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THE DEVELOPMENT AND PRODUCTION OF HELICOPTERS IN THE USSR

1947 - 1 JULY 1962

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

FOREWORD

This report presents a discussion of the development and production of the helicopter in the USSR from 1947 through the second quarter of 1962. Facilities for production of helicopters and helicopter component parts are identified; the annual production of individual helicopters at airframe plants is estimated by number and weight; and Soviet expenditures for the procurement of helicopters, including initial spares, are estimated. All helicopter designs believed to have been developed by the USSR are briefly described. The principal performance characteristics are estimated for those helicopters that are believed to have entered into series production since 1953 and those recently developed helicopters that are expected to enter into series production in the near future.

Uses of Soviet helicopters are discussed, and confirmed reports of helicopter activities are included whenever possible.

This report has been informally discussed at the working level with representatives of the Assistant Chief of Staff, Intelligence, US Air Force, and the Assistant Chief of Staff, Intelligence, US Army. The report, however, has not been formally coordinated.

Although the over-all classification of this report is TOP SECRET some of the pages are of a lower classification and are so designated.

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THE DEVELOPMENT AND PRODUCTION OF HELICOPTERS IN THE USSR* 1947 - 1 JULY 1962

Summary and Conclusions

Since the end of World War II the USSR has made significant progress in the development and production of helicopters and has placed increasing emphasis on production of helicopters as a segment of the Soviet aircraft industry. The growing importance of the helicopter in the USSR is evidenced by the annual increase in production since 1953 and by the recent development of turbine-powered helicopters.

It is estimated that the USSR produced approximately 5,100 helicopters from 1947 through the second quarter of 1962. Of this total, about 4,800 were produced since 1953. It is believed that five Soviet helicopters -- the Hare (Mi-1), the Hound (Mi-4), the Horse (Yak-24), the Hook (Mi-6), and the Hog (Ka-18) -- are currently in series production and that within 1 or 2 years five new turbine-powered helicopters -- the Harke, the Hip (V-8), the Hoplite (V-2), the Harp, and the turbine Horse (Yak-24P) -- and the short take-off and landing (STOL) aircraft, the Hoop, will enter into series production. It is anticipated that production of turbine-powered helicopters will result eventually in the phasing out of some types of piston-engine helicopters in the USSR.

With increasing annual production of helicopters in the USSR, expenditures for the procurement of these aircraft also have increased on an annual basis. It is estimated that such expenditures reached a high in 1961 of approximately 210 million dollars.**

As production of helicopters has assumed prominence in the Soviet aircraft industry, helicopters have been equipped to perform in a variety of military and civil roles. In a military support capacity, Soviet helicopters serve as utility, liaison, and reconnaissance aircraft with the Armed Forces. The use of helicopters as missile carriers and in nuclear testing, antisubmarine warfare, and airlifting indicates their increasing importance to the Soviet military program. As civil aircraft, helicopters serve agriculture and industry in the USSR.

All indications point to the fact that the development and production of helicopters will continue to be emphasized in the USSR. The helicopter field is relatively new, and it is anticipated that as techniques improve, the Soviet helicopter will become increasingly valuable as a support aircraft.

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 July 1962.

** All values in this report are in 1961 US dollars.

I. Introduction

A. Pre-1950

There is evidence of experimentation with the concept of rotary-wing aircraft in Russia as early as the eighteenth century, but it was not until after the turn of the twentieth century that theory became reality and helicopters were designed and built which succeeded in lifting men into the air. In the early part of the century, the First World War and the Bolshevik Revolution interrupted the development of the helicopter, but work resumed in the 1920's, and during the 1930's and 1940's several experimental models were constructed and successfully flight-tested.

1. Omega I

In 1939, Professor I. P. Bratukhin designed the Omega I, a two-place helicopter having laterally disposed dual rotors mounted on outriggers (see the photograph, Figure 6*). The Omega I was flight-tested after World War II and was displayed at the Tushino Air Show in 1946.

2. Omega II

The Omega II, an eight-place version of the Omega I, was built in Kiev in 1947. The outriggers supporting the three-bladed rotors were replaced by a trapezoid-shaped wing (see the photograph, Figure 7*). Shafts running through the wing synchronized the two engines of the helicopter, thus enabling it to fly on a single engine in case of the failure of the other. The Omega II was displayed at the Tushino Air Show in 1948.

3. Hat (Ka-10)

Also displayed for the first time at the Tushino Air Show in 1948 was the Hat (Ka-10) helicopter designed by N. S. Kamov.** The Hat, a one-place helicopter, had dual counterrotating three-bladed coaxial rotors mounted above an open framework (see the photograph, Figure 8*).

The Hat was designed primarily for short-range reconnaissance and courier missions and was equipped with twin pontoons to enable it to land on ground or water. It is believed that the Hat never was produced in quantity.

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* Appendix D, p. 41, below.

** For the major Soviet helicopter designers, see Appendix A, p. 23, below.

B. 1950-60

1. Hare (Mi-1)

The first modern Soviet helicopter, the Hare (Mi-1), was designed in 1948 by Dr. Mikhail L. Mil' and was first seen at the Tushino Air Show in 1951.* The original version of the Hare helicopter is a three- to four-place model of conventional design having a three-bladed main rotor and a three-bladed antitorque tail rotor (see the photographs of the Hare, Figures 9 to 13**).

This helicopter was designed to meet the requirements of a small liaison and utility aircraft and was modified to serve a variety of purposes. Such a modification, the Mi-1NKh helicopter,*** appeared in 1957 (see the photograph, Figure 10†). Its design was essentially the same as that of the Hare, but a fourth blade was added to the main rotor, a more powerful engine was installed, and the cabin was enlarged. In order to facilitate its job as an aerial taxi, the Mi-1NKh helicopter was equipped for night and all-weather flying.

2. Hound (Mi-4)

In addition to the Hare, another Mil'-designed helicopter appeared in the early 1950's. The Hound (Mi-4), a transport/cargo helicopter, was flown at the Tushino Air Show in August 1953. The Hound resembles the Hare in general design but is an enlarged version, carrying 12 passengers and having a four-bladed main rotor (see the photographs of the Hound, Figures 14 to 19††).

3. Yak-100

The only Soviet helicopter in series production that has been attributed to the designer A.S. Yakovlev is the Horse (Yak-24).††† Yakovlev's name has been associated, however, with at least one other rotary-wing aircraft design. The helicopter designation Yak-100 was noted in 1958 under a picture in a Moscow Air Museum. It was reported that the helicopter in question resembled the US helicopter S-51 designed by Sikorsky. 1/‡ It is possible that the Yak-100 was, in fact, a copy of this US helicopter. A photograph of the Yak-100 later appeared in a June 1959 edition of Kridla vlasti 2/ (see the photograph, Figure 20‡‡), and it has been reported that a picture of a three-bladed single-rotor helicopter, designated the Yak-100, appeared in a Soviet book published in Moscow in 1960. 3/ The extent to which this helicopter design was developed in the USSR is not known.

* For the principal characteristics of the Hare helicopter and other major Soviet helicopters that have been developed since 1950, see Table 6, Appendix B, p. 32, below.

** Appendix D, pp. 43 and 45, respectively, below.

*** The Mi-1NKh helicopter has been referred to as the Mi-3 helicopter.

† Appendix D, p. 43, below.

†† Appendix D, pp. 47, 49, and 51, respectively, below.

††† See 4, p. 5, below.

‡‡ Appendix D, p. 53, below.

4. Horse (Yak-24)

The Horse (Yak-24) helicopter, designed by A.S. Yakovlev, was first seen at the Tushino Air Show in July 1955. Subsequent sightings of small numbers of Horse helicopters occurred at Tushino in 1956 and at rehearsals for the 1957 Air Show.

The Horse is distinctive in design among Soviet helicopters with its rectangular-shaped fuselage and tandem-rotor configuration. Such a rotor configuration had never before been used on a Soviet helicopter. The rear rotor is supported by a vertical pylon on which are mounted twin vertical stabilizers (see the photographs of the Horse, Figures 21 and 22*).

A transport helicopter, the Horse can accommodate a crew of 4 and 40 soldiers. It is equipped for night and all-weather flying.

5. Hook (Mi-6)

The Hook (Mi-6) helicopter was first sighted [redacted] at Khimki airfield in Moscow in October 1957. 4/ Later that same month the USSR publicly announced that this new Mil'-designed helicopter had established a record by carrying a payload of approximately 26,500 pounds to an altitude of almost 8,000 feet. 5/ The payload and altitude records set by the Hook and the size of the helicopter** mark it as a significant development in the history of helicopter production. This turbine-powered heavy transport helicopter is typical of Mil'-designed helicopters in its rotor configuration. It has a five-bladed main rotor and a four-bladed tail rotor (see the photographs of the Hook, Figures 23 to 27***).

A stub-wing version of the Hook was later designed by Mil', and one of these modified Hook aircraft was flown in the Tushino Air Show in 1958. On the basis of sightings in 1961 of the Hook at Moscow/Fili airfield, the airfield serving Airframe Plant No. 23, a production site of the Hook, it is believed that the original Hook may have been further modified by adding a sixth blade to the main rotor (see the photograph, Figure 27†).

[redacted] the possibility that these modified Hook aircraft have been designated the Mi-8 and/or the Mi-10.

[redacted], it is felt that any positive statement concerning the validity of these designations must depend on the receipt of more conclusive evidence.

6. Hen (Ka-15)

It is estimated that a prototype of the Kamov-designed Hen (Ka-15) helicopter was completed by the end of 1956, but this helicopter was not displayed publicly until the Tushino Air Show in July 1958. The Hen is a small

* Appendix D, p. 53, below.
** The Hook is the largest helicopter produced in the world.
*** Appendix D, pp. 55 and 57, respectively, below.
† Appendix D, p. 57, below.

two-place utility helicopter with twin coaxial rotors mounted over a closed fuselage. A conventional horizontal tail supports twin vertical stabilizers (see the photographs of the Hen, Figures 28 and 29*).

7. Hog (Ka-18)

In April 1957, reported sightings at Moscow/Lyubertsy airfield of what might be Hen helicopters or the new Kamov-designed helicopter, the Hog (Ka-18). 8/ It was not until the following spring, however, that the USSR publicly announced that the Hog had completed its flight tests and would soon go into series production. The Hog, almost identical in design to the Hen, is somewhat larger, being a three- to four-place model. It differs in appearance mainly in its somewhat streamlined fuselage nose. In addition, the Hog is equipped with a conventional four-wheel landing gear; whereas the Hen has a tricycle landing gear (see the photographs of the Hog, Figures 30 and 31**).

C. 1961

1. Harke***

The Mil'-designed Harke, a "Flying crane" helicopter, was displayed publicly for the first time on 9 July 1961, when one prototype was flown in the Tushino Air Show. Powered by twin turboshaft engines, the Harke is a development of the Hook helicopter. The rotor system has been enlarged and the fuselage lengthened and modified (see the photographs of the Harke, Figures 32 and 33†).

2. Harp††

Also displayed at the Tushino Air Show in July 1961 was a prototype of the Kamov-designed Harp. Powered by twin turboshaft engines, the Harp is a development of the Hog helicopter. The Harp has the twin coaxial counter-rotating rotors found on all Kamov helicopters, but a third vertical stabilizer has been added to the tail assembly. This helicopter carries one large air-to-surface missile on each side of its fuselage (see the photographs of the Harp, Figures 34 and 35†††).

3. Hip (V-8)

The Hip (V-8), another new Mil'-designed helicopter seen at the Tushino Air Show in 1961, is a development of the Hound. Powered by a single turboshaft engine, the Hip has the conventional single main rotor and antitorque tail rotor found on all Mil'-designed helicopters. Its enlarged cabin can accommodate 26 passengers (see the photograph, Figure 36‡).

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* Appendix D, p. 59, below.

** Appendix D, p. 61, below.

*** The helicopter was referred to as the Kran (Crane) in a Czechoslovak periodical. 9/

† Appendix D, p. 63, below.

†† The designation Ka-20 appeared in a Czechoslovak periodical under a picture of the Harp. This designation has not been confirmed, however. 10/

††† Appendix D, p. 66, below.

‡ Appendix D, p. 65, below.

4. Hoplite (V-2)

The Mil'-designed Hoplite (V-2) helicopter, powered by two turboshaft engines, is an enlarged eight-passenger version of the Hare. The Hoplite has conventional three-bladed main and tail rotors (see the photograph, Figure 37*). The development of this turbine version of the Hare was announced in Pravda in November 1961, and at least one photograph of a flying prototype has appeared (see the photograph, Figure 38*). As yet, however, no reported sightings by [redacted] of flying prototypes have been received.

5. Turbine Horse (Yak-24P)

A model of the turbine-powered version of the Horse, designated the Yak-24P, was displayed at the Soviet trade fair in London in July 1961 (see the photograph, Figure 39*). The turbine Horse reportedly is designed to carry about 60 soldiers and is essentially the same as the Horse in size and design. As yet, no flying prototype models of the turbine Horse have been sighted by [redacted].

6. Hoop**

The Hoop, a short take-off and landing (STOL) aircraft designed by Kamov and referred to as "the Vintokryl convertiplane," 11/ was first observed at Moscow/Lyubertsy airfield in March 1959 12/ (see the photograph, Figure 40***). The aircraft could not be identified at that time. In the fall of 1959, however, [redacted] the development of a new large rotary-wing aircraft at Kamov's Design Bureau at Lyubertsy. 13/

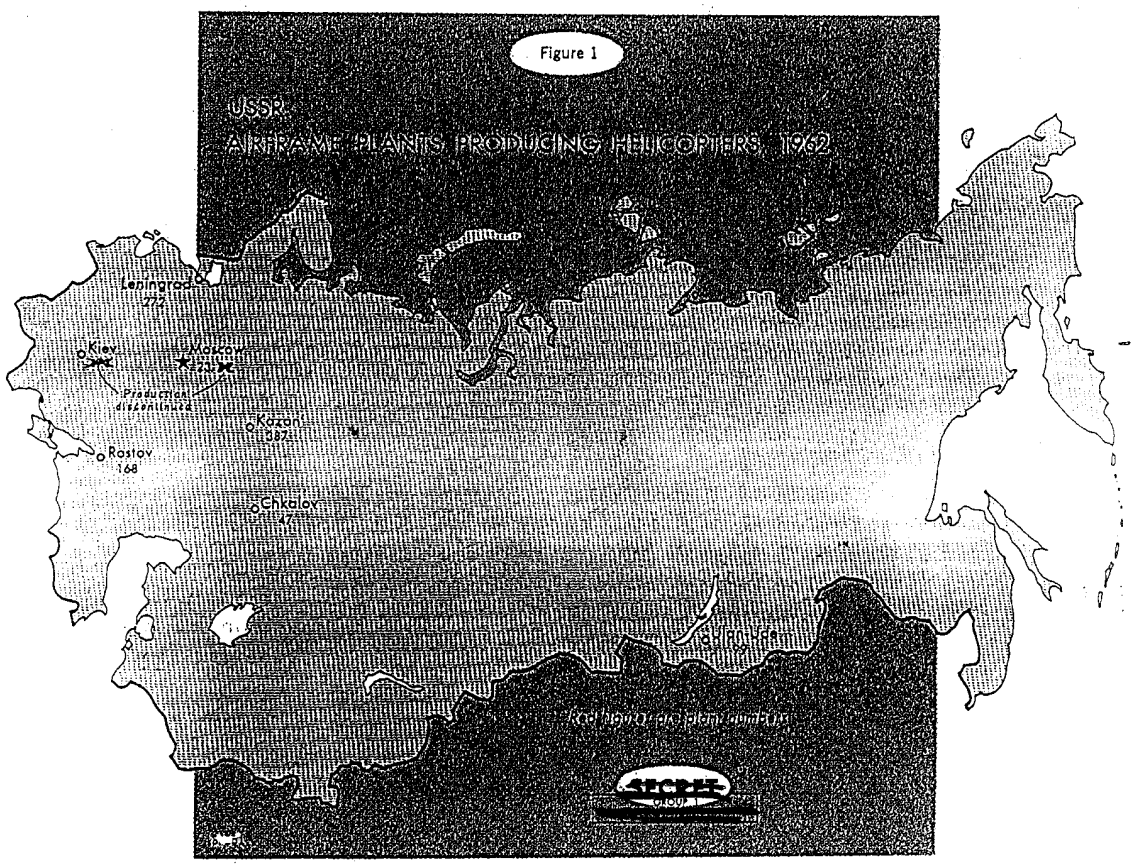
The demonstration of one Hoop at the Tushino Air Show in 1961 confirmed the existence of such a new Kamov-designed aircraft. In general design the Hoop resembles the Omega II. The fuselage is like that of a transport, and two four-bladed rotors are mounted on each wingtip (see the photograph, Figure 41***).

II. Production of Soviet Helicopters

During the period from 1947 through the second quarter of 1962 the USSR is estimated to have utilized eight airframe plants (see the accompanying map, Figure 1†) and a total of at least 9.1 million square feet of plant floorspace (see Table 3††) in production of helicopters. It is further estimated that

* Appendix D, p. 67, below.
** The designation Ka-30 has been used by [redacted] in reference to the Hoop, but such a designation has not been confirmed.
*** Appendix D, p. 69, below.
† Follows on p. 8.
†† Appendix B, p. 29, below.

during this period seven Soviet helicopters entered into series production at these plants.*



A. Omega

Kiev Airframe Plant No. 473

Construction of the first Omega helicopter was begun in 1946 at Kiev and completed in 1947. 15/ Although no significant numbers of Omega helicopters ever have been sighted, information indicates that the Omega may have entered into series production in 1947. Various reports refer to the fact that Kiev Airframe Plant No. 473 (see the photograph, Figure 42**) was at one time involved in production of helicopters, and prisoners of war claim that such production was taking place in 1947. 16/ During the period from 1947 through 1949, approximately 270 Omega helicopters are estimated to have been produced at Plant No. 473.

* For the estimated annual production of helicopters in the USSR as of 1 July 1962, by plant, model, and number, see Table 1, Appendix B, p. 27, below, and by model and number, see the chart, Figure 2, following on p. 9. For the estimated annual production of helicopters in the USSR as of 1 July 1962, by weight, see Table 2, Appendix B, p. 28, below, and the chart, Figure 3, following on p. 9.

** Appendix D, p. 71, below.

Figure 2

USSR

ESTIMATED ANNUAL PRODUCTION OF HELICOPTERS

By model and number

1947-62

*Figure for 1962 are 12-month estimates based on 6 months of production

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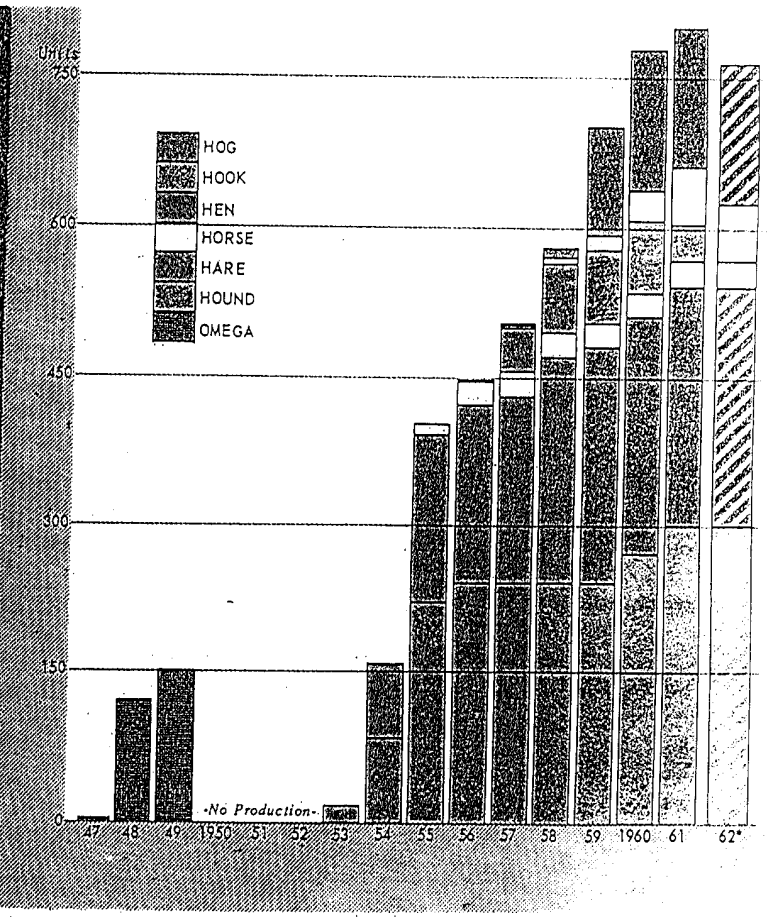

Figure 3

USSR

ESTIMATED ANNUAL PRODUCTION OF HELICOPTERS

By weight excluding intral spares

1947-62

*Figure for 1962 are 12-month estimates based on 6 months of production

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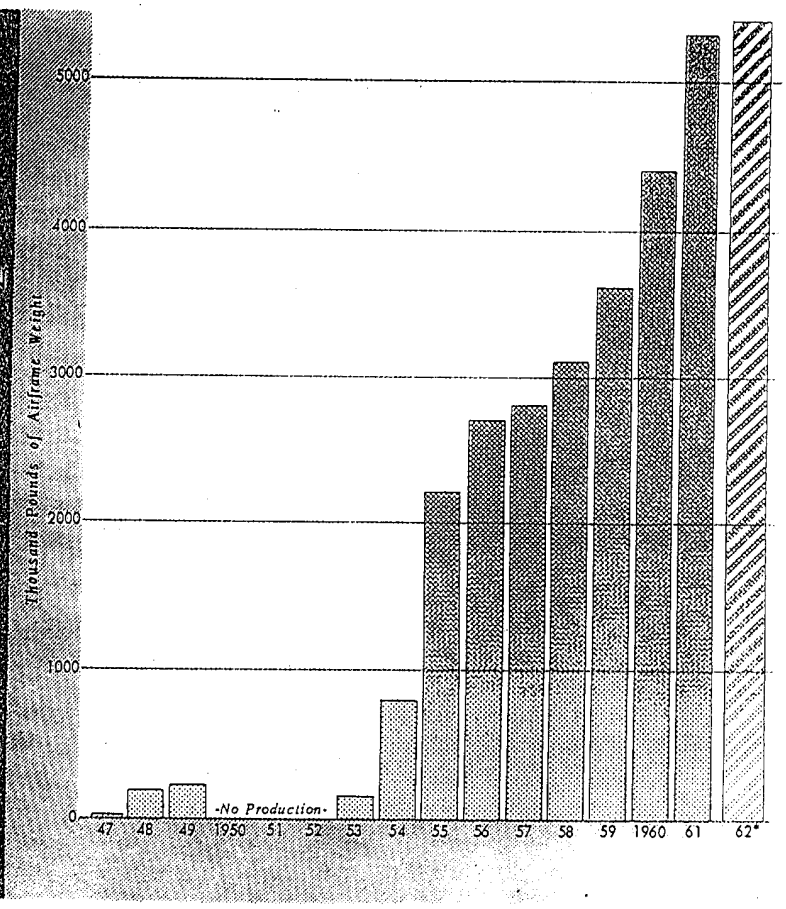

B. Hare (Mi-1)

1. Chkalov Airframe Plant No. 47

At the Tushino Air Show on 8 July 1951, 9 Hare appeared, and, at the Air Show in 1952, 11 were shown. It is believed, however, that series production of the Hare did not begin until late 1954. On the basis of and US experience in production of aircraft, it is estimated that, during 1956, 15 Hare helicopters per month were being produced at Chkalov Airframe Plant No. 47. It is believed that this rate of production continued through the second quarter of 1962 and that approximately 1,400 Hare helicopters had been produced at Plant No. 47 by the end of June 1962.

It was originally believed that production of the Hare was to take place also at Komsomol'sk Airframe Plant No. 126. Reports received during 1954 and 1955 indicated that Mil' was sending his helicopter designers to Plant No. 126 and that this plant was in the process of preparing for production of helicopters.

2. Rostov Airframe Plant No. 168

The established Rostov Airframe Plant No. 168 (see the photograph, Figure 44***) as the second production site of this helicopter. † 19/

†† , it is estimated that production of the Hare began in 1957 at Plant No. 168 and that during 1959 the rate of production was five helicopters per month. It also is estimated that this rate of production continued through June 1962 and that approximately 270 Hare helicopters had been produced at Plant No. 168 by the end of the second quarter of 1962.

In view of the recent development of the Mil'-designed Hoplite helicopter, an enlarged version of the Hare, it is possible that production of the Hare may phase out at some future date. As yet, however, no information has been received indicating such plans.

C. Hound (Mi-4)

1. Moscow Airframe Plant No. 82

Sightings in 1953 and 1954 of Hound helicopters on the airfield at Moscow Airframe Plant No. 82 indicated that this plant was producing the Hound.

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* Appendix D, p. 73, below.

** For a summary of significant developments concerning production of the Hare at Plant No. 47, see Table 7, Appendix B, p. 35, below.

*** Appendix D, p. 75, below.

† For a summary of significant developments concerning production of the Hare at Plant No. 168, see Table 8, Appendix B, p. 35, below.

†† For methodology, see Appendix E.

eported, however, that no Hound helicopters were seen on the airfield later than November 1954. 20/ On the basis of this information and information indicating that production of the Hound began in 1954 at Kazan' Airframe Plant No. 387, it is estimated that only about 20 Hound helicopters were produced at Plant No. 82 in 1953 and that production of this helicopter was transferred to Plant No. 387 in 1954.

2. Kazan' Airframe Plant No. 387

Sightings in 1955 of Hound helicopters in various stages of construction on the plant airfield at Kazan' Airframe Plant No. 387 (see the photographs, Figures 45 and 46*) identified Plant No. 387 as a producer of the Hound.**

. Production of the Hound is estimated to have begun in 1954 at Kazan' Airframe Plant No. 387. it is further estimated that the rate of production for the Hound during the period from 18 July 1959 through 26 April 1960 was approximately 20 helicopters per month 21/ and that the rate of production for this helicopter for the period from 26 April 1960 through 26 May 1961 was 25 helicopters per month. 22/ It is estimated that this rate of production of 25 helicopters per month continued through the first quarter of 1962 and that approximately 2,000 Hound helicopters were produced at Plant No. 387 by the end of the second quarter of 1962.

In view of the recent development of the Mil'-designed Hip helicopter, an enlarged version of the Hound, the future phaseout of the Hound is a possibility. As yet, however, no information pointing to such a development has been received.

D. Horse (Yak-24)

Leningrad Airframe Plant No. 272

In 1958, Leningrad Airframe Plant No. 272 (see the photograph, Figure 47***) was identified as the producer of the Horse helicopter.†

reported the sighting of as many as 15 such helicopters at Leningrad/Kolomyagi Airfield in the summer of 1958. 24/ An article in a Soviet publication gave further evidence that Plant No. 272 was producing Horse helicopters. 25/ This article described the plant in question as resembling a shipbuilding plant, and Plant No. 272, by virtue of its position on a river and its general physical layout, most closely fits such a description.

* Appendix D, p. 77, below.

** For a summary of significant developments concerning production of the Hound at Plant No. 387, see Table 9, Appendix B, p. 36, below.

*** Appendix D, p. 79, below.

† For a summary of significant developments concerning production of the Horse at Plant No. 272, see Table 10, Appendix B, p. 36, below.

The Horse was first sighted in 1955, but sizable quantities of the helicopter failed to appear from 1955 to 1958.

s. It is believed that the Horse entered into series production in 1955 and was produced through the second quarter of 1962.

production estimates are based on the estimated output capacity of Leningrad Airframe Plant No. 272 and the maximum number of Horse helicopters reported at a single sighting. It is estimated that the average rate of production for the Horse has been 2 helicopters per month and that approximately 170 Horse helicopters had been produced at Plant No. 272 by the end of the second quarter of 1962.

The turbine-powered Horse may have been developed as a replacement for the Horse. If such a development has taken place, the phaseout of the Horse can be anticipated. Until information is received indicating that the Turbine Horse has entered into series production and/or that the Horse has phased out at Leningrad Airframe Plant No. 272, it is estimated that the status of production of the Horse has not changed.

E. Hen (Ka-15)

Ulan-Ude Airframe Plant No. 99

identified Ulan-Ude Airframe Plant No. 99 as the production site of this aircraft. * 26/

On the basis of this information, it is estimated that a prototype of the Hen was produced in 1956 and that series production began in 1957. O

it is estimated that approximately 300 Hen helicopters were produced at Ulan-Ude Airframe Plant No. 99.

In view of information received during the latter part of 1961 suggesting that a new Yakovlev-designed jet trainer was to be produced at Ulan-Ude Airframe Plant No. 99, it is believed that, by the end of 1961, production of the Hen at Plant No. 99 had phased out. If Plant No. 99 is continuing to produce Kamov helicopters, it is reasonable to assume that the Hog, the latest Kamov-designed helicopter in series production, and not the Hen remains in production. It is hoped that future reports clarify the status of the Hen at Plant No. 99.

F. Hog (Ka-18)

Ulan-Ude Airframe Plant No. 99

* For a summary of significant developments concerning production of the Hen at Plant No. 99, see Table 11, Appendix B, p. 37, below.

the Hog, like the Hen, was being produced at Ulan-Ude Airframe Plant No. 99 and that 157 Hog helicopters had been produced at this plant by April 1960.* 28/

It is believed that a prototype of the Hog was produced in 1957, that it completed its test phase early in 1958, and that series production began during the same year.

, it is estimated that in 1960 the rate of production for the Hog reached 12 helicopters per month. It is estimated that this rate of production continued through the second quarter of 1962 and that a total of approximately 480 Hog helicopters had been produced at Ulan-Ude Airframe Plant No. 99 by the end of June 1962. In the absence of evidence clearly indicating that production of helicopters has ceased entirely at Plant No. 99, production of the Hog is believed to be continuing.

G. Hook (Mi-6)

1. Rostov Airframe Plant No. 168

that by some time in 1961 at least 70 Hook helicopters had been produced at Rostov Airframe Plant No. 168.

, it is estimated that a rate of production of two Hook helicopters per month was reached in the last quarter of 1959 and that by the end of the second quarter of 1962 a total of 84 Hook helicopters had been produced at Plant No. 168.

The possible connection between the designation Mi-8 and Plant No. 168 indicates that the aircraft designation may refer to the stub-wing versions of the Hook, first seen at the Tushino Air Show in 1958. Plant No. 168 is the only airframe plant credited with producing the Hook as early as 1958.

2. Moscow Airframe Plant No. 23

* For a summary of significant developments concerning production of the Hog at Plant No. 99, see Table 11, Appendix B, p. 37, below.
** For a summary of significant developments concerning production of the Hook at Plant No. 168, see Table 8, Appendix B, p. 35, below.
*** See I, B, 5, p. 5, above.
† Appendix D, p. 81, below.

The receipt of pertinent information offered almost conclusive evidence that Moscow/Fili Airframe Plant No. 23 began producing the Hook in 1960.

The helicopters produced at Moscow/Fili Airframe Plant No. 23 were identified as Hook helicopters of Moscow/Fili airfield in 1960. These sightings, were the basis for the estimate of production figures for the Hook at Plant No. 23.

The Hook was first sighted at Moscow/Fili airfield on 27 April 1960, when one helicopter was seen. No more than one Hook was observed until 19 December 1960, when two were sighted. By the end of 1960, as many as seven Hook helicopters were reported as having been seen. The number of Hook helicopters that were sighted increased gradually in 1961, until 32 were seen on 22 November 1961. During the second quarter of 1962, as many as 40 were seen in May.

On the basis of the reported sightings of the Hook at Moscow/Fili airfield during the period from April 1960 through the second quarter of 1962 and of it is estimated that, by April 1961, at least three such helicopters were being produced each month. It is further estimated that this rate of production continued through the second quarter of 1962 and that by the end of June 1962 a total of 57 Hook helicopters had been produced at Moscow/Fili Airframe Plant No. 23.

The reported sightings of the Hook at Moscow/Fili airfield indicate not only a continuing rate of production of this helicopter but also continuing technical difficulties experienced with the rotors of the aircraft. The designer of the Hook, M.L. Mil', was reported as having admitted that the rotor on the Hook had a blade life of only 20 hours but that this life expectancy would be increased by adding stub wings to the original design and a sixth blade to the rotor and by redesigning the rotor hub. 33/ A stub-wing version of the Hook did appear at the Tushino Air Show in 1958, and it is believed that sightings at Moscow/Fili airfield may reveal six-bladed rotors. The extent to which these improvements have increased the blade life is not known.

* For a summary of significant developments concerning production of the Hook at Plant No. 23, see Table 12, Appendix B, p. 37, below.

Throughout 1960, 1961, and the second quarter of 1962, observers reported that Hook helicopters without rotors were appearing on the Moscow/Fili airfield and that the percentage of helicopters without rotors changed As late as 26 February 1962, all 32 Hook helicopters that had been sighted were reported to be without rotors. This information indicates that difficulties with the rotors on the Hook continue to exist and that Moscow/Fili Airframe Plant No. 23 is in the process of testing and attempting to improve the rotor on the Hook.

The six-bladed modified Hook helicopters that may have been seen at Moscow/Fili airfield have perhaps been designated Mi-10.

The validity of this designation is questionable, and a positive statement concerning its existence and its meaning is reserved until more information is received.

Recent reports point to the possibility that in spite of continuing technical difficulties the Hook has become operational. On 19 August 1961, one Hook was observed at Moscow/Sheremet'yevo airfield, 35/

In addition to the initial appearance of Hook helicopters at these two bases in the USSR, the Hook has appeared at bases in East Germany during the first quarter of 1962. On 30 January 1962, five helicopters flew to Oranienburg, 37/ five Hook helicopters were parked on this airfield. 38/ The same source reported that during this period four Hook helicopters were observed on Schonwalde airfield. On 16 March, 5 unidentified aircraft landed at Oranienburg, 39/ reported the presence of 10 Hook helicopters at this airfield. 40/

In addition to the reported flights of Hook helicopters to bases in the USSR and East Germany, a recent report indicates that several of these helicopters may be exported to India in the near future. India is considering purchasing a number of Hook helicopters from the USSR. 41/ This report, however, is the first and only such indication of such a sale by the USSR and has not been confirmed.

The announcement by Aeroflot that, in 1962, the Hook will be used in an agricultural capacity is further confirmation of the fact that this helicopter is being put into service.

H. Hip (V-8)

Moscow Airframe Plant No. 23

Since the first appearances in 1961 of five new Soviet helicopters - the Mil'-designed Harke, Hip, and Hoplite; the Kamov-designed Harp; and the turbine Horse - and the Kamov-designed STOL aircraft, the Hoop, there have been no reports confirming the conclusion that any of these aircraft are operational or that they have entered into series production.

Recent information does indicate, however, that Moscow/Fili Airframe Plant No. 23 may be involved in the assembly of the Hip helicopter. On

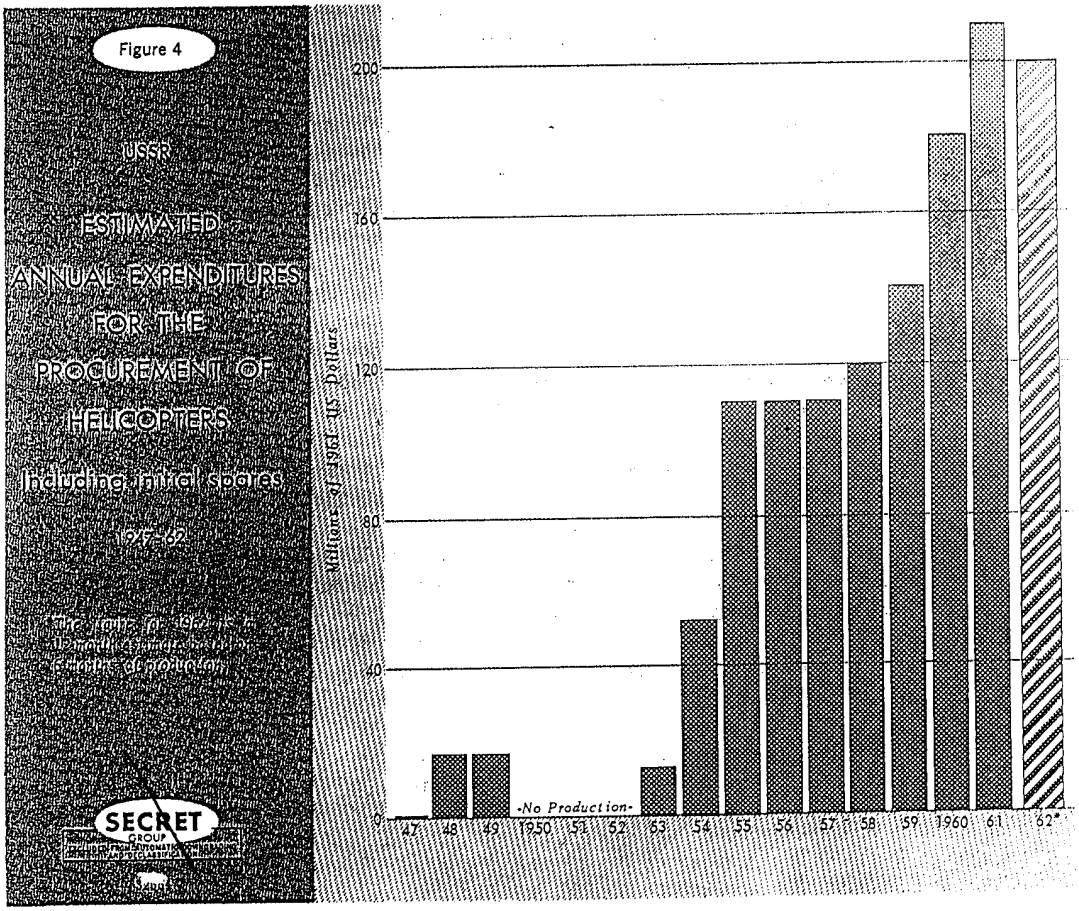
* See I, B, 5, p. 5, above.

27 October 1961, one Hip was observed on the Moscow/Fili airfield. 42/ This sighting was the first such sighting of a Hip, and no further sightings have been reported through the second quarter of 1962.

At this time, however, it is not possible to make a positive statement regarding the status of the Hip at Moscow/Fili.

III. Expenditures for Procurement of Soviet Helicopters

Expenditures for the procurement of Soviet helicopters, including initial spares, has increased annually during the period from 1947 through 1961 in the years when Soviet helicopters were in series production. Table 5* and the accompanying chart, Figure 4, show the estimated expenditures by the USSR



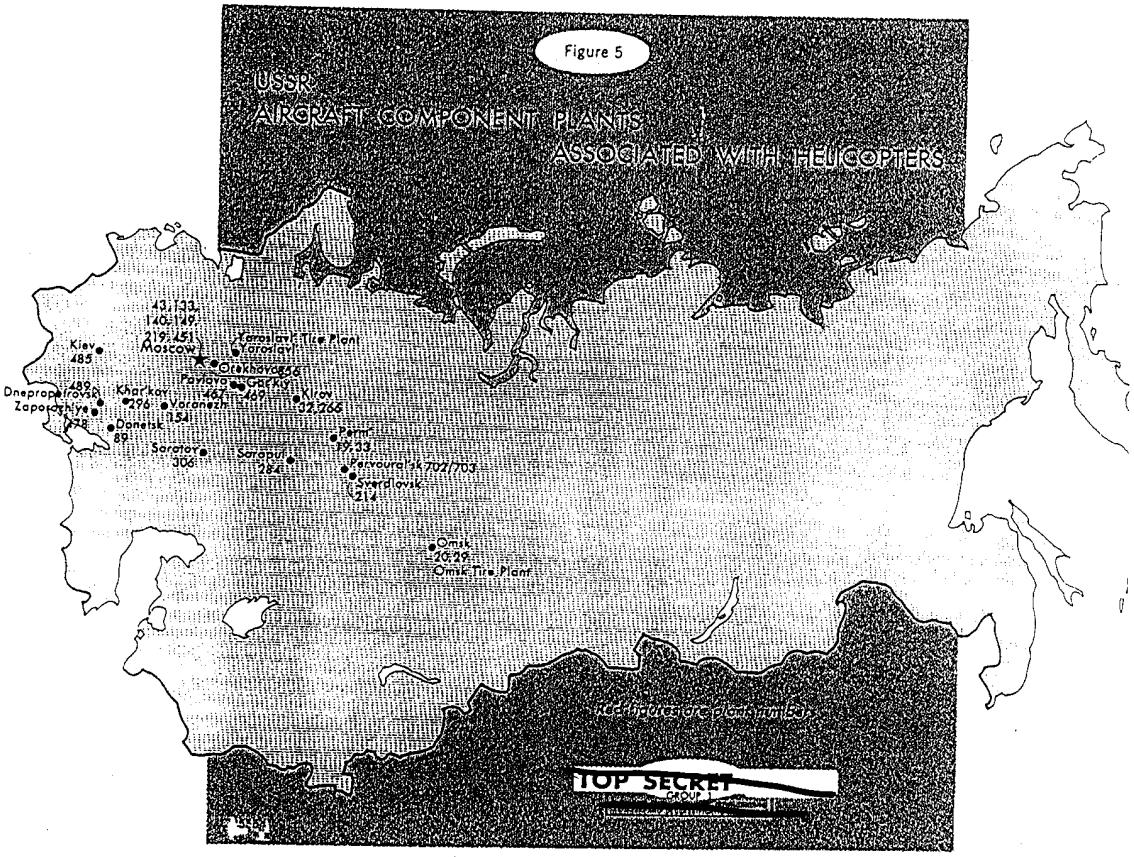
for the procurement of helicopters, including initial spares, for the period from 1947 through the second quarter of 1962. During the period from 1947 through 1949 the USSR is estimated to have spent $35 million for the procurement of helicopters, including initial spares. The annual totals for this period increased from $700,000 in 1947 to $17 million in 1949. During the period from 1953 through 1961 the USSR is estimated to have spent approximately $1 billion for the procurement of helicopters, including initial spares. The annual expenditures for this period increased from $13 million in 1953 to

* Appendix B, p. 31, below.

$210 million in 1961. Finally, during the first 6 months of 1962, it is estimated that the USSR spent $95 million for the procurement of helicopters, including initial spares. If the current trend continues, it is estimated that the expenditures by the USSR for the procurement of helicopters in all of 1962 will be $200 million, a decrease of $10 million from total expenditures for helicopters in 1961.

IV. Helicopter Component Plants

At least 27 aircraft component plants in the USSR are believed to be supplying parts for Soviet helicopters (see the map, Figure 5). The equipment supplied includes powerplants and accessories, electrical equipment, and instruments.*



* For a list of the individual component plants and the parts that they supply, see Table 4, Appendix B, p. 30, below.

V. Use of Helicopters

A. Military*

1. Tactical Doctrine

Ever since the mid-1950's when the development and production of helicopters became a significant segment of the aircraft industry in the USSR, these aircraft have become increasingly indispensable in the field of tactical warfare. The capability of the helicopter to take off and land vertically and to hover at extremely low altitudes, together with its general maneuverability, make it particularly well suited to serve as a military utility, liaison, reconnaissance, and/or transport aircraft.

In all these uses the helicopter serves to implement Soviet tactical doctrine, the central aim of which is the destruction of enemy forces. The basic means of such destruction are heavy firepower and deep envelopment. Heavy firepower can be provided by nuclear and/or nonnuclear weapons. Soviet tactical doctrine emphasizes the elements of surprise, speed, and dispersion. The mobility of the helicopter increases the ability of troops to exploit opportunities for surprise attacks. Also central to Soviet tactical doctrine is the avoidance of prolonged battle situations, a condition which necessitates the rapid and efficient movement of troops. The helicopter has proved to be indispensable as a troop carrier.

In general, the helicopter expedites and supports Soviet military operations. Its major uses are for transportation and observation.

2. Troop Carrier

The use of the helicopter as a troop carrier in airborne operations is particularly significant. The helicopter provides access to mountainous and rugged areas otherwise inaccessible to airborne troops and provides rapid and efficient transport across water.

By increasing the mobility and maneuverability of airborne forces, the helicopter provides necessary support for ground forces. Airborne forces are landed in direct support of ground forces to increase manpower or may be used in indirect support in raiding enemy-held rear areas or in facilitating the advancement of friendly troops.

3. Reconnaissance

The Hare and Hound helicopters have found wide use in the USSR as reconnaissance aircraft. Helicopters are well suited for visual air reconnaissance, including observation of weather conditions, surveys of terrain, and reconnoitering of enemy lines. Such reconnaissance missions increase the possibility of successful attack.

Helicopters also find use as photographic aerial reconnaissance aircraft. The helicopter designer, M.L. Mil', has said that the capabilities

* Unless otherwise indicated, information concerning Soviet military tactical doctrine and the role of Soviet helicopters in military operations is based on a study by source 44/. The fact that Soviet helicopters are adapted for certain duties does not necessarily indicate that such duties would be performed by helicopters in time of war.

of the helicopter have permitted the application of new photographic methods. 45/ One report indicates that an unidentified helicopter in service with the Black Sea Fleet Air Force was to carry out a photographic mission at a missile firing in the USSR in July of 1961. 46/

Artillery aerial reconnaissance also plays an important role in support operations. Hare and Hound helicopters have been reported to be attached to such reconnaissance units. Artillery aerial reconnaissance involves artillery spotting and the control of artillery firing. This type of support activity demands close and constant liaison between the aerial observer and the firing unit.

4. Weapon Support

The arming of helicopters greatly increases their usefulness as support aircraft. Both the Hare and the Hound are known to be fitted with machineguns. In addition, it has been reported that Hound helicopters have fired rockets and have test-fired cannons. Helicopters fitted with armaments could be used to suppress enemy ground fire in support of friendly ground troops. An armed helicopter also can serve as a cover aircraft. The Hare has been photographed providing air cover for a river crossing (see the photograph, Figure 12*).

5. Bombing Signals

helicopters have provided Shorewalk Beacon Service in support of Soviet bombers. This signal system permits the plotting of the course and the target and enables the bomber to bomb targets ahead of the frontline. 47/

6. Minelaying and Detection

Soviet helicopters are used in the laying and detection of mines. Mines are laid by a low-flying helicopter using a retractable chute or ramp. Such a ramp has appeared on a Hound helicopter having Polish markings (see the photograph, Figure 16**). For the purpose of detecting minefields, helicopters are fitted with extended mine detectors.

7. Aerial Crane

Soviet helicopters are equipped to serve as aerial cranes in support of ground operations. The Horse has been photographed lifting a truck (see the photograph, Figure 22***), and at the Tushino Air Show in 1961 the Harke "flying crane" helicopter lifted a small prefabricated house (see the photograph, Figure 33†). The extent to which Soviet helicopters actually are used as aerial cranes is not known.

8. Missile and Rocket Associations

The sightings at the Tushino Air Show in 1961 of the Hook and Harp helicopters carrying missiles indicated that helicopters will serve as

* Appendix D, p. 45, below.
** Appendix D, p. 49, below.
*** Appendix D, p. 53, below.
† Appendix D, p. 63, below.

transport aircraft for such weapons. The Harp carried one air-to-surface missile on each side of its fuselage (see the photograph, Figure 35*), and the Hook carried Frog and Scud missiles.

In addition, . helicopters are being used at missile firings and recoveries.

9. Nuclear Testing

Hound helicopters are used in support of nuclear testing.

The nature of this activity, however, is not known. 49/ Although no reports have been received indicating such a support function, there is a possibility that Soviet helicopters may be equipped for radiation detection.

10. Chemical, Bacteriological, and Radiological (CBR) Warfare

The Soviet military training program includes emphasis on CBR warfare, and helicopters are well suited to deliver CBR agents.

heli-copter designer N.S. Kamov has said that both the Hen and Hog helicopters have been equipped with aerosol generators for the spraying of toxic chemicals. 51/ Not only could helicopters be used to aerate areas with chemical or radiological matter, but they could deliver CBR agents in thin-walled containers.

11. Antisubmarine Warfare (ASW)

A Soviet book published in Moscow in 1960 is reported to have included a photograph that showed a Hen helicopter taking off from the deck of a naval vessel. The caption under the photograph stated that the helicopter was to carry out a patrol mission with the task of securing a convoy against submarines. The accompanying article indicated that in the role of a submarine detector the Soviet helicopter utilizes hydroacoustic buoys and airborne sonar and magnetic detectors.

Instances of Soviet Hound helicopters engaged in ASW operations also have appeared i] the Hound has been engaged in dropping sonobuoys and using magnetic anomaly detection (MAD) gear in an effort to discover a submarine position. 53/

* Appendix D, p. 65, below.

The installation of search radar on the Harp suggests the future use of this helicopter in ASW operations. It is believed that this particular radar equipment is suited for the detection of small-size radar targets such as surfaced submarines. 54/

12. Polar Activities

Soviet helicopter designer M. L. Mil' has reported that the Hare and the Hound helicopters have been used extensively in the polar regions for the purposes of transportation and reconnaissance. Hound helicopters reported for service in 1954 and ever since have served as transport aircraft for troops and equipment (see the photograph, Figure 18*). The Hound also is used as a reconnaissance aircraft in the locating of landing sites for cargo aircraft and in the conducting of scientific observations.

The Hare has been based on the decks of icebreakers and has conducted ice reconnaissance missions and has aided ships in locating the proper course (see the photograph, Figure 13**). 55/ In addition to the activities performed by the Hare and Hound helicopters,

that this helicopter also may be in service as a polar reconnaissance aircraft. 56/

13. Casualty Evacuation

Because of its access to practically all areas the helicopter is invaluable as an airborne ambulance in time of war or disaster. It can be used to evacuate the wounded or to deliver medical personnel and supplies to the front. A casualty evacuation model of the Hare has been fitted with removable panniers for stretchers, which are mounted on each side of the cabin with a connecting tunnel providing access to the cabin. It is reported that both the panniers and the cabin are heated. 57/

The Hound helicopter has been photographed evacuating patients (see the photograph, Figure 17*) and is well equipped for such duties. The casualty model is equipped for stretchers and facilities for medical personnel.

The small Kamov-designed Hen and Hog helicopters and the Hare helicopter also are suitable for evacuation purposes. The Hog has been photographed performing such duties (see the photograph, Figure 31***), and a Hen fitted with enclosed litters has been photographed (see the photograph, Figure 29†).

B. Civil

1. Forestry and Agriculture

Helicopters are used to a great extent in agriculture in the USSR. The Hare, the Hound, the Hen, and the Hog helicopters are believed to engage in crop spraying, dusting, and fertilizing. F

58/

* Appendix D, p. 51, below.
** Appendix D, p. 45, below.
*** Appendix D, p. 61, below.
† Appendix D, p. 59, below.

and references have been made to an agricultural version of the Hound equipped with an airborne chemical spray apparatus. 59/ In addition, Soviet helicopter designer N.S. Kamov has said that the Hen and Hog helicopters are equipped with spraying apparatus used to combat forest and agricultural pests. 60/ It has been suggested that the turbine-powered Hoplite helicopter will be used for utility work such as crop spraying. 61/

In forestry, Soviet helicopters may be used for purposes other than combating pests. Kamov has claimed that the Hen and the Hog could be used also for estimating forest resources and combating forest fires.

Additional agricultural uses have been suggested for Soviet helicopters. The designer of the Horse, A.S. Yakovlev, has said that this helicopter could be used to deliver soil researchers into the taigas and marshes in the USSR and to bring water into the desert. 62/

2. Industry

Helicopters are believed to serve as utility aircraft for a variety of industries in the USSR. M.L. Mil' has said that in the Antarctic the Hound is based on the flagship of a whaling flotilla for the purpose of carrying out reconnaissance flights to promote more effective catches. 63/ In a Polish periodical the Hog helicopter also has been mentioned as a reconnaissance aircraft for the fishing fleet. 64/

The Hook was reported to be destined for drilling and mining operations. By using helicopters to transport drilling equipment to remote areas, potential reserves could be discovered before access roads are built. 65/

Reports indicate that the Horse was especially intended for industrial use. Mil' said that the Horse was designed for heavy construction work, 66/ and Yakovlev claimed that the helicopter would be used for the laying of pipelines over swamps and deserts and for transporting crossties and rails into the mountains for the building of railroads. 67/

3. Miscellaneous

Soviet helicopters are used for numerous additional civil purposes. One version of the Hare is equipped with containers for carrying mail. The Hog helicopter also is reported to carry mail. Moreover, as civil airline carriers Soviet transport helicopters provide commuter service in urban areas in the USSR.

The ability of the helicopter to hover makes it an invaluable rescue aircraft in time of disaster.

Regarding additional uses of the helicopter, Kamov has claimed that helicopters are used for blowing snow from overhead communications lines and for inspecting high-voltage electric powerlines. The Hound also has been reported to participate in geological surveys, and an article in a Soviet civil aviation magazine is reported to have revealed that Hound helicopters engaged in such surveys were specially equipped. 69/ Kamov has said that the Hen and the Hog could be employed for geological exploration. The use of helicopters in remote areas would greatly facilitate scientific exploration.

APPENDIX A

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APPENDIX B

STATISTICAL TABLES

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Table 1

Estimated Production of Helicopters in the USSR, by Model, Plant, and Number a/
1947 Through the Second Quarter of 1962

Units

Model	Airframe Plant	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1st 6 Months 1962	Total
Hare (Mi-1)	Chkalov No. 47								76	170	180	180	180	180	180	180	90	1,400
Hare (Mi-1)	Rostov No. 168											11	53	60	60	60	30	270
Total Hare									76	170	180	190	230	240	240	240	120	1,700
Hound (Mi-4)	Moscow No. 82							20										20
Hound (Mi-4)	Kazan' No. 387								81	220	240	240	240	240	270	300	150	2,000
Total Hound								20	81	220	240	240	240	240	270	300	150	2,000
Omega	Kiev No. 473	2	120	150														270
Horse (Yak-24)	Leningrad No. 272									10	24	24	24	24	24	24	12	170
Hook (Mi-6)	Rostov No. 168											2	6	16	24	24	12	84
Hook (Mi-6)	Moscow No. 23														7	32	18	57
Total Hook												2	6	16	31	56	30	140
Hen (Ka-15)	Ulan-Ude No. 99										1	45	70	72	72	40	0	300
Hog (Ka-18)	Ulan-Ude No. 99											1	8	110	140	140	72	480
Total helicopters		2	120	150				20	160	400	440	500	580	700	780	800	380	5,100

a. Because of rounding (not to exceed two significant digits), components may not add to the totals shown.

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Table 2

Estimated Production of Helicopters, Excluding Initial Spares, in the USSR, by Weight
1947 Through the Second Quarter of 1962

Model	Airframe Weight (Pounds)	Airframe Plant	Thousand Pounds of Airframe Weight a/															
			1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1st 6 Months 1962
Hare (Mi-1)	2,300	Chkalov No. 47								170	390	410	410	410	410	410	410	210
Hare (Mi-1)	2,300	Rostov No. 168											25	120	140	140	140	69
Total Hare airframe weight										170	390	410	440	540	550	550	550	280
Hound (Mi-4)	7,550	Moscow No. 82							150									
Hound (Mi-4)	7,550	Kazan' No. 387								610	1,700	1,800	1,800	1,800	1,800	2,100	2,300	1,100
Total Hound airframe weight									150	610	1,700	1,800	1,800	1,800	1,800	2,100	2,300	1,100
Omega	1,500	Kiev No. 473	3	180	220													
Horse (Yak-24)	18,200	Leningrad No. 272									180	440	440	440	440	440	440	220
Hook (Mi-6)	32,300	Rostov No. 168											65	190	520	780	780	390
Hook (Mi-6)	32,300	Moscow No. 23														230	1,000	580
Total Hook airframe weight													65	190	520	1,000	1,800	970
Hen (Ka-15)	1,000	Ulan-Ude No. 99										1	45	70	72	72	40	0
Hog (Ka-18)	1,600	Ulan-Ude No. 99											2	13	180	230	230	120
Total helicopter airframe weight			3	180	220				150	790	2,200	2,700	2,800	3,100	3,600	4,400	5,300	2,700

a. Because of rounding (not to exceed two significant digits), components may not add to the totals shown.

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Table 3

Estimated Floorspace of Soviet Airframe Plants Producing Helicopters
1962

Plant Number	Location	Models Produced	Floorspace a/ (Million Square Feet)
23	Moscow	Hook (Mi-6)	3.1
47	Chkalov	Hare (Mi-1)	1.3
82	Moscow	Hound (Mi-4)	0.68
99	Ulan-Ude	Hen (Ka-15) Hog (Ka-18)	0.70 b/
168	Rostov	Hare (Mi-1) Hook (Mi-6)	1.3
272	Leningrad	Horse (Yak-24)	0.37
387	Kazan'	Hound (Mi-4)	0.77
473	Kiev	Omega	0.89 b/
Total			9.1

a. Data are rounded to two significant digits.
b. Before 1954.

Table 4

Soviet Aircraft Component Plants Associated with Helicopters
1962

Plant Identification	Associated Product
Perm' No. 19	Engine
Omsk No. 20	Pump
Omsk No. 29	Engine
Kirov No. 32	Winch
Perm' No. 33	Carburetor
Moscow No. 43	Motor and windshield wiper
Donetsk No. 89	Voltmeter
Moscow No. 133	Air speed indicator
Moscow No. 140	Relay
Moscow No. 149	Gyro compass, amplifier, transmitter, and loading device
Voronezh No. 154	Engine and compressor
Sverdlovsk No. 214	Artificial horizon
Moscow No. 219	Braked wheel
Kirov No. 266	Generator, actuating motor, and filter
Sarapul No. 284	Generator, electric motor, and filter
Khar'kov No. 296	Pump
Saratov No. 306	Booster coil and magneto
Moscow No. 451	Filter, alcohol pump, gear pump, solenoid, and valve
Pavlovo No. 467	Hydraulic booster
Gor'kiy No. 469	Radiator
Zaporozh'ye No. 478	Engine
Kiev No. 485	Motor and solenoid
Dnepropetrovsk No. 489	Fuel injector, motor, and pump

Table 5

Estimated Expenditures for the Procurement of Helicopters, Including Initial Spares, in the USSR a/
1947 Through the Second Quarter of 1962

Million 1961 US $

Model	Airframe Plant	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1st 6 Months 1962
Hare (Mi-1)	Chkalov No. 47								16	23	21	19	18	17	17	16	8
Hare (Mi-1)	Rostov No. 168											4	10	9	8	8	4
Total Hare									16	23	21	23	28	26	25	24	12
Hound (Mi-4)	Moscow No. 82							13									
Hound (Mi-4)	Kazan' No. 387								36	67	62	57	53	51	56	63	28
Total Hound								13	36	67	62	57	53	51	56	63	28
Omega	Kiev No. 473	0.7	17	17													
Horse (Yak-24)	Leningrad No. 272									16	24	20	18	17	16	15	7
Hook (Mi-6)	Rostov No. 168											8	15	32	41	36	17
Hook (Mi-6)	Moscow No. 23														21	58	27
Total Hook												8	15	32	62	94	44
Hen (Ka-15)	Ulan-Ude No. 99										0.6	6	6	6	5	3	0
Hog (Ka-18)	Ulan-Ude No. 99											0.3	2	11	11	10	4
Total helicopters		0.7	17	17				13	52	110	110	110	120	140	180	210	95

a. Because of rounding (not to exceed two significant digits), components may not add to the totals shown.

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Table 6

Principal Characteristics of Soviet Helicopters a/

Characteristics and Units of Measurement	In Series Production						Prototypes					
	Hare (Mi-1)	Hound (Mi-4)	Hook (Mi-6)	Horse (Yak-24)	Hen (Ka-15)	Hog (Ka-18)	Harke	Harp b/	Hip (V-8) b/	Hoplite (V-2) b/	Turbine Horse (Yak-24P) b/	Hoop b/
Engines												
Number	1	1	2	2	1	1	2	2	1	2	2	2
Designation	AI-26V	ASh-82V	TV-2VM	ASh-82V	AI-14V	AI-14VFS	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Type	Air-cooled radial	Air-cooled radial	Axial flow free turbine	Air-cooled radial	Air-cooled radial	Air-cooled radial	Turbine	Turbine	Turbine	Turbine	Turbine	Turbine
Take-off weight (pounds)												
Normal	4,960	15,840	70,000	35,400	2,865	3,300	85,000 b/	4,700	20,000	5,500	40,000	80,000
Maximum (vertical take-off)	5,400	21,700	88,000	38,600	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Number of passengers	2 to 3	12	70 to 120 soldiers	40 soldiers	1	2 to 3	150 b/ soldiers	N.A.	26 soldiers	8 soldiers	60 soldiers	70 soldiers
Payload (pounds)												
Normal	355	2,640	20,000	8,800	200 c/	350	20,000 c/	N.A.	N.A.	N.A.	N.A.	N.A.
Maximum	795	8,500	38,000	12,000	N.A.	440 to 550	33,302 b/	720	4,400	1,500	12,000	36,349
Internal fuel (gallons)	63.4	253	1,320	917	40	84	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Range with normal payload (nautical miles)	210 c/	240 c/	250 c/	135	230 c/	240	45 b/	250	350	200	200	400
Average speed with normal payload (knots)	75 c/	75 c/	110 c/	116	65 c/	65 to 70	55 b/	70	90	80	80	160

a. Unless otherwise indicated, data are based on source 71/.
b. 72/
c. 73/

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APPENDIX C

SIGNIFICANT DEVELOPMENTS IN PRODUCTION OF HELICOPTERS AT AIRFRAME PLANTS IN THE USSR

Information concerning significant developments in production of helicopters at airframe plants in the USSR is included for all plants as available. Because of the lack of sufficient information, however, tables have not been included for production of the Omega helicopter at Kiev Airframe Plant No. 473 and the Hound helicopter at Moscow Airframe Plant No. 82.

Table 7

Significant Developments in Production of the Hare (Mi-1) Helicopter at Chkalov Airframe Plant No. 47 1951 Through the Second Quarter of 1962

Date	Developments
8 July 1951	First sighting of nine Hare at Tushino
27 July 1952	Eleven Hare sighted at Tushino
1954	Series production of the Hare estimated to have begun
November 1955	Total production of at least 99 Hare
1956	Rate of production for the Hare estimated to have reached 15 per month
13 June 1957	Total production of at least 395 Hare

Table 8

Significant Developments in Production of the Hare (Mi-1) and the Hook (Mi-6) Helicopters at Rostov Airframe Plant No. 168 1957 Through the Second Quarter of 1962

Date	Developments
1 October 1957	First sighting of the Hook at Moscow/Khimki airfield
26 April 1957	report indicating production of aircraft at Plant No. 168
1957	Production of the Hare at Plant No. 168
1957	Two Hook prototypes believed to have been completed
16 April 1958	Sightings at Khimki and Tushino observers confirm existence of a second Hook
20 July 1958	Stub-wing Hook sighted at Tushino
November 1959	Total production of at least 6 or 10 Hook at Plant No. 168
1959	Rate of production for the Hare estimated to have reached five per month
1960	Rate of production for the Hook estimated to have reached two per month
17 January 1961	report confirming production of the Hare in 1960 at Plant No. 168
1961	Total production of at least 70 Hook
9-13 March 1962	Five Hook sighted at Oranienburg airfield and four Hook sighted at Schonwalde airfield in East Germany
19 March 1962	Ten Hook sighted at Oranienburg Airfield

Table 9

Significant Developments in Production of the Hound (Mi-4) Helicopter at Kazan' Airframe Plant No. 387 1953 Through the Second Quarter of 1962

Date	Developments
March 1953	Hound first observed
1954	Series production of the Hound estimated to have begun
20 June 1954	Thirty-six Hound sighted at Tushino
1955	Hound observed in various stages of construction on plant airfield
1956	Rate of production for the Hound estimated to have reached 20 per month
December 1957	
26 April 1960	Total production of at least 1,326 Hound
April 1960	Rate of production for the Hound estimated to have reached 25 per month
26 May 1961	Total production of at least 1,650 Hound

Table 10

Significant Developments in Production of the Horse (Yak-24) Helicopter at Leningrad Airframe Plant No. 272 1955 Through the Second Quarter of 1962

Date	Developments
1955	Series production of the Horse estimated to have begun
3 July 1955	First sighting of four Horse at Tushino
1956	Rate of production for the Horse estimated to have reached two per month
24 June 1956	Four Horse sighted at Tushino
14 June 1958	Scheduled flight of one Horse out of Leningrad
28 July 1958	Fifteen Horse sighted at Leningrad/Kolomyagi airfield
1960	at least 70 Horse in operational units

Table 11

Significant Developments in Production
of the Hen (Ka-15) and the Hog (Ka-18) Helicopters
at Ulan-Ude Airframe Plant No. 99
1956 Through the Second Quarter of 1962

Date	Developments
1956	One Hen prototype believed to have been completed
1957	Series production of the Hen estimated to have begun
17 May 1957	Hen in production at Ulan-Ude
April 1957	One Hog observed at Moscow/Lyubertsy airfield
12 May 1958	Total production of at least 46 Hen
20 July 1958	One Hen sighted at Tushino
31 May 1959	Total production of at least 80 Hen
12 April 1960	Total production of at least 157 Hog at Ulan-Ude
1960	Rate of production for Hog estimated to have reached 12 per month
1961	Production of Hen believed to have phased out

Table 12

Significant Developments in Production of the Hook (Mi-6) Helicopter
at Moscow/Fili Airframe Plant No. 23
1960 Through the Second Quarter of 1962

Date	Developments
27 April 1960	First sighting of one Hook at Moscow/Fili on plant airfield
17 December 1960	One aircraft believed to be a helicopter returned to Moscow/Fili from a test flight
19 December 1960	Two Hook sighted on plant airfield
28 December 1960	Seven Hook sighted on plant airfield
31 December 1960	Total production of at least six Hook
30 January 1961	Identification of test aircraft from Plant No. 23 as helicopters
April 1961	Rate of production for the Hook estimated to have reached three per month
27 June 1961	Total production of at least 20 Hook
22 November 1961	Thirty-two Hook sighted on plant airfield
26 February 1962	Thirty-two Hook sighted on plant airfield -- all without rotors
18 May 1962	Forty Hook sighted on plant airfield

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APPENDIX D

PHOTOGRAPHS OF SOVIET HELICOPTERS
AND HELICOPTER AIRFRAME PLANTS

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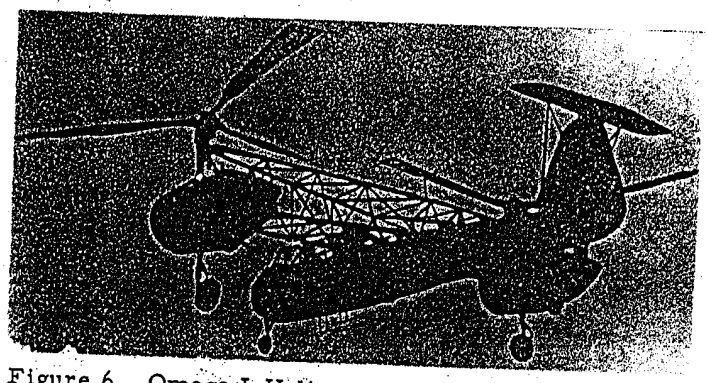

Figure 6. Omega I Helicopter

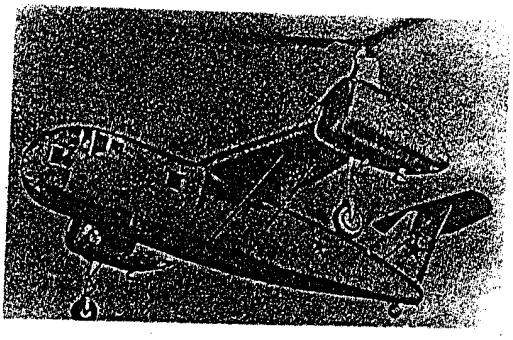

Figure 7. Omega II Helicopter

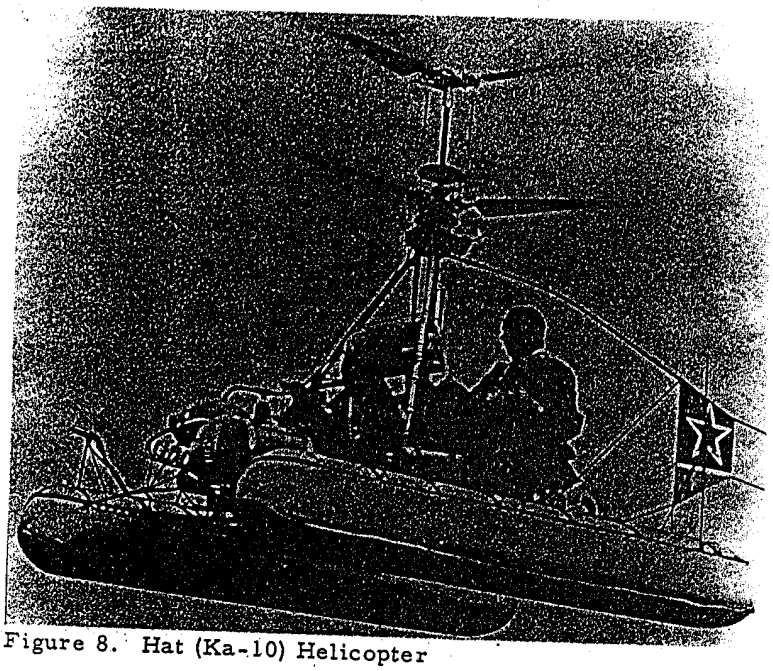

Figure 8. Hat (Ka-10) Helicopter

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Figure 9. Hare (Mi-1) Helicopter

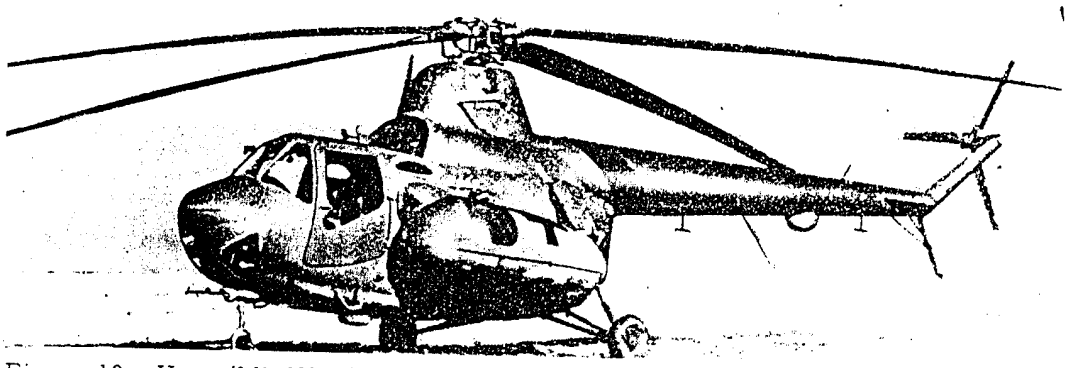

Figure 10. Hare (Mi-1NKh) Helicopter

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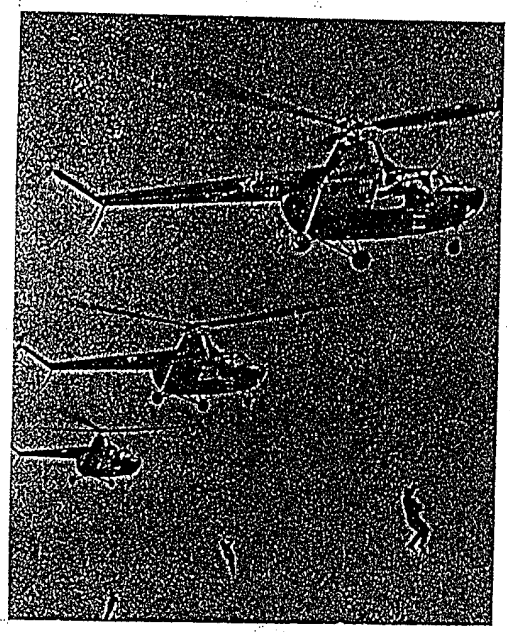

Figure 11. Hare Helicopter Engaged in Training Missions

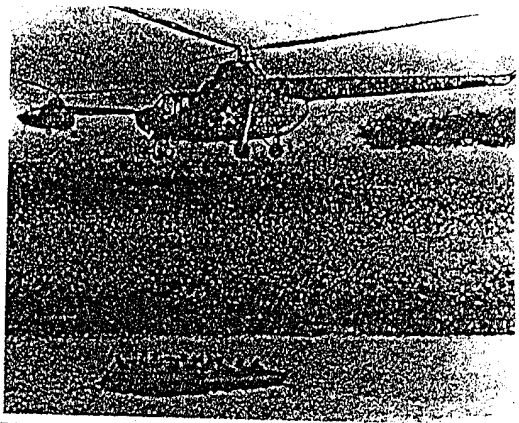

Figure 12. Hare Helicopter Providing Cc in a River-Crossing Operation

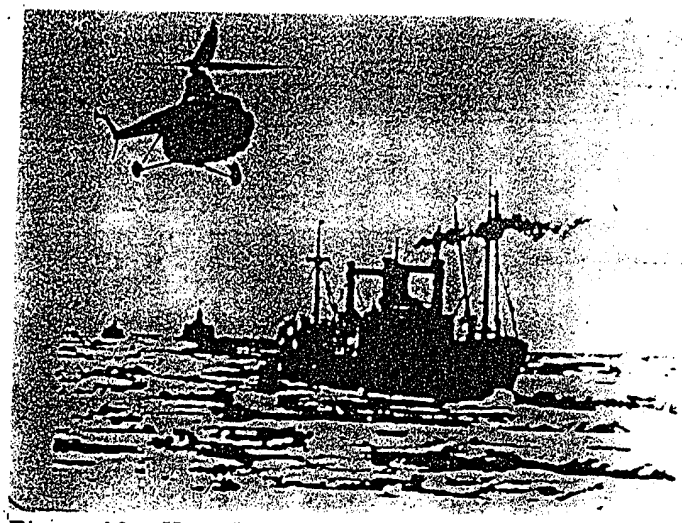

Figure 13. Hare Helicopter on an Ice Reconnaissance Mission in the Arctic Ocean

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Figure 14. Hound (Mi-4) Helicopters

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Figure 15. Hound Helicopter Being Fitted with a Machinegun

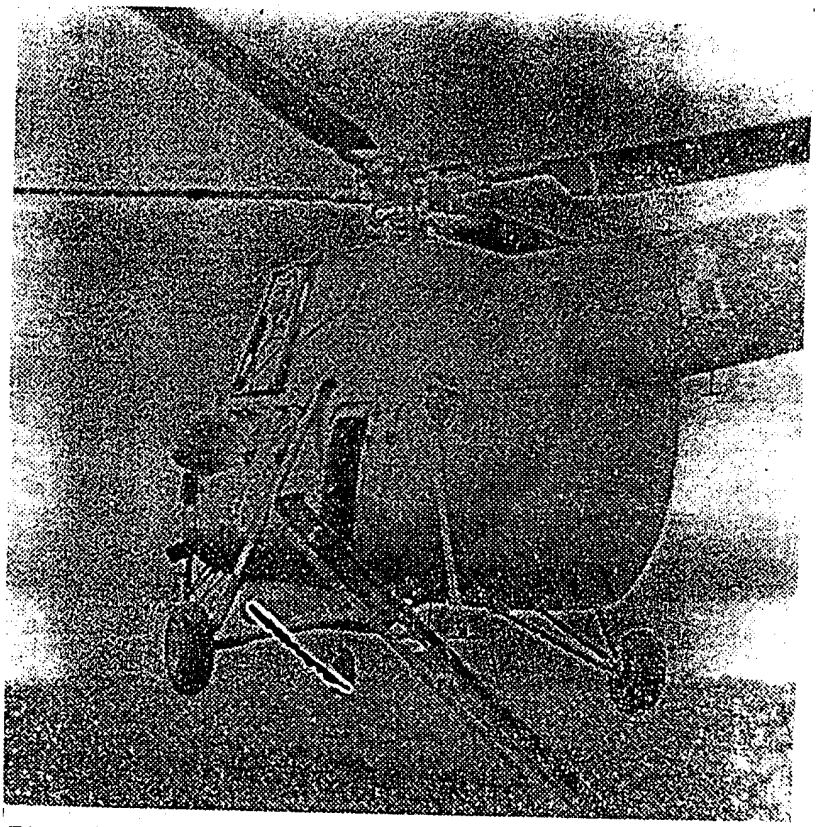

Figure 16. Hound Helicopter Equipped with a Minelaying Ramp

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Figure 17. Hound Helicopter Evacuating Wounded

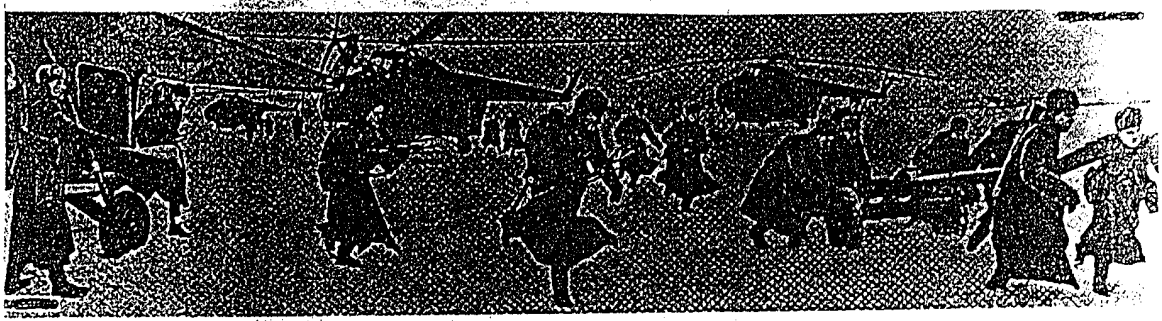

Figure 18. Troops Disembarking from a Hound Helicopter

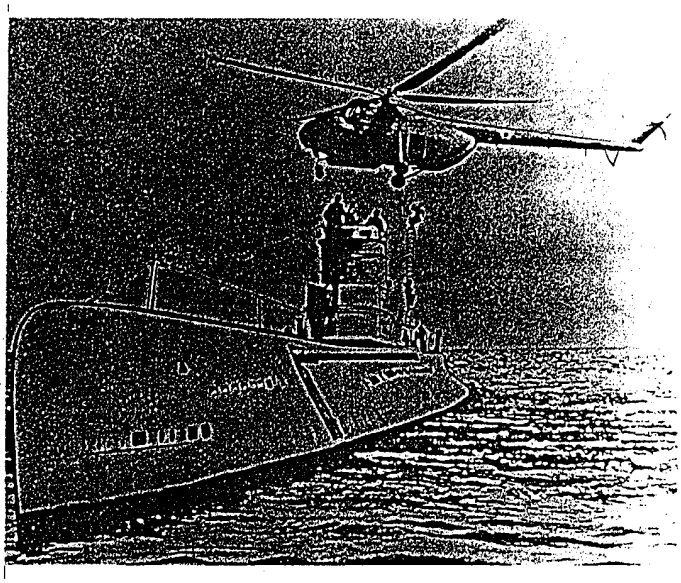

Figure 19. Hound Helicopter in Liaison with a Submarine

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Figure 20. Yak-100 Helicopter

Figure 21. Horse (Yak-24) Helicopter

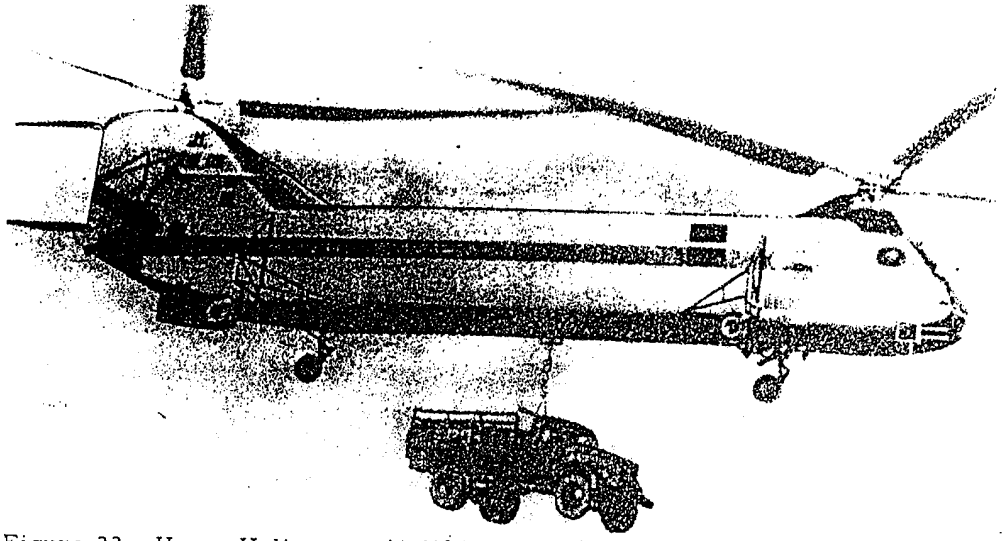

Figure 22. Horse Helicopter Airlifting a Truck

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Figure 23. Hook (Mi-6) Helicopter

Figure 24. Hook Helicopter

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Figure 28. Hen (Ka-15) Helicopter

Figure 29. Hen Helicopter Equipped with a Litter

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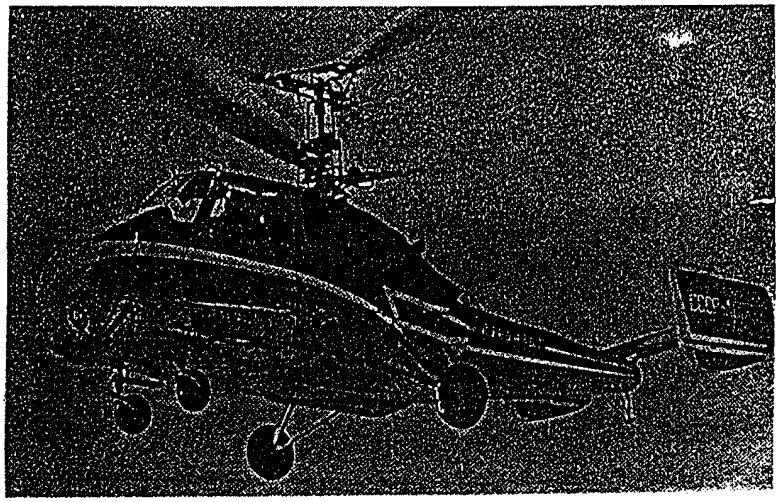

Figure 30. Hog (Ka-18) Helicopter

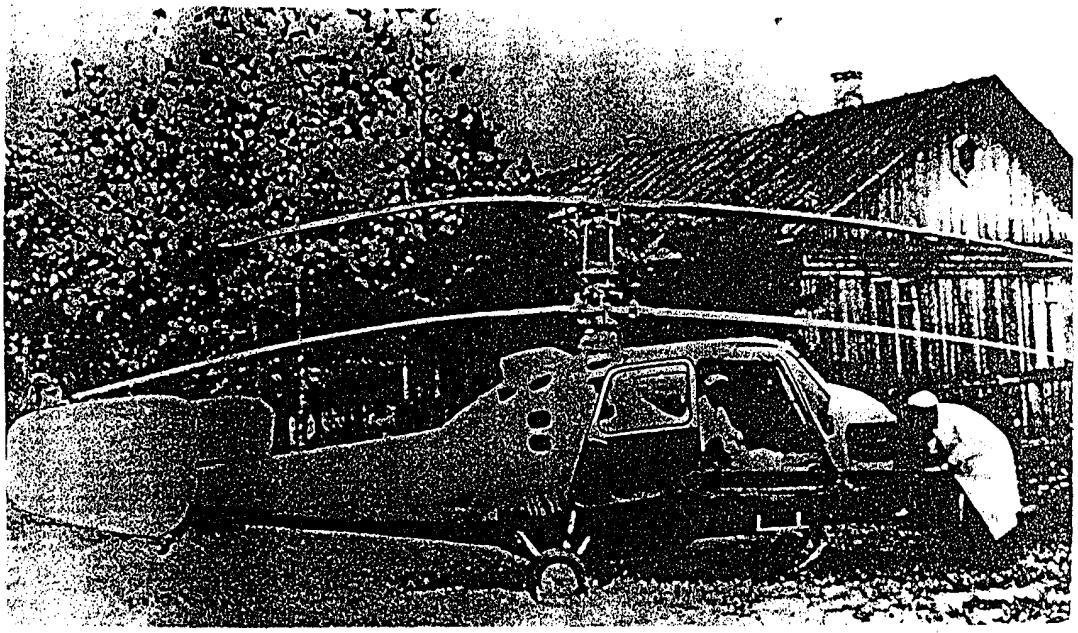

Figure 31. Hog Helicopter Evacuating Wounded

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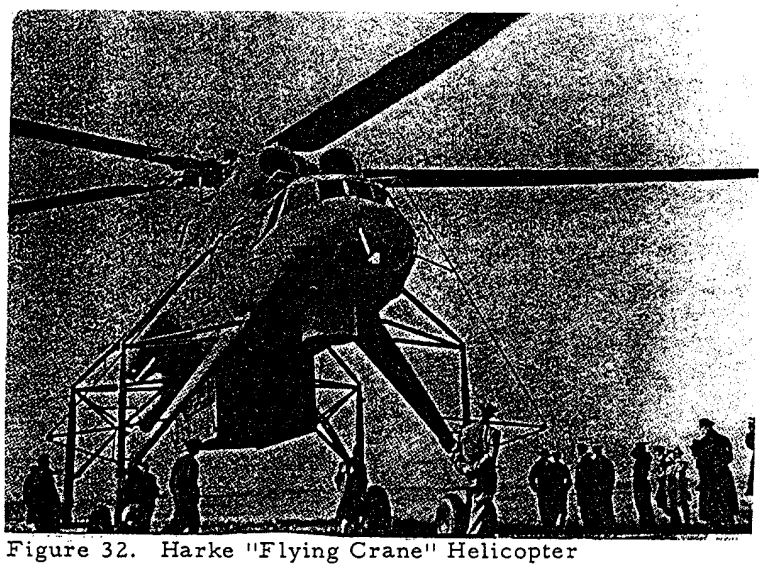

Figure 32. Harke "Flying Crane" Helicopter

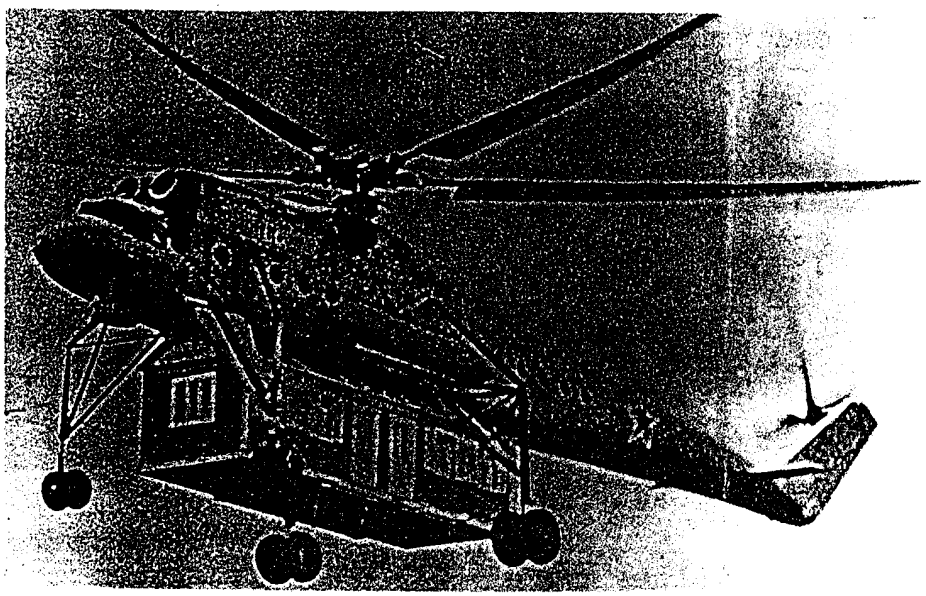

Figure 33. Harke Helicopter Transporting a Small House at the 1961 Tushino Air Show

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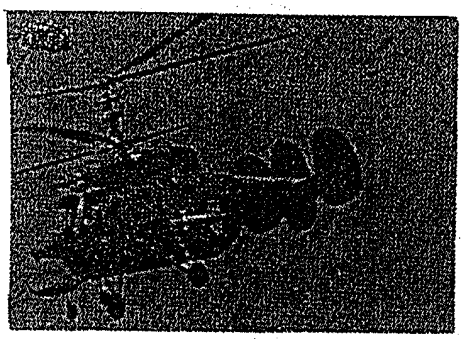

Figure 34. Harp Helicopter

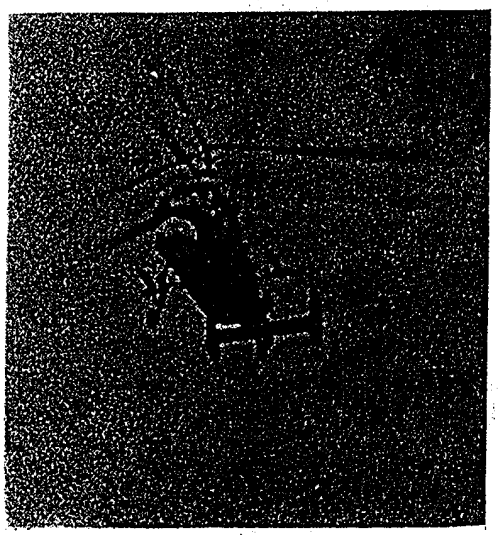

Figure 35. Harp Helicopter Carrying Two Air-To-Surface Missiles

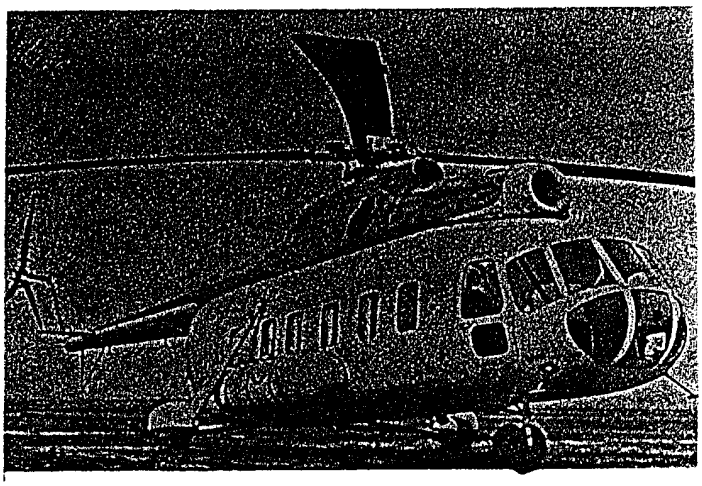

Figure 36. Hip (V-8) Helicopter

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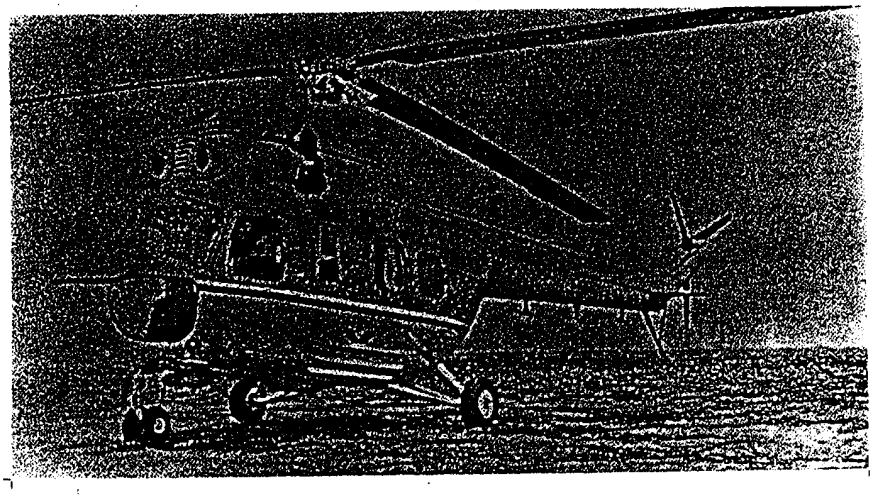

Figure 37. Hoplite (V-2) Helicopter

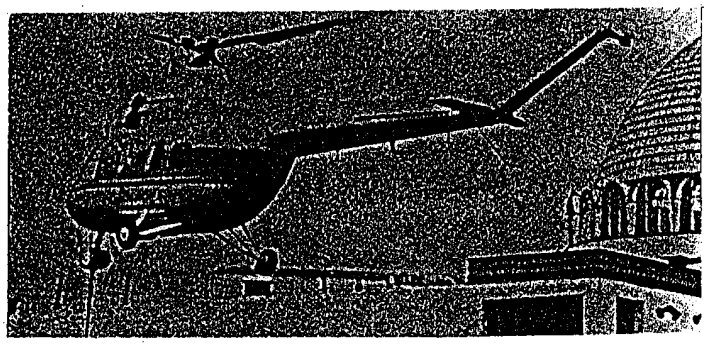

Figure 38. Hoplite Helicopter in Flight

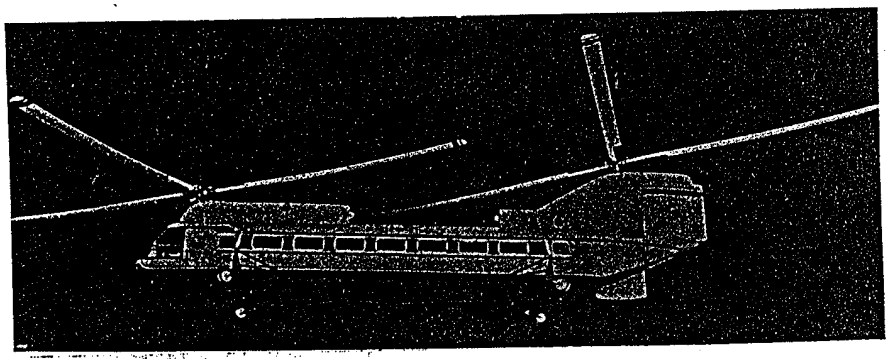

Figure 39. Turbine Horse (Yak-24P) Helicopter

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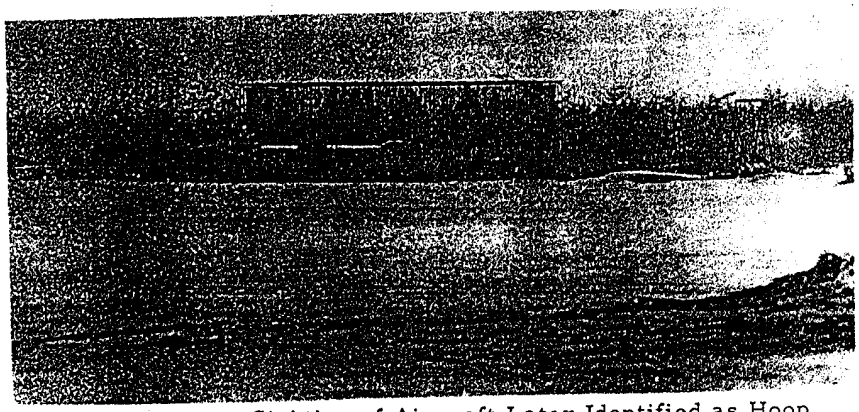

Figure 40. First Sighting of Aircraft Later Identified as Hoop, at Moscow/Lyubertsy Airfield

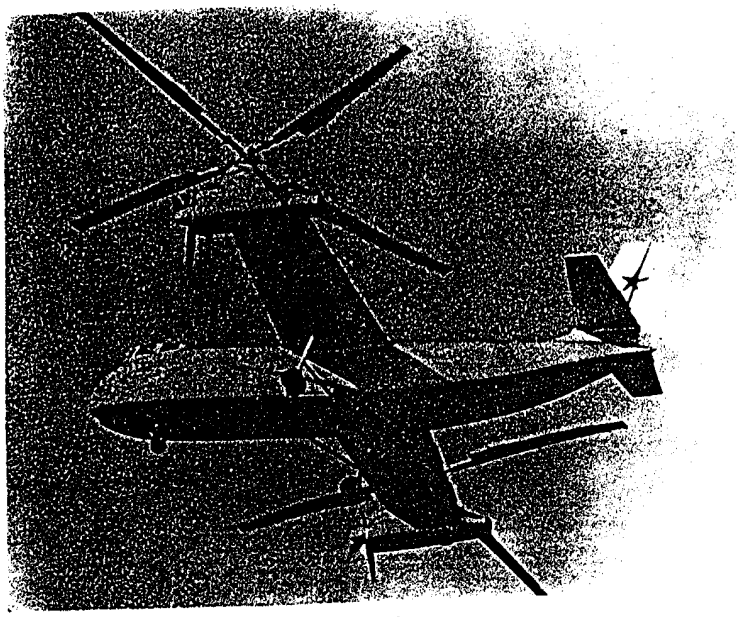

Figure 41. Hoop STOL Aircraft

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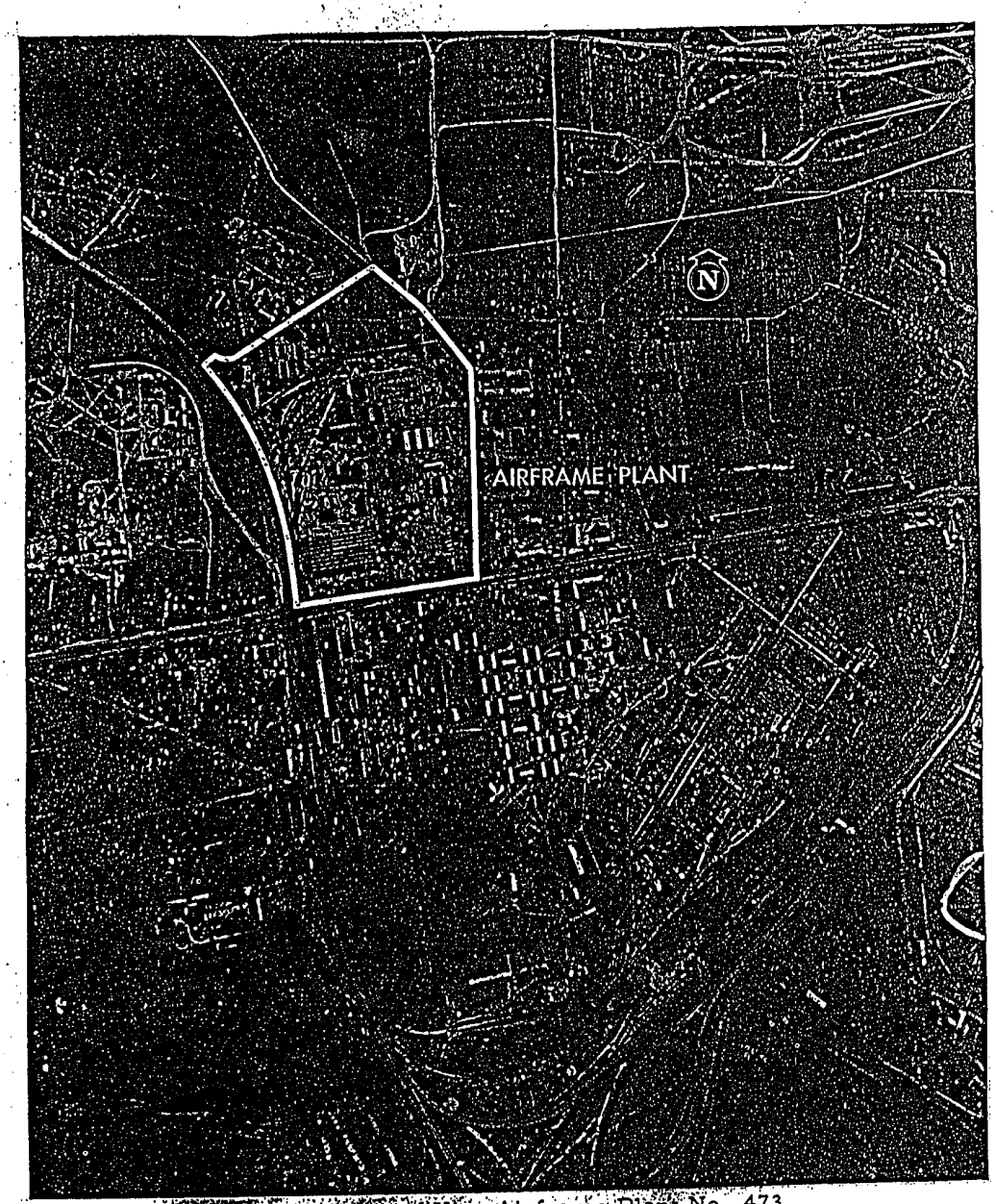

Figure 42. Aerial Photograph of Kiev Airframe Plant No. 473

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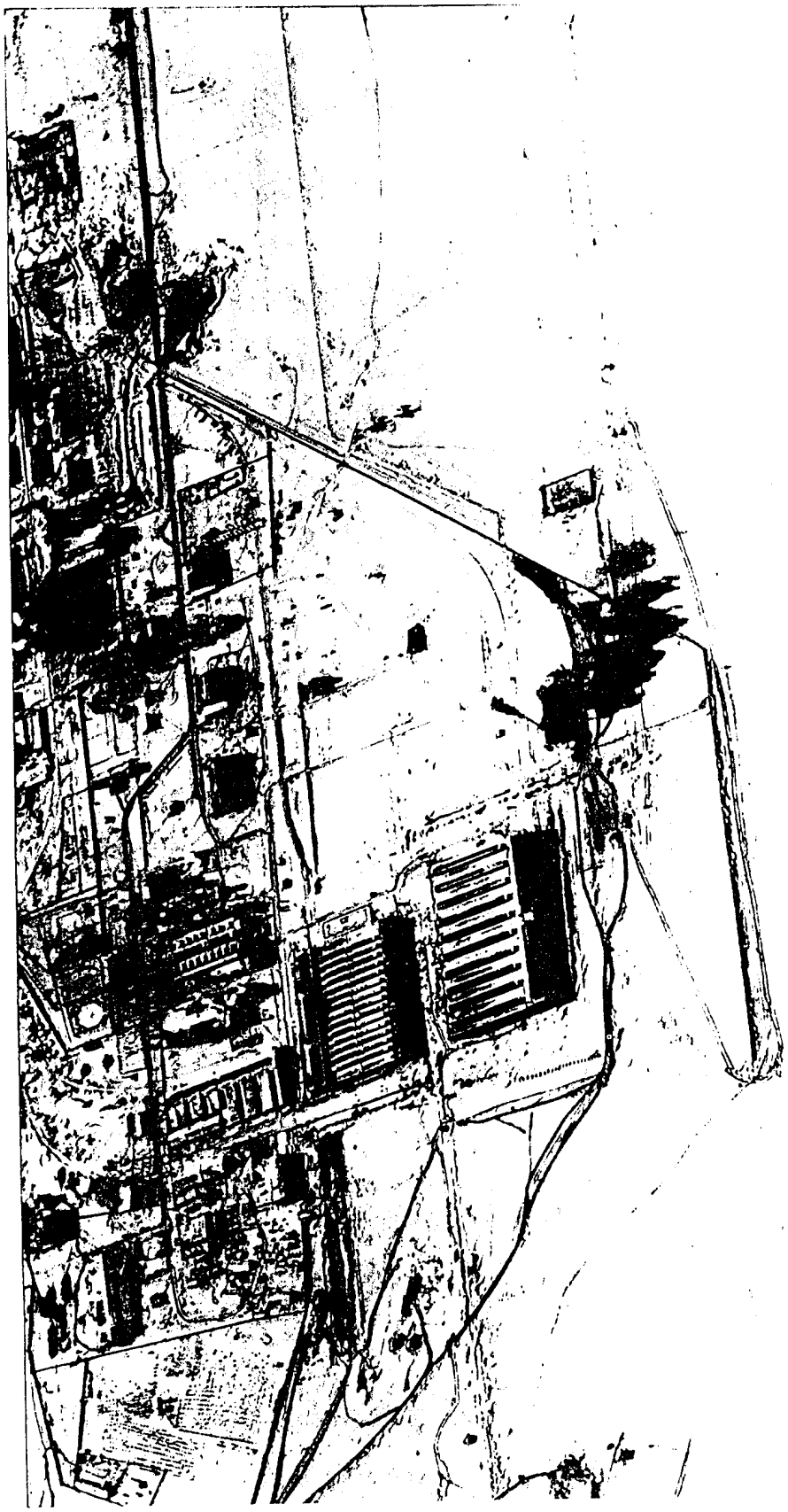

Figure 43. Aerial Photograph of Chkalov Airframe Plant No. 47

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Figure 44. Aerial Photograph of Rostov Airframe Plant No. 168

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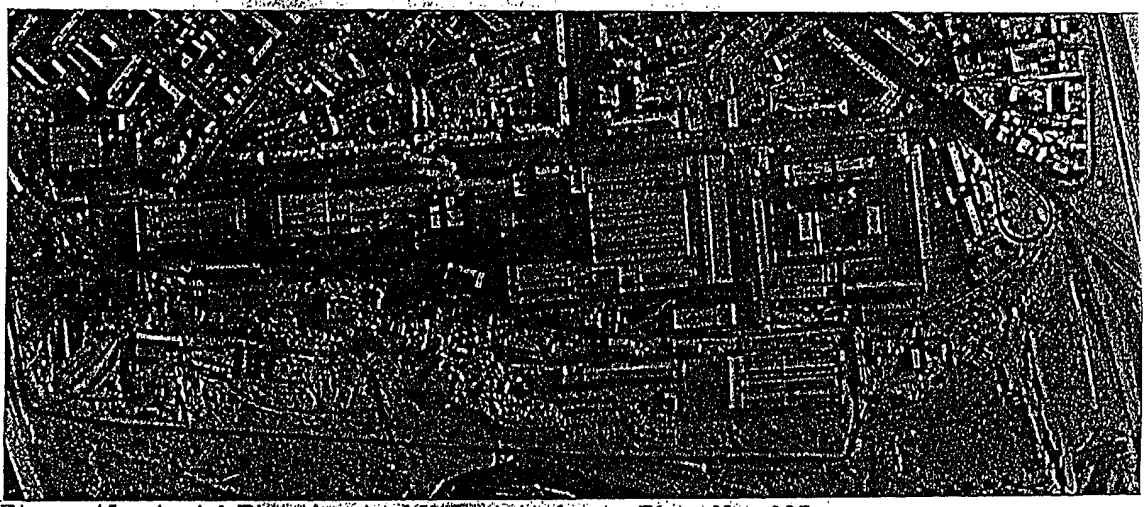

Figure 45. Aerial Photograph of Kazan' Airframe Plant No. 387

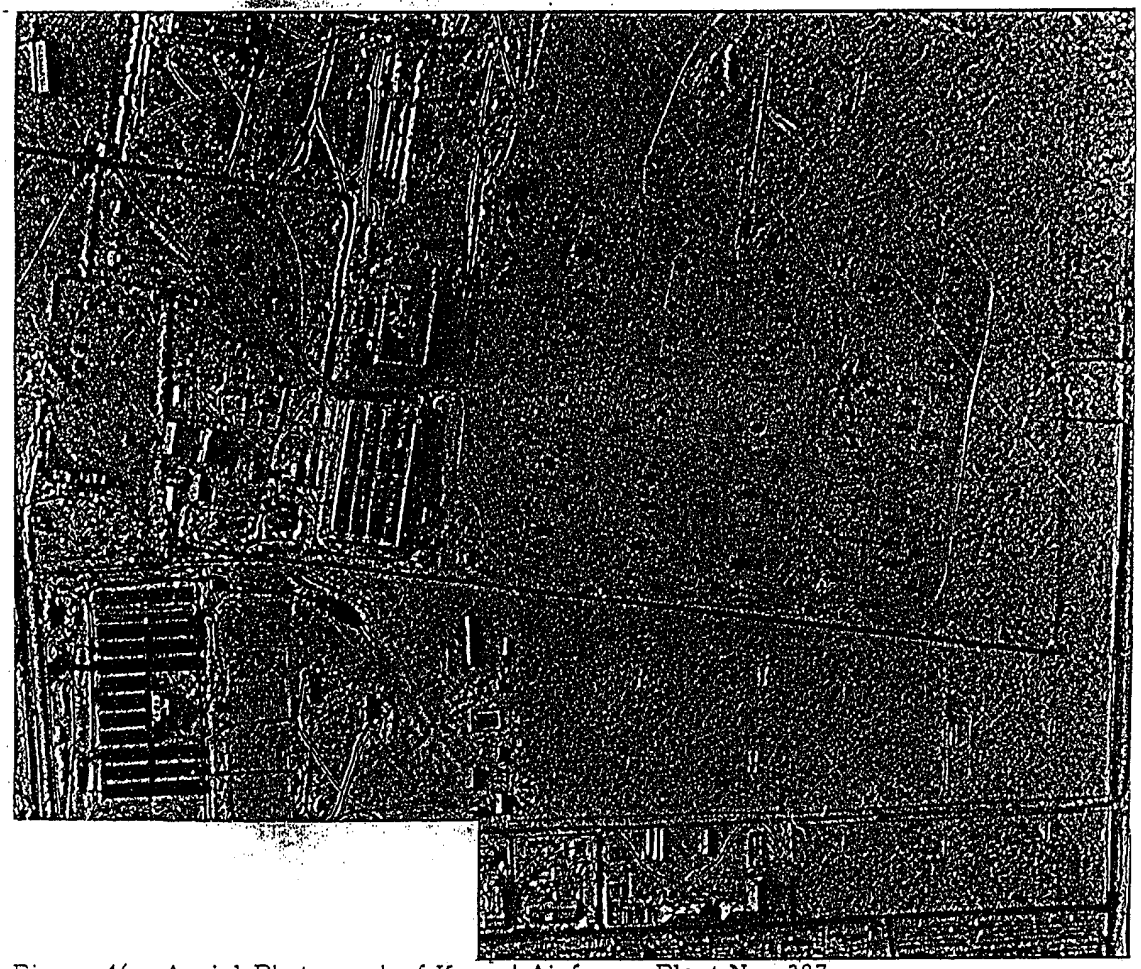

Figure 46. Aerial Photograph of Kazan' Airframe Plant No. 387

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Figure 47. Aerial Photograph of Leningrad Airframe Plant No. 272

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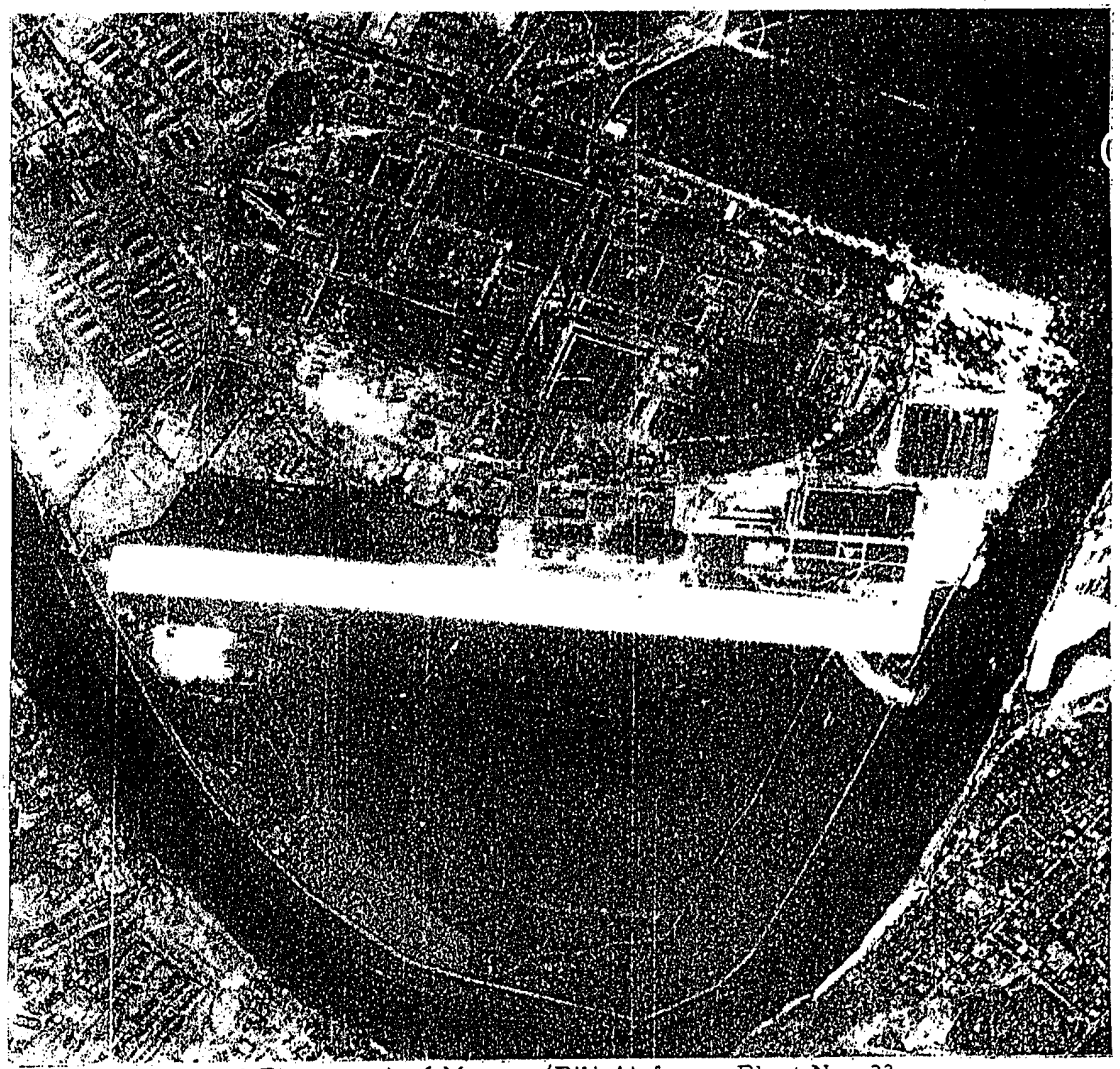

Figure 48. Aerial Photograph of Moscow/Fili Airframe Plant No. 23

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APPENDIX E

METHODOLOGY

The methodology employed in estimating the production figures that appear in this report is based on US experience in the manufacture of aircraft. This methodology utilizes the learning curve, the airframe weight, the man-hours per pound, and the estimated plant floorspace.

Estimates of airframe plant floorspace before 1954 are based on metrical analysis of German photography during World War II and on prisoner-of-war interrogations. Estimates made since 1954 are based on observations and photography

The identification of particular airframe plants as production sites of Soviet helicopters is based on all-source intelligence.

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Data concerning the characteristics and performance of Soviet helicopters are based on studies by the US Army and Air Force.

Data relating to the use of Soviet helicopters are based on all-source intelligence. open-source Soviet literature, and knowledge concerning the employment of helicopters by the US Armed Forces provided much of this information.

* For the costing methodology employed in estimating expenditures for procurement of Soviet helicopters, see source 74/.

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APPENDIX G

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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