DISSEMINATION CONTROL ABBREVIATIONS

NOFORN-	Not Releasable to Foreign Nationals
NOCONTRACT-	Not Releasable to Contractors or Contractor/Consultants
PROPIN-	Caution-Proprietary Information Involved
ORCON-	Dissemination and Extraction of Information Controlled by Originator
REL . . .-	This Information has been Authorized for Release to . . .

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Central Intelligence Agency

Washington D C 20505

Directorate of Intelligence

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Taboshar Solid-Propellant Motor Production Plant: A Preliminary Assessment of Facilities and Process Flow [redacted] 25X1

Summary

The Taboshar solid-propellant motor production plant has recently been identified [redacted] the south-central Soviet Union. However, [redacted] construction on the first part of the plant began in about 1970 and was finished by 1973. The plant experienced a major expansion in the late 1970s and early 1980s. A second major construction program began in the mid-1980s and is still in progress. [redacted]

The plant is made up of two separately secured production lines. While these two lines display many of the characteristics we normally observe at other Soviet solid motor plants, many aspects of their design are unusual. Neither line is directly served by rail. Instead, shipments to and from the

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Information available as of 1 October 1987 was used in this report. (U)

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production lines must be made by truck. Another unusual feature is that the first line was built in a mountain ravine--a feature common to Chinese solid-motor production plants but unique in the Soviet Union. Also, the plant--unlike all the other Soviet solid-propellant motor plants--does not appear to have a static test facility for its motors, and has several unique structures not normally found at Soviet motor production plants. [redacted] 25X1

Analysis [redacted] 25X1
[redacted] *has allowed us to make several judgments about the plant:* 25X1

- *The production line in the mountain ravine was probably first constructed as an experimental propellant production facility.*

- *After the expansion of this line in the late 1970s and early 1980s, it began serially producing propellant, probably for cartridge-loaded motors. By the early 1980s, this line was producing propellant grain and motors for the third stage of the SS-25 ICBM, and perhaps for the SS-25 follow-on. This facility may have produced about one-fourth to one-third of the third-stage motors required for the approximately 175 SS-25 missiles probably assembled to date.*

- *In the mid-1980s, construction began on the second production line, which we believe will produce case-bonded motors possibly for follow-ons to the SS-X-24 ICBM, SS-N-20 SLBM, or for some other missile system. While the major portion of this line is still under construction, it may already have a limited operational capability and may eventually be able to produce enough motors to assemble approximately 45 to 80 three-stage ballistic missiles annually.* [redacted] 25X1
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Background

The Taboshar solid-propellant motor production plant is located in the south-central USSR, about 40 kilometers south of Tashkent near the town of Taboshar (figure 1). [redacted] 25X1

[redacted] portions of the plant have existed since at least the early 1970s. Major construction programs have occurred twice since then--first in the late 1970s and early 1980s and a second, continuing program that began in the mid- 1980s. The plant displays many of the characteristics normally associated with Soviet solid-propellant motor plants, but many aspects of its design are unusual including such anomalies as a lack of rail service into the plant, an apparent absence of a static test facility for motor testing, and the construction of several unique buildings. [redacted] 25X1 25X1

[redacted] a comparison of the facility with other Soviet plants, and some analytical judgments, this paper describes the plant's facilities and process flow, discusses the types of motors that are probably or could eventually be produced there, and attempts to project production capability. [redacted] 25X1 25X1

Figure 1
Location of Taboshar Solid Motor Production Plant, USSR

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The Taboshar solid-propellant motor production plant is composed of two separately secured production lines. One propellant production line, located in a mountain ravine, probably produces cartridge-loaded motors. The second line, in the neighboring valley, is probably for production of case-bonded motors[1] (figure 2). [redacted] 25X1 25X1

[redacted]

[1] In cartridge-loading, propellant cartridges are inserted into molds, and then later, the propellant cartridges are inserted into the motor case. In case-bonding, the propellant is poured directly into the motor case. [redacted] 25X1

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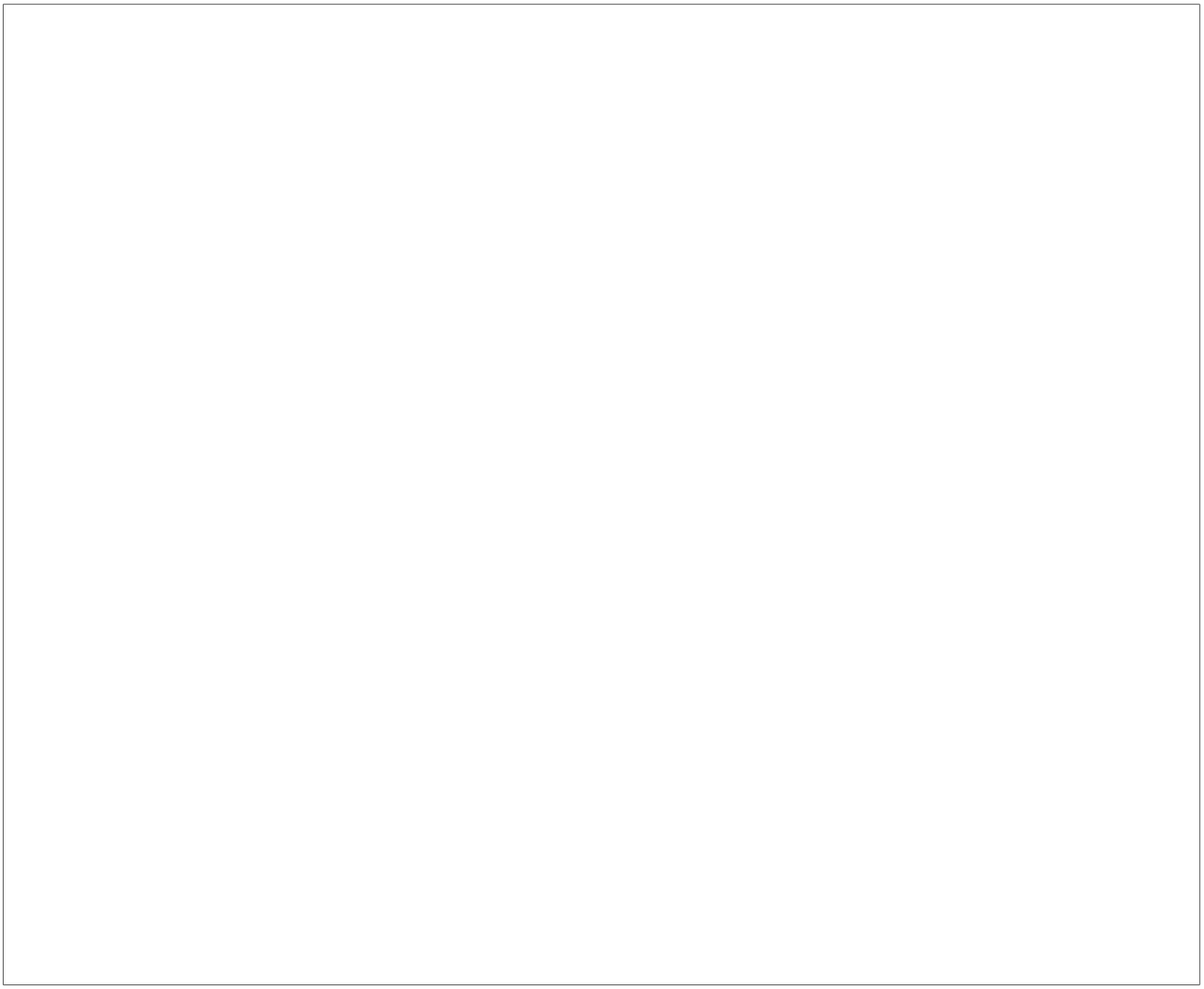
Probable Cartridge-loaded Propellant and Motor Production Line

Nestled in a mountain ravine, just west of town, is the cartridge-loaded propellant and motor production line--the oldest and most unique area of the Taboshar plant. Its location and layout more closely resemble Chinese solid-propellant facilities than other Soviet solid-propellant plants (figures 3, 4, and 5). Initial construction on this line began in about 1970 and ended in about 1973. Several storage sheds and other small buildings occupied the site before construction began, suggesting that this line may have been built on a site formerly involved in mining operations. The natural terrain around this production line isolates each building involved in hazardous operations, and probably saved the Soviets time and money since they did not need to construct extensive revetments around all



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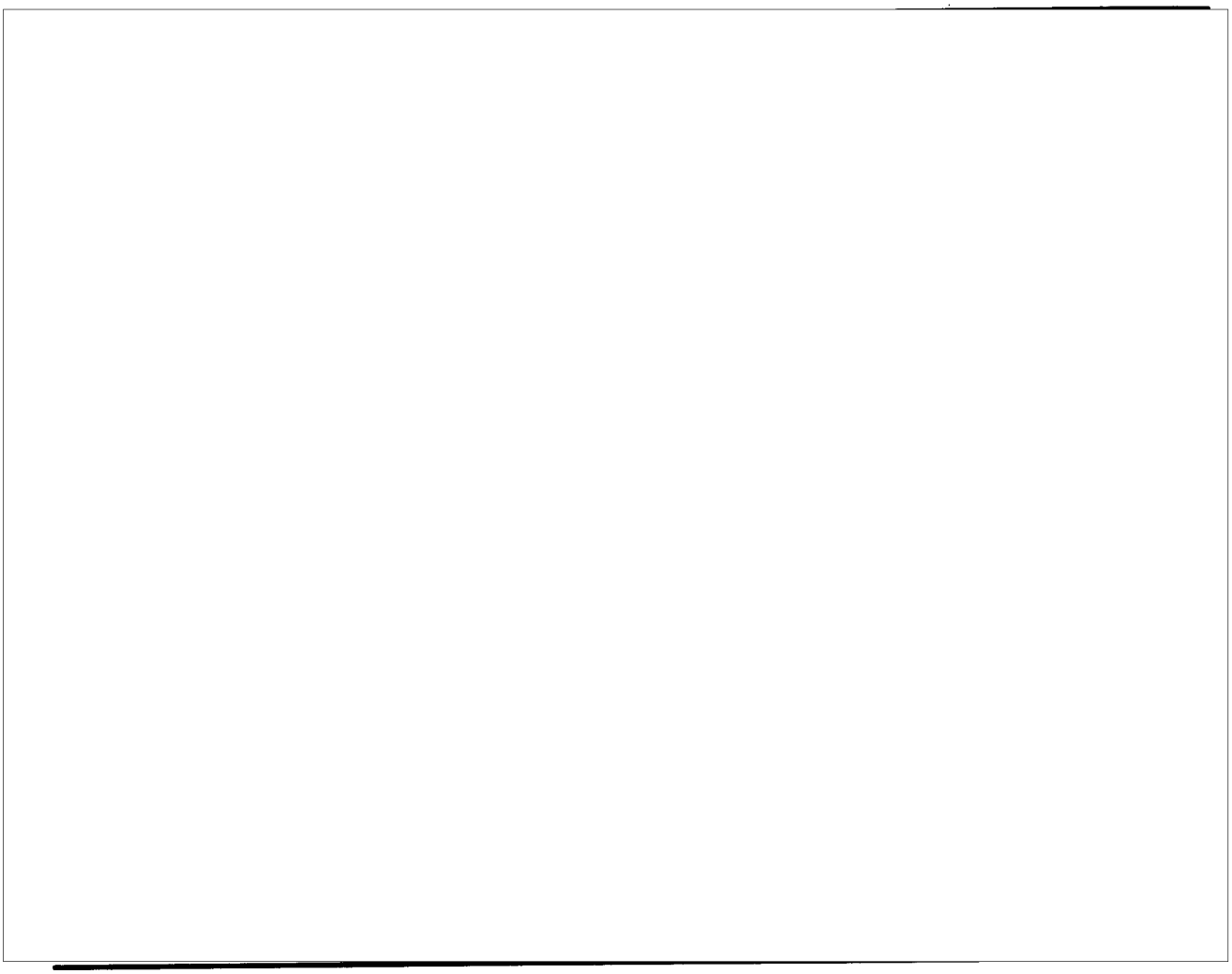

the buildings. This line has some building-to-building rail service within its confines, but it is not served by a mainline track--a very unusual feature perhaps dictated by the rugged terrain. In fact, for the internal rail service to negotiate the terrain and move material between sections of the plant, a rail elevator was constructed (figure 4). Shipments to and from this area must be made by truck. The trucks probably travel back and forth to Leninabad--the nearest rail-served city--where motor components and motors are loaded off of and onto railcars for long distance shipments. Since the layout of this line appears to be unique among motor plants in the Soviet Union, it may have originally been an experimental industrial design.

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Initial facilities at this propellant line consisted of propellant-production-related buildings, a propellant disposal area, an administrative area, a firehouse, probable underground storage areas, and other support buildings. Three adits that

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are present in the southern part of the ravine may have existed before 1970 as entrances to mine shafts; later they probably only had to be modified to serve as entrances to the underground storage areas (figure 4). [redacted] 25X1

The small scale of the initial construction in the early 1970s and the unusual design of the line lead us to believe that it was originally constructed as an experimental plant, not meant to serially produce propellant or motors. On the basis of building layout and safety requirements, we judge that only two of the original buildings constructed were initially capable of producing propellant (figure 4). Both of these buildings are similar to structures that handle solid-propellant at other Soviet plants. They are physically separated from the other buildings in the area and a lightning arrester is immediately adjacent to one of the buildings. [redacted] 25X1

[redacted] 25X1

[redacted] Since grinding is 25X1
one of the more hazardous aspects of propellant production, we believe installation and eventual operation of the machinery in the early 1970s occurred in the building protected by the lightning arrester although the absence of an earthen barricade around the building limits our confidence in this judgement. The other probable production building was, and probably still is, involved in less hazardous work such as ingredient receiving and preparation since it apparently has no lightning arrester protection. [redacted] 25X1

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The second phase of construction at this line occurred during the later half of the 1970s and early 1980s and, we believe, signaled the conversion of this facility from experimental production to serial production of propellant and motors. During this time frame, construction was completed on a propellant grinding building on the western end of the line

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(figure 3). The building is very similar to grinding buildings for series production at such solid motor plants as Biysk and Kamensk-Shakhtinsky. It is completely surrounded by an earthen revetment, flanked by two lightning arresters, and is some distance away from other structures. These safety measures and the similarity of this building to those for serial production at other solid motor production plants suggests that it, too, was built for serial production of propellant. We cannot confidently identify a propellant mixing building at this line. Possibly, the grinding building also serves as a mixing building, or the building involved in grinding operations in the early 1970s may now be used to mix propellant. [redacted] 25X1

Three additional facilities--a probable propellant casting building, a probable propellant curing building, and what may be a motor finishing area--were built at this line in the early 1980s and provide further evidence that Taboshar's role in solid motor production was expanding (figures 4 and 5). The casting and curing buildings are similar in size and layout to casting and curing buildings found at the Biysk, Kamensk-Shakhtinsky, and Pavlograd solid motor plants. The casting building is revetted, rail-served, and situated between two lightning arresters. We believe it contains a casting pit where propellant is cast into molds or sheaths for the cartridge-loaded motors.[2] [redacted] 25X1

The curing building is adjacent to the casting building and is connected directly to it by rail. It is also protected by two lightning arresters. The building houses curing ovens and a control section. Here, the propellant is cured for a specific time period under elevated temperatures and strictly controlled humidity levels. [redacted] 25X1

The third facility built during this time frame is located at the extreme northeast end of the line (figure 5). We believe this facility may be for motor finishing and shipping, that is, propellant X-ray testing, mold disassembly, cartridge insertion, and packaging for shipment. Although there are several buildings within this area, only three appear to be devoted to motor finishing. The other structures in the finishing area probably house administrative, engineering, and component storage areas. The ductwork on a section of roof of one building is similar to ductwork on the roofs of other propellant X-ray test buildings in the Soviet Union and suggests that X-ray tests of the propellant are conducted in that section. We

[2] A casting pit is a chamber, below ground level, in which propellant is poured into molds or motor cases. Its purpose is to provide protection in the event of an accidental explosion. (U)

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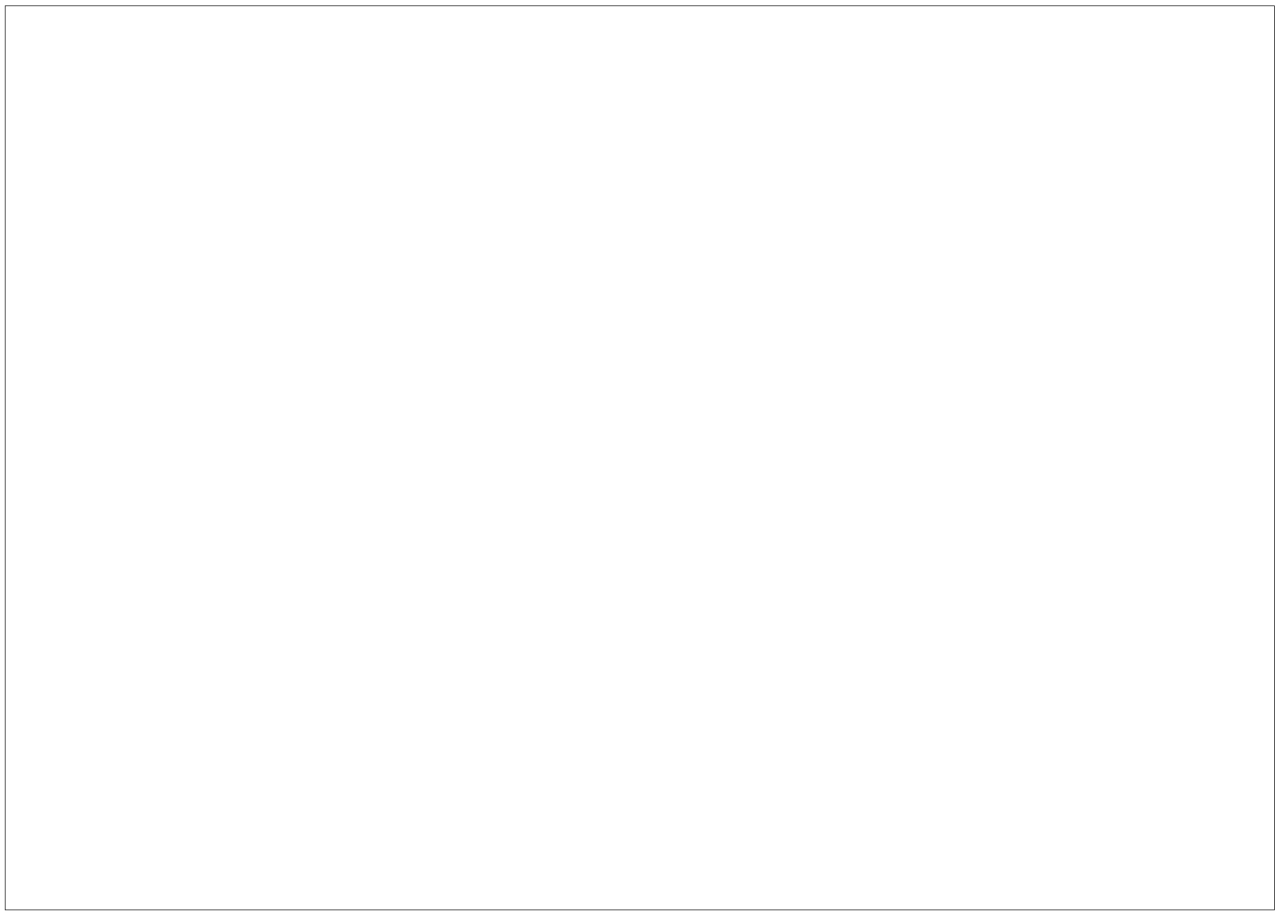

believe that in the adjacent high-bay section the molds are disassembled, cartridges are inserted into the cases, the propellant is machined, and auxiliary equipment is installed on the motor. The other finishing building--which is connected by rail to the X-ray and component installation building--probably is used to check out the completed motors, ready them for shipping, and store the motors before shipment. [redacted] 25X1

[redacted] 25X1

Recent special intelligence indicates that Taboshar has been producing the third-stage propellant grain and motors for the SS-25 ICBM and possibly its follow-on since at least early 1985.[3] The construction of the casting, curing, and finishing buildings has corresponded to the development and production of the SS-25 program. Moreover, the casting building at Taboshar is almost identical to a casting building constructed at about the same time at the Kamensk-Shakhtinsky plant, which is

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assessed to produce motors for the SS-25. These factors suggest that the casting, curing, and finishing facilities at Taboshar were constructed specifically for the SS-25 program, and that Taboshar has probably been producing SS-25 third-stage propellant grain and motors since the early 1980s. [redacted] 25X1

[redacted] 25X1

Possible Case-bonded Propellant and Motor Production Line

The newest section of Taboshar is located in the valley adjacent to the mountain range containing the original part of the plant (figure 6). Construction on this propellant line began in the mid-1980s, and much of it is still unfinished. This production line is similar to the newer motor production lines for the SS-N-20 SLBM at Biysk and for the SS-X-24 ICBM at Pavlograd. This similarity is the main reason we believe this area of Taboshar will eventually produce case-bonded motors like those probably used on the SS-N-20 and SS-X-24. However, this line also has unusual features not normally seen at other Soviet motor plants. The line has some unique buildings and, like the cartridge-loaded line, lacks a main rail line. Components and finished products must be sent by truck to and from the nearest rail line in Leninabad. [redacted] 25X1

Several of the buildings at this line have been completed and are surrounded by a temporary security fence--used to keep uncleared construction workers out of sensitive areas--suggesting that these buildings may be operational or are at least receiving production equipment. Within this secured area is an X-ray test building and a 10-bay curing building--connected via a support section to another 10-bay curing building still under construction (figure 6). Both of these structures are served by an enclosed transverser--a device that runs along rails and feeds propellant, motor cases, and motors into the various bays of the production buildings. These two buildings are nearly identical in size and layout to the buildings performing the same functions at Biysk and Pavlograd. [redacted] 25X1

We believe the other two production buildings within the secured area are either for motor casting operations or motor finishing functions such as igniter, exit nozzle, and cableway installation (figure 6). The two buildings are connected by a central support section and are served by the transverser. They are equipped with fire escapes for the overhead crane operators, indicating hazardous materials are handled inside. The presence of the temporary security fence suggests this area could be operational. These buildings may be for motor casting--the

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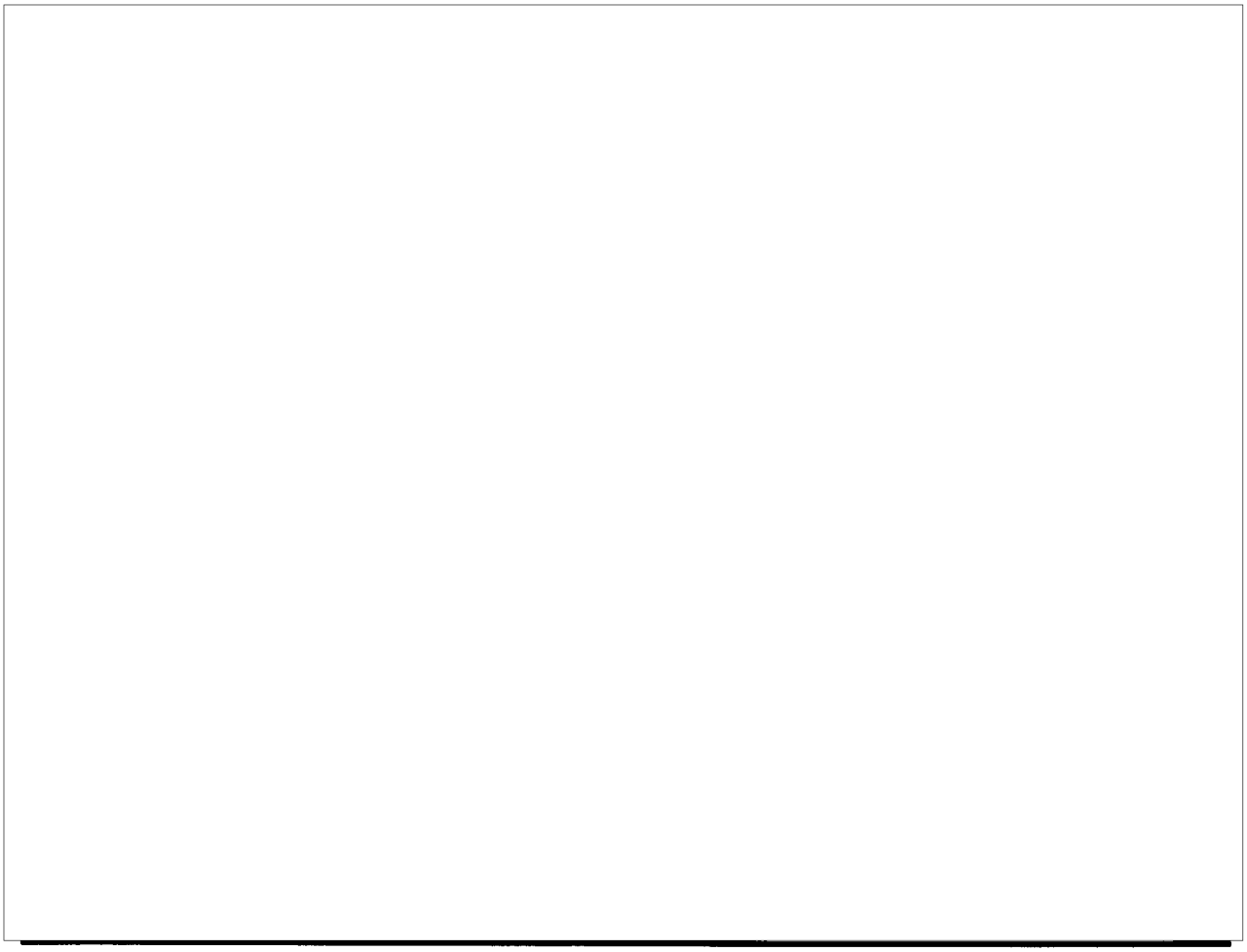

process that occurs before curing and X-ray testing. However, these buildings differ from other casting buildings in that they are not revetted, are situated relatively close to other buildings, and apparently have no lightning arresters near them. This lack of safety features suggests that the two buildings may instead perform less hazardous finishing operations, and that a casting building will eventually have to be constructed, perhaps in the open area adjacent to these two buildings.

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A number of other production buildings are still under construction at this line and will need to be completed before the line can be fully operational. Among them are a motor case receiving, inspection, and preparation building; a probable propellant mixing building; a second ten-bay curing building; and several support buildings probably for such functions as mold disassembly and propellant machining (figure 6). The receiving, inspection, and preparation building is similar to structures located at Biysk and Pavlograd that serve the same

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function. It should be externally complete by the end of 1987 and operational by early-to-mid 1988. The curing and mixing buildings are in an earlier stage of construction. The second curing building--which is identical to the one already completed--will probably be finished by early 1988. The mixing building will probably not be finished and operational until late 1988. It will be very similar to those already existing at Biysk and Petrokrepost and others now under construction at Pavlograd and Biysk. [redacted] 25X1

Adjacent to the mixing building is a row of five tank-like structures, three of which will eventually be served by a second rail transverser now under construction (figure 6). Similar tank-like structures are located at Biysk. However, the structures at Biysk are not served by a transverser and are not aligned in a row, but are clustered. All five of these structures at Taboshar (and presumably the ones at Biysk) are constructed with inner and outer walls that we believe may be designed to contain an accidental explosion. A possible control building is located to one side of the tank-like structures. The exact function of these structures is unknown, but their location adjacent to the mixing building and their double wall construction suggest that they could be a new design for propellant grinding facilities. The three tank-like structures served by the transverser may perform the actual grinding operations, while the other two may store propellant ingredients. [redacted] 25X1

The Soviets are currently developing two ballistic missiles that probably will use case-bonded motors--a follow-on to the SS-X-24 ICBM and a follow-on to the SS-N-20 SLBM. Some fragmentary evidence suggests the Soviets may also be developing a large-diameter solid-propellant ICBM that could eventually replace all or part of the SS-18 ICBM force. Other plants already have, or are building, production lines that we believe are specifically for these new systems. However, it is possible that some motor production for one or more of these systems will occur at Taboshar--perhaps to augment the production capability for these systems. Conversely, the Soviets may also be developing other ballistic missiles that will use case-bonded motors produced at Taboshar on which we have no other information. [redacted] 25X1

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Production Capability

The relatively small scale of the cartridge-loaded propellant line (compared to other Soviet motor plants) suggests that this line has not been producing large numbers of SS-25 third-stage motors. Since the line only has one casting and one curing building for the production of SS-25 motors, we estimate that it has supplied about one-quarter to one-third of the third-stage motors required for the approximately 175 SS-25s produced to date. Special intelligence and imagery indicate that most of the third-stage motors along with all of the first- and second-stage motors for the SS-25 are probably produced at the Kamensk-Shakhtinsky Motor Plant. [redacted] 25X1

The layout, facilities, and large rail transversers of the case-bonded production line closely resemble those at Biysk and Pavlograd that produce large case-bonded motors, suggesting that this new line at Taboshar has also been designed to manufacture this type of motor. Soviet open source reporting indicates that their case-bonded motors require 15 to 25 days to cure.[4] This large range in curing time (similar US motors generally require five to eight days to cure) suggests that the Soviets stress-cure motors--a process that involves curing the propellant from the inside by inserting a heating element into the propellant cavity. In this process the curing time varies according to the motor diameter. A smaller-diameter motor requires less time to cure and vice versa. We do not know the size of the motors that will be produced at Taboshar's case-bonded motor line and, therefore, cannot estimate a single production capability for the line. However, we do know that the curing time ranges from 15 to 25 days, and that there will soon be 20 curing ovens available. From this information, we can estimate that the line has a maximum capacity to produce approximately 280 to 480 motors annually. However, limited data indicate that Soviet plants usually operate at about 50 percent of estimated capacity. Therefore, we estimate that Taboshar will produce around 140 to 240 case-bonded motors per year or enough motors to assemble approximately 45 to 80 three-stage missiles each year. [redacted] 25X1

[4]For further information see *Solid-Production Rocket Engines*, I.KH. Fakhrutdinov, Moscow 1981. (U)

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Appendix A

Probable Production Flow at the Cartridge-Loaded Line

Motor cases and propellant ingredients arrive at the main gate and administrative area (A)[1] on the west end of the line. The propellant ingredients are taken to the adits (B) for storage, and then to the preparation building (C) for screening and weighing. The cases are transported to the motor finishing facility (D) for inspection, cleaning, and liner installation. The propellant ingredients are next moved to the grinding building (E), where they are ground to specific sizes, and then to the possible mixing building (F) where the ingredients are mixed together--probably along with a hardening agent. After mixing is complete, the propellant is taken to the casting building (G) where it is poured into cartridge segments. The cartridges are then moved into the curing building (H) to undergo heat treatment for a specific time period. After propellant curing, the cartridges go by truck to the finishing facility (D) where the molds are first disassembled and the propellant is X-ray tested to ensure no cracks or voids have formed in the propellant during production. Next the cartridges are machined and inserted into the cases. Finally, the motors are packaged for shipment and either shipped immediately from the facility out the east gate (I) or placed in temporary storage. [redacted] 25X1

[1]All letters refer to figures 7, 8, and 9.

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APPENDIX B

Probable Production Flow At the Case-Bonded Line

Trucks bring motor cases and propellant ingredients to the south gate and administrative area (A)[1] of this production line. Cases are taken to the motor case receiving and preparation building (B) for inspection, cleaning, and liner installation. Propellant ingredients are transported via the transverser to the tank-like possible propellant grinding and storage buildings (C). There, ingredients are either stored before grinding or are immediately ground to specific particle sizes. Next, the ingredients are moved by the transverser to the propellant mixing building (D) where the ingredients are mixed together, probably with a hardening agent. Motor cases and propellant meet at the casting building or buildings (E). The cases are placed into the casting pit and propellant is poured into the cases at a constant rate under vacuum conditions. After casting operations, the motors are transported by a second transverser to the curing building (F), placed into an oven, and cured for 15 to 25 days. Afterward, the mold is disassembled and the motors are moved to the X-ray test building (G) to ensure no cracks or voids have formed in the propellant during production. The propellant is then machined, and the motors are taken to a finishing building (H) where igniters, cableways, nozzle rings, and exit nozzles are attached. The motor is then packaged for shipment, and shipped by truck to the rail line in Leninabad.

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[1] All letters refer to figure 10.