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CENTRAL INTELLIGENCE AGENCY

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THE SOURCE EVALUATIONS IN THIS REPORT ARE DEFINITIVE.
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(FOR KEY SEE REVERSE)

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Comments

1. Throughout this report, for Krasnoarmeyskiy read Krasnoarmeysk.

2. The ministry abbreviated MSKhM in this report is the Ministry of Agricultural Machine-Building.

3. In paragraph 75, eskizzniy projekt should read eskiznyy proyekt (literal translation - draft).

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C O N F I D E N T I A L

REPORT [redacted] 50X1

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SUPPLEMENT TO REPORT NO.

THIS IS UNEVALUATED INFORMATION

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C O N F I D E N T I A L

2. [redacted] projects being conducted by the Soviets in which the Germans did not participate [redacted] 50X1-HUM

A few minor things. For example, the parallel development on the ABRS-220 was performed by the Soviet institute located near the Yaroslavskiy Railroad Station in Moscow. [redacted] 50X1-HUM [redacted] a rocket combustion chamber [redacted] was built in (or by) that institute. [redacted] It was unusually heavily built, and in place of a central jet, a series of jets formed into a wreath was provided. These jets were slightly off-set (tangentially located), most likely in order to cause rotation. Whether the rocket was stabilized by means of spinning or whether a separate stabilizer was provided is not known to me. However, it is not impossible that a stabilizer was provided. The Soviet rocket was provided with very thick walls, and my general impression was that very high performance could not be expected of this rocket in view of the heavy construction. 50X1-HUM

The Soviets also worked on shaped charges. [redacted] based [redacted] design originally on the old German "Panzerfaust" design. 50X1-HUM According to the Soviets, they had been able to considerably increase the penetration capacity by altering the position (or shape) of the steel lining. The new shape was cup-like or trumpet-like. The Soviets claimed that tests had shown this shape to be most effective. [redacted] built a few test models 50X1-HUM simply using the Soviet data without making any preliminary calculations but discovered a great scattering effect. There were a few models which actually showed improvement in performance but approximately 50 per cent of the models (built in the same manner) achieved only approximately 50 per cent of the required performance. The Soviets continued to work on this project to the exclusion of any Germans and a great many blasting tests were carried out. [redacted] [redacted] the caliber of the rocket was 90 mm. (diameter) and that it had a strength of 200 mm. to 220 mm. (safety-factor?). 50X1-HUM

3. [redacted] Instead of concentrating this charge, it would appear that the Soviet design would disperse it [redacted] 50X1-HUM

[redacted] group once attempted to study the problem analytically, using a novel process which was developed by [redacted] 50X1-HUM [redacted] the USSR. [redacted] regarded this as an optical problem to determine the refraction index along the detonation front at the point of separation between the explosive and the steel and the steel and the air. Having determined this, it is possible to determine a parabola shape which will concentrate the entire mass at one point. Applying this method to the Soviet curve (shape), it was found that there did not exist a concentration at one point. 50X1-HUM 50X1-HUM

While working on the ABRS-220 project, the Soviets queried [redacted] 50X1-HUM on the possibility of utilizing the ABRS-220 against ground troops. That is, the projectiles were to be fired from a multiple launching device mounted on a truck. [redacted] 50X1-HUM [redacted] the ABRS-220 design had been chosen on the basis of completely different requirements. Firing the projectile from the ground, with a relatively short launching guide meant that the projectile was extremely sensitive to ground cross winds which could not be counter-balanced by the design of the ABRS-220. It would have been necessary, for example, to compose the propellants differently in that a great acceleration would have to be provided for the first phase of flight; furthermore, it would have been necessary to decrease the combustion period. Consequently, it can be seen that the propellant would have required a completely different geometric shape. However, judging from the tenacity with which the Soviets continued to work on this project, [redacted] 50X1-HUM [redacted] the Soviets worked on a parallel development to the exclusion of German personnel, and that for this reason, the chief of the Design Bureau No. 3 (DAVISHEV) was interested in getting a foothold in this development work.

4. [redacted]

5. [redacted]

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6. [redacted]

[redacted] In regard to literature on rocket development, the Soviets have a great deal of material which cannot be purchased by the general public. These publications are classified somewhat comparable to the former German classification "For Official Use"; that is, not strictly security controlled but yet in restrictive circulation. These publications were not placed at the disposal of the Germans. The Soviet engineers at the Design Bureau could obtain this literature without any difficulty from the library. Documents classified any higher were inaccessible to the German engineers.

7. [redacted]

When the Germans required material for a rocket combustion chamber, they usually requested details on the characteristics of the steel from the supplier plant. Usually they could not get this information, as such things as the heat and strength quality of the material were secret. 50X1-HUM

The library [redacted] in the Design Bureau was well stocked. A great many volumes were available on the problem of material strength and tension. DAVISHEV was very active in obtaining the necessary means with which to support a project. However, he often assigned some phases to Soviet personnel who were frequently not qualified for the tasks. 50X1-HUM 50X1-HUM

8. [redacted]

The Soviets apparently did not use the Germans for questions dealing with manufacturing stages of production. It would seem that they had another group of Germans in Obranovka to supply that information on specific articles (fuses) and to learn the technique for transferring a development project to the manufacturing stage.

The task of the Germans at Krasnoarmeyskiy consisted primarily of showing the Soviets how to approach a missile development project. [redacted] the Soviets had the added motive of coming cheaply into possession of some new ideas. 50X1-HUM

[redacted] main tasks was to show the Soviets how, once a tactical requirement had been established, to realize these requirements in a design. Specifically, the Soviets wanted to know what ballistic calculations were required and how these were performed. 50X1-HUM

[redacted] the chief of Design Bureau No. 3 [redacted] told semi-officially that the Soviets had lost during the war a great number of technicians and specialists and that the young engineers and scientists did not possess the necessary experience; that it was the task of the German engineers to convey their experiences to these recent graduates; and that they would be returned once this task had been completed. This official explanation was, however, contradicted [redacted] 50X1-HUM

[redacted] lower ranking Soviet engineers [redacted] said that hardly ever had a specialist or technician been used at the front. In fact, there had been such a shortage of technicians that they had been well cared and provided for and consequently few were lost during the war. There were among the Soviet engineers who worked with the Germans many recent graduate engineers who were very interested in studying [redacted] approach and who would often contact the Germans after hours in order to ask specific questions regarding the work. The over-all majority of the Soviet engineers, however, fulfilled only their given assignments and otherwise showed little interest in the engineering field pertaining to missiles. 50X1-HUM 50X1-HUM 50X1-HUM

9. [redacted]

In the early years [redacted] the absence of experimental data made aerodynamic work on guided missiles extremely difficult. [redacted] were forced to analyze and derive aerodynamic characteristics on the basis of [redacted] theoretical calculations. In the later projects, [redacted] inability to obtain the necessary reference data and full tactical requirements presented the most difficult phase of [redacted] work. For example, [redacted] required to work on an air-to-air missile but would not be told the type or dimensions of the carrier plane or the space available in the carrier plane for the storage of rockets, the exact position of the storage hold, the speed of the plane, or its altitude limits, etc. Obviously, this could result in unrealistic designs when they arbitrarily assigned over-all dimensions or weights to such rockets. Another difficulty was caused by the absence of sufficient tests on the projects that were being carried out. This meant that [redacted] experience in development was not cumulative, [redacted] could never determine whether a new approach had given satisfactory results. Consequently, every project had to be approached anew. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

Above all, however, and this affected every [redacted] projects, the absence of precision testing instruments represented the greatest handicap. Measuring methods and testing facilities were extremely primitive, so [redacted] could not obtain the critical values that were of interest. Consequently, flight characteristics such as the trajectory, the speed variation (curve), impulses during the flight, could not be ascertained. For example, when making an impulse diagram, it was often the case that the calibrated spring of the indicator had been previously overloaded so that it recorded inaccurately. Often it would be pointed out to the Soviet engineers that valuable measuring equipment was available in Berlin or had been brought from Berlin to the USSR. They, however, would answer that another organization had received the equipment. The only equipment which was somewhat modern was a 50X1-HUM 50X1-HUM

motion picture theodolite station (a complete Askania station with three to five frames per second). The Soviets were never successful in putting this unit into operation. They once asked the Germans whether they could operate the unit. [redacted] could organize an instrument detachment at least for the testing of [redacted] designs. [redacted] then charged with devising the complete schedule for the modus operandi of the theodolite, but never were approached again on this subject by the Soviets. The primitive testing facilities in the USSR were all the more a handicap as [redacted] in Germany, where [redacted] worked only on the basis of concrete data obtained from experiments with very precise instruments. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

10. [redacted]

Generally speaking, the Soviets in KB No. 3 initiated the projects for the Germans. In the beginning before the Germans began working, the Soviets [redacted] asked for recommendations as to what work started in Berlin [redacted] to continue, bearing in mind increased performance regarding range. Actually, however, the Germans did not initiate projects, rather the Soviets increased the performance requirements generally for all the projects [redacted] worked on in Berlin, and gave [redacted] some choice as to the order in which [redacted] to approach the tasks. Even then, the Soviets emphasized that the three main projects for the Germans were the ABRS-220, Fluse, and Sokol and that these three projects had to be concluded [redacted] It appeared advisable at the time for the Germans to begin work immediately on these three projects. [redacted] once [redacted] accepted one of the major projects, should the execution thereof prove inaccurate or inferior, the Soviets might regard this as an act of sabotage. This was, therefore, the reason [redacted] did not rush to take on the complicated priority projects but first strived to seek the necessary prerequisites, such as wind tunnel data and laboratories for testing, before embarking on the three projects. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

11. [redacted] 50X1-HUM

[redacted] When a new project was initiated, the head of Design Bureau No. 3 would call the individual group leader into his office. At times, when the project was of a general nature and affected all three German groups, he would invite all the German group leaders. There was seldom more than one German present, but DAVISHEV usually had one or two Soviet engineers witness the discussion. It was always thought that this was a measure designed to provide witnesses in the event that difficulties should later arise in connection with the project. To the individual German group leader, DAVISHEV would then outline the requirements for the new project. Furthermore, he would issue a deadline by which the work was to be completed. Generally, there was no further interference from the Soviet leadership until the end of a project, at which time a summary review of the work was given to the chief by the respective German group leader, and at the same time, a new project was generally assigned by DAVISHEV. Seldom did more than fourteen days elapse between the completion of one project and the commencement of a new project.

Once the German Group began working on a new assignment, it was generally required that after a period of about fourteen days, a preliminary report be submitted in which the general approach to be used by the Germans had to be outlined. For example, such a report would include a rough estimate on the over-all dimension of the rocket to be designed, its weight and the weight of the propellants, as well as a very rough sketch. [redacted] the chief of Design Bureau No. 3 submitted this preliminary report to a higher headquarters for approval. Whether this was a requirement or whether this lack of initiative was simply a precautionary measure to insure against any unpleasantness that might result from failure of the project is not known [redacted] During the early years in the USSR, the preliminary report translated into Russian was countersigned by the German group leader before it was forwarded to a higher headquarters. Later this measure was dispensed with.

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12. [redacted]

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[redacted] the Design Bureau No. 3 was suitable for the projects assigned to it for the following reasons: The Design Bureau No. 3 was originally intended as a site for powder propellant (solid propellant) rocket developments. Since Rheinmetall-Borsig was one of the leading German companies for solid propellant rockets, the Germans were sent to Design Bureau No. 3. [redacted]

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50X1-HUM liquid rockets were tested on the S.N.I.P. firing range in Krasnoarmeyskiy because of the distinctive sound heard coming from the test stend. this sound establishes without a shadow of a 50X1-HUM doubt that liquid rockets were tested. It is difficult to identify specific data on the basis of sound impressions; nevertheless, the rockets had very high capacity, and the combustion period was considerably longer than one minute. When the propulsion units were tested, a loud hum could be heard in a radius of several kilometers. Most often the combustion test ended with a loud crack. These liquid rockets were not designed or constructed in Krasnoarmeyskiy but only tested on the firing range there. 50X1-HUM

13.

The German engineers at Krasnoarmeyskiy were supposedly experts on solid propellants and for this purpose they were brought to the USSR. there is no definite proof that any liquid propellant power plants were developed in Krasnoarmeyskiy.

14.

15.

It may be said that Sokol was based partly on the "X-4" developed by Dr. Max KRAMER during the war. However, the X-4 was based on a different principle in that it rolled throughout its entire trajectory. Furthermore, it was provided with four stabilizing surfaces. Except for the X-4 no 50X1-HUM other German controlled, air-to-air rocket project. 50X1-HUM

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As for the Zenith, single-stage rockets of similar construction design had been developed during the war but no projects of two-stage rockets had been started. Excluded from this general statement are a few tests carried out in the very last phases of the war by Rheinmetall-Borsig, when a standard-size powder propulsion unit intended for Rheintochter was combined with a warhead consisting of a number of individual

mine projectiles. Each one of these mine projectiles could have been singly emitted as small rockets. The Falke is the same as Moewe.

In regard to Rheintochter, a great many trajectories were measured by means of motion picture theodolites. They had been able to differentiate the trajectory so as to be able to obtain accurate values for acceleration, speed and transverse forces. Analyzing the resulting trajectories, they were able to determine very accurately the lift coefficients that acted at any given moment of flight. [redacted] took the data obtained for the Rheintochter and, after making the necessary changes such as increased transverse acceleration and lift coefficient, applied the aerodynamic data to the controlled missile projects done for the Soviets in Berlin. (The lift coefficient had to be greater than in the Rheintochter in order to be able to follow the tactical evasion maneuvers of the target.) 50X1-HUM

16. [redacted] 50X1-HUM

[redacted] only the theoretical work was performed. Zenith was not controlled. [redacted] could therefore use the data of Rheinboote, such as the separation process and the interference (disturbances) that may be expected, how much will the firing direction deviate from the theoretical trajectory, what kind of wind influences may be expected. [redacted] had continuously made trajectory measurements with photogrammetric measurements, and thus were able to compare theory with practice and to derive constants. 50X1-HUM 50X1-HUM

17. [redacted]

The various component processes of the Rheintochter had been analyzed in detail by the Germans during the war. For example, tests were made with the fuselage using various different angles of attack. Then, the airfoils were tested separately when joined with the fuselage at various positions. The surface controls, then the whole combination using different angles of attack and different surface control positions was tested. All these reports were available in the USSR, and the values for the Rheintochter could be used for Moewe by inter- or extra-polation. It should be noted, however, that the Moewe was a simplified version insofar as it was a two-foil rocket. This of course meant that the control mechanism had to be basically changed. It is perhaps feasible that the control techniques of the HS-293 could have been utilized for the Moewe. But then again, the HS-293 control surface was located aft while the Moewe control surface was located in front.

[redacted] 50X1-HUM

19. [redacted] the Falke project [redacted] concluded [redacted] and then turned it over to the chief of the Design Bureau, as was done with all other work. Throughout the period, it was under the auspices of the regular ministry (M.S.Kh.M.).

20. [redacted]

What was required was an electro-technical laboratory, and the Soviets repeatedly promised that such a laboratory would be constructed. The Soviets did finally put [redacted] a laboratory, although only a very primitive one which contained only a cathode-ray tube, cathode-ray oscillograph and a few more instruments. [redacted] this laboratory was installed specifically for work on the Moewe. [redacted] 50X1-HUM

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[redacted] as [redacted] completed the project Moewe, all work on controlled missiles was transferred to another ministry. It is possible, [redacted] the Soviets concluded that it was not economical to have this type of work performed at several separate places and that it would be more productive to have this work centralized. Another factor that may have been determinant in making this switch is the desire for security, since one place is more easily controlled than several.

[redacted]

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25. ROTSTEIN was assigned to the Design Bureau No. 3 specifically for this project. During the period that the Germans worked on this project, he occupied himself exclusively with this project. Also, he functioned during this period as liaison officer with the ministry when there was need to clarify any doubtful points.

When the testing program for the Falke was devised, the plane that was to carry the Falke. was an old plane would be used to carry out the experimental flights.

28. an observer required to operate Falke 50X1-HUM

in order to manipulate the "Knueppel". do not recall the Soviets ever expressed the wish that they should attempt to include the operation of the rocket with the pilot's other tasks. The reason for this may well be that a fighter plane is too light to carry such rockets. As in tactical use, probably two to four of the rockets will be carried by one plane.

29. [redacted]

Using an oridnary fighter airplane, the external attachment of a missile like the Sokol will reduce the resistance to such a point that the plane will no longer possess its original flight characteristics.

30. [redacted] this missile will be used in multiple number [redacted]

Only because it was assumed that such relatively large projectiles will be carried by some type of flying fortresses. [redacted] not necessarily [redacted] a bomber, but rather something in-between a fighter and bomber which nearly reached the speed of a fighter but was much more powerful. If the Soviets were dissatisfied, they always had the opportunity to interrupt [redacted] development along this line.

31. [redacted]

[redacted] in effective-range calculations, it was generally assumed that two to four missiles would be carried. 50X1-HUM

32. [redacted]

They were to be fired individually. Firing more than one rocket at a time would have led to disturbances and also would have made the "Knueppel" control very difficult, if not impossible. Of course, the Soviets once did request [redacted] 50X1-HUM
equip the rocket with a homing device, but [redacted] Group did not 50X1-HUM
have any experience in this field and thus rejected this design, pointing out that other Germans who had been conscripted to the USSR would be in a better position to do this kind of work.

33. [redacted]

[redacted] calculated this for Falke, making the assumption that no technical defects were inherent and that the rocket functioned as theoretically calculated.

34. [redacted] the calculated kill probability [redacted]

Many probability calculations were performed, but they assumed that given a certain control command from the mother plane, this command was actually executed. It was also assumed that the target itself had a given angle with the pursuing plane and that it had a fairly high maneuverability for evasive movement. [redacted] used at first a transverse acceleration of 50X1-HUM

3 g's. The Soviets then had [redacted] additional calculations raising the acceleration to 10 g's for the target plane. The probability was calculated with the various different combinations of factors listed. 50X1-HUM

a. How will the man manipulating the "Kneuppel" react?
b. What kind of command will be give?
c. How great is the [illegible] later in issuing the necessary counter-command?

Also considered was the fact that at a certain distance the detonation process was activated and using the Gaussian Error Curve, [redacted] determined how many of the several hundred incendiary pellets actually penetrate the critical parts of the airplane. All these factors were coupled with the transverse acceleration of 3 g's on part of the target, and [redacted] arrived at a probability result of approximately 1.3 missiles per hit, or two hits per three projectiles. 50X1-HUM 50X1-HUM

35. [redacted]

[redacted] these theoretical calculations did not make use of a homing device but only subjective steering.

36. [redacted] 50X1-HUM

These were performed by BACHMANN exclusively. BACHMANN was a very good mathematician.

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37. The value 1.3 refers, however, to large bombers, [redacted] of the type B-29 or B-24. Shortly before the completion of this project, [redacted] received new tactical requirements from the Soviets. Again, it dealt with a controlled rocket, but this time not against bombers but rather for a fighter type plane. These new requirements against fighter planes called for the allowance of a transverse acceleration of 10 g's and speeds just below the speed of sound (approximately 300 m. per second). Various parameters were given; some of them just below and some just above the speed of sound. 50X1-HUM

38. [redacted] the probability for this calculated as well [redacted] but the performance was very poor. This rocket was not suitable for these new requirements.

39. [redacted] this missile pull [redacted] at a figure some place between 8 and 10 g's. 50X1-HUM 50X1-HUM

40. [redacted] do not believe that it could successfully attack a 10 g fighter [redacted]

It was a hopeless case with this rocket. Recognizing this, [redacted] design another missile to satisfy these new requirements. [redacted] made some preliminary calculations and they pointed to extremely great weights for the missile since an enormous propulsion unit was required. The weight arrived at was too high for a missile suitable against fighter planes. In order to satisfy the requirements against a 10 g fighter, [redacted] the Soviets would have to use a propulsion system other than liquid or solid propellant. 50X1-HUM

41. [redacted] the 1.3 value [redacted] 50X1-HUM

[redacted] conformed more or less with the tactical requirements of the Soviets. It did not go beyond the requirements of the Soviets, for they always set the requirements at such a level as to make it impossible to achieve the requirements exactly. 50X1-HUM

42. The factor 1.3 apparently took into account everything except the technical deficiencies. [redacted]

[redacted] the Soviets would ever come below the figure [redacted] and that figure could only be achieved if the production process was very accurate.

43. [redacted] proximity fuse [redacted]

They did not build this fuse themselves. Instead, they set aside a given space which could house a fuse similar in size to the one used in the Rheintochter. They provided for a dipole in front but nothing more.

44. [redacted]

For Falke, [redacted] a combustion chamber for the powder propellant was built for testing purposes. At least, an order was issued by the Design Bureau for the powder propellant and some requests for information came from that factory. The test model chamber was [redacted] built in order to carry out tests on the test stand. This motor was to have enlarged wall dimensions and was to be a structural design that would permit making several combustion tests at the same time. 50X1-HUM

51. designed the rocket chamber, for Falke or any other missile

the main dimensions and also determined the general arrangement of the various parts. The actual designing work was then performed by BAUSCHKE. The latter was assisted generally by one or two Soviet technicians for the drafting work. 50X1-HUM

53.

At the time of arrival in Krasnoarmeyskiy, a bedplate with several suitable safety bunkers was available. This test stand, however, had not been in operation for a while Some tests were made on this test stand during the war, but afterwards it fell into disuse and the measuring instruments had been removed. Among very first tasks was the reconditioning of this test stand. For this purpose, the Soviets put a very primitive indicator. It was a Maihak indicator of the same type used in Germany for this type of tests, but the steel spring driving mechanism was very primitive and obsolete, resembling the driving gear of a victrola. Obviously, this instrument could not accurately measure the time constant. The time element was controlled by means of a "Wagnerian hammer". The hammer worked on the following principle: It is an electromagnetic interrupter system (circuit-breaker) which could be assigned a given natural frequency, and this inherent frequency then left a definite time marking on the band (or strip). The "Wagnerian Hammer" was not very accurate. The stand itself was fitted for horizontal thrust. That is, it consisted of a large concrete slab, one extremity of which had a small bank (or crown) against which the rocket motor could rest. On top of the horizontal table were two clamps which were simply clipped over the motor. This permitted the sliding of the rocket chamber. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

Tests were generally made only to determine the pressure curve (gradient). For this purpose, a gas pressure connection had to be made with the rocket chamber. Thrust diagrams

45. for the Zenith

Only the drawings were made and handed over to the Soviets. Here, too, more work on the project, but this was interrupted when an order came to work only on civilian-type projects.

46.

Generally speaking, based development work on data collected in Germany (reports on the German wartime development, at least at Rhein-metall, were available in the library in KB-3). Occasionally, also received the critical values, such as the dependence of the pressure from a respective jet cross-section or the relationship of jet cross-section to powder surface layer.

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47.

48.

Dr. RACKETT was a chemist.

49.

He was charged with making a detailed report of his experiences with the various types of propellants used in Germany. The same was true for PREUKERT, who had worked in a powder plant in Germany.

The Soviet powder (propellant) was inferior to the German.

50.

RACKETT's task more or less was carrying out of laboratory tests, but he was not the man who could suggest a new propellant mixture. Nor could RACKETT make any suggestions regarding changing the mixture in order to improve the performance.

could also be derived from tests. The liquid piston, however, for the hydraulic pressure cell used for manometric measurements and for the indicator fitting, did not function very well. It recorded great oil losses, so that we had to work very quickly between the preparatory period and the actual testing to prevent too much leakage.

54. [redacted] the test stand [redacted] was capable of absorbing a thrust of between five and ten tons (metric).

55. [redacted]

The steel clamps were designed to hold motors of 250 mm. diameter, but if necessary, the clamps could be replaced with other fastening devices so as to permit testing of larger motors.

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[redacted]

[redacted] the Soviets planned another larger test stand for S.N.I.P., [redacted] These proposals included data for both a horizontal as well as a vertical test stand. [redacted] do not know when or whether the Soviets will build this test stand, nor whether they will decide on a vertical or on a horizontal version.

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In addition to this test stand, plans were made [redacted] for the construction of a rotary test stand. The cyclone-effect was to be tested on this rotary stand. This effect occurred frequently in rockets that spun and could not fully be calculated by the group. Rockets stabilized by means of rotation frequently worked well on the test bench but exploded during flight. The cause of this explosion was not known. [redacted] suspected at first that the strength of the solid propellant was not sufficient so that the cylinders which housed the propellants were torn apart by centrifugal force. This theory apparently was not fully correct, nor is it correct to say that the projectiles did not spin enough, for the projectiles were stable in flight until the moment of explosion. [redacted]

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For this purpose, a proof stand was planned which permitted rotating the rocket motor to the speed that the rocket will be subjected in flight. This was to be accomplished by additional propulsion units. The Soviet designing plan called for a driving motor equipped with the necessary transmission gearing which would transmit the required rotation to the projectile. The Germans submitted to the Soviets a different variation for this test stand which dispensed with the driving motor because the latter required a large housing to protect it against damage in case of explosions. The German plan was simpler, for the rotation was to be accomplished not by motor and gears but rather by the utilization of an additional rocket chamber equipped with tangential jets. A very strong and robust housing could be built, equipped with tangential jets, and the propellant could be arranged from test to test so that the required rotary speed was achieved. It was originally planned to obtain the maximum rotary speed and then to ignite the test body. In view of the fact that the absorption of the axial thrust was to be achieved by means of a hydraulic piston, [redacted] did not fear that the friction losses would be excessive. Should these tests have revealed that an excessive rotary speed loss did occur, it would have been possible of course to provide a continuous compensation for this friction loss by means of an additional rocket chamber. 50X1-HUM 50X1-HUM

57. [redacted]

The table [See pages 24 &25] shows only the activity of [redacted] group. Only two types of propellants were used in the USSR; one burned slowly and one a little faster. The composition was generally nitro-glycerin powder.

58. [redacted] the rocket engines tested at Krasnoarmeyskiy [redacted] are German [Smoke data are given on page 25].

59. [redacted]

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60. the Soviets

were too fearful to discuss with the Germans matters which were not directly applicable to their own projects. They did say that they had improved the designs. For example, when they gave the requirements for the extremely fast and accurate rocket (650 meter per second speed differential), and the Germans were not in a position to build this kind of a rocket, the Soviets indicated that it was possible and that they could fulfill the requirements.

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61. the Soviets are doing development work on solid or liquid propellant engines or propellants

the institute in the vicinity of the Yaroslavskiy Railroad station Soviet personnel were assigned there in the capacity of engineers who had appeared in the role of Soviet officers in Berlin in the post-war period. In view of the fact that these engineers were especially interested in solid propellant rockets in Berlin, it is possible they were also engaged in solid propellants at the Yaroslavskiy institute. It appears that the purpose of the German group in Krasnoarmeyskiy or other groups in the USSR who worked on solid propellants was to develop and design missiles on the basis of their approach and method in Germany. Parallel with this, the Soviets had their own personnel and institute working on the same requirements. This gave the Soviets an opportunity of comparing the work of the two groups with the aim of finding a stimulant for the Soviet development efforts.

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62.

They only performed designing work in this institute. Security considerations probably made it impossible for the Soviets to test rockets there, since the institute was located in Moscow.

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63. [redacted] only one bonafide project for a guided missile. The guidance system was to be optical.

64. [redacted] Moewe was to use an optical control system utilizing a polar coordinate "Beeper". They contemplated the use of the successor of "Fritz X"; [redacted] it was "Kolmar".

65. [redacted]

66. [redacted]

67. [redacted] An electrical fuse was proposed because this type of fuse had been the furthest developed in Germany [redacted]

68. [redacted] the servo mechanism for the control of the rudders [redacted] design went into a great many details which would have permitted the immediate construction of the servo machine. Rheintochter's servo mechanism would have been much too heavy. This required a lighter version.

69. [redacted]

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70. [redacted]

[redacted] the gyro lies outside of the rudder-machine and only transfers its impulses.

71. [redacted]

[redacted] took the dimensions of the Rheintochter gyroscope and applied them to the design. [redacted] had an experimental model of the Rheintochter gyroscope [redacted]

72. [redacted] the designation of the gyro [redacted] was the same gyro which was used in the last version of Rheintochter. (In the first stages of Rheintochter, the Germans used the gyro of "Fritz X". Later, however, they developed their own gyro which was equipped with its own small servo-motor which would return the principal gyro to its original course after a roll.)

73. [redacted]

[redacted] had some German automatic calculators, but they often were out of order and [redacted] had to use manual machines.

74. [redacted]

[redacted] such machines had been developed in the Western world. [redacted] the Soviets are or were busily engaged in copying this Western model. It is usually the case that a circle of specialists is assigned to develop or reconstruct technical novelties reported from the West. For instance, there is a central department in Moscow which studies and analyzes international technical literature and which translates and disseminates the material to the interested technical branches in the USSR. [redacted]

[redacted] a central office in Moscow is charged with the collection and translation of international technical literature.

75. [redacted]

No work had been formed on Fluse in Germany prior to the capitulation. The requirements for the "Fluse Project" were delineated for the first time [redacted] under Soviet

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control. It is difficult to express the amount of work on Fluse which was done in Berlin in terms of percentage. However, the design work was carried out in detail for every phase of the missile. This design work was performed only on the basis of theoretical calculations and assumptions. For example, one of the assumptions was that it would be possible to control the combustion along a length of 1.5 to 2 meters, or that it would be possible to achieve given lift coefficients with the provisionally assigned dimensions. Should laboratory tests later have shown that the conditions were more favorable or less favorable, [redacted] would then have had to make the necessary changes in the design. This phase of an assignment would have been classified as "Vorprojekt" in Germany, and [redacted] the Soviets termed this phase of a project "eskizzniy projekt" (phonetic spelling). This phase is distinguished from the more advanced phase in which experimental data are applied to the design. 50X1-HUM 50X1-HUM

Actually, however, the Fluse work in Gema had progressed beyond what is normally "eskizzniy projectk", for we actually prepared some detailed drawings which permitted the workshop construction of these parts. These drawings were made even though the concrete experimental measurements for these parts had not been obtained. In summary, the work on Fluse (at Gema) had progressed to a stage half-way between "sketching project" and "technical project". 50X1-HUM

76. [redacted]

No experiments were ever made to support the solution of the capsule sea launching of the Fluse missile. No other details are known [redacted]

77. [redacted]

The Ministry, M.S.Kh.M., never issued any bonuses. [redacted] the German specialists in Obranovka (fuse plant) who also were assigned to the Ministry, M.S.Kh.M., did not receive bonuses either. This does not mean that the Ministry issued no bonuses at all but only that German specialists received none. The Soviet engineers at Design Bureau No. 3

did on occasions receive such subsidies. [redacted] 50X1-HUM

[redacted] The sums involved were not very large; [redacted] it amounted to a fraction of the monthly salary of the particular engineer. 50X1-HUM

78. [redacted] 50X1-HUM

CHARACTERISTICS OF MISSILE MOTORS DESIGNED AT KB-3 — 1946 to 1950

MISSILE	IMPULSE kg/s	AVERAGE THRUST-kg	COMBUSTION PERIOD-s	PROPELLANT WT.-kg	PROPELLANT CONFIGUR'N.	NUMBER OF NOZZLES	OUTSIDE DIA. mm	GAS PRESS. kg/cm^2	STATIC FIRING TESTS	WAS COMB'N. CHBR. TESTED?	COMMENTS
ABRS 220	4700	5500	85	24	6 Nitroglycerin 3 Channels + 1 Nitroglycerin Powder Stick	1 Centrally Located	220	100	YES Previously	YES Stationary Tests & Launching Tests	Light Grey Combustion Gas With Some White Coloring
ABRS 240 "MOLNYA"	870	1450	.6	4.6	7 Nitroglycerin Powder Channel	1 Centrally Located	130	100	YES Previously	YES Stationary Tests & Launching Tests	Light Grey Combustion Gas With Some White Coloring
FALKE "SOKOL"	12700	1270	10	65	1 Powder Cylinder 285/20 ⌀ or 6 Powder Cyls. 265 ⌀	4 or 6 Around Circumference	300	90	Construct'n Drawing Only	NO	⁄
ZENITH 1st. Stage	2200	580	3.8	11.3	1 Powder Cyl. 107/15 ⌀	⁄	~120	100	NO	NO	⁄
2nd Stage	410	187	2.2	2.1	1 Powder Cyl. 61/8.5 ⌀	⁄	68	100	NO	NO	⁄
RING MAGAZINE	5800	5800	1.0	30	6 Nitroglycerin 3 Channels + 1 Nitroglycerin Powder Stick	1 Centrally Located OPTIONAL 6 Jets Along Circumference	240	100	Construct'n Drawing For Central Jet Only	Probably YES Aerial Tests Whitnessed by Accident	NONE ⁄
AUTOMATIC ROCKET	~185	~125	~ 1.5	~.95	1 Powder Stick	1 Central Jet	252	100	NO	NO	⁄
LAUNCHING ROCKET FOR SOVIET RAM-JET PROJECTS	⁄	⁄	⁄	⁄		⁄	⁄	⁄	⁄	⁄	In Design Similar to "RHEINTOCHTER" With 7 Powder Stick Channels & Central Jets Or Multiple Jets (Approx. 7)
BOOSTER ROCKETS FOR 15 CM HOWITZER GERNADE	?	?	~ 1.2		2 Powder Channels Centrally In Line	4 or 6 With Tangential Components to Increase Rotation + Central Jet With Igniter	15.2	~200-300	YES Previously	YES-Stationary & Firing Tests, But I was not present during tests	The High Gas Pressure Caused Very Short Combustion Periods Without Increasing The Steel Weight.

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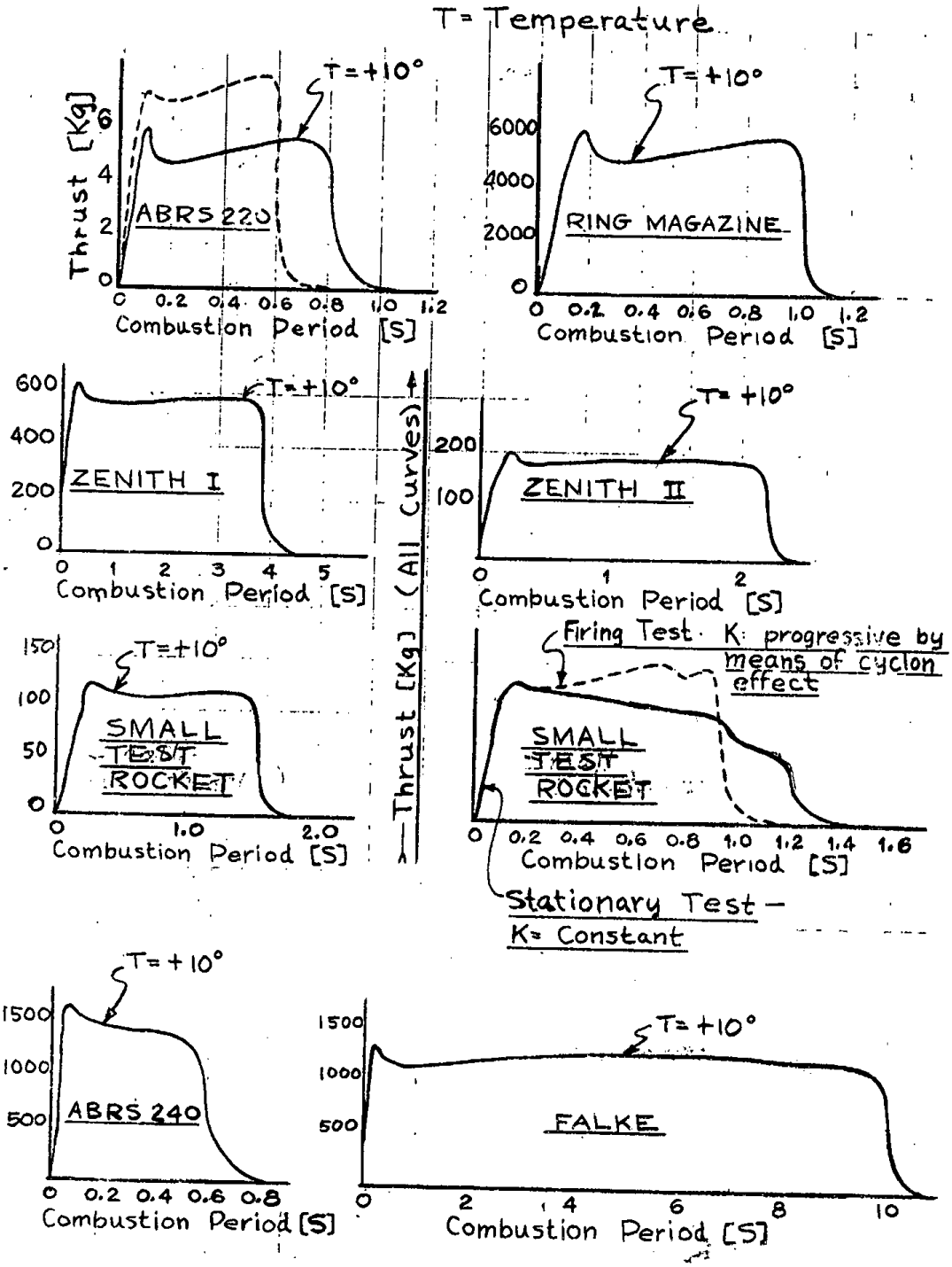

THRUST TIME SCHEDULE FOR MISSILE MOTORS
DESIGNED A/O TESTED IN PUTILOVO

CONFIDENTIAL