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May 1964

PHOTOGRAPHIC INTERPRETATION REPORT

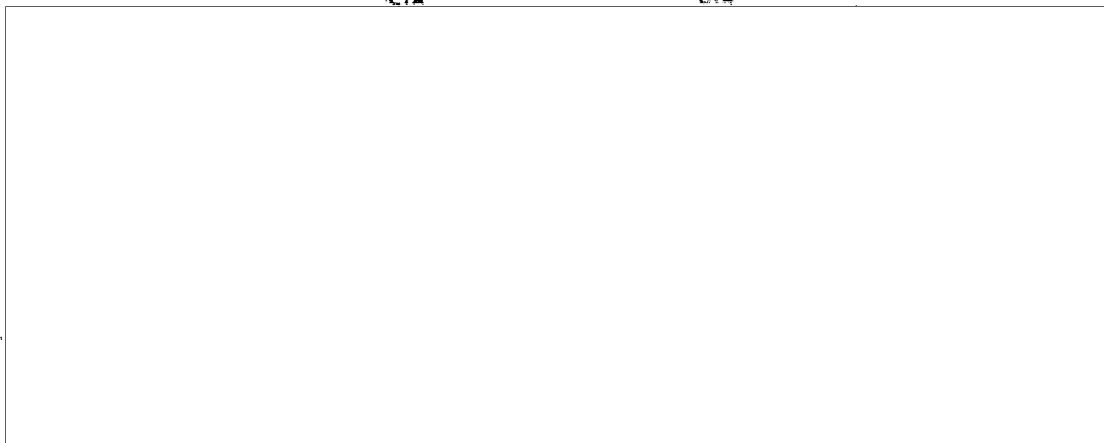
CONSTRUCTION OF SOVIET TYPE IIIA ICBM LAUNCH SITES



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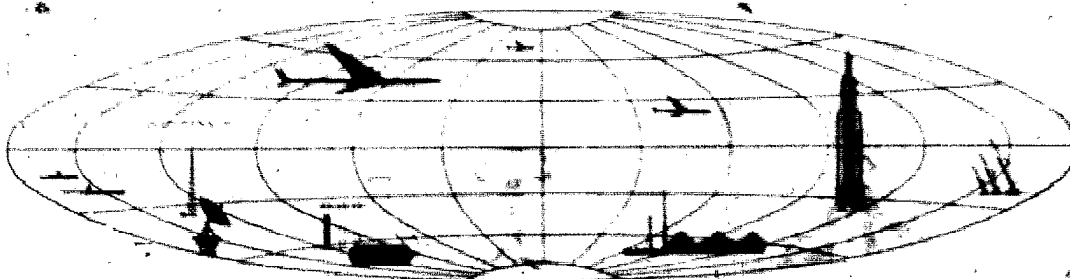


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CONSTRUCTION OF SOVIET TYPE IIIA
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INTRODUCTION

A detailed photographic study has been made of Soviet Type IIIA hard ICBM launch sites observed on large-scale photography from Mission 4006. This report is based on a requirement for extensive detailed information on construction practices, methods of operation, degree of hardness, and similar items.

The ten sites studied included those in a midstage of construction and those that have been completed for some time. It was not possible to provide data on some important features such as the thickness of silo covers, diameter of tanks, and details of a typical spray pond. The photography did not provide many additional details of construction within a site under construction, because of quality or lack of stereo coverage.

Conclusions regarding the facilities and the various stages of construction at Type IIIA sites are given at the end of the report.

MENSURATION DATA

Some of the more significant mensuration data are listed below. Additional measurements are included in the graphics and textual descriptions for specific launch sites.

[Redacted]

The separation of the silos at the completed sites had a variation [Redacted] with an average separation [Redacted]. The variation in separation of silos under construction was 15 feet, with an average separation [Redacted]. The rectangular silo covers measure [Redacted]. The square pad-like areas adjacent to the left edge of the covers are 20 by 20 feet. The small structure adjacent to the rear of the rear pad-like area varies in measure-

[Redacted]

A number of measurements were made of the inside diameter of the open silo at Launch Area F at Verkhnyaya Salda and the most consistent figure obtained [Redacted]. The edges of the light-toned wall or collar around the top of the silo are difficult to determine but it appears to [Redacted]. The cover fits a rectangular enclosure around this silo that has an [Redacted]

The construction ramps observed at Launch Areas E and F at Drovyanaya varied in measurement from 110 to 120 feet in length and are about 20 feet wide.

The width of the probable passageways constructed at Launch Areas B and C at Olovyanaya, and Launch Area E at Drovyanaya, ranged [Redacted]

SITES IN THE MIDSTAGE OF CONSTRUCTION

LAUNCH AREA E, DROVYANAYA

Excellent photography of this site in the midstage of construction (Figure 1) reveals

many details previously not seen, but the lack of stereo coverage hampers interpretation. The three silos are under construction, with ramps extending out over the excavation. A square

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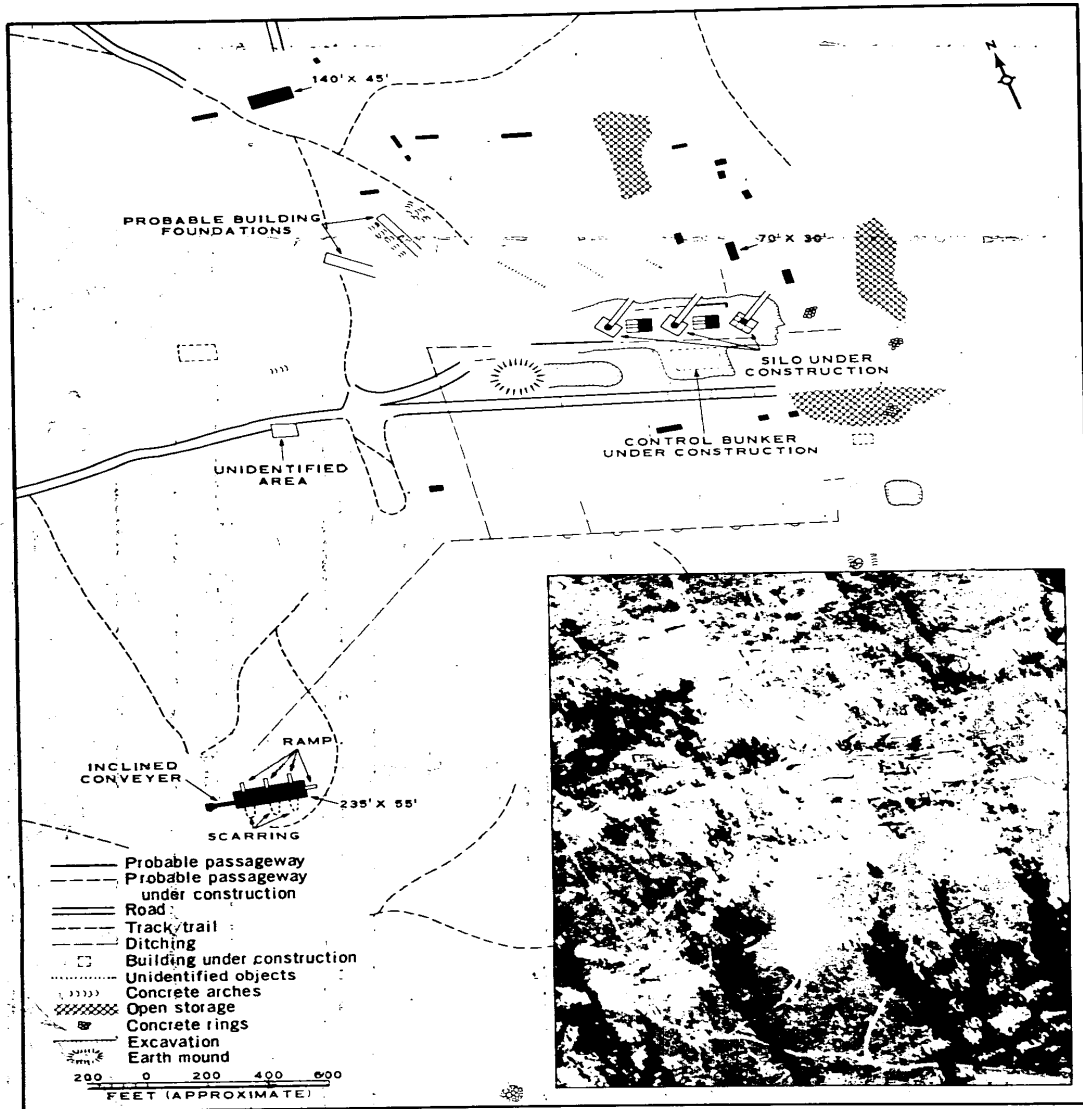


FIGURE 1. LAUNCH AREA E, DROVYANAYA.

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framework or structure appears to arise from the bottom of the excavation around the silos. At the right silo this structure appears to consist of three or four equal-sized sections around the silo.

The two equipment bunkers between the silos, approximately 80 by 50 feet, are under construction, with half of the bunkers roofed. Two inside walls in the unroofed half divide the bunkers into three sections paralleling the long axis of the excavation. The control bunker, about 135 by 95 feet, is under construction with structural supports erected for three of the walls.

Probable passageways are under construction within the site. What appear to be large concrete rings observed outside the large excavation may be used for constructing these probable passageways by placing them in a system of ditching around the site. A probable passageway at the front of the site has been built between the center and right silos, with a segment extending toward the right silo. A wide ditch for a probable passageway extends for some distance beyond the ends of the excavation, running the long axis of the excavation between the control bunker and the silos. A section of this probable passageway has been laid in the left end of the ditch which probably will connect to a system of ditches extending some distance to the rear of the launch site. This network of ditches, with an average [redacted] and characterized by sharp turns, has small cutouts in the side at intervals suggesting provisions for expansion joints. The access road behind the control bunker has been cut by ditching in six places.

To the left of the control bunker is a large oval-shaped excavation about 370 by 95 feet which may be for burying tanks. Two large scarred areas, with probable building founda-

tions, are northwest of the excavation. Numerous concrete arches, [redacted] are stacked around these areas. Along the front of the excavation are three rows of small objects or foundations in scarred areas. Their locations and positions equate to those of three structures found later in the construction phase.

There are about 20 various-sized buildings scattered around the site, and foundations are evident for the construction of several more. One odd-shaped structure 235 by 55 feet is located about 2,400 feet south-southwest of the launch site. It is near one of the ditches from the launch site, and has an inclined conveyer extending upward from one end and a ramp at the other end. Three ramps [redacted] extend from one side of the building, and scarring is evident directly opposite these on the other side.

LAUNCH AREA F, DROVYANAYA

Launch Area F (Figure 2) is in the midstage of construction, somewhat behind that of Launch Area E. The lack of stereo coverage hampers identification and interpretation of construction details. The three silos are under construction, with ramps extending out over the excavation. There appear to be square construction platforms at the ends of the ramps, with the silo itself in the center. This square area around the silo may have been built up from the bottom of the excavation at the center silo. Excavation for the equipment bunkers is evident between the silos. Some foundations for the control bunker have been laid in the notch of the excavation. A minor amount of ditching is apparent for laying the probable passageways within the site. About 10 buildings of various sizes, some under construction, are scattered around the site with scarring and foundations for several others.

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LAUNCH AREA B, OLOVYANNAYA

Launch Area B (Figure 3) is in the midstage of construction, with extensive activity within the excavation. Forms and structures are evident around the silos at the ends of the construction ramps, although the silos cannot be seen. The two equipment bunkers have been roofed and some backfilling has taken place along their forward sides; the backfilling also covers some of the probable passageway running the long axis of the front side of the excavation. The probable

passageway running the long axis of the excavation between the control bunker and the silos is well along in construction. A deep notch in the excavation has been cut for the control bunker, and two walls of the bunker are up with the others under construction. Two deep L-shaped ditches extend from the rear of the control bunker. A shallow irregular excavation left of the control bunker may be for the location of buried tanks. At least seven various-sized buildings, probably for construction support, are around the site. One structure, approxi-

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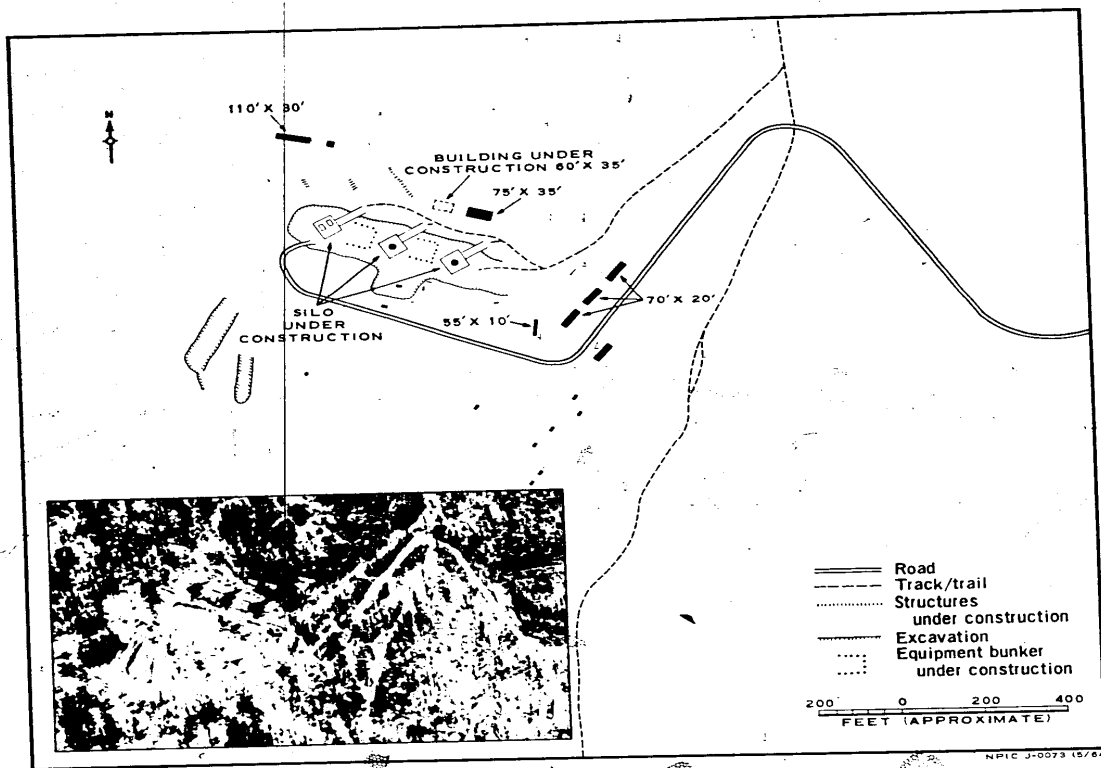


FIGURE 2. LAUNCH AREA F, DROVYANAYA.

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mately 95 by 20 feet, is to the left front of the left silo at about a 45-degree angle to the long excavation.

A possible pipeline parallels the access road from the site support facility.

LAUNCH AREA C, OLOVYANNAYA

This launch site (Figure 4) is in a slightly earlier stage of construction than Launch Area B. Construction ramps extend out over the excavation to the positions of the three silos. The actual silos, in various stages of construction, are not apparent. At the position of the right silo there are structures and forms at the bottom of the excavation below the end of the

construction ramp. Very little finished construction is evident around the positions of the other two silos. The walls are up for the equipment bunker between the right and center silos, but only the foundations are in for the other equipment bunker. Only portions of two walls of the control bunker have been constructed in the notch of the excavation.

Probable passageways are under construction throughout the site. The long one between the silos and control bunker extends beyond the excavation, passes under the site loop road, and connects to an extensive system of ditching. This ditching, with an average width of 10 feet and characterized by sharp turns, apparently will serve several different facilities

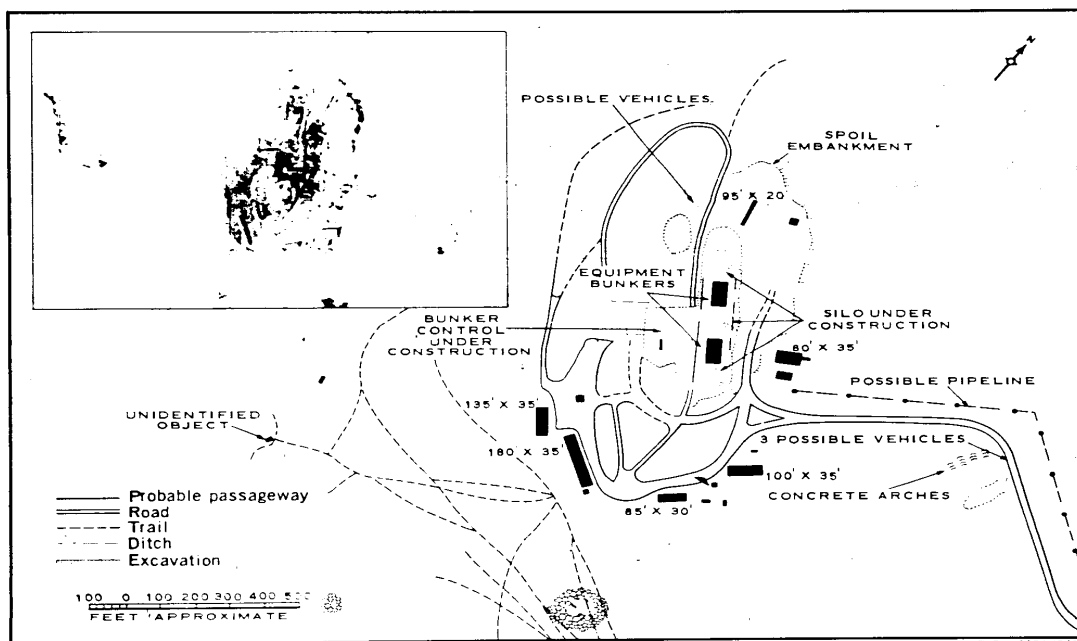


FIGURE 3. LAUNCH AREA B, OLOVYANNAYA.

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within the launch area. The probable passageway under construction along the front side of the excavation appears to have segments branching off at right angles and extending between the right silo and the equipment bunker, and between the center silo and left equipment bunker. A shallow oval-shaped excavation to the left of the control bunker may be the future location of buried tanks. A possible pipeline extends from behind the left rear of the control bunker out to a small structure. There are at least 14 buildings and structures of various sizes, some under construction, around the perimeter of the launch site.

LAUNCH AREA K, YURYA

Dark photography obscures most of the details of construction within the site (Figure 5). Three light-toned, vague images appear at the points where the silos are under construction. The construction ramps to the silos are barely discernible. There appear to be excavations under the ramps around the forward side of the silos. The control bunker and one of the equipment bunkers are under construction. There is evidence of probable passageways being constructed on both sides of the silos, running the long axis of the excavation. Two irregular-

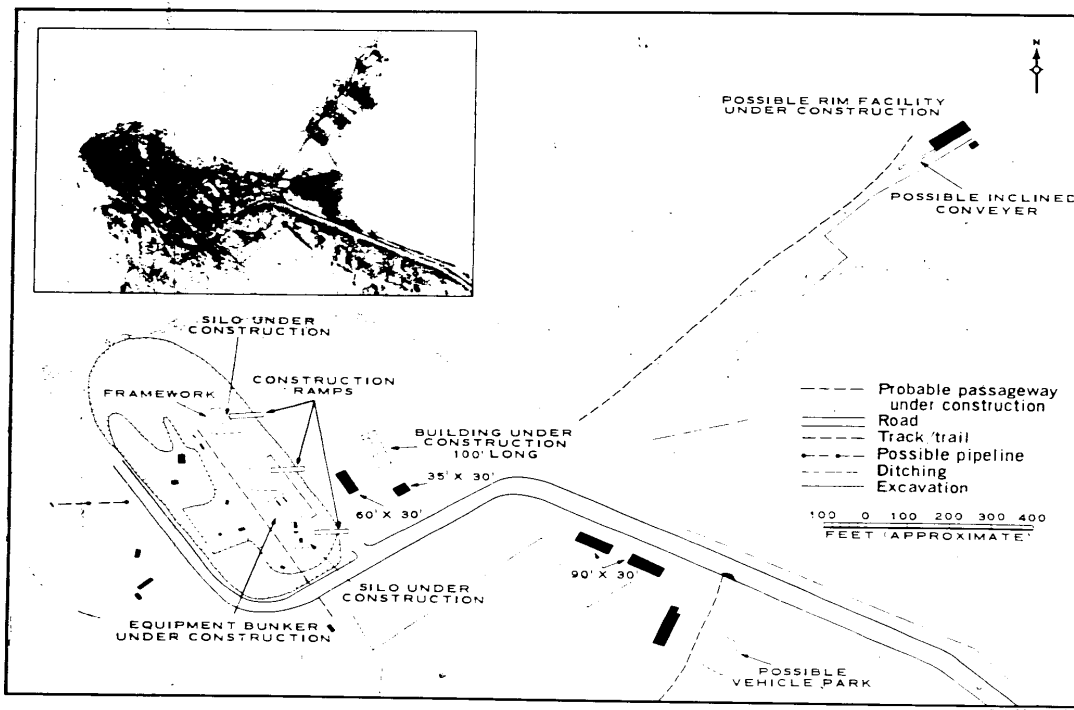


FIGURE 4. LAUNCH AREA C, OLOVYANNAYA.

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shaped excavations at the left end of the site may be for buried tanks. To the left rear of the control bunker is a probable shallow excavation with an adjacent roughly circular excavation which may be the location of a possible spray pond. Three long narrow structures approximately 100 by 15 feet, and probably round or curved, are positioned on the bank opposite the control bunker. Two large buildings and several small ones, probably for construction support, are located around the site. Evidence of ditching can be seen leading to the launch site from the site support facility.

LAUNCH AREA F, PERM

The quality and obliquity of the photography of Launch Area F (Figure 6) does not permit

a detailed examination of this site in the mid-stage of construction. It was not possible to obtain reliable mensuration data on this site. Structures and facilities within the excavation are well along in construction. Construction ramps are evident but the exact positions of the silos cannot be identified. Structures of an undefinable shape, with considerable height above the bottom of the excavation, are at the ends of the construction ramps. At the center silo position this structure appears rectangular, similar to the rectangular enclosure around the silo, and supporting the cover, at a completed site. Probable passageways are being constructed within the site; the one between the silos and the forward side of the excavation is

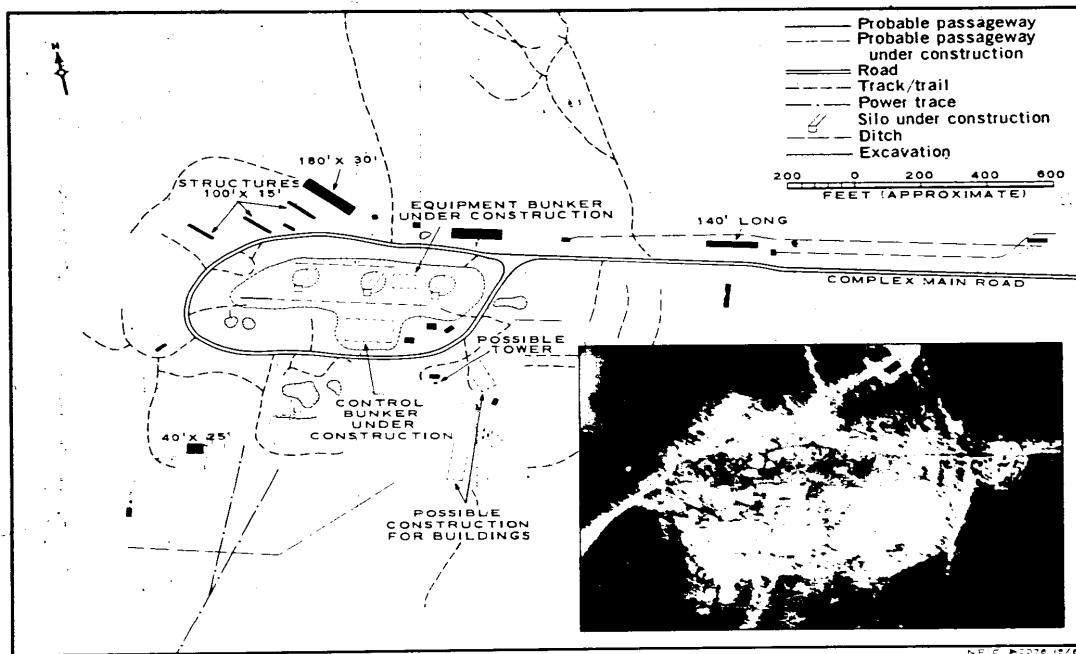


FIGURE 5. LAUNCH AREA K, YURYA.

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apparently in place, with a segment outside the left silo leading toward the rear of the excavation. The equipment bunker between the left and center silos apparently has been roofed. The one between the right and center silos presents an uneven appearance and there appear to be two connections, smaller than the probable passageways, running to the center silo. The control bunker in the notched excavation to the rear of the silos is still under construction, although a portion has been roofed.

Three structures are positioned in front of the excavation just outside the loop road at about a 45-degree angle from the long axis of the excavation.

A possible spray pond under construction appears as a shallow excavation or basin to the left rear of the control bunker. A long narrow excavation or ditch extends from near the right silo eastward to a point beyond the security fence. Seven buildings or structures are located around the site.

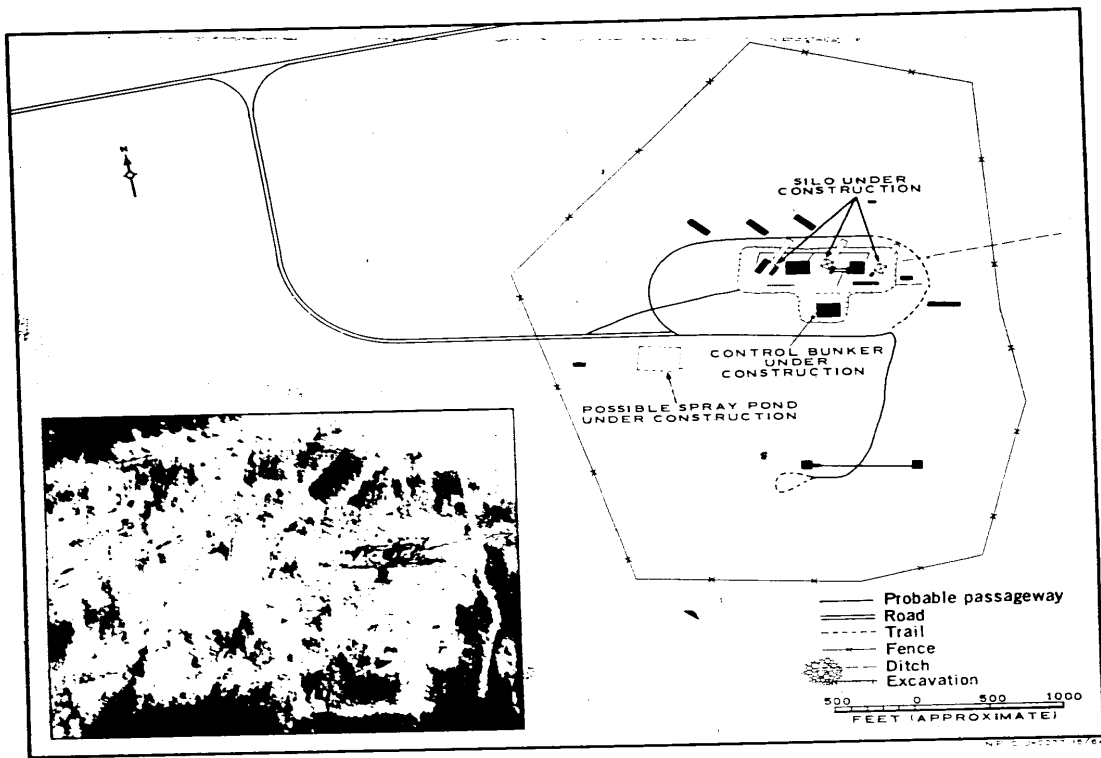


FIGURE 6. LAUNCH AREA F, PERM.

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COMPLETED SITES

LAUNCH AREA G, VERKHNYAYA SALDA

Launch Area G (Figure 7) has been completed since mid-1963. The excellent photo

coverage from Mission 4006 revealed several small details, although the site was under a heavy snow cover. One peculiar feature of this site is the height of the earth mounding over

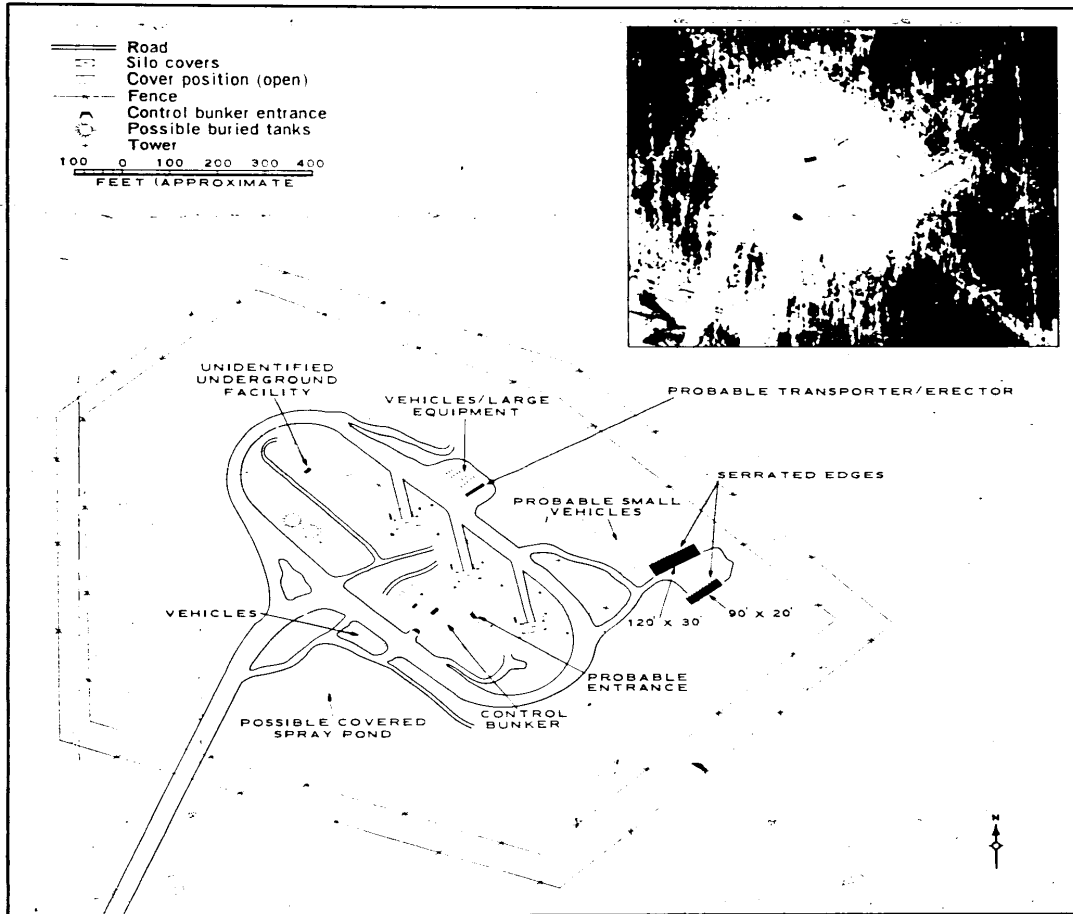


FIGURE 7. LAUNCH AREA G, VERKHNYAYA SALDA.

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the control bunker. This extends for some distance above ground level, indicating the control bunker is only semiburied. Two small structures, [redacted] and an object are atop the bunker. A probable entrance is located on the right front side of the bunker but the main entrance is at the rear along the loop road. At the left end of the site are two possible buried tanks; there is no earth mounding over this area and only a faint indication of their possible location. Just forward of this area is a large earth-mounded area with a small structure [redacted] similar to those atop the control bunker. The nature of the underground facilities here cannot be determined.

The three identical silo covers are all in the closed position. The left cover has been completely cleared of snow, with the other two showing varying degrees of snow melt or clearing. The positions for the covers to move into are apparent at the left and center silos. A small, low tower-like structure is adjacent to the rear of these positions. Two square pad-like areas to the left of the silo covers have an irregular-shaped structure at the rear of the rear pad and a small tower-like object at the front left corner of the front pad. Several other small unidentified objects or structures are positioned around the silos. Four short towers are located within the launch site. A parking apron off the loop road at the front of the site contains one probable transporter/erector about [redacted] and 4 large vehicles or pieces of equipment. Two buildings are located at the northeast corner of the site outside the original area of excavation, with two adjacent areas containing probable small vehicles.

A possible covered spray pond is located to the rear of the control bunker. The only visible evidence of it is an indistinct square outline with a few faint dark lines running through it.

LAUNCH AREA F, VERKHNYAYA SAIDA

Launch Area F (Figure 8) was considered complete in mid-1963. The silo cover was moved back from the center silo on Mission 4006. A rectangular enclosure is visible when the cover is moved back, with the silo apparently centered within this enclosure. A light-toned ring around the silo opening extends to the edges of the rectangular enclosure. This may constitute the thickness of the silo wall or could be a collar around the silo top. There is some suggestion that it slants downward in a funnel shape toward the inside of the silo. The top of the silo is at an undetermined depth below ground level but it cannot be determined if this depth is equivalent to the thickness of the silo cover. Prepared positions for the covers to move into are evident to the right of the silos. Small tower-like objects are adjacent to the rear of these positions. The two square pad-like areas to the left of the covers are not as evident as those at Launch Area G. Those to the front cannot be precisely delineated because of the snow cover. A small tower-like object at the front and an irregular-shaped structure at the rear are adjacent to the pad areas.

Several unidentified small structures and objects are positioned around the silos. The control bunker has been mounded over up to ground level, although the terrain drops off in front to a lower level at the silos. Three small structures, [redacted] and several small objects are atop the control bunker. A probable tower or stick mast is off the right side of the bunker. The entrance to the control bunker is on the back side along the loop road. Across the road from this entrance is an odd-shaped unidentified structure which appears to be built up at an angle. Two semiburied probable tanks are located at the west end of

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the site. A semiburied earth-mounded structure or bunker is located outside the loop road forward of the left silo. The earth mounding is in a circular pattern with access to the entrance from the loop road. Many small dark patches are visible atop the earth mounding. One large and two smaller buildings are at the northeast corner of the site, outside the loop road. Five large and eight smaller vehicles or pieces of equipment are parked in this area. A possible spray pond to the left rear of the control bunker appears as a faint striated area within a square enclosure. Adjacent to this is an unidentified

circular outline of what may be a shallow basin



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LAUNCH AREA A, OLOVYANNAYA

Launch Area A (Figure 9) was considered complete in February 1964 on KH-4 Mission 1004-1. From the larger-scale photography of Mission 4006 the loop road appears as only partially graded and paved. The center silo cover is open, revealing the silo within the rectangular enclosure. The silo is the only thing visible within the enclosure. The same pattern of

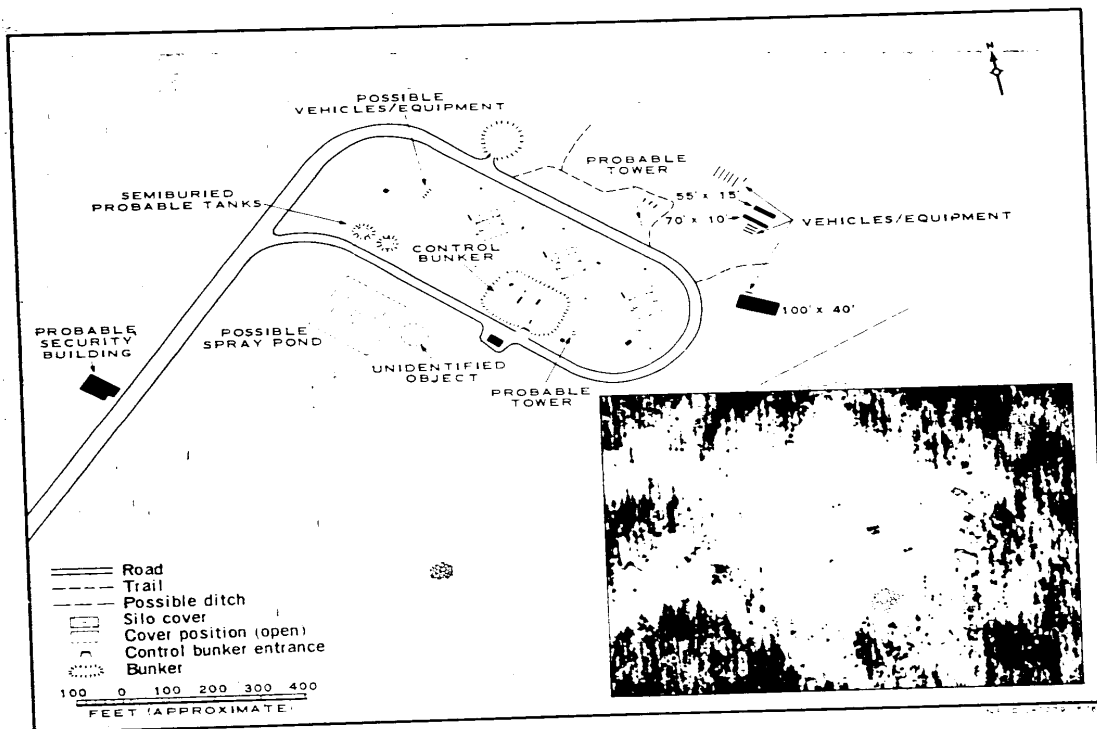


FIGURE 8. LAUNCH AREA F, VERKHNAYA SALDA.

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structures observed adjacent to the silos at other completed sites is apparent around the silos here.

The outline of the control bunker cannot be precisely defined, as backfilling of the excavation has been only to ground level and the bunker is not mounded over. Several structures and objects are visible atop the bunker, with the entrance to the rear along the loop road. The location of probable buried tanks cannot be ascertained.

A possible spray pond to the left rear of the control bunker appears as a shallow open excavation or basin approximately 115 by 80 feet, possibly concrete lined, that slopes down to a lower depth at the rear. No other details of this facility are visible.

A structure is located just outside the loop road, forward of the left silo. Two other structures being constructed in this area on earlier coverage have been removed.

Three large buildings are at the northwest corner of the site, with one appearing to have three different roof levels. Several vehicles or pieces of equipment are visible around the site.

LAUNCH AREA E, YURYA

The photography of this completed site (Figure 10) does not permit as detailed an examination as the sites at Verkhnyaya Salda. Slightly smaller scale and some clouds, plus heavy snow cover, obscure some smaller details. The three identical silo covers are closed. The same configuration of structures and objects as observed at Verkhnyaya Salda are evident around the silos here. The control bunker and possible spray pond to the left rear are visible only as slightly raised mounds. Several small objects are apparent atop the control bunker, and the entrance is visible along the loop road. Three vehicles are parked on an apron across the road from

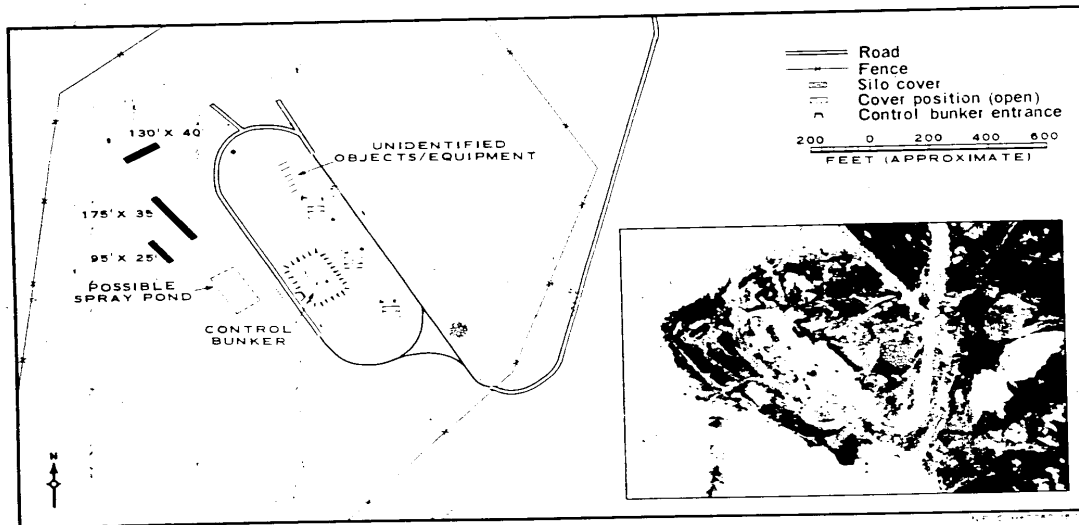


FIGURE 9. LAUNCH AREA A, OLOVYANNAYA.

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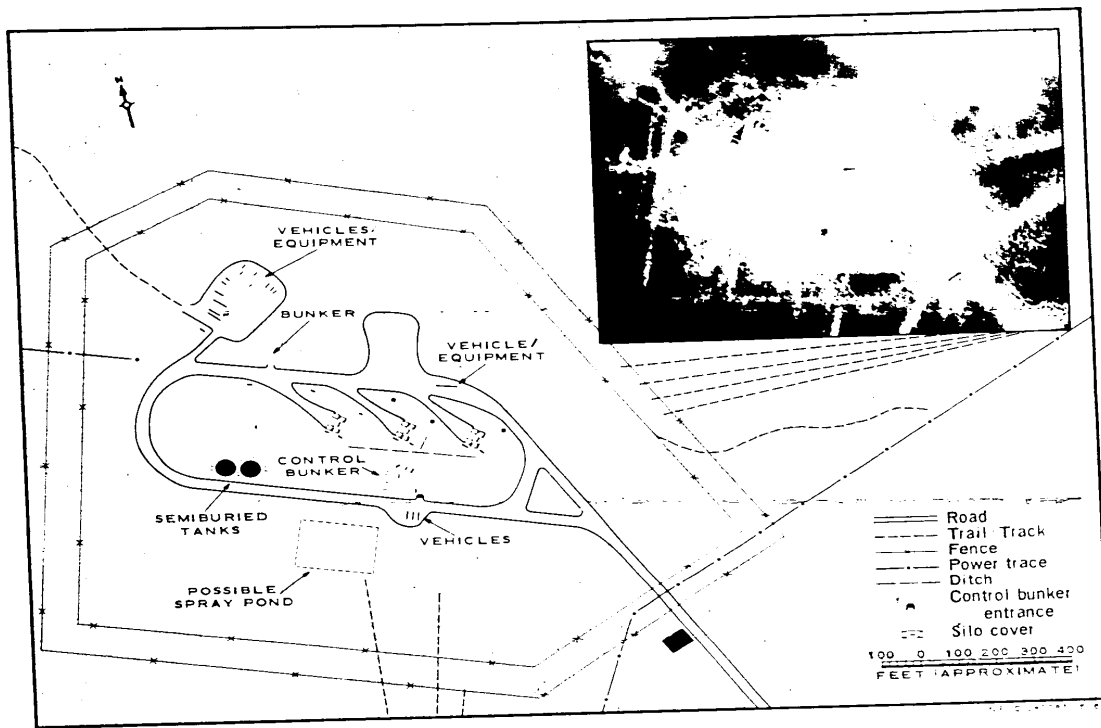


FIGURE 10. LAUNCH AREA E, YURYA.

the entrance to the bunker. Two semiburied probable tanks are to the left of the control bunker, inside the loop road. An earth-mounded bunker is located at the forward left end of the site, as at Launch Area F at Verkhnyaya Salda, with an entranceway from the loop road. Two

large parking aprons are at the forward ends of the site. Thirteen various-sized vehicles or pieces of equipment are parked on the left apron. One other large piece of equipment is on the road near the right silo. Some snow removal is evident on the loop road and parking aprons.

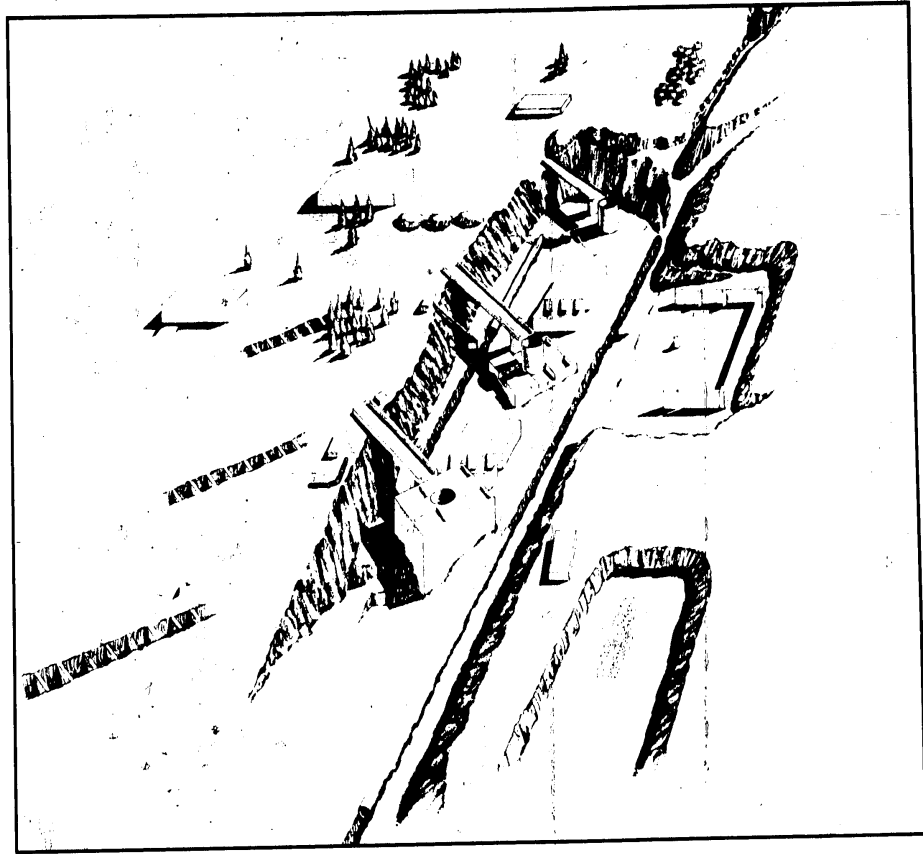
CONCLUSIONS

Construction of a typical Type IIIA site begins with a long relatively shallow excavation being scraped out. Deeper excavating then begins within the actual site, with sides of the

excavation starting to take shape. At this point the holes for the missile silos are excavated. The method of excavating the silos, whether by scooping out with the usual equipment or by

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FIGURE 11. CONCEPT OF TYPE IIIA ICBM SITE IN MIDSTAGE OF CONSTRUCTION.

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drilling out the core of the silo, has not been determined. As excavation and construction of the silos begins, a square notch is cut in the back side of the excavation for the control bunker. Construction of the control bunker begins as the silos rise from the main excavation. Two structures for housing equipment are started between the silos. During this period ramps are laid out from the bank opposite the control bunker to the silos, providing access for equipment and materials. The ramps terminate in a square framework or structure around the silo. This square structure around the silo in some cases appears to be divided into several sections. Whether these are compartments around the wall or only scaffolding for construction has not been determined.

During this midstage of construction (Figure 11) probable passageways for personnel movement and services within the site are constructed on both sides of the silos running the long axis of the site. These passageways appear to be built of preformed concrete rings laid in a ditch or foundation, and probably provide access to the silos and equipment bunkers. Extensive ditching is evident outside of the launch site on the latest sites observed in the midstage of construction. This system of ditching appears to connect to the long passageway running between the silos and the control bunker. A shallow oval-shaped excavation appears to the left of the control bunker, where probable earth-covered tanks are observed at the completed site. During the late midstage of construction, three long, narrow, round or curved structures are built just back from the excavation on the bank opposite the control bunker. During the later stages of construction these structures disappear. From early photography of Type IIIA sites these structures were reported as being the construction ramps but at present a function cannot be assigned to them. Some possibilities

have been suggested, among them exhaust vents or silo liners. These structures are spaced equally apart and their long axis points generally toward the silos at about a 40-45 degree angle from the long axis of the excavation. However they are not spaced the same distance apart as the silos are.

During the late stage of construction, backfilling of the excavation gradually takes place as structures are completed. To the left rear of the control bunker a possible spray pond is constructed as a square, shallow basin. When observed at a completed site this facility has been covered in some manner and the details are not apparent. When construction of the site has been completed, the excavation will be completely backfilled and an oval road pattern will enclose the silos, control bunker, and probable tanks.

The three rectangular silo covers are opened by moving them in the direction of their short axis and to the right, as viewed from the control bunker. The actual method used to move them cannot be determined but at one open silo (Launch Area F, Verkhnyaya Salda) a dark line is evident at the end of, and within, the rectangular opening, indicating some type of track for the cover to move on. Additional evidence of this is observed on closed covers with partial snow melt, where they appear to be smaller because of less snow melt at the ends of the cover, indicating a heavier structure under the ends. A rectangular prepared position, probably a concrete pad, is adjacent to the cover to hold and contain it when the silo is open. The silo appears to be centered within a rectangular opening, with the top of the silo at a depth below ground level. It is not possible to determine if this entire depth constitutes the thickness of the silo cover.

Two square pad-like areas are located at the front and rear along the left side of the

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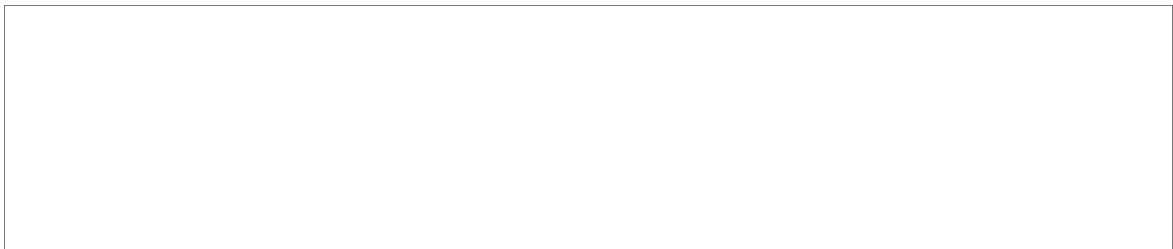
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rectangular silo enclosure. A small irregular-shaped structure is adjacent to the rear of the rear pad. The access road to the silo terminates between these pad areas by the silo at what appears to be a slightly lower level than the edge of the silo enclosure. At this point the side of the rectangular silo enclosure seems to have a thick, slightly curving edge. This may provide some type of support for the transporter erector when offloading the missile, or could provide an additional degree of hardening where a portion of the edge of the silo enclosure may be exposed above ground for a few feet.

Access to the earth-covered control bunker from the loop road is provided by an entrance-way at the rear of the bunker. Several small structures and objects, probably housing optical and electronic devices, are located atop the earth covering over the control bunker.

A pattern of small unidentified structures is apparent around the three identical silo covers. A small, low, tower-like structure is adjacent to the rear of the position the covers move into. A similar type of structure is adjacent to the front of the forward pad-like area, left of the silo cover.

REFERENCES



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REQUIREMENT

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