer, USN (Ret.)
Col. R. M. Osborne, USA

Subcommittee On Radar

K. T. Compton, Chairman
F. B. Jewett
Rear Adm. J. A. Furer, USN (Ret.)

Radar Division - 14 - A. L. Loomis, Chief

Radar Committee

A. L. Loomis, Chairman
J. R. Loofbourow, Acting Secretary
W. R. G. Baker
R. Bown
L. A. DuBridge
M. Eastham
J. A. Hutcheson
L. F. Jones
M. J. Kelly
E. O. Lawrence
I. I. Rabi
C. G. Suits
F. E. Terman
A. T. Waterman - NDRC
W. Weaver
H. H. Willis

Radar Division Office

24-221

J. R. Loofbourow, Technical Aide
Eleanor Blair
E. H. Cutler, Technical Aide
J. L. Danforth, Technical Aide
Elizabeth Hanlon
Nora Mohler, Technical Aide
A. P. Rogers

A. F. Coleman (Visitor from OSRD)

Capt. T. Garber
1st Lt. S. L. Ackerman
1st Lt. C. M. Ludwig

Virginia Shallow
Edna Cherry
Rita Heimberg
Florence Hibbs
Mildred Howe
Mary Keegan
Norma Lazarus
H. Irma Lynch
Clare Sullivan

Patent Section

H-310

J. C. Batchelor

Ruth Goldberg
Elizabeth Orpin

Col. J. K. Stotz, Commanding Officer, Army Electronic Training Center, Harvard and M.I.T.

LIAISON

Sig. C.

Lt. Col. A. O. Dodge, O. I. C.
Capt. C. E. Abbott
Capt. R. S. Scott
1st Lt. E. W. Bivans
Mary-Margaret Shanahan, Ass't.

1st Lt. F. Cunningham, Jr. (Det. to 65)

Secretaries, etc.
22-260
Sally Poor

Patent Liaison

H-205
Helen Cronin
Barbara Bennett
Mary Bloomstein
Alice Cahill
Clare DeBlois
Margaret Fogarty
Shirley Grodberg
Isabelle McDermott
Julia Ramey

Capt. P. Colman
Capt. G. C. Biddle
Capt. P. J. Chandler
Capt. E. A. Cockey, II
Capt. H. M. Denison
Capt. H. E. Downer
Capt. G. Ferebee
Capt. H. T. Kilburn
1st Lt. F. F. Fagal
1st Lt. D. D. Mooney
1st Lt. R. D. Sanborn
1st Lt. E. B. Therkelsen

2nd Lt. C. P. Boberg
2nd Lt. H. G. Dean, Jr.
2nd Lt. E. U. Dithmar
2nd Lt. F. J. Epstein
2nd Lt. E. V. Haake
2nd Lt. J. C. Haden
2nd Lt. R. D. Harbour
2nd Lt. R. A. Henshaw
2nd Lt. E. H. Waters
2nd Lt. W. A. Welsh
2nd Lt. M. S. Winters

Draftsman
H. R. Nordberg

2nd Lt. A. Fafarman (Det. to PO)
2nd Lt. W. S. Routon (Det. to PO)

Signal Property Officer
Capt. E. T. Ebersol, Jr.

A. A. F.

Lt. Col. F. H. MacDuff
Major R. E. Johnson
Major E. V. B. Van Pelt, Jr.
Capt. D. P. Duffy (RRL)
Capt. J. A. LaRochelle
Capt. J. C. Mays
Capt. J. W. Pruett
Capt. I. A. Summers (RRL)
Capt. A. P. Whitmire
Capt. J. E. Woodward
1st Lt. R. A. Johnson (RRL)

1st Lt. R. C. Allen (Det. to 104)
1st Lt. J. B. Higley (Det. to 64.1)
1st Lt. B. Lax (Det. to 104)
Capt. F. W. Martin (Det. to 44)
1st Lt. G. M. Nonnemaker (Det. to 103, Det. to 65)
1st Lt. I. R. Weingarten (Det. to 103)
M/Sgt. R. M. Bennett (Det. to 91.1)

4148th AAF Base Unit (Electronic Experimental Squadron)

Bedford Airport
Barbara Dowd

Lt. Col. J. J. Mullen - Commanding Officer
Capt. R. S. Dau - Communications Officer
Capt. J. F. Dryden, III, - Operations Officer
Capt. D. Kennedy - Ass't. Operations Officer, Pilot
Capt. C. J. Lyness - Navigator
Capt. E. P. Miller - Engineering Officer
Capt. J. P. Moore - Adjutant
Capt. G. K. Shako, Jr. - Technical Inspector, Pilot
1st Lt. K. J. Benoit - Ass't. Eng. Officer, Pilot
1st Lt. J. E. Hensler - Personal Equipment Officer, Pilot
1st Lt. P. K. Hoffman - Ass't. Operations Officer, Pilot
1st Lt. J. P. McKeon, Jr. - Ass't. Communications Officer, Pilot
1st Lt. M. F. O'Toole - Pilot
1st Lt. E. J. Romanak - Supply Officer, Pilot
1st Lt. R. C. Ruecroft - Ass't. Eng. Officer, Pilot
1st Lt. J. E. Thiaville - Armament Officer, Pilot
1st Lt. R. E. Thompson - Weight and Balance Officer
2nd Lt. R. K. Richardson - Ass't. Armament Officer, Pilot

LIAISON (cont.)

Navy

Cdr. D. T. Ferrier, USN (Ret.)
Lt. J. W. Barden, USNR
Lt. A. J. Coale, USNR
Lt. R. H. DeWitt, USNR
Lt. G. F. Duvall, USNR (Ret.)(D-103)
Lt. J. K. Mitchell, USNR
Lt. H. Picker, USNR
Lt. R. P. Read, USNR (Ret.)
Lt. W. L. Thompson, USNR
Lt.(jg) J. Brand, II, USNR
Lt.(jg) J. S. Flagg, USNR
Lt.(jg) C. Henriquez, Jr., USNR

Lt.(jg) A. D. Tuttle, USNR
Ens. S.L. Katz, USNR (Det. to PC)
F. L. Cavanaugh, Y 2/c, USNR
C. A. Cox, S 1/c, USNR
W. F. O'Connor, RM 2/c, USNR
Mary Stewart, SK 2/c, USNR (W)
Marjorie Wolfe, Y 1/c, USNR (W)
D. Carlson, Y 3/c, USNR (Det. to PC)

Secretaries, etc. 20D-212
Miriam Kelly
Nancy Russ
Pauline Sullivan
Virginia Duffy
Dorothy Sleeper
Phyllis Adams
Joan Luitwieler
Elizabeth Sheehan
Nelita Nickerson
Sylvia Linden
Rosamond Carlsen
Frances Conway
Rose Sawyer

J. N. Hall (additional duty from Bureau of Ships)
R. M. Purinton (additional duty from Bureau of Ships)

Office of Patents and Inventions
H-306

Lt. G. F. Langford, USNR
Lt. S. B. Pritchard, USNR
Lt. A. H. Rosen, USNR
Lt.(jg) R. L. Spencer, USNR
Lt.(jg) G. S. Willard, USNR

Doris Hobby, Y 3/c, USNR (W)
Dorothy Kinney, Y 3/c, USNR (W)
Arlene Mintz, Y 3/c, USNR (W)
Helen Nelson, Y 3/c, USNR (W)
E. A. Davidson, S 1/c, USNR

Special Project Engineers (Under Instruction)

Lt. H. B. Allen, USNR	(Det. to 64.1)	Lt. R. L. Kellner, USNR	(Det. to 35.2)
Lt.(jg) E. H. Ardahl, USNR	(Det. to 102)	Lt.(jg) J. H. Kline, USNR	(Det. to 82)
Ens. R. E. Benn, USNR	(Det. to 91.3)	Lt. R. W. Landon, USNR	(Det. to 82)
Lt.(jg) K. N. Bergan, USNR	(Det. to 91.4)	Ens. B. Loesch, USNR	(Det. to 91.4)
Ens. T. A. Bergstralh, USNR	(Det. to 103)	Lt.(jg) H. J. Loggan, USNR	(Det. to 55.4)
Ens. A. L. Bletcher, USNR	(Det. to PC)	Lt.(jg) C. E. Long, Jr., USNR	(Det. to 81)
Ens. S. Breen, USNR	(Det. to 91.2)	Lt. W. M. Lynch, USNR	(Det. to 91.2)
Ens. H. Brettman, USNR	(Det. to 91.3)	Ens. F. P. Maclay, USNR	(Det. to PC)
Lt.(jg) C. V. A. Bullen, USNR	(Det. to PC)	Lt.(jg) M. J. Madigan, USNR	(Det. to 91.2)
Lt. W. A. Carlson, USNR	(Det. to 91.2)	Lt. C. A. Martin, USNR	(Det. to 91.2)
Lt. H. S. Carmack, USNR	(Det. to 55.4)	Lt. A. B. Miller, USNR	(Det. to 45)
Ens. J. N. Childs, Jr., USNR	NLO	Lt.(jg) W. E. Miller, USNR	(Det. to 55.4)
Lt. A. H. Chismark, USNR	(Det. to 91.4)	Ens. A. H. Nelson, USNR	(Det. to PC)
Lt. H. R. Christensen, USNR	(Det. to 71.2)	Lt.(jg) F. W. Nelson, USNR	(Det. to 91.2)
Lt.(jg) R. J. Collopy, USNR	(Det. to PC)	Lt. C. W. Ottensman, USNR	(Det. to 51.1)
Lt.(jg) B. L. Cook, USNR	(Det. to 91.2)	Lt.(jg) E.J. Pelletier, Jr., USNR	(Det. to 45)
Lt.(jg) W.W.F.V. deGruy, USNR	(Det. to 82)	Lt.(jg) P. H. Peters, USNR	(Det. to 72)
Lt.(jg) W. P. Dershimer, USNR	(Det. to 65)	Lt. H. B. Rand, USNR	(Det. to 91.2)
Lt. H. D. DeWar, USNR	(Det. to 102)	Lt. Cdr. M. Sandfort, USNR	(Det. to 35.2)
Ens. C. S. Diehl, USNR	(Det. to 35.2)	Lt. F. F. Segesman, USNR	(Det. to 102)
Lt.(jg) R. W. Elton, USNR	(Det. to 54.1)	Lt.(jg) E. L. Smith, Jr., USNR	(Det. to 91.2)
Lt.(jg) W. J. Greene, USNR	(Det. to 91.2)	Lt. J. F. Sodaro, USNR	(Det. to 104)
Lt. A. R. Gregory, USNR	(Det. to 91.2)	Lt.(jg) C. B. Stanley, USNR	(Det. to 54.1)
Lt. W. S. Grenfell, USNR	(Det. to 71.2)	Lt. E. B. Staples, USNR	(Det. to 72)
Lt. E. C. Gulick, USNR	(Det. to PC)	Lt.(jg) L. B. Stein, USNR	(Det. to PC)
Ens. W. H. Hailey, USNR	(Det. to 55.4)	Ens. F. H. Steuck, USNR	(Det. to 103)
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Lt.(jg) C. Hardin, Jr., USNR	(Det. to 103)	Lt. F. E. Swain, USNR	(Det. to 101)
Ens. C. F. Hazelwood, USNR	(Det. to 72)	Lt. R. J. Walker, USNR	(Det. to 91.1)
Lt.(jg) H. S. Hemstreet, USNR	(Det. to 82)	Ens. G. A. Walters, USNR	NLO
Lt. J. H. Hoffman, USNR	(Det. to 91.4)	Ens. G. D. Watkins, USNR	(Det. to PC)
Lt. Cdr. B. B. Jeffrey, USNR	(Det. to 91.2)	Lt.(jg) F. E. Wyman, Jr., USNR	(Det. to 55.4)
Lt. J. I. Jolley, USNR	(Det. to 91.2)	Lt. J. F. Yeager, USNR	(Det. to 102)

LIAISON (cont.)

Project Cast

Bedford Airport

Cdr. H. Christensen, USNR
Lt. Cdr. H. V. Anderson, USNR
Lt. W. E. Ragsdale, USNR
Lt. J. T. Hogan, USNR
Lt. J. O. Adams, USNR
Lt. C. J. Anderson, USNR
Lt. N. D. Champlin, USNR
Lt. C. M. Baker, USNR
Lt. L. D. Condon, USN
Lt. D. C. Twitchell, USNR
Lt. B. M. Griffin, USN
Lt. O. F. Jarmon, USN
Lt. C. G. Knoblock, USN
Lt. D. M. Carroll, USNR
Lt. R. Q. Ranson, USNR
Lt. J. M. Panetta, USN
Lt.(jg) D. W. Thomson, USNR
Lt.(jg) L. Ewing, USN
Lt.(jg) A. A. Jorgenson, USN
Lt.(jg) L. G. Lesh, USNR
Lt.(jg) A. G. Erb, USN
Ens. L. L. Barton, USN
C. R. Elec., V. O. Smith, USN

Marian Dreisbach
Marion Prouty
Gemma Russo

B. A. C.	D. M. Robinson G. R. Tingley (Visitor from TRE, London)	Jeannette Horzempa	24-302
B. A. D.	Lt. J. G. Armitage		24-302
Aust. L. O.	M. Beard	Miriam Newhall (Also 41)	22-241
D. I. C. 6030 (NDRC)	A. R. von Hippel	Liaison with Transition	
D. I. C. 6093	A. C. Hall	RRL - L. D. Leet R. B. Monroe USL - H. R. Stewart	
OEMsr-39	F. V. Hunt		
OSRD	A. F. Coleman		

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P. R. Weiss - BuOrd

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Louise Van Tuyle, Ass't.

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J. Farley
R. Perlman

2nd Lt. A. Fararman (Det. fr. ALO)
2nd Lt. W.S. Routon (Det. fr. ALO)

Draftswoman
(Det. fr. 32.1)

Tice, Margaret

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20B-101

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Bertha Salvucci, Ass't. — Eleanor Giordano

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D. Gagliardi
A. H. Shulman

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Ruth Heaney
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F. W. Loomis
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R. E. Meagher
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W. L. Kelly
H. A. Kirkpatrick
J. K. Knipp
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J. R. Loofbourow
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E. M. Lyman
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L. C. Marshall
R. A. McConnell
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J. T. Soller
G. L. Stancliff, Jr.
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G. F. Tape
F. E. Terman
J. G. Trump
L. A. Turner
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L. C. Van Atta
S. N. Van Voorhis
A. R. von Hippel
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H. J. White
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J. R. Zacharias

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M. D. Fagen, 1st Vice Chairman (62)
C. Crosby, 2nd Vice Chairman (RCC)
R. Bigwood, 3rd Vice Chairman (USL)
H. B. Morley, 4th Vice Chairman (RRL)

Bertha Salvucci, Ass't.
20B-101

Director's Office	-	J. E. Exter		Division 7	-	G. F. Pieper, Jr.	(71)
					-	R. G. Heaton	(Alt.)
Transition &	-	H. P. Wile			-	H. Schwartz	(Alt.)
Production Office	-	W. W. Winter, Jr.	(Alt.)		-	M. D. O'Day	(72)
	-	E. F. Breen			-	F. E. Brooks	(Alt.)
	-	R. M. Jackson, Jr.	(Alt.)		-	P. A. DePaolo	(Alt.)
Division 1	-	C. F. Willett	(12)				
	-	W.G. Johnson, Jr.	(16)	Division 8	-	J. A. Clemente	(Div. 8)
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	-	C. W. J. Brown	(Alt.)		-	R. L. Sinsheimer	(Alt.)
	-	G. S. Clark	(34)				
	-	W. L. Kelly	(36)				
	-	G. Hoey	(Alt.)	Division 10	-	P. S. Clymer	(Div. 10)
	-	J. P. Quinn	(Alt.)		-	B. F. Harrell	(102)
					-	C. A. Smith	(Alt.)
Division 5	-	R. S. Stanton	(51)		-	V. A. Counter	(103)
	-	R. G. Fluharty	(Alt.)		-	C. E. Mandeville	(Alt.)
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	-	J. W. Severinghaus	(Alt.)				
	-	F. H. Abbott	(56)				
	-	H. W. Baur	(Alt.)	RRL	-	H. B. Morley	
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	-	L. M. Belleville	(61)	USL	-	R. Bigwood	
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T. F. O'Donnell - Head, Division 1
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J. J. Snyder - Leader, Contract Settlement Office
Annabelle Jensen, Ass't.

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R. P. Smith - Associate Leader
J. H. Sole - Washington Liaison

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L. Baumbach
A. A. Bright, Jr.
K. W. Comsey (Also Div. 6)
W. H. Fields, Jr.
W. N. Flynt
P. A. Lockwood
J. A. Morton
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R. Daniels (Det. to 35.2)
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H. Holst (Det. to Div. 10)
H. W. Long (Det. to 91.1)
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J. C. Sheridan (Det. to Div. 10)
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R. J. Woodrow (Det. to PC)

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P. C. Mulkern
J. B. Rice, Jr.
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Sylvia Stillman
E. C. Belknap, Ass't.
L. K. Englund, Ass't.
Bettina, Hansen, Ass't.
Hazel Hunsche, Ass't.
W. Scott, Ass't.

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Beatrice Avedisian
Elizabeth Brannen (Also 35.2)
Harriet Emerson
June Jordan
Lora Mangham
Violet Williamson
Blanche Worth

Margaret Shaub (Det. to 91.4)

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Ruth Cardinal
Lillian Carney
Mary Connell
Nancy Duggan
E. J. Farrell
Madelyn Glendon
Catherine Jeffrey

Joan Leary
Katherine Malloy
Beatrice Moore
Ruth Murphy
Ruth Murray
Marjorie O'Connor
Marion Stone
Ethel Sullivan
Eunice Turner

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P. Hunt

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H. T. Andrews, Chief
C. B. Leard, Ass't.
Carolyn Tomei, Ass't.

R. A. Sayers - Supplier Claims
H. T. Andrews - Planning
W. H. Ballard - Auditing

Secretaries, etc.

Constance Vose
Kathryn Hatton
Hope Schloesser

Surplus Property Department

C. W. Blackmon, Chief
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Secretary

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E. P. Duffy
H. F. White

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35.0 Group Office

Newton, C., Leader

Secretary
20B-113
Ellis, Mary
(Also 35.1)

35.1 Special Publications - Photography

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Musgrave, A. B.
Perkins, Nancy, Ass't.

Percival, R. W. (Det. fr. 32.4)
Remde, H. F. (Det. fr. 104)

Photographers

*Alexander, J., Jr.
Dale, R. G.
Doherty, J. P.
Ellis, T. C.
Gill, F. A.
Henderson, A. G.
Huff, L. C.
Kirkendall, M. E.
Mahony, L. G.
Pizzano, C. W.
Sanford, L. C.
Wennermark, A. J.
West, J.

* Outside the United States

Secretaries, etc.
20B-113
Cheney, Margot
Cotter, Pauline
Kelley, Irene
Murphy, Eleanor
Serriello, Esther
Thomas, Barbara

Draftswoman
(Det. fr. 32.3)

Weidmann, Lois

Draftsman
(Det. fr. 32.4)

Woodington, W. G.

35.2 Training Manuals

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Caswell, A. E., Chief
Benham, 1st Lt. M. J.
Boas, Marie
Carmody, W. R.
Farrell, T. A., Jr.
Simonds, W. N., Jr.
Johnson, Gwyneth, Ass't.

Daniels, R. (Det. fr. Tr S)
Diehl, Ens. C. S., USNR (Det. fr. NLO)
Kellner, Lt. R. L., USNR (Det. fr. NLO)
Robinson, M. M. (Det. fr. Tr S)
Sandfort, Lt. Cdr. M., USNR (Det. fr. NLO)

Draftswomen
(Det. fr. 32.3)

Elliott, Nancy
Santoro, Prudence

Secretaries, etc.
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Clark, Ruth H.
Brannen, Elizabeth (Also Tr S)
Williams, Doris

35.3 "Radar" Magazine (Washington)

Staff Members

20B-113

Masters, D. W., Chief
Copland, Ruth
Johnson, Dallas
Lavoie, Avis, Ass't.
Sewell, Lucie, Ass't. (based at Radiation Laboratory)

35.4 Motion Pictures

Staff Members

Sewall, J. K., Chief
Babish, R. C.
Bostick, Virginia
Pendergast, Sarah, Ass't.
Peterson, Thelma, Ass't.

Draftswomen
(Det. fr. 32.3)

Emery, Norma
Franklin, Mary
Lane, Laura

Cameramen

Carbonaro, C. J.
Hartley, T. F.

Secretaries, etc.
20B-119
Butler, Louise
Byers, Susan
Colby, Marilyn
Curtis, Helen

Photographer

Cripps, W. J.

SECRET

REPORT TO THE PRESIDENT

on
operations of the

OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

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SECRET

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   - (c) Anti-aircraft measures.
   - (d) Anti-tank measures.
   - (e) Combat vehicles.
   - (f) Bombing aids.
   - (g) Explosives and propellants.
   - (h) General.
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   - (b) Aviation medicine.
   - (c) Chemotherapy.
   - (d) Tropical medicine.

SECRET

1. NEW WEAPONS.

(a) Special Project.

A report has recently been submitted on the status of this project, which was discussed with Mr. Wallace, and it hence will not be further summarized here. It may well turn out to be the most important matter under development.

(b) Anti-submarine measures.

The problem of destroying submarines consists, first, in locating them generally, and second in locating them precisely and bombing them. The sole asset of the submarine is its concealment. If it can be completely located, this asset is gone, and it is readily destroyed, for it is slow and vunerable. If the devices now in use, and now emerging from the laboratory, are well perfected and put into full service use, the day of the submarine as the prime commerce raider will, in my opinion, be over.

The most striking development in this field is in radio location of surfaced submarines by aircraft, the code name for the device being ASV. An aircraft thus equipped can sweep a lane 20 miles wide and detect every surfaced submarine in the area. A single

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OFFICE FOR EMERGENCY MANAGEMENT

NATIONAL DEFENSE RESEARCH COMMITTEE
OF THE
OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT
1530 P STREET NW.
WASHINGTON, D. C.

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RICHARD C. TOLMAN, Vice Chairman
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MAJ. GEN. R. C. MOORE
CAPT. LYBRAND P. SMITH

IRVIN STEWART, Executive Secretary

February 26, 1942

Dr. Vannevar Bush
Dr. James B. Conant

Gentlemen:

During the last few months we have discussed the need for careful attention to the basic organization of the microwave program, in view of its extraordinary growth and success, in order to insure the best possible framework for anticipated still further growth in size and importance to our war effort.

Section D-1 has come to certain conclusions, in which I concur, regarding the policy which should be pursued in order to secure maximum quick usefulness of microwave developments in this war. In reaching these conclusions it has consulted Army and Navy officers concerned with procurement and use of microwave equipment and it has examined the situation within the Radiation Laboratory, the laboratories of the armed services, the associated manufacturing companies, and several educational institutions. The following conclusions represent unanimous judgment, after very careful consideration.

1. Urgent needs and new opportunities for applications of microwave equipment will require severalfold increase in the number of scientists and engineers engaged in its research and development program. Thus far development of new types of equipment has been the principal activity. This will continue and grow, but coming soon are large new demands for personnel for field testing and initial servicing of new equipment, while it is being adapted to field use and while armed service personnel are being trained to handle it.

2. Both Army and Navy are relying on N.D.R.C. to meet these needs and opportunities in research and development. They have concentrated their own efforts almost entirely on procurement, testing, training and operation.

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3. The Microwave Committee for policies and the Radiation Laboratory for technical developments have supplied coordination in the Radar development program and must continue to perform this function.

4. The Radiation Laboratory should continue to be the center for "systems" developments of strictly microwave character (10 cm. or lower wavelength). In this function it should not be subdivided or scattered, and every effort should be made to provide adequate quarters and personnel for most effective operation.

5. Whenever more purely scientific research projects can advantageously be carried on in other laboratories, with close affiliations with the Radiation Laboratory for exchange of information and mutual guidance, such projects should be sought out and supported.

6. Minor research, development, measurement or testing projects can sometimes be established advantageously in other laboratories. Benefits may derive from either the direct result of the work or the indirect influence as training and recruitment centers. Such projects should also be sought out and sponsored.

7. As needs for field research stations develop, these should be established under direction of Section D-1, with intimate technical coordination with the Radiation Laboratory, and wherever possible under contract with a nearby institution for a purely business management (salaries, rents, purchases, overhead, etc.).

8. Developments in the field of detection or microwaves, not concerned primarily with 10 cm. or less microwave systems, should be carried on elsewhere than in the Radiation Laboratory.

Appended hereto is a list of notes pertaining to various aspects of the policy outlined above.

Very sincerely yours

Karl T. Compton

KTC/L

Karl T. Compton

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Notes to accompany letter to Drs. Vannevar Bush and James B. Conant from Karl T. Compton, February 26, 1942

I. Development of Strong Microwave Centers

From the beginning it has been the policy of Section D-1 to enlist and build up centers of microwave activity wherever this can be done to advantage. The first actions were to recommend contracts with every center of microwave activity known to exist at the time of N.D.R.C.'s formation. These centers were Bell Laboratories, General Electric, Westinghouse, Radio Corporation of America, M.I.T., and the combination Sperry Gyroscope Company-Stanford University.

In contradistinction with some of the other N.D.R.C. interests, the major competence in microwave radio has been associated with industrial companies. Furthermore, anticipation of large procurement orders following successful research development has emphasized the importance of establishing centers of interest and competence in connection with manufacturing organizations.

Subsequently to these initial moves, Section D-1 contracts have been made also with General Radio Company, Link Aviation Devices, Inc., Raytheon Production Company, University of California and Brooklyn Polytechnic Institute. Contracts with other institutions will be recommended at the next meeting.

For the same reason the Radiation Laboratory has placed purchase orders with companies which could thereby be put into condition for handling much larger purchase orders in connection with subsequent Army or Navy contracts. These companies include United Shoe Machinery Company, Stromberg Carlson, Submarine Signal Company, Great Lakes Electric Manufacturing Company, Harvey Radio Manufacturing Company, Weymouth Instrument Company, Mico Instrument Company, James Millen Manufacturing Company, Browning Laboratories, Philco and Crossley Radio Companies.

The usefulness of this policy is proven by the fact that some 12 of the above companies now have or are negotiating Army or Navy production contracts for microwave equipment.

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II. Distribution of Microwave Research Personnel

As of February 1st the number of professional scientists and engineers engaged in microwave research and development in those companies or institutions with whom N.D.R.C. has made direct contracts through Division 1 is as follows:

Bell Laboratories and Western Electric Co.	450
Massachusetts Institute of Technology	208
General Electric Company	143
Sperry Gyroscope Company	90
Westinghouse Elec. & Mfg. Company	75
Radio Corporation of America	72
Raytheon Corporation	30
General Radio Company	2
University of California	1
Total	1071

These figures do not include scientists or engineers employed by the sub-contracting companies, although this number is probably not large. The figures show that the Radiation Laboratory, although it has been a coordinating center of this microwave development, actually employs less than 20% of the total.

III. Section D-1 Projects

a. At 10 cm. or Less Wavelength

The first undertaking was to develop a 10 cm AI equipment. This is now on large scale production. The next large scale job, and the one which is at the moment most urgent, was the production of ASV equipment. This also is rapidly going into large scale production and has been the first NDRC equipment, working in association with the magnetic submarine detector, to have a military success in this war. The ~~Secretary~~ Division believes that AGL equipment, which is now under very active development, will be the most important project during the coming year.

In addition to these major jobs, other developments include range only equipment for various applications to fire control in collaboration with optical tracking; complete Radar automatic gun laying and search-light control; powerful equipment of high resolving power for GCI (ground control interception) and for height finding; GSV (ground surface vessel) detection

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equipment for harbor or coast patrol; SSV (ship surface vessel) detection equipment for use on shipboard in sea patrol. All of these systems are under test, three of them are in quantity production and another appears close to this stage.

An additional very important project in this same wavelength range is blind landing on which work is urgently requested by both Army and Navy. Two systems are in advanced stage of development and tests, one for emergency use involving no equipment in airplanes and the other a more complete system for permanent installation on planes and landing fields. The above systems operate in the 10 cm or 3 cm range. The possibility of 1 cm Radar now appears encouraging. If successful, this will open up important new possibilities as, for example, precision bombing on land objectives through overcast.

b. At Other Ultra Short Wavelengths

A long range navigation project has completed initial tests successfully and is being extended with Navy cooperation for tests in the field of actual Naval operations.

A very important and highly secret new project on Radar counter measures is in its early stages of organization.

In the Radiation Laboratory alone some 40 Radar systems are now under construction or tests. Small scale production on two important systems is under way in the Model Shop, one of these for United States Army and the other for British Lend-Lease. Several additional types of systems are under development in the cooperating industrial laboratories.

IV. Size of Radiation Laboratory

At the present time the staff of the Radiation Laboratory is made up as follows:

Scientific and Engineering Staff	265
Technicians, Draftsmen, Secretaries, Computors, Assistants, Stock Clerks, Messengers, Chauffeurs, Guards, and Switchboard Operators	384
Total	649

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The question has been raised as to whether this laboratory is becoming too large for efficient operation. It is our unanimous judgment not only that this is not the case but that it would introduce serious inefficiency to subdivide it in so far as its basic attention to microwave "systems" is concerned. Activities outside of this category can frequently be set up advantageously elsewhere as indicated in the text of my letter. The following observations bear upon this point:

If the research and development projects involved were of diverse character and relatively unrelated to each other, they could advantageously be handled with wide dispersion of each project set up in a favorable environment of its own. This appears to be the situation in most of the lines of chemical research, for example. It is only incidentally true, however, in the microwave field.

Most of the activity in the microwave field has to do with the development of "systems" fundamentally similar and involving the same general types of components. The situation is very analagous to that of the telephone industry which has found it advantageous and efficient to concentrate research in the whole field of telephone systems into one laboratory, which is far larger than anything now existing or contemplated in the Radiation Laboratory. We believe that this intrinsic characteristic of the main stem of microwave research requires continuation of this central laboratory and that its dispersal will be just as improper as a dispersal of the Bell Telephone Laboratories all over the East, West, North and South of the country.

While Section D-1 holds firmly to this basic idea, it also believes that the effectiveness of a central Radiation Laboratory requires that extraneous microwave projects not already related to the main line of systems development should be carried on elsewhere wherever an invironment can be found which will permit successful prosecution of the work.

V. Location of Radiation Laboratory

The requirements for the Radiation Laboratory include the following essentials: laboratory space, adjacent living quarters, an adjacent airport with hangar and shops, and an outlook over the ocean. The location in Cambridge and Boston supplies these facilities probably better than any other in the country. The Radiation Laboratory has occupation and control of the National Guard hangar at the East Boston Airport, one of the largest and best equipped hangars in the country and

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now vacated by the National Guard Observations Squadron since this was absorbed in the United States Army. The Coast Defense Station at Deer Island in the Boston Harbor provides excellent facilities for first-class cooperation in testing land or seaboard equipment intended for sea patrol. Originally the M.I.T. Electrical Engineering and Physics laboratories were a great asset, although these have now been so far outgrown that they are no longer comparable with the airport and harbor facilities in determining the location of the laboratory.

The events which led to the selection of M.I.T. as the sponsoring institution for the Radiation Laboratory should be made a matter of record. The Microwave Committee first considered the new Cyclotron Laboratory of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington as a suitable location, but soon abandoned this idea because another NDRC activity had already become established in these quarters and it was even evident that the Radiation Laboratory would require more than the remaining space there available.

It was next arranged with the Army Air Corps to establish the laboratory in a temporary building on Bolling Field in Washington. This would have been a central location with airplanes available for practice but without the advantage of look-out over the sea. However, immediately prior to submission of this recommendation by Section D to NDRC word was received from the Army Air Corps that a change of plans made the Bolling Field location impossible. Drs. Bush and Loomis asked whether M.I.T. could make space available and could get any facilities at the East Boston Airport. I telephoned the situation up to Mr. Killian at M.I.T., who 'phoned back in a few hours that M.I.T. could make available 11,000 square feet of good laboratory space and the National Guard hangar at the East Boston Airport would soon be available. On the basis of this information, NDRC proceeded to make the contract with M.I.T. for the establishment of the Radiation Laboratory. Since that time M.I.T. has handled the business arrangements, but the selection of personnel and the technical direction of the program have been in the hands of officers chosen by Section D-1.

VI. Radiation Laboratory as a Coordinating Center

The significance of the Radiation Laboratory as a coordinating center for the entire microwave development of the country may not be entirely appreciated. During the past month, for example, more than 800 official visitors from the Army, Navy, Britain, Canada, American manufacturers, and NDRC contractors

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were admitted to the Laboratory. At the monthly Microwave meeting in Washington, this work is further coordinated under the chairman of Section D-1 by bringing together reports of all important developments or progress in procurement during the month.

The Radiation Laboratory is cooperating with the Army, Navy and manufacturers by taking the lead in establishing standardizing committees to agree on important standards as soon as this procedure seems justifiable and thus to guide the direction of procurement prior to the time at which the Army and Navy standardizing committees take more permanent action.

Section D-1 Technical Aide located in the Radiation Laboratory is chairman of a committee, comprising also an Army and a Navy representative, charged with preparing periodic progress reports on matters of Army - Navy procurement and industrial production of microwave equipment.

Recently the Army and Navy have requested NDRC through its Radiation Laboratory to coordinate certain microwave developments planned to involve the cooperation of several manufacturers. This activity is definitely in line with one of the directives in the Executive Order establishing the Office of Scientific Research and Development and Section D-1 has recently been engaged in the task of formulating contracts acceptable to all parties whereby NDRC, through its Radiation Laboratory, may act effectively as a coordinator of industrial developments.

VII. Microwave Contracts at Other Universities

It has already been noted that the principal dispersion of microwave activity has been among the manufacturing industries. Prior to 1942 the only university contracts in Section D-1 have been with M.I.T. and the University of California.

At the next meeting of the Microwave Committee a contract will be proposed for the establishment of a tube research laboratory at Columbia University to operate under the direction of Dr. Rabi. There appear to be excellent reasons for establishing such a laboratory outside the Radiation Laboratory but in close cooperation with it. It is hoped that this may develop into as much of a center in this country as Dr. Oliphant's tube laboratory in England. A group of minor contracts is being arranged with perhaps 15 or 20 educational institutions, one of these, the Brooklyn Polytechnic Institute, was authorized at the last NDRC meeting. Others at Purdue, Cornell, Bartol and Georgia Tech will be recommended at the meeting next week. There may be a dozen more of these in the near future.

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They have to do with the development of measuring instruments, or of specific components, or research of basic phenomena, or measurements of physical and electrical properties of materials, or of short wave propagation. Each of these projects will be set up as an independent contract under Section D-1, but each will have its technical liaison connection directly with the individual in the Radiation Laboratory who would be most directly in a position to utilize the results coming from these contracts.

The long-range navigation project, which was one of the first initiated in the Radiation Laboratory, has reached the stage of preparation for field tests under Naval operated conditions in critical areas of the Atlantic and perhaps later of the Pacific. The Navy has agreed to cooperate in these tests to be carried out with equipment designed and provided by N.D.R.C. Contracts for the production of this test equipment from Harvey Radio Company and R.C.A. will be recommended at the next meeting. A search is being made to find a suitable contractor to carry through the tests with the Navy. At the present time Melville Eastham has a small group in the Radiation Laboratory, rather separate from other Radiation Laboratory projects, who have handled this project very ably. The obvious thing to do would be to put the subsequent tests in their hands. However, they could be handled through a separate contract and with another institution than M.I.T., if desirable, although it would seem to be an unnecessary waste of background time to make a change in the actual technical personnel involved.

The Radar counter measures project was set up at the very urgent request of the Navy as an ultra secret affair. Dr. Terman of Stanford University has been put in charge of this project and is assembling a staff and has been assigned space in the Hood Building adjacent to M.I.T. grounds. For purposes of secrecy, as well as of best performance, this project should be rather separate from the Radiation Laboratory, but it is difficult to see how it could be got effectively under way without reasonably convenient one-way contact with this laboratory. In order to get the project going, the Radiation Laboratory has thus far sponsored it. If the proposal now before NDRC is adopted, this will be set up as a separate project with M.I.T. as the initial contractor but with the understanding that it will be transferred in its entirety to a different contractor just as soon as a suitable one can be found. Section D-1 feels strongly that Harvard University

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should be this contractor. It has about the right location with reference to the Radiation Laboratory and several members of its staff will be important members of the RCM staff. I hope that President Conant will soon feel that it would be proper for Harvard University to accept the responsibility for this contract.

VIII. Field Research Stations -

Although field research groups are already in action in various centers on land and sea, it is probable that a small number of important field research stations will be established. The first of these will undoubtedly be in connection with the "Trigger" project in Florida. The Army officers in charge of "Trigger" have expressed enthusiastic approval of the establishment of a microwave field research station under NDRC direction to operate in conjunction with "Trigger".

Of necessity this field research station should be in extremely close contact with the Radiation Laboratory and should in part be operated by personnel on leave of absence from the Radiation Laboratory. Other personnel may similarly be sent to this station by the industrial or other contractors of NDRC.

I have written in an exploratory way to the President of the University of Florida, without giving details as to the nature of the proposed project, and have ascertained that the University of Florida would be willing to undertake a contract with NDRC for the business management of this field research station with the understanding that its technical direction (like that of the Radiation Laboratory itself) would be supplied by Section D-1.

It has been suggested that a somewhat similar station, primarily for tests of ground borne equipment for harbor patrol and antiaircraft fire direction might advantageously be established at Fort Monroe in order to come somewhat closer to war operation conditions than now appears possible at Deer Island.

IX. Army-Navy Procurement Resulting from Radiation Laboratory Activities -

At the present time the Army and Navy have placed orders for 3732 sets of microwave equipment of 10 different types with 11 companies all of which have been developed in prototype form by the Radiation Laboratory. There is reason to believe that even this large procurement will be greatly exceeded by orders for equipment now on test or nearing demonstration and test stage.

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X. Personnel Problems

Of course the basic personnel problem is to find enough men with proper qualifications to carry on the work now in sight with the desired dispatch. This has been continually the most pressing problem of all of the Section D-1 contractors from the beginning. Remarkable progress has been made in the training of men in the Radiation Laboratory both for its own purposes and for industry and the Radiation Laboratory has assisted to some extent also in the training of Army and Navy personnel through the E.S.M.D.T. program.

As to the staff of the Radiation Laboratory, there are ~~the~~ variety of problems which have caused anxiety but have not proved serious. Chief of these is a decision regarding the next academic year's appointment which arises each spring when the universities are making out their budgets and the personnel have to decide whether or not to request continued leaves of absence from their own institutions, although government action on the budget has not yet been taken so that the personnel of contracting institutions, and the institutions giving leaves of absence have to absorb the financial risk.

What may become a much more serious question involves the technical and mechanics staff more directly than the scientific staff and has to do with the competition in the matter of wages. There is probably not an individual in the entire Radiation Laboratory who could not step into an industrial position at an equal or higher base rate of pay for a 40 hour week and with time and a half for overtime on Saturdays and perhaps double time for Sundays. The Radiation Laboratory is now operating on a 6 day week, with considerable voluntary work on Sunday. The time may come when the basic pay rate will have to be raised to come closer to meeting industrial standards. Already the situation has forced M.I.T. to raise its regular mechanics wage scale since, in spite of the differential between temporary and more permanent jobs, widely different wage scales can not be long maintained side-by-side.

XI. Future Radiation Laboratory Location

To provide realistically for the future growth of the Radiation Laboratory while still retaining the advantages of the East Boston Airport and Boston Harbor laboratory and testing facilities, Section D-1 is recommending the rental, if possible, of a suitable building not on the M.I.T. grounds with at least 200,000 square feet of floor space. Such a building should be conveniently located as regards transportation facilities to the East Boston Airport and also, if possible, to M.I.T. The Radiation Laboratory would retain the

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present roof laboratories at M.I.T. and as much other space as might be needed, but would relinquish at least the more scattered aspects of the space now being used in the M.I.T. buildings.

The entire history of the Radiation Laboratory thus far has been one of continual over-crowding with step-by-step relief never large enough to accomplish the objective and always involving some loss of time in transfers. Rental of existing space, if available, would be the quickest and cheapest solution. If such space can not be found, the alternative appears to be quick construction of temporary type of building to extend the present laboratories.

Karl T. Compton