

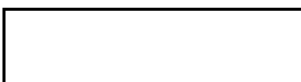
DIRECTORATE OF  
INTELLIGENCE

## *Imagery Analysis Report*

Naro Fominsk Probable ABM Phased Array Radar Complex



Declass Review  
by NIMA/DOD



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September 1967

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IMAGERY ANALYSIS SERVICE

NARO POMINSK PROBABLE AEM PHASED ARRAY RADAR COMPLEX

MARCH 1965 TO JUNE 1967

SUMMARY

The northwest-facing antennas at the Moscow Doghouse Radar Complex are probably externally complete, some five years since initial construction was identified, and about three years since the start of actual face construction. This degree of completion is seen at both the probable receiver and transmitter sites (Operations Areas A and B). The readiness of these antennas for initial operation will now depend on the amount of internal construction, equipment installation, and checkout remaining to be done.

The southeast-facing antennas at Operations Areas A and B are not yet complete. Their construction is approximately one year less advanced than that of the northwest-facing antennas.

The antenna faces of Doghouse A were found to be constructed in separate layers, installed over a heavy steel truss framework. The basic composition of the face consists of a vertical arrangement of adjacent, rod-like elements, over which is installed a thicker layer composed of diagonally-set, ten-foot square blocks.

An azimuth sector scan of about 60 degrees is indicated for the northwest-facing probable transmitter antenna, rather than the 90 to 100 degrees previously assumed. The 60-degree sector is suggested by tree removal in a fan-shaped pattern in front of the antenna, extending outward at 30 degrees to either side of boresight [ ]. No similar clearing activity has yet occurred in front of the southeast-facing antenna, probably because of its less advanced construction status.

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The only visible source of external electric power for the Doghouse is supplied to the operations areas through a buried 6-to 10-kv line from the associated power substation. However, a 110-kv powerline passes nearby and possibly constitutes an additional source of power.

Construction at the associated complex support facilities is also nearing completion. Of specific significance are 17 large multi-story apartment buildings which constitute the permanent housing at the Doghouse complex. These buildings could accommodate at least 4,500 personnel, compared to accommodations for approximately 1,800 personnel at both Mischelevka (Angarsk) and Sary Shagan Site 13 Anti-Satellite/Space Tracking Radar Complexes.

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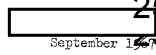
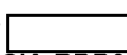
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INTRODUCTION

This study presents a photographic analysis of the Naro Fominsk Probable ABM Phased Array Radar (Doghouse) Complex, with emphasis on mensural and structural analysis of the radar antennas. It also constitutes an update of the associated facilities, showing their chronological development since [redacted]

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The Naro Fominsk Probable ABM Phased Array Radar (Doghouse) Complex is located about 35 nautical miles (nm) southwest of Moscow and consists of two separate operations areas and associated support facilities (Figures 1 and 2). The larger of the two operations areas (Operations Area A) contains the large A-frame antenna structure, Doghouse A; the smaller area (Operations Area B) is located approximately 8,000 feet west-southwest of Area A, and contains two smaller linear antennas, Doghouse B.

All mensuration in this report has been performed by the MPTG Technical Intelligence Division, unless otherwise indicated, and is considered accurate within the stated limits. Since some mensuration in this report differs from previously published measurements, the basis for the refinements and the present degree of confidence is as follows: the small refinements in antenna bore-sight azimuth angle and elevation angle (degrees) were felt to be justified, since previous figures fell in the outer parameters of the narrow range of latest results to be computed from numerous large and small-scale [redacted] missions.

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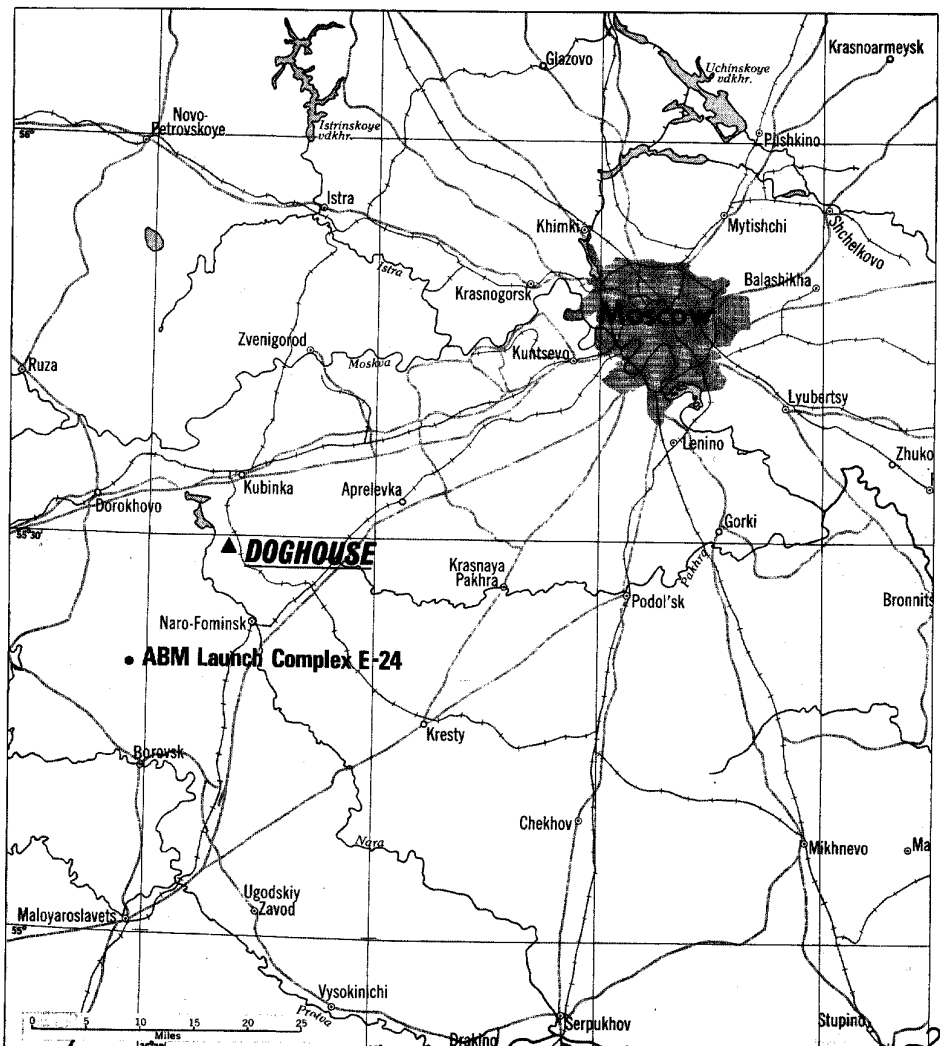
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Correlation between antenna measurements computed from four separate large-scale [redacted] missions resulted in a greater degree of confidence than previously obtained. Advances in computer systems and methods, plus a close coordination between the imagery analyst and the photogrammetrist to derive the most accurate results, also increases this confidence.

For the purposes of this report, the facilities previously termed Support Area A and Support Area B have been redesignated Construction Support Area and Main Support Area, respectively, to better identify their functions.

OPERATIONS AREA A

Operations Area A is located in the southeast corner of the complex (Figure 2). The major structure in the area is a large A-frame antenna structure (Doghouse A), which has been under construction for over three years. Other permanent facilities include a control building, a T-shaped earth-mounded structure, and a steam plant. A photograph and drawings with detailed mensuration of the structures in Operations Area A are shown in Figures 4, 5, and 6.

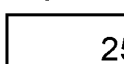
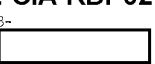


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Figure 1

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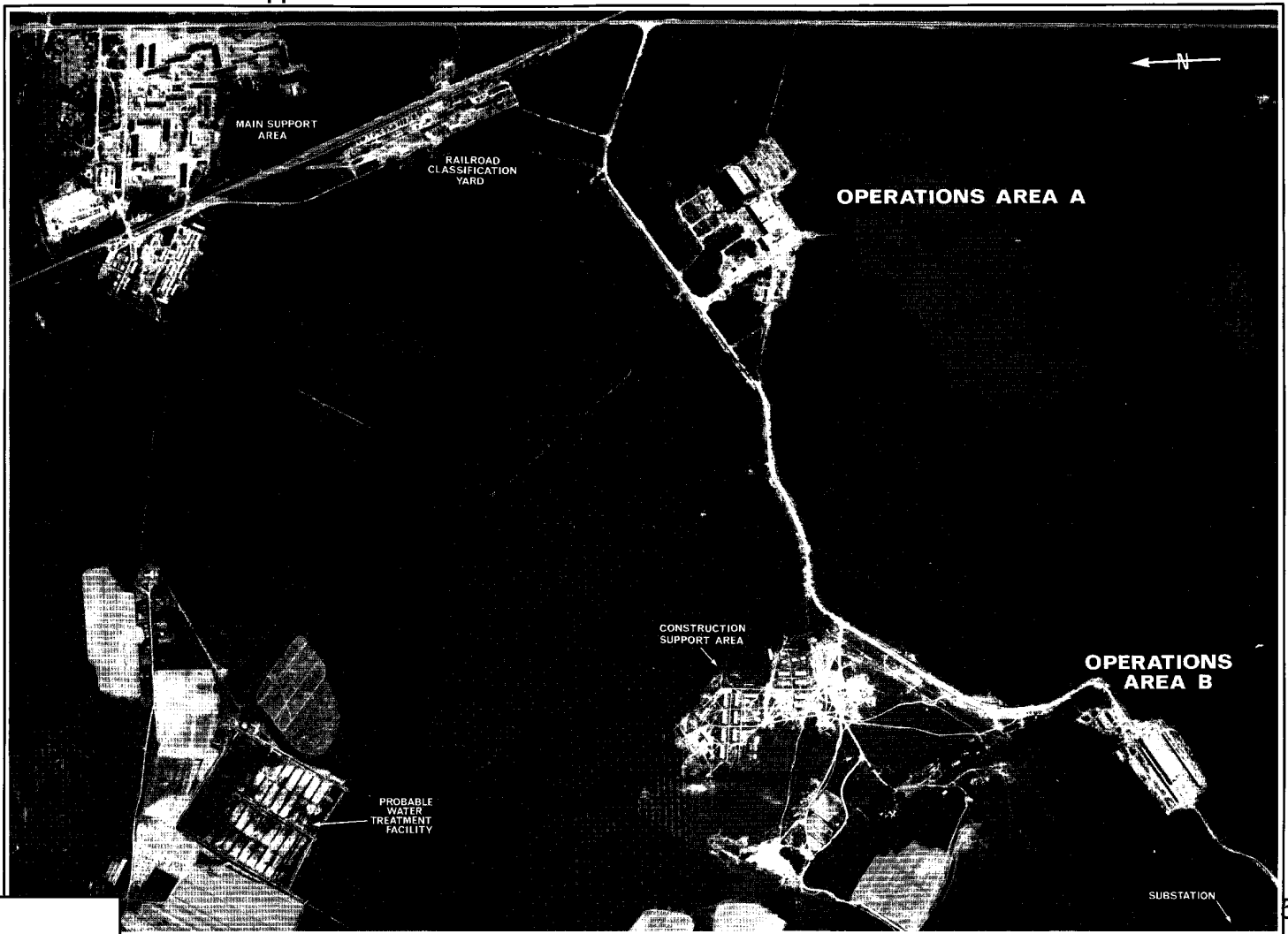
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NARO FOMINSK DOGHOUSE RADAR COMPLEX AND RELATED FACILITIES.

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Figure 2

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Doghhouse Radar A

This is a large A-frame antenna structure, 400 feet square at the base and 360 feet high (Figures 5 and 6). It supports two 345 by 365-foot probable receiver antennas, one facing north-northwest and the other south-southeast. Both have bore-sight elevation angles of 25 degrees. A comparative graphic, showing the size of Doghhouse A relative to other large, more familiar structures, is shown in Figure 3.

Structural Analysis. The basic skeleton of the Doghhouse A radar is formed by the use of heavy steel truss members. These members are emplaced in two opposing rows to create the load-bearing frame or surface plane of each face on the A-frame structure (Figures 4 and 8). Each of the surface planes is vertically subdivided by 19 truss members, spaced at 20-foot intervals. These divide the face opening into 20 vertical openings or "slots," each with a width of 20 feet. The 19 truss members within each face plane converge inward toward an apex at angles of 25 degrees. At the top, they are attached to a flat, probably solid roof, [redacted] and 400 feet long (Figures 5 and 6). Joined to the load-bearing truss members within each face opening are 18 horizontal braces or pylons, vertically spaced at 20-foot intervals. There is indication on several ground photographs that these horizontal braces possibly alternate in thickness, nine thick and nine thin. The resulting broadside configuration is that of a steel grid, 400 feet wide and 360 feet high, composed of 380 twenty-foot squares. The thickness or depth of the face frame is approximately ten feet. Diagonal steel members add further structural support to the main trusswork on the face of the antenna. These are most prominently noted across the open border between the top of the antenna face and the roof of the structure. The diagonal members are installed at one per each 20-foot division at alternating 45-degree angles. Although no other diagonal bracing can be as clearly identified as that above the face, there are indications from ground photography of additional diagonal bracing within the overall face. It is assumed, therefore, that such members are probably present throughout the face structure.

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The southeastern face was observed on [redacted] and it was noted through shadow analysis that sunlight did not pass through the yet-uncovered framework in the lower half of the face. A comparison with earlier photography, where sunlight did pass completely through the structures, suggests that a closely spaced arrangement of braces is installed within the ten-foot depth of the main trusswork during preliminary construction. This additional bracing would probably serve for mounting electronic components and/or facing material and might provide additional structural support.

Also evident prior to the installation of facing material, is one probably thickly latticed 20-foot-wide column or shaft in each side of the open face, approximately 40 feet in from the end walls. Each of these columns appears to be constructed between a pair of main vertical truss members. It is possible that these columns could be either open elevator shafts providing interior access to the antenna screen, lift mechanism housings for interior scaffolding, or functional parts of each antenna face.

The end walls of the A-frame are constructed of a solid material of undetermined thickness and are probably supported by a superstructure which is more massive than the inclined truss members within the face opening. The outer edges of the end walls on both sides of the A-frame extend approximately nine feet past the surface plane created by the inclined trusses (Figure 6). This would allow a maximum usable depth of [redacted] for application of face layers, assuming the final layer to be on an inclined plane coincident to the outer edges of the end walls. A wedge-shaped section appears to have been purposely omitted from the outer edge of the base along both sides for the full length of the structure (Figures 5 and 6). This omission may be a temporary feature for construction access, or a part of the original design. No accurate measurement is currently available for this section; however, based upon existing measurements and photo analysis, it appears that the base of the outer edge is approximately 30 feet above ground level. The result is a vertical wall 30 feet high which has been observed under construction and appears to meet the outer edge of the base of the end wall. This feature is illustrated in Figure 6.

Photography of [redacted] permitted the identification of a row of V-shaped probable counter-braces within the A-frame structure (Figures 7 and 9). The foundations for these counter-braces are set at 20-foot intervals, parallel to the base of the main truss

members, and probably extend the full length of the antenna on both sides. The V-braces extend 60 to 70 feet back from the main truss member foundations in the southeastern face opening. The tops of the "V" span a 20-foot width, equal to the width of the main vertical divisions in the antenna face. Lack of accurate mensuration precluded a determination of where or how the V-braces are attached to the inner face frame. It appears, however, that they are intended to counter the 25-degree slope of the northwestern face has never been photographed from an angle which would allow identification of similar counter-bracing there; however, it is presumed that construction of both faces is identical.

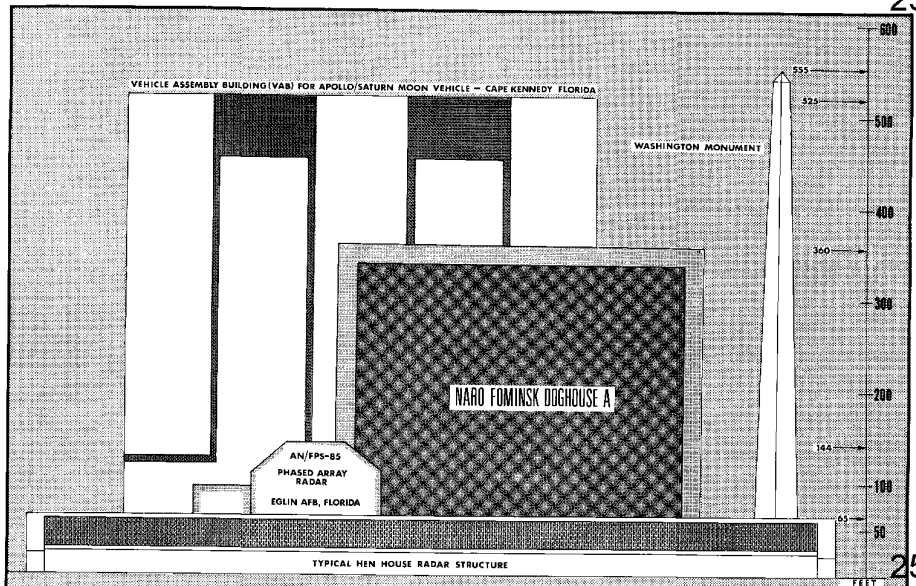
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On numerous ground photographs, indications of major diagonal members have been observed within the A-frame structure prior to installation of facing materials. This also suggests that within the interior of the Doghhouse radar, a complex arrangement of bracing and counter-bracing may be present, stabilizing the structure as a whole.

a. Layer 1, Facing Materials. The first material or component to be installed over or within the basic steel framework (Layer 1, Figure 7) consists of a vertical arrangement of approximately 50 adjacent, probable rod-like elements. Installation of these elements, each approximately five [redacted] feet in width

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RELATIVE SIZE COMPARISON BETWEEN DOGHOUSE RADAR A AND OTHER LARGE STRUCTURES.

Figure 3

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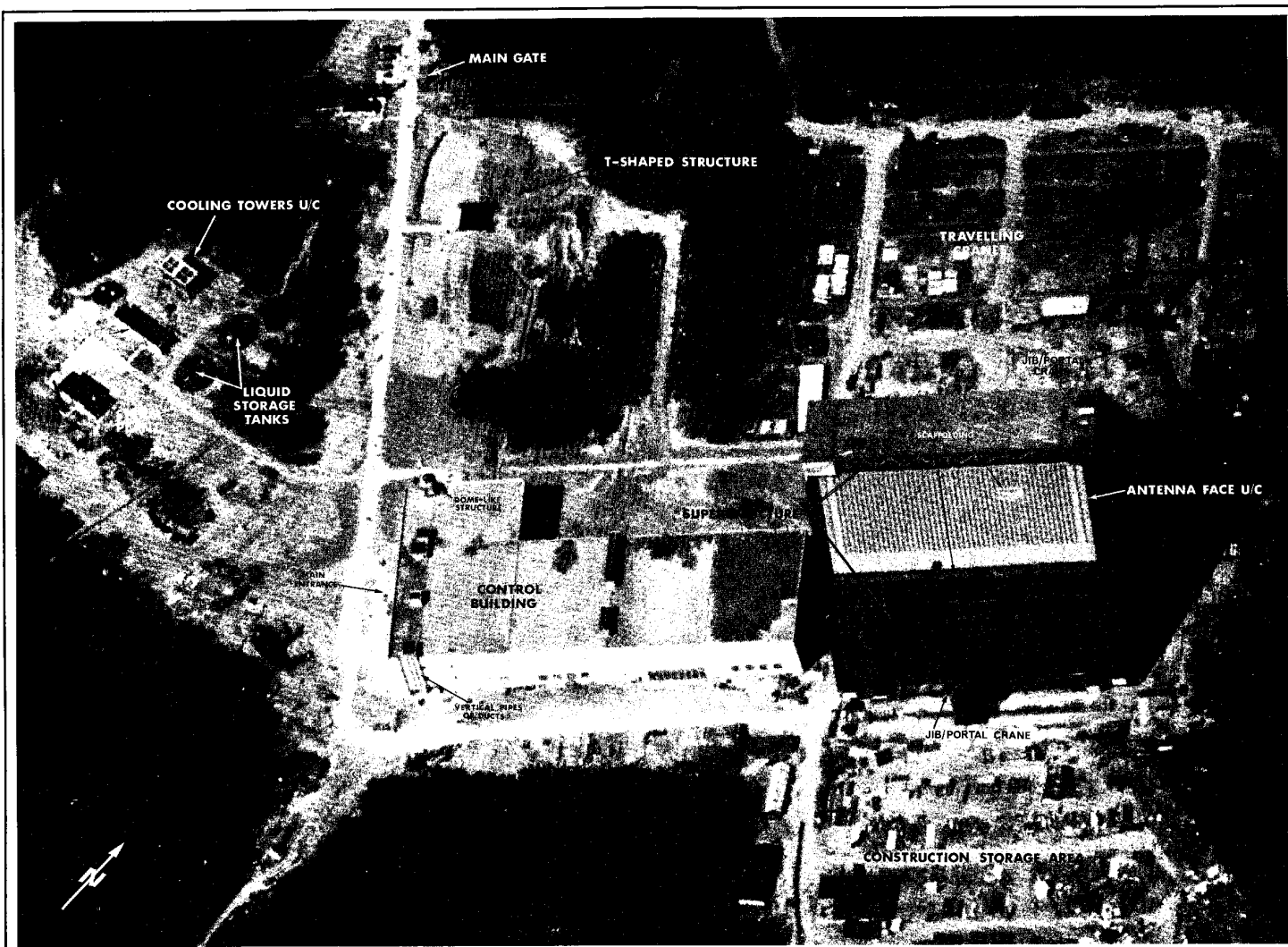
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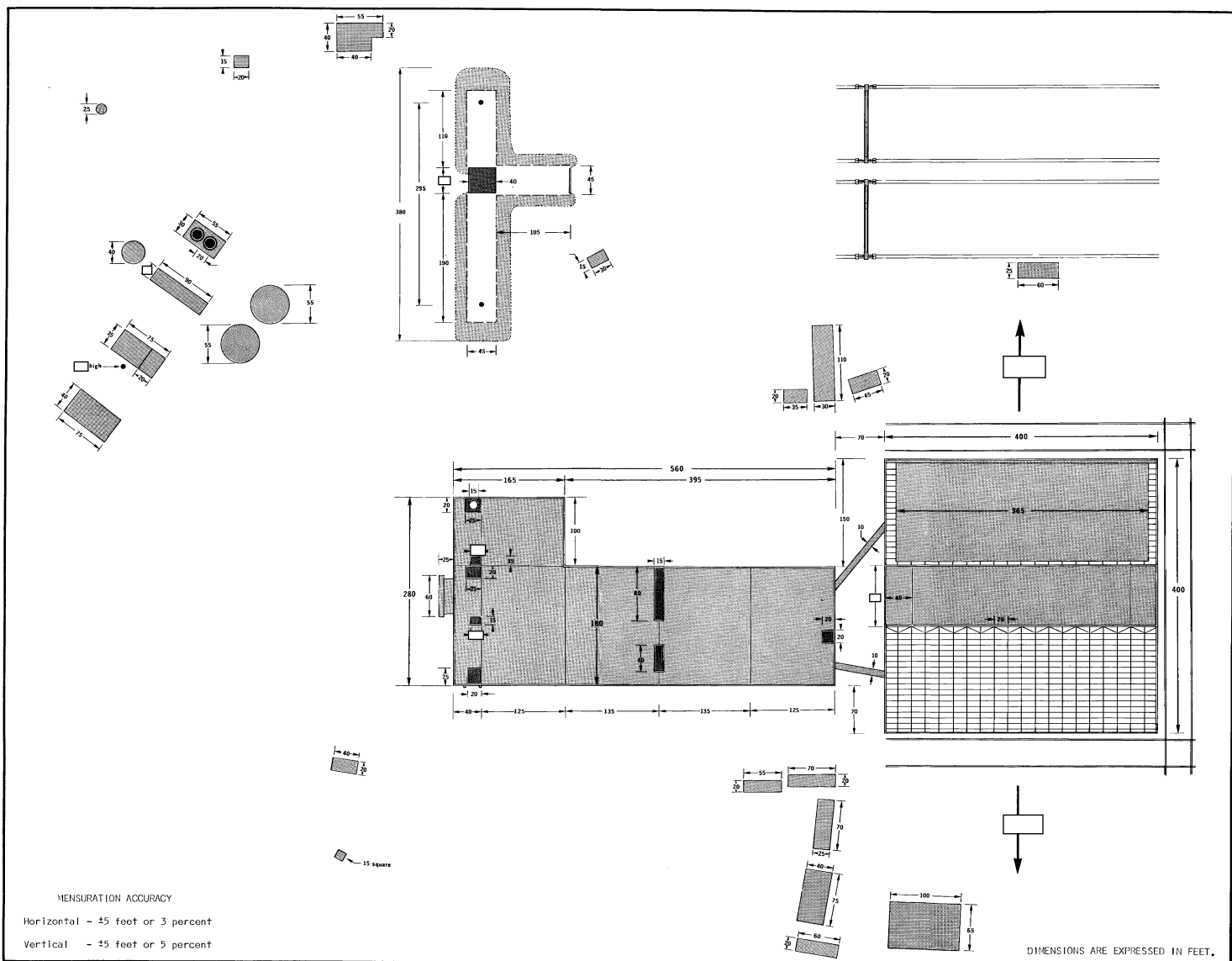
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Figure 4

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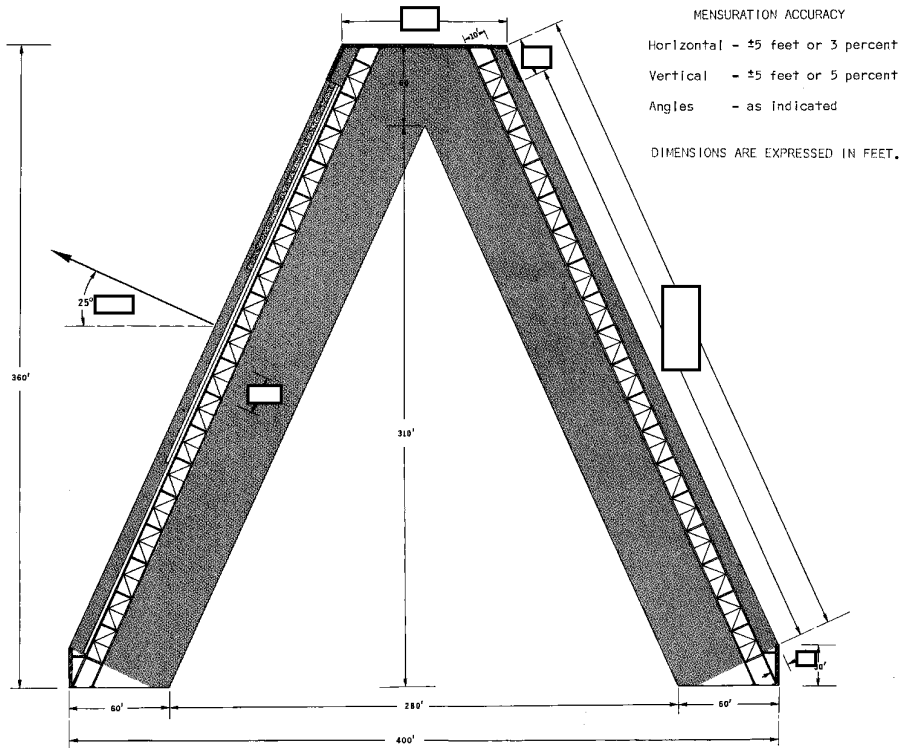


UNRECTIFIED PLAN DRAWING WITH DIMENSIONS, OPERATIONS AREA A.

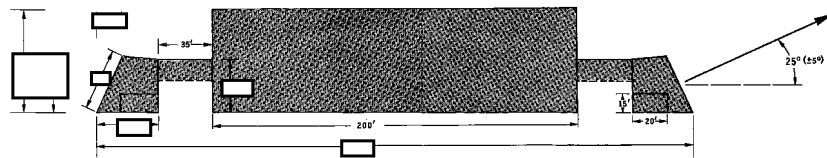
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DRAWINGS ARE INTENDED FOR PRESENTATION OF PROFILE DIMENSIONS AND ARE NOT TO PRECISE SCALE.



PROFILE DIMENSIONS OF DOGHOUSE RADARS A AND B.

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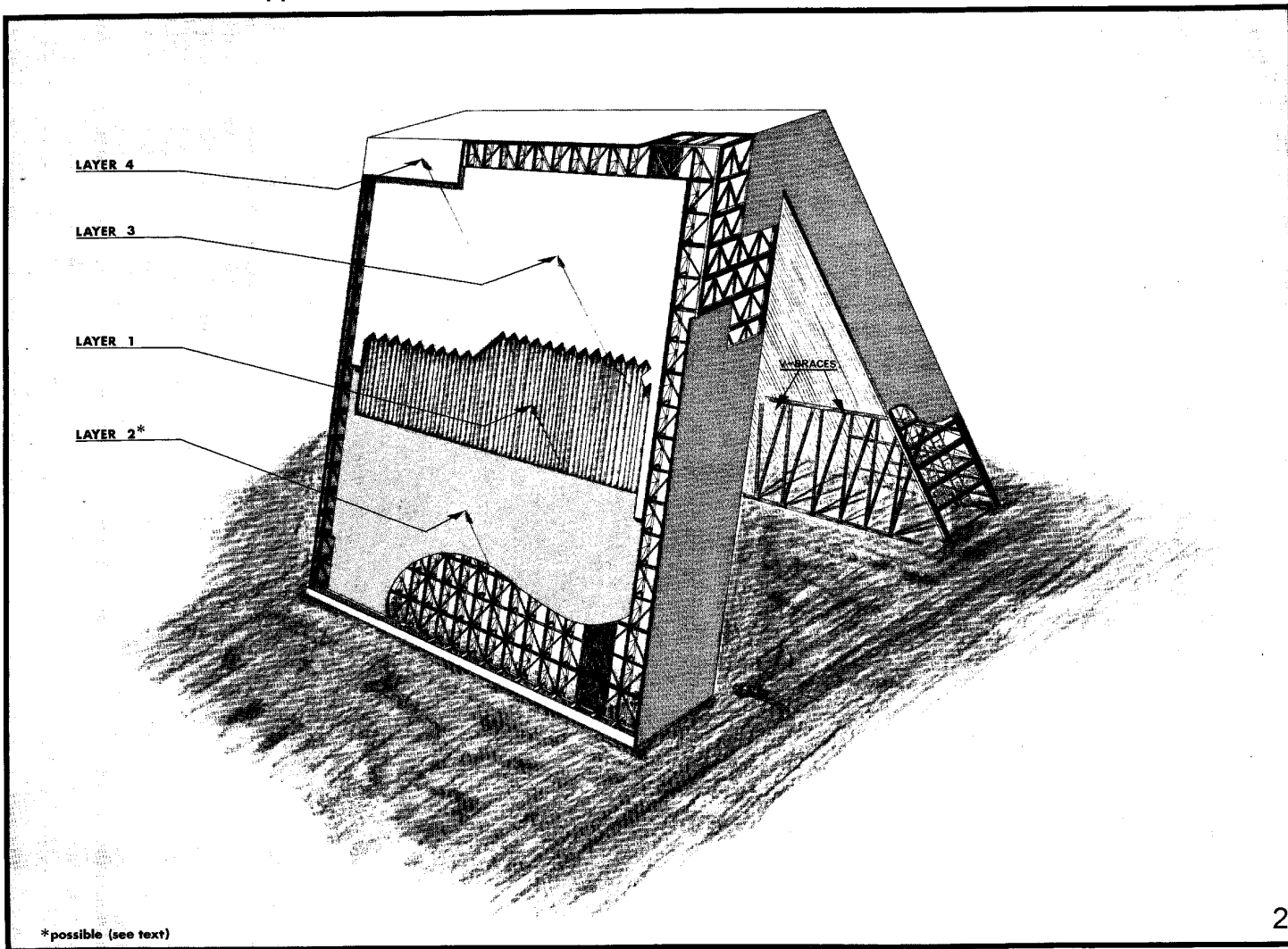
Figure 6

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\*possible (see text)

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Figure 7

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(or diameter), begins at the top of the antenna face (approximately 20 feet below the roof level) and progresses downward toward the base in even strips across the antenna face. Once completely installed, the elements extend vertically from the top of the base of the (slant height) antenna face; however, these rod-like elements may not extend completely to the edge of the completed screen.

b. Layer 2 (Possible), Facing Materials. This layer appears light toned on photography and is probably of a smooth texture. The appearance of this layer consistently occurs some distance below or in advance of the descending construction progress of the elements in Layer 1 (Figure 7). However, since this light-toned material disappears when the rod-like members become visible in the same location, it is believed that this possible second layer could actually be a series of individual "package" units. Each unit could contain segments of the rod-like elements which form Layer 1. Assuming this to be the case, the light-toned package units containing these elements would actually be the first material to be attached to the face, the package or covering then being systematically removed from each unit, exposing the vertically-striated signature of the rod-like elements. This light-toned layer, however, cannot be discounted as a separate functional layer.

A departure from this construction technique was observed on the northwestern face on [redacted]. At that time, a 45-foot-high strip of probable light-toned package units (Layer 2) was in place across the base of the A-frame superstructure for a horizontal distance of 345 feet. Yet to be installed was one 20-foot wide segment on the northern end. By [redacted] additional face layers were installed across the total width of the antenna face (365 feet), from the top down to a point approximately 20 feet above the previously observed 45-foot strip at the base. The result was an approximately 20-foot high lateral gap across the face. This opening remained for about a year until large-scale photography of [redacted] revealed that the gap had been filled.

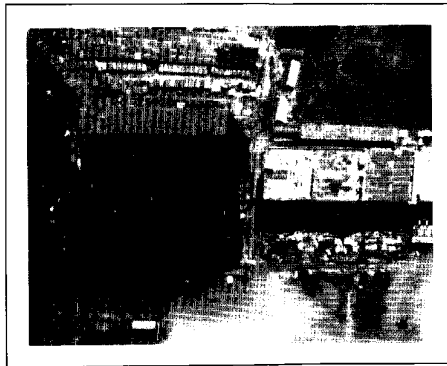
c. Layer 3, Facing Materials. Layer 3 (Figure 7) appears to consist of a series of sections probably ten-foot square and installed over the vertical rod-like elements (Layer 1), and is probably the thickest of the four layers. The probable square sections are light toned and are installed, commencing at the top, in lateral rows across the antenna face. Each square section is set at a 45-degree angle from the horizontal. The resulting configuration, during construction, is a saw-tooth pattern formed along the horizontal row being installed, as shown in Figures 7 and 10. A ten-foot wide column is constructed along the vertical borders of the face. It is apparently made of the same type material as the ten-foot squares, but with no evidence of a diagonal or saw-tooth pattern.

To completely cover the near-square ([redacted] feet) antenna face with these diagonally set blocks, the square sections should be supplemented, possibly by similar type triangular sections which would allow a smooth and even border around the face. This leads to the assumption that roughly 1,200 of the ten-foot square sections, plus possible triangular sections, would be needed to completely cover the 124,830-square-foot sur-

face of each antenna face. Though it appears that the ten-foot square sections are the most likely basic element for Layer 3, it is possible that triangular or other quadrangular-shaped sections could also fit within the construction format being followed in this layer.

d. Layer 4, Facing Material. Layer 4 (Figure 6) consists of a smooth light toned material forming a 20-foot-wide border along the top and both sides of the antenna structure. Although this border appears to overlap the antenna face by several feet, it does not seem to relate to the operation of the radar itself.

Construction Chronology. A complete and comprehensive chronology of the construction of individual face layers is precluded since only [redacted] missions provide clear large-scale coverage of Doghouse A prior to [redacted]. However, information obtained from this photography is provided in the following chronology.

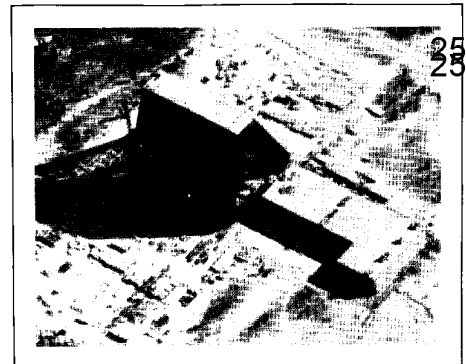


DOGHOUSE RADAR A, [redacted] Figure 8

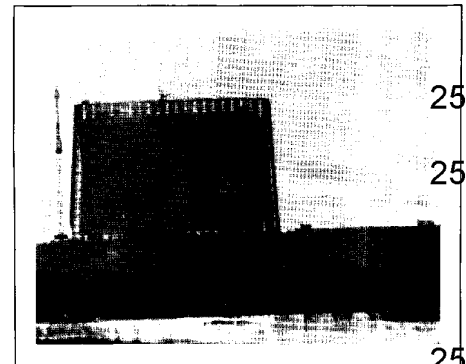
a. Northwest Face. The first firm evidence of face layer installation on either of the two antenna faces was seen on [redacted]. At that time, a 345-foot strip of material, approximately 45 feet high, was observed across the lower edge of the northwestern face. The strip possibly consisted of the rod-like elements (Layer 1) encased within a smooth-textured material (Layer 2). From [redacted] this possible arrangement of Layers 1 and 2 had been installed from the top of the antenna face down to a point approximately 20 feet above the existing strip at the base, leaving a 20-foot gap across the lower portion of the face. At the same time, it was noted that the light-toned material (Layer 2) had probably been removed from a portion of the top of the antenna face and elements of Layer 3 were being installed on top of the exposed rod-like elements. One row of the probable ten-foot square sections (or perhaps triangular half sections) had been installed across the top of the face to within 40 to 50 feet of the left edge. At that point, installation of a second row had progressed back to about the center of the antenna face.

A vertical border, probably of Layer 3 material, had been constructed along the left and right edges of the face with a break at the lateral gap near the lower edge.

[redacted], the light-toned Layer 2 had been removed from the top of the antenna face downward for more than half of the height of the face, leaving the rod-like signature of Layer 1. No progress had been made on Layer 3 across the top since [redacted] however, several probable solid gray sections, possibly Layer 4, were present above the face opening, to the left of center.



DOGHOUSE RADAR A, [redacted] Figure [redacted]



DOGHOUSE RADAR A, [redacted] Figure [redacted]

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external face panel installation or modifications had been made (i.e. Hen House).

b. Southeast Face. The first evidence of face material installation over the southeastern face opening was observed on [redacted] At that time a light-toned material was present across the upper part of the face. Due to the small scale of the photography, however, the extent or type of covering could not be determined.

By [redacted] this material probably extended over the greater portion of the top of the face.

[redacted] provided the first large scale photography of the southeastern face (Figure 4). From this photography, the installation of rod-like elements in Layer 1 was clearly evident over approximately half of the face area. A light-toned, vertical 20-foot-wide border (probably Layer 2) was present on each side of the antenna face. In addition, probable Layer 2 material was also present below the visible rod-like elements, in a 30-foot-wide strip which extended completely across the face. A wide scaffold, at least 365 feet long, was suspended from the roof to about the point where construction had progressed. A smaller probable scaffold was visible against the background of the elements in Layer 1. Construction progress during the five-day period between the two passes on Mission [redacted] was as follows. On [redacted] the light-toned border of Layer 2 material below the elements of Layer 1 was not yet complete, and several light-toned sections were present on the ground in front of the antenna. By [redacted] however, the border had been completed, and the sections lying on the ground had disappeared. A 40-foot section of border or framing material (Layer 4) was also observed in place on the upper left corner of the face opening.

By [redacted] antenna construction had progressed slightly, and the extent of the border above the face had been increased to more than half the distance across the face opening.

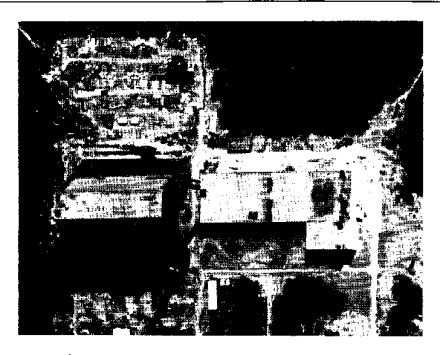
On [redacted] face construction had advanced to within 150 feet of the base. The border above the face appeared complete, although the center portion was noticeably darker in tone than the ends.

First evidence of the installation of Layer 3 material on the southeastern face was observed on [redacted] with approximately 50 to 75 feet of the thick, light-toned layer present across the top of the face. However, no vertical border of Layer 3 material, such as seen during similar construction on the northwestern face, was present. Construction of the Layer 2 elements had progressed to within 100 feet of the base.

Clear, large-scale, non-stereo photography of [redacted] previously observed. The only progress seen at this time was the installation of Layer 1 elements to within about 20 feet of the base. It was also noted that the previously completed border section above the face had assumed an interrupted pattern, as if portions had been removed.

Between [redacted] no conclusive interpretation of the northwestern antenna face could be performed due to unfavorable camera angles and poor-quality, cloud-covered photography. During this period, however, the lateral gap in the lower portion of the face was filled.

The clearest large-scale photography of the Doghouse radar to date, was on several passes from [redacted] Unfortunately, on the clear passes the northwestern face was in dark shadow (Figure 11). Evident, however, was the installation of the antenna border (Layer 4) across the base and halfway up the right side of the face opening. Although the antenna face was in shadow, this photography also revealed a large section in the lower right corner of the face to be of a somewhat darker tone than the remainder.



DOGHOUSE RADAR A, [redacted] Figure 11

On a series of ground photographs taken in [redacted] vertical borders were observed extending to the top of the face, but not all the way to the roof. Several possible border sections previously seen above the face were not noted on this photography. The vertical borders appeared slightly lighter in tone than the actual face, possibly indicative of some degree of translucence.

Good-quality but small-scale photography during the summer and fall of 1966 did not permit antenna layer details to be seen.

The facility was next observed on large-scale photography on [redacted] Though the camera angle and weather conditions were unfavorable for obtaining additional detail in face construction, all previous interpretations were confirmed.

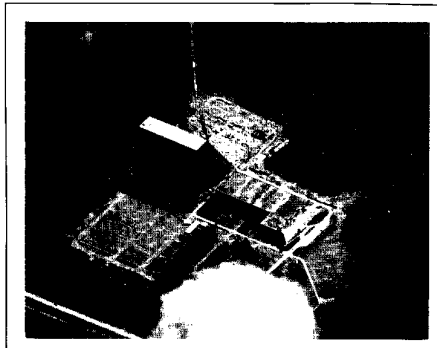
Succeeding small-scale [redacted] missions were also of insufficient scale and resolution for further detailed interpretation.

[redacted] provided the most recent large-scale photography of the facility. Three passes provided interpretable photography, though all were nonstereo.



DOGHOUSE RADAR A, [redacted] Figure 12

Photography of the [redacted] pass was the best quality. The other two passes were identical to the [redacted] photography in both camera angle and time of day. The northwestern face was in shadow on all three passes, and no significant developments were visible. Only scattered remnants of the previously observed construction material remained in the cleared area in front of the northwestern face.



DOGHOUSE RADAR A, [redacted] Figure 13

It is likely that the northwestern face is nearing completion and that little more construction detail will be observed from photography. Initial operation of the northwestern face can probably no longer be gauged by external construction progress. The complexity of interior construction has now become the principal factor governing this consideration. It should be noted, however, that similar large Soviet radars have become active, though not necessarily operational, before

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No further progress on the face could be confirmed until photography of [redacted] revealed the upper half of the face to be covered by Layer 3. Also at this time, the elements of Layer 1 had probably been completed to the base limits of the face. A dark-gray covering was present in the border area between each edge of the face and end walls.

The advancing construction of Layer 3 toward the base of the southeastern antenna was observed most recently on [redacted]. Only the northwestern face of Doghouse A was observed on Mission [redacted] (Figure 13).

It is believed that no more than a year should be required to advance the southeastern face to a state of external completion equal to the present status of the northwestern face.

**Construction Materials.** Since [redacted] the amount of construction material in front of the northwestern face of the Doghouse A radar has decreased steadily as construction on the antenna progressed. By the end of 1966, only scattered pieces of material remained in the area. A considerable amount of stacked construction material still remains in front of the southeastern face, although it too is disappearing as construction progresses.

While the types of construction materials vary, there appear to be four common sizes which have consistently been observed (Figure 14). The largest of the four (Figure 14a) is approximately [redacted] feet and is possibly some type of packing crate or container. It usually appears light toned and is frequently seen with a diagonal section removed from one end. Of similar size, but probably a foot or so shorter, is a rectangular object (Figure 14b) of varying shades of gray. At least one of these objects was observed partially encased within the light-toned larger crate (Figure 14a) in front of the southeastern antenna face. This object could be, or contain, a group of smaller pieces of material, as suggested by frequently observed differences in height and by the presence of nearby light-toned material on the ground.

Another item (Figure 14c) is a [redacted] object similar in appearance to a canvas-covered trailer. The object is usually dark in tone. The smallest of the four objects (Figure 14d) is an approximately [redacted] square of material, most often seen during final stages of construction and appearing in stacks of various heights. In addition, numerous other pieces of unidentified construction material have appeared in the cleared areas.

**Related Facilities.** The support elements in Operations Area A (Figure 4) consist of a large L-shaped control building, an earth-mounded T-shaped structure, and at least ten smaller structures of a miscellaneous or construction support category. Also present are a

steam plant, a pumphouse, three earth-mounded liquid storage tanks, a bank of two cooling towers, and several cranes. Mensuration for these elements is shown in Figure 5.

a. **Control Building.** This [redacted] L-shaped structure is located 70 feet from the western side of Doghouse A and appeared complete in [redacted] (Figure 4). The main part of the building is 560 feet long and 180 feet wide, with a 165 by 100-foot wing on one end. A main personnel entrance is present in the southwest end of the building, and at least three possible vehicle entrances are visible around the structure. Eight objects of various sizes are located on the roof, the most significant of which appears to be a possible 15-foot-diameter dome-like structure on the southwest corner. The remaining seven objects are probably related to internal building functions or activities.

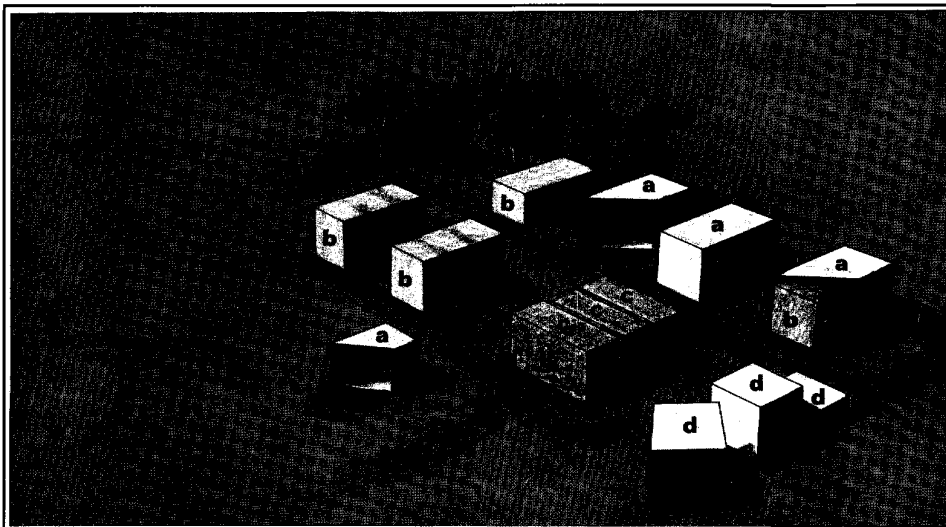
Two ten-foot-wide possible elevated cableways extend from the northeast wall of the control building to an undetermined point within the A-frame structure. These are 35 feet above the ground and are supported on lattice columns.

b. **T-Shaped Earth-Mounded Structure.** A T-shaped, earth-mounded structure of unknown function is located northwest of the control building (Figure 4). This is one of four such structures identified in the Moscow area. It was completed by [redacted] and remains unchanged to date. The other three are located within the Triad Electronics Area at three of the six deployed ARM launch complexes (E-05, E-24, and E-33). The facility at the Naro Fominsk Radar Complex consists of three earth-mounded rectangular structures which extend outward from a 25-foot-high central bay to form a T-shaped configuration. This structure, with a small parking area near its entrance, is the first facility encountered upon entering the main gate. The front entrance into the unmounded central bay of the T-shaped structure appears to handle considerably more traffic than the larger opening in the "stem" or northernmost end. The road to the rear entrance has remained unsurfaced though it is wider than the road to the front entrance and appears to be able to handle large, heavy vehicles.

The two mounded sections paralleling the site access road are probably the main functional components of the facility and are vented on the extreme ends. The shortest of the three sections appears to be a possible drive-in loading or receiving wing for the other two sections.

c. **Utilities.** All of the heating and water pumping facilities in the area were probably still under construction in [redacted] not becoming completely operational until late 1966. The principal components of the facility include the steam plant, a pumphouse, two water cooling towers, three earth-mounded liquid storage tanks, and a probable storage/maintenance building. Mensuration and photographs of these structures are provided in Figures 4 and 5.

d. **Construction Cranes.** Two large jib or portal-type cranes have been associated with the construction of the Doghouse (Figure 4). The cranes were



MAJOR TYPES OF CONSTRUCTION MATERIALS OBSERVED AT DOGHOUSE RADAR A.

Figure 14

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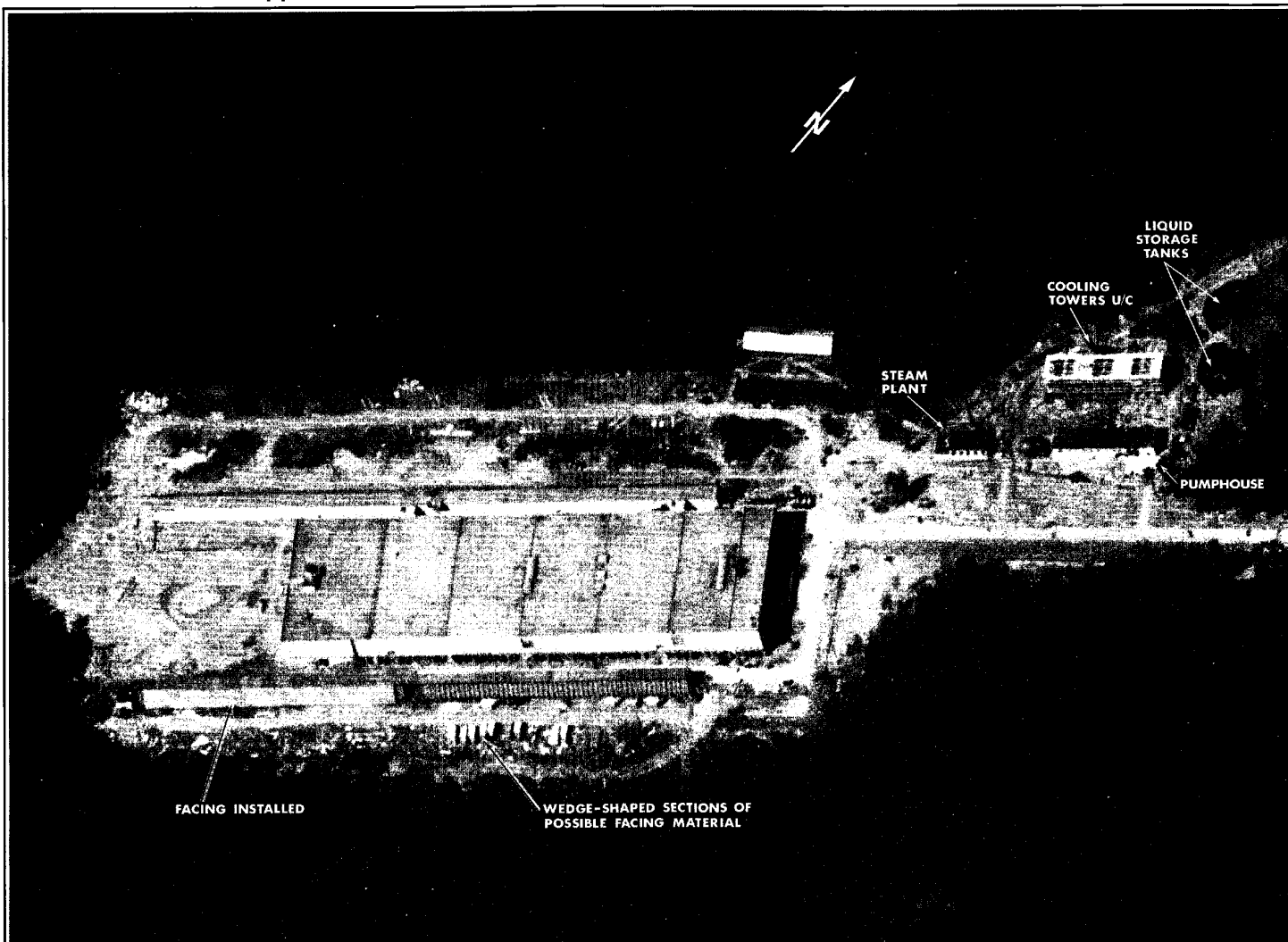


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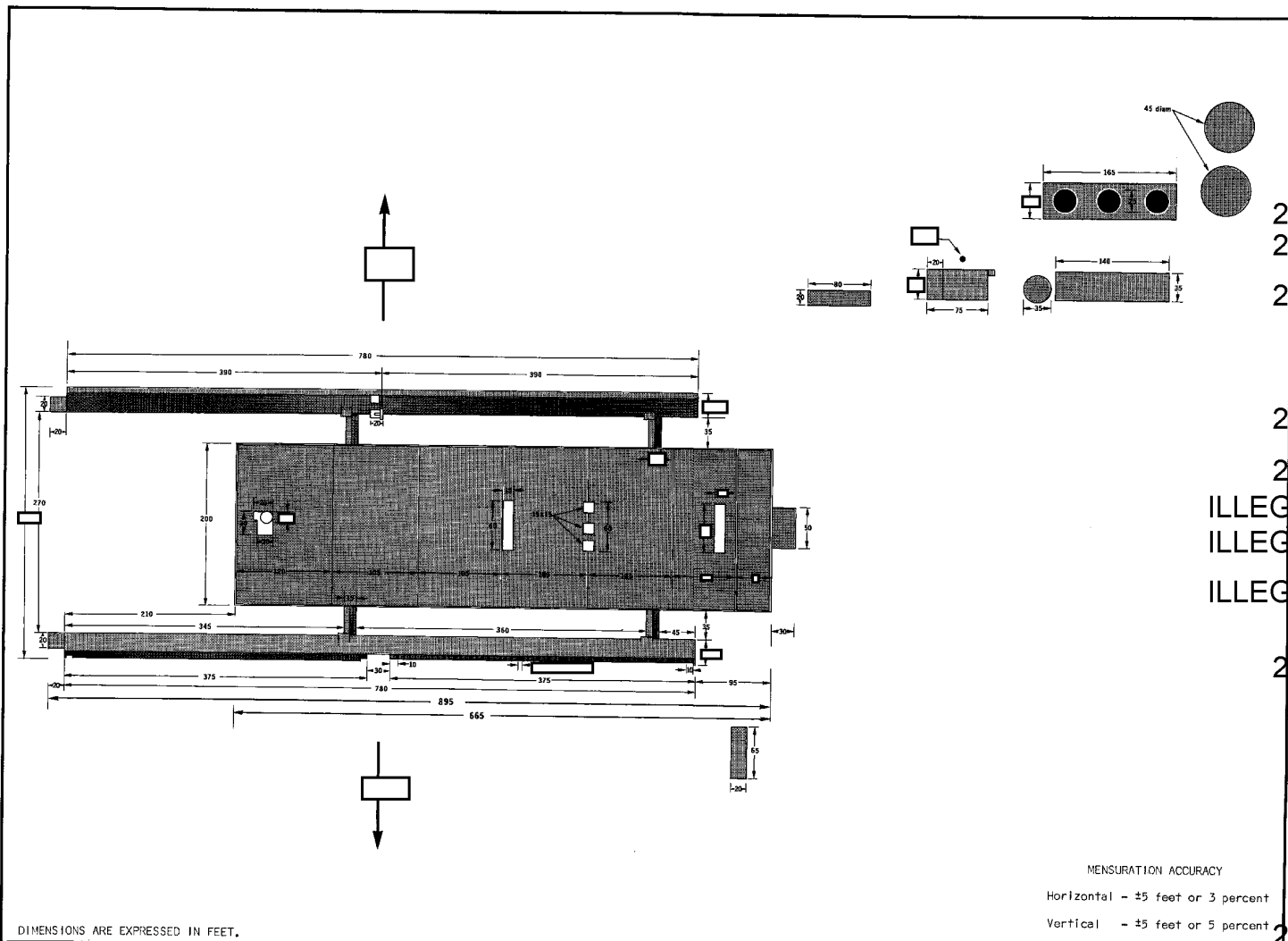
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Figure 15 25X1

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DIMENSIONS ARE EXPRESSED IN FEET.

MENSURATION ACCURACY  
Horizontal - ±5 feet or 3 percent  
Vertical - ±5 feet or 5 percent

UNRECTIFIED PLAN DRAWING WITH DIMENSIONS. OPERATIONS AREA B

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Figure 16

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set within parallel runways and could service three sides of the A-frame structure (Figure 5). The crane used in construction of the northwestern antenna was not observed after [redacted] it was removed or possibly relocated within the A-frame structure. As of [redacted] the crane servicing the southeastern face was still in operation. Two travelling gantry cranes, probably for handling construction materials, were originally present in the cleared storage area in front of the northwestern antenna face (Figure 4). These two cranes were removed by [redacted] Although much construction material has been observed in a similar cleared area in front of the southeastern antenna face (Figures 1 and 12), no gantry-type cranes have ever been observed. Several smaller mobile construction cranes have been observed operating in the area.

e. Other Structures. Another group of buildings, near the northwest corner of the Doghouse radar, appears to have a close relationship to the radar. Two structures, present in [redacted] were presumed to support local construction. Between [redacted] a third structure was added, and ground scarring and a possible wall of conduit has since been observed between the northern wall of the newest structure and the northwest corner of the Doghouse. Additional large-scale photography will be required to further identify this activity.

A 60-by 25-foot building, present in [redacted] was removed from the cleared area in front of the northwestern antenna face by [redacted] The remainder of the buildings in the area are probably for construction support, with the exception of a security building at the main entrance to the operations area.

OPERATIONS AREA B

Operations Area B is located approximately 8,000 feet west-southwest of Area A in the southwest corner of the complex (Figure 2). The major structures in this area are two linear antennas (Doghouse B) and a large control building. The antennas have been under construction for over three years and are now in the late stages of construction. Also present in this area are heating and water pumping facilities and various construction support buildings. A photograph and drawings with detailed mensuration of the structures in Operations Area B are shown in Figures 6, 15, and 16.

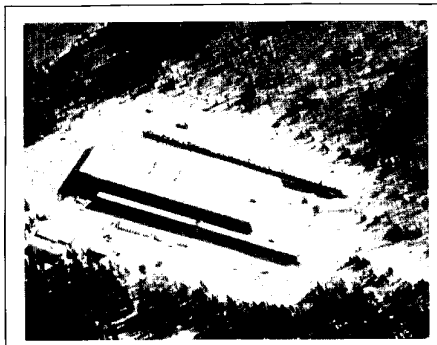
Doghouse Radar B

This radar consists of two [redacted] structures, [redacted] probably housing transmitter antennas (Figures 6, 16, and 18). These antennas have boresight azimuths and elevation angles identical to those of Doghouse A.

Because of the relatively small size of the antennas, and the lack of ground photography, less is known about the antenna construction details of the Doghouse B radar than of Doghouse A. The northwest and southeast-facing antennas will therefore be described as one since all available photographic evidence indicates they are of identical configurations, as are the two faces of the Doghouse A antenna.

Structural Analysis. The operating components of Doghouse B are two parallel 780-by 34-foot antenna structures, located approximately 8,000 feet southwest of, and in close longitudinal alignment with, Doghouse A. When externally completed, these structures resemble the "Thin Boy"-type Hen House radar in basic configuration. The individual antennas are located on opposite sides of a 665-by 200-foot control building and have opposing boresight azimuths, identical to those of Doghouse A [redacted]

No antenna construction details were obtainable until large-scale, non-sterile photography covered the facility on [redacted] (Figure 17), approximately two years after construction had begun. In [redacted] the structural enclosure for the northwestern antenna elements appeared to be externally complete, and installation of antenna facing was in progress. Possible containers or sections of facing material were visible in front of the antenna.



DOGHOUSE RADAR B [redacted] Figure 17

Excellent quality photography of [redacted] provides the basis for the current knowledge of the internal antenna configuration (Figures 16 and 18). At this time the probable interior elements in part of the southeastern antenna structure were revealed, and it is from this observation that we derive the following analysis of the antenna.

Each of the 780-foot-long antenna structures contains two distinctly separate rows of elements; the abutting ends of these rows are separated by a 30-foot open area. Each row is 375 feet long and contains fifty-one 6.5-foot-wide elements, plus a ten-foot-wide element on each end. The number and width of elements in each row is similar to (and possibly the same as) the number and width of inclined rod-like elements in Layer 1 of Doghouse A (Figure 11). Although it is unknown how deep the individual elements extend into the structure, the surface plane of each row is not deeply set within the structure. This suggests that the face covering layer here is somewhat thinner than that of the Doghouse A antennas.

Once the internal elements are in place, a smooth light-gray covering material is installed. This material covers only 51 elements in each row, resulting in a ten-foot-wide gap in each end of the antenna face, with a larger uncovered area in the center of the antenna structure. These gaps, or openings, are subsequently covered with sections of material which appear to protrude slightly forward of the face covering. On the roof, in the approximate center of the northwestern antenna structure, several small platforms or structures are present. A number of unidentifiable objects are positioned on at least one of the platforms. As of [redacted] no similar structures have appeared upon the southeastern facing antenna structure.

Attached to the southern end of each antenna structure is a low 20-foot-square building. The physical relationship between this building and the antenna structure closely equates with that of the terminal building and antenna structure at a Dual Hen House radar. The significant difference between the two radars, other than size, is the presence of a building at each end of a Hen House radar.

Construction Chronology. Although foundation construction for both antennas at the Doghouse B radar probably began simultaneously in mid-1963, the northwestern antenna has progressed more rapidly. While the northwestern antenna itself was probably completed externally by [redacted] major ditching and earth scarring around it remained evident until summer 1967. At that time, trenching had been filled and a hard-surface road had been constructed around the antenna structure. One trench could still be seen along the road parallel to the antennas, possibly for drainage requirements.

In terms of construction, the southeastern antenna is probably more than a year behind the northwestern antenna. In [redacted] it was at a stage approximating that of the northwestern antenna in [redacted]

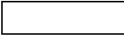
Between [redacted] the trees were cleared from a large area in front of the northwestern antenna up to the security fence, leaving the area free from vertical obstructions for a total distance of approximately 700 feet in the direction of boresight azimuth [redacted]. Beyond the security fence, the larger trees had also been removed, leaving only small trees and brush. This cleared area extends outward from each end of the antenna structure at an angle of approximately 30 degrees from boresight (Figure 19). In the spring of 1967 with the melting of snow, it was noted that the cleared area was being smoothed and graded out to the security fence. No such clearing activity has yet occurred in front of the southeastern antenna, most likely because of its less advanced construction status.

Construction Materials. The only construction materials which could be identified as antenna associated were in the form of wedge-shaped sections, located in front of the antenna structures. These sections appeared very similar to the sections or crates (Figure 14b) observed during construction at Doghouse A, although their relation to construction at each radar may be different. At Doghouse A, these possible crates, or their contents, were never identified as close to the antenna structure as they were at Doghouse B. At the southern antenna of Doghouse B, these wedge-shaped sections occur in several configurations. All forms

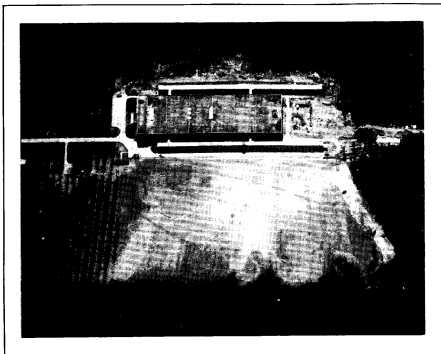
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DOGHOUSE RADAR B, [redacted] Figure 19

appear to be variations of a basic rectangular component approximately [redacted] which is either truncated or segmented into triangular units. The triangular segment or unit averages approximately [redacted] feet.

Once installed on the antenna, the location of these sections is undetermined. The most probable location is on the face, as paneling material, since no other types of material are present to be used for such purposes. Also possible is their use as roof sections, although this seems less likely.

Since the antenna faces are not vertically segmented or paneled as are Hen House antenna faces, no antenna details can be observed once the face is covered.

Related Facilities. [redacted] the supporting facilities within Operations Area B were probably still under construction. At that time, they included a control building, a steam plant, pumphouse, three rounded liquid storage tanks, a security building and several construction support buildings (Figures 15 and 16).

a. Control Building. Both of the antenna structures are joined to a central control building by a pair of elevated, 15-foot-wide possible cableways (Figure 18). The building is 665 feet long, 200 feet wide, and [redacted] with a higher section on the northern end where the main entrance is located. It was externally complete in [redacted] The presence of doorways, or openings, was observed in [redacted] in the lower level of the southern wall for all but approximately 100 feet of the length of the building (Figures 15 and 18). A dark tone along the lower level of the building, observed on the latest photographic coverage, indicates that this open area is probably still present in both sides of the control building facing the rear of the antenna structure. Two "niches" or inset areas are present in identical locations in the upper portions of both side walls.

Among six structures on the roof is a 15-foot-diameter dome or dome-like object similar to that seen upon the roof of the control building for the Doghouse A radar.

An I-shaped structure, located at the south end of the control building midway between the two antenna

structures, was first observed under construction in [redacted] The structure consists of one 75-foot wing plus an adjoining 115-foot wing which is oriented perpendicular to the antennas. Each wing is approximately 15 feet wide. In [redacted] a 15-foot-diameter tank, or circular pedestal, was observed to the corner of the wing closest to the control building (Figure 19).

b. Steam Plant and Other Structures. The permanent utility-type structures including the steam plant, pumphouse, and liquid storage tanks appeared complete and operational by [redacted] A bank of three cooling towers constructed since [redacted] also appeared complete and operational by [redacted]

Four construction support buildings were present in the vicinity of the antenna structures (Figure 17) in [redacted] three of these structures, which would have fallen within the fan-shaped cleared area in front of the northwestern antenna, had been removed.

By [redacted] an additional construction support-type structure had been constructed southwest of the antennas. In the same period, a small possibly operations-related structure was also constructed between the steam plant and the northwestern antenna structure.

COMPLEX SUPPORT AREAS

The complex support areas consist of a large main support and housing area, a construction support area, railroad classification yard, power substation, and a probable water treatment facility (Figure 2).

Main Support Area

The Main Support Area (Figures 20, 21, and Table I), containing the housing, administrative/technical facilities, and two motor pools, is located about one mile north of Operations Area A along the main highway linking the towns of Maro Fominsk and Kubinka. In [redacted] a total of eleven four-story apartments had either been completed or were still under construction in the area. By [redacted] probably the last of 17 apartments were nearing completion, each of which could accommodate over 250 personnel (at 150 square feet per person). A large interconnected three-section structure (Figure 20, Item 15) has also been constructed west of the southernmost apartment building.

In the centrally located administration/technical area, four buildings (Figure 20, Items 27, 35, 37, and 50) have been added since [redacted] All of these appeared externally complete by [redacted]

A separate housing area containing probable wood frame dwellings of various sizes is located west of the rail line. The only significant change here since [redacted] has been the removal of one of the larger dwellings, between [redacted]

On [redacted] approximately 100 miscellaneous vehicles were present within the two fenced motor pool areas. Five days later, no more than 20 vehicles remained.

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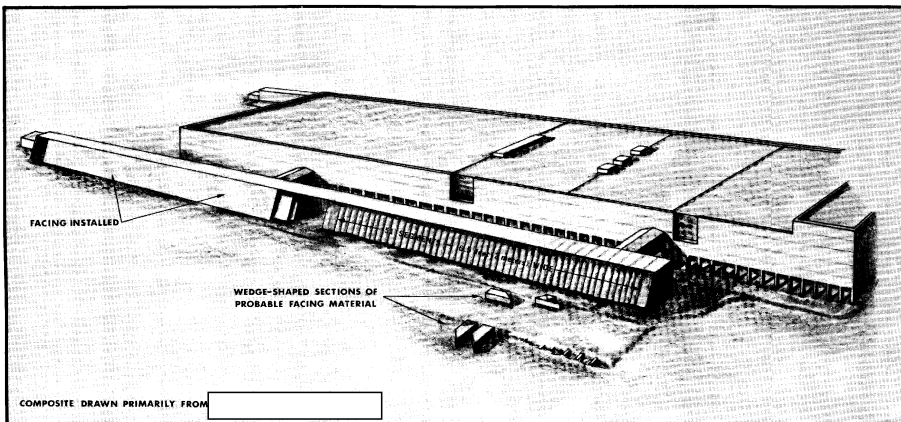
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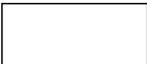
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ARTIST CONCEPT OF DOGHOUSE RADAR B CONSTRUCTION.

Figure 18

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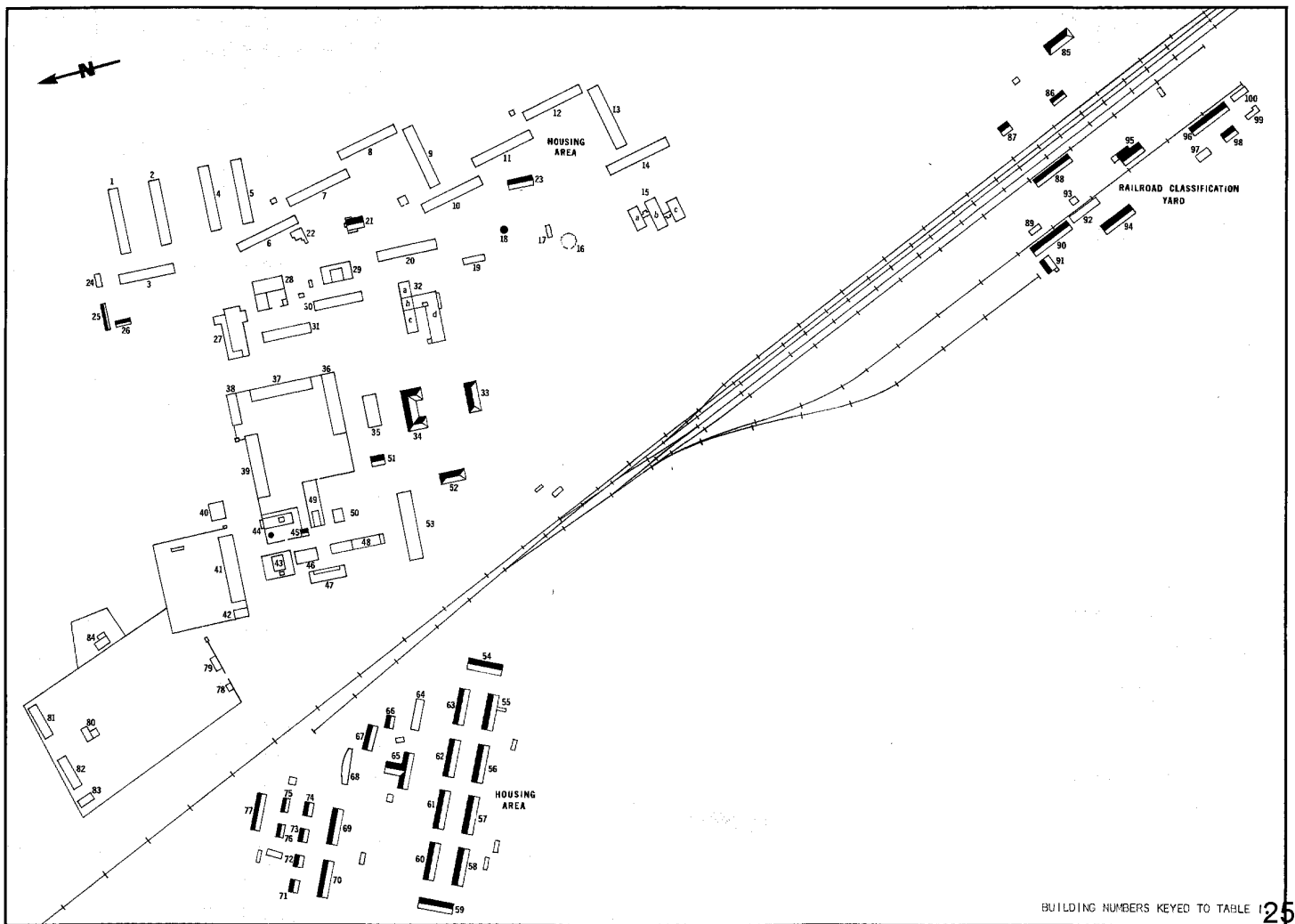
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BUILDING NUMBERS KEYED TO TABLE 1

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UNRECTIFIED LINE DRAWING OF MAIN SUPPORT AREA AND RAILROAD CLASSIFICATION YARD.

Figure 20

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TABLE I

STRUCTURES IN MAIN SUPPORT AREA AND RAILROAD CLASSIFICATION YARD (Item numbers keyed to Figure 20)

Item	Description	Dimensions (Feet)*	Item	Description	Dimensions (Feet)*
1	Multi-Story Apartment Buildings	40 by 260	46	Unidentified	50 by 80
2	Multi-Story Apartment Buildings	40 by 260	47	Administration/Technical Support	50 by 150
3	Multi-Story Apartment Buildings	40 by 200	48	Administration/Technical Support	40 by 240
4	Multi-Story Apartment Buildings	40 by 260	49	Administration/Technical Support	60 by 185
5	Multi-Story Apartment Buildings	40 by 260	50	Unidentified	45 by 50
6	Multi-Story Apartment Buildings	40 by 260	51	Unidentified	45 by 60
7	Multi-Story Apartment Buildings	40 by 260	52	Unidentified	40 by 85
8	Multi-Story Apartment Buildings	40 by 260	53	Unidentified	65 by 265
9	Multi-Story Apartment Buildings	40 by 260	54-63	Wooden Barracks	40 by 145
10	Multi-Story Apartment Buildings	40 by 260	64	Support	40 by 120
11	Multi-Story Apartment Buildings	40 by 260	65	T-Shaped Messhall	40 by 145, 45 by 70
12	Multi-Story Apartment Buildings	40 by 260	66	Storage	30 by 50
13	Multi-Story Apartment Buildings	40 by 260	67	Storage	40 by 100
14	Multi-Story Apartment Buildings	40 by 260	68	Vehicle Storage	140 Long-Width Varies
15	Three-Section, Interconnected Structure	(a) 45 by 85 (b) 45 by 120 (c) 45 by 85	69	Barracks	40 by 145
16	Probable Earth-Mounded Tank	60 Feet Diameter	70	Barracks	40 by 145
17	Possible Pumphouse	25 by 40	71	Barracks	30 by 50
18	Water Standpipe	110 Feet High	72	Barracks	30 by 50
19	Unidentified	25 by 100	73	Barracks	30 by 50
20	Multi-Story Apartment Building	40 by 260	74	Barracks	30 by 50
21	Construction Support Structure	Variable	75	Barracks	30 by 50
22	Construction Support Structure	Variable	76	Barracks	30 by 50
23	Construction Support Structure	Variable	77	Barracks	40 by 145
24	Construction Support Structure	25 by 50	78	Storage	20 by 25
25	Construction Support Structure	20 by 100	79	Storage	25 by 30
26	Construction Support Structure	25 by 60	80	L-Shaped Storage	30 by 40 Overall
27	Unidentified	Variable	81	Vehicle Storage/Maintenance	40 by 150
28	Two-Section, L-Shaped Support Structure	60 by 115, 50 by 70	82	Vehicle Storage/Maintenance	40 by 150
29	Possible Maintenance	75 by 145	83	Storage	30 by 60
30	Multi-Story Apartment Building	40 by 185	84	L-Shaped Storage	40 by 60 Overall
31	Multi-Story Apartment Building	40 by 185	<b>Railroad Classification Yard</b>		
32	Irregularly Shaped Structure	(a) 35 by 70 (b) 35 by 100 (c) 35 by 35 (d) 35 by 90, 50 by 185	85	Possible Administration	45 by 100
33	Administration	45 by 100	86	Unidentified	20 by 60
34	U-Shaped Administration Building	75 by 165 (Overall)	87	Storage	45 by 45
35	Unidentified	45 by 125	88	Storage	40 by 165
36	Administration/Technical	50 by 250	89	Storage	20 by 40
37	Administration/Technical	50 by 250	90	Storage	40 by 170
38	Administration/Technical	45 by 110	91	Unidentified Facility	40 by 75
39	Administration/Technical	50 by 250	92	Storage	40 by 125
40	Possible Athletics-Associated	65 by 65	93	Storage	40 by 40
41	Vehicle Maintenance	65 by 275	94	Unidentified	40 by 125
42	Storage	30 by 60	95	L-Shaped Support	50 by 90 Overall
43	Equipment Storage	45 by 65	96	Storage	40 by 170
44	Steamplant	40 by 120 (Stack - 80)	97	Storage	40 by 65
45	Storage	25 by 25	98	Storage	40 by 65
			99	L-Shaped Storage	20 by 65 Overall
			100	Storage	30 by 75

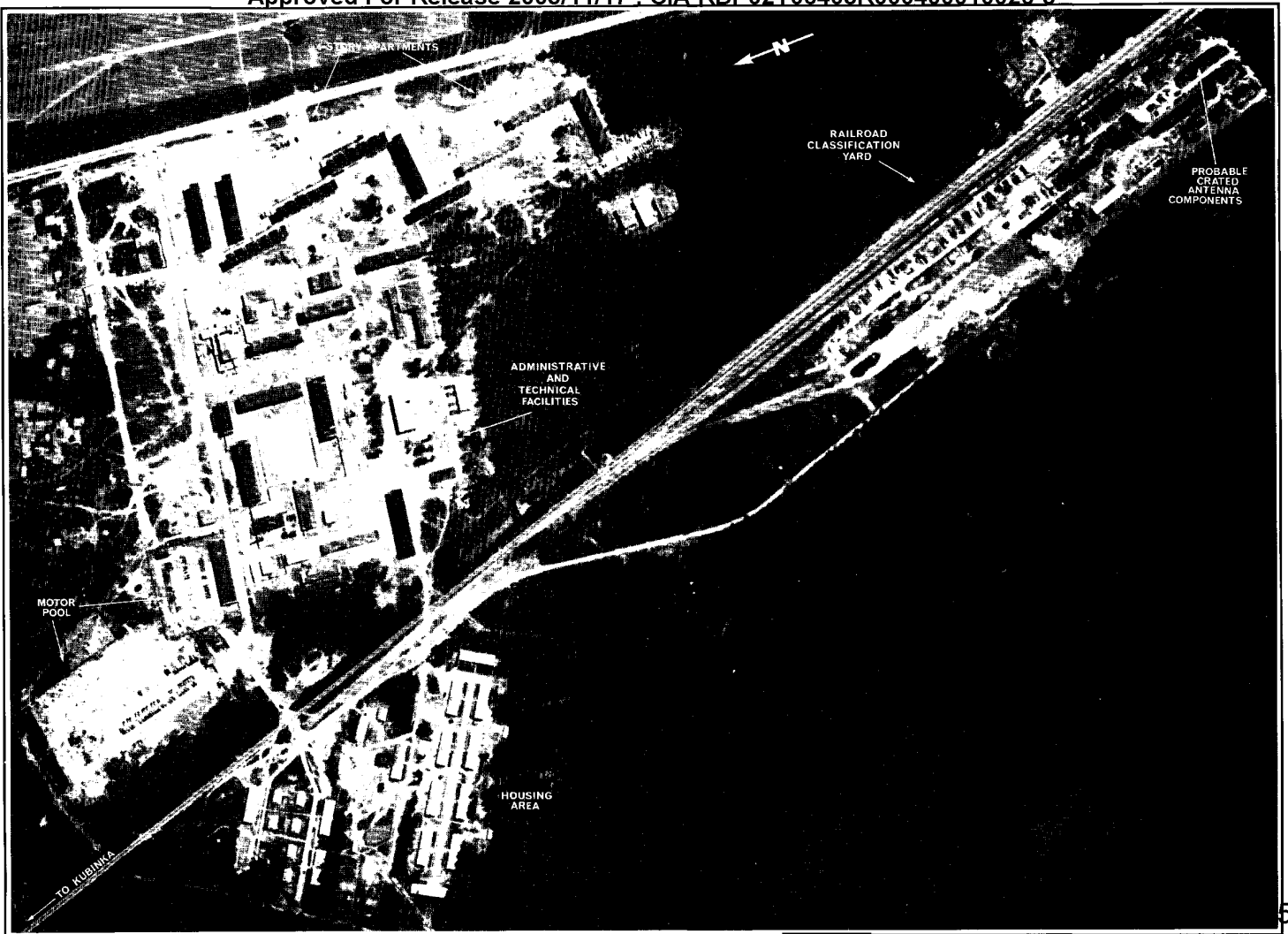
\* All mensuration was performed by CIA/IAS, using scale factors provided by NPIC/TID.

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MAIN SUPPORT AREA AND RAILROAD CLASSIFICATION YARD.

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Figure 2

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Construction Support Area

The Construction Support Area (Figures 22, 23, and Table II) is located midway between Operations Areas A and B and in [redacted] contained 20 barracks and numerous miscellaneous structures. Between [redacted] and [redacted] five of the larger barracks buildings had been razed. Most of the scattered structures located between barracks area and Doghouse B had been removed by [redacted]. It appears that this area is gradually being abandoned and will eventually probably serve only storage needs.

Railroad Classification Yard

The railroad classification yard (Figures 20, 21, and Table I), located north of Doghouse A, has undergone no significant changes since [redacted]. The structures within the yard, however, have been more clearly identified since that time and are shown in Table I.

Power Substation

The large transformer and switching substation (Figures 24 and 25), located southwest of the operations areas, is still under construction. Though partially operational, it has undergone considerable development since [redacted] when a main 220-kv switching yard and a separate 39-kv switching yard were under construction. A probable six to ten-kv buried powerline from the latter yard extends into Operations Area B and is the only visible source of external electric power serving the Doghouse operations areas. In late 1966, facilities for a 110-kv switching yard were being installed in the northern section of the substation, and by [redacted] six of an anticipated total of 12 circuit breakers had been replaced.

Although transmission towers are present for two incoming three-phase 220-kv circuits, only one such circuit can be identified entering the substation. Step-down transformers were in place on three of the five transformer platforms by [redacted]. The remaining two platforms are complete but unoccupied. Also recently installed were powerlines for two, three-phase 110-kv circuits extending southward from the 110-kv yard parallel to the existing 220-kv powerlines.

Observed in [redacted] and now complete was a probable buried six to ten-kv powerline, originating near the main entrance to the substation housing area and extending southwestward for over ten miles to a small substation at ABM Launch Complex M-24.

Probable Water Treatment Facility

A large probable water treatment facility (Figure 2) is located approximately 8,500 feet northwest of Doghouse A. Its relationship to the Doghouse complex is unknown at present. It was constructed concurrently with the Doghouse complex and consists of 43 earth-banked basins or compartments occupying some 35 acres. Each compartment is 300 feet long and 120 feet wide. Although facilities similar to this are found elsewhere throughout the Soviet Union, no known operations at the Doghouse complex would appear to require such an extensive treatment facility.



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Figure 22



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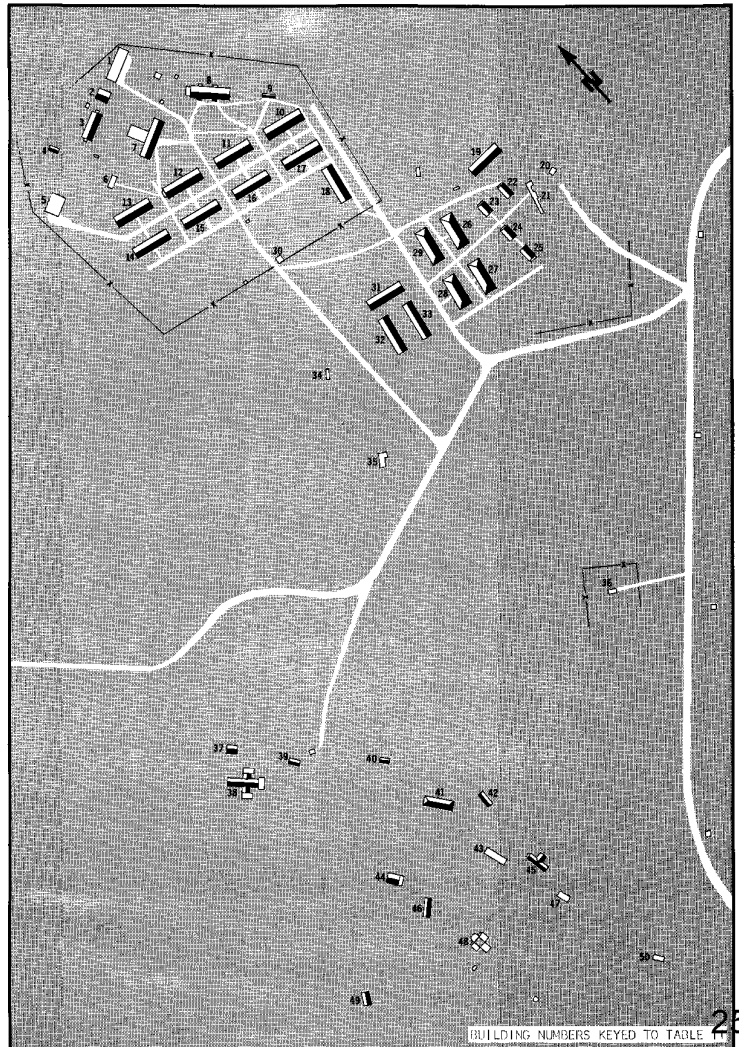
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TABLE II

Structures in the Construction Support Area  
(Item numbers keyed to Figure 23)

Item	Description	Dimensions (Feet)*
1	Storage	40 by 135
2	Storage	40 by 45
3	Storage	30 by 100
4	Unidentified	15 by 30
5	Steamplant	45 by 70
6	Storage	15 by 45
7	T-Shaped Messhall	40 by 145, 40 by 70
8	Unidentified	40 by 145
9	Storage	15 by 45
10-18	Barracks	40 by 145
19	Storage	35 by 135
20	Unidentified	15 by 20
21	F-Shaped Storage	Variable
22	Barracks	30 by 50
23	Barracks	30 by 45
24	Barracks	30 by 45
25	Barracks	30 by 45
26	Barracks	40 by 125
27	Barracks	40 by 125
28	Barracks	40 by 125
29	Barracks	40 by 125
30	Security Guard House	15 by 25
31	Barracks	40 by 145
32	Barracks	40 by 145
33	Barracks	40 by 145
34	Unidentified	15 by 35
35	Unidentified	Undetermined
36	Possible Electric Power-Associated Structure	15 by 30
37-49	Miscellaneous Unidentified Structures, Probably Unrelated to the Support Area. Most Removed by [redacted]	
50	Possible Electric Power-Associated Structure	15 by 30

\* All mensuration was performed by CIA/IAS, using scale factors provided by NPIC/ITD.



BUILDING NUMBERS KEYED TO TABLE

UNRECTIFIED LINE DRAWING OF CONSTRUCTION SUPPORT AREA.

Figure 23

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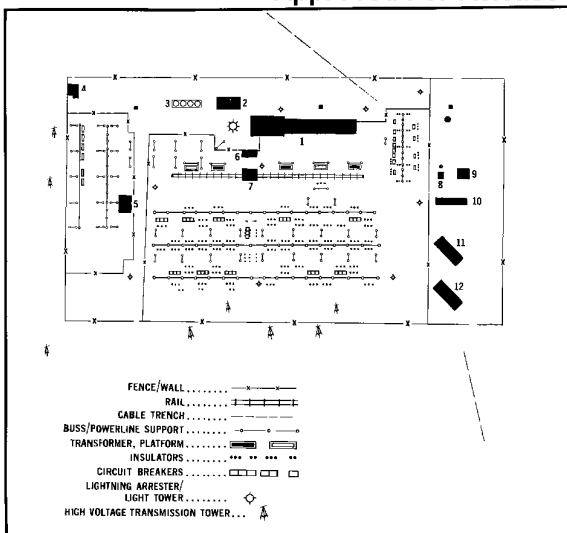
25X1

TOP SECRET

25X1

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IMAGERY ANALYSIS SERVICE



UNRECTIFIED LINE DRAWING OF POWER SUBSTATION.

Figure 24

Item	Description	Dimensions (Feet)*
1	Control Building with Attached Switching Bay	70 by 100 50 by 255
2	Support Structure	45 by 75
3	Four Oil Storage Tanks	15 Feet Diameter
4	Support Structure	30 by 45 Overall
5	Support Structure	20 by 40
6	Possible Dumping Station	20 by 45
7	Transformer Repair/Service Facility	40 by 45
8	Stump/Plant	20 by 30
9	Support Structure	40 by 40
10	Support	25 by 95
11	Barracks	40 by 100
12	Barracks	40 by 100

\* All mensuration was performed by CIA/IAS using scale factors provided by NPIC/2ID.



POWER SUBSTATION

Figure 25

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TOP SECRET

25X1

25X1

25X1

25X1 [redacted]

TOP SECRET [redacted]

[redacted] 25X1

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25X1

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Requirement

C-227-84,403

IAS Project

30831-7



Maps and Charts

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25X1

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TOP SECRET [redacted]

[redacted] 25X1

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