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NATIONAL AIR & SPACE INTELLIGENCE CENTER (AF ISR AGENCY)
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AUG 25 2009

John Greenewald, Jr.
[REDACTED]

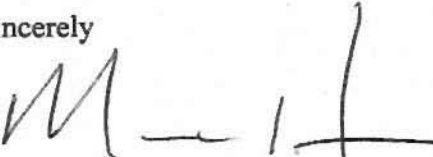
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Sincerely


MARK E. HESS, Colonel, USAF

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MIG-23 - The Mystery in Soviet Skies

FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH

11 DEC 1981

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FOREIGN TECHNOLOGY DIVISION



MIG-23 -- THE MYSTERY IN SOVIET SKIES

by

Jiri Hornat



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MIG-23 -- THE MYSTERY IN SOVIET SKIES

Jiří Hornát

The Facts

The great display staged by Soviet aviation on 19 July 1967 in Domodedovo culminated in introduction of four prototypes of a formerly absolutely unknown heavy two-engine jet fighter aircraft. The almost standard feature of all Soviet supersonic aircraft up to that time was delta wings or at least considerably swept-back wings and, thus, it was rather surprising to see wing surfaces with a relatively small sweepback and a considerable depth of profile along the entire length on an aircraft which, as the local commentator claimed, attained speeds on the order of Mach 3. At first sight the new fighter aircraft resembled the heavy American fighter aircraft A-5 Vigilante. Its almost square fuselage and the unusual shape of the intake ports were actually reminiscent of the North American design, but it soon became obvious that both the thickness and span chord ratio as well as that of the vertical empennage areas of the Soviet type were much smaller. The new aircraft differed from the Vigilante also by the number of rudder tails projecting from the upper corners of the rear part of the fuselage and deflecting outward at a relatively sharp angle.

Nothing except the configuration of the aircraft itself gave an indication as to which Soviet design bureau was the originator of this most interesting of all Domodedovo debutants. However, Western aviation journalists remembered the words of Alexander Yakovlev, uttered in Paris at last year's Salon de l'Aeronautique. The Soviet designer then stated that his newest and also last combat aircraft, a military machine capable of attaining the Mach number 3, would appear at Domodedovo (and that his design bureau would subsequently specialize exclusively in the design of civil transport aircraft). Thus, the mystery surrounding the

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new aircraft seemed to be solved, as Foxbat, the code name assigned to this aircraft by NATO, was the only aircraft at the entire show about which the commentator stated that it was capable of attaining three times the speed of sound and, finally, seeming to warrant meeting of such expectations. Notwithstanding, there appeared to be some doubts in the circles of specialists whether an aircraft of such conventional configuration could actually perform as claimed.

However, let us return to the time preceding the Domodedovo show by two years and a quarter. In April 1965 it was announced in Moscow that a two-engine jet aircraft, designated as E-266, set a new speed record in a 1,000 km closed circuit by an average speed of 2,320 km/h with an on-board load of 2,000 kg. The aircraft was piloted by Alexander Fedotov (who, among others, set on 7 October 1961 a still valid record by flying the E-166 aircraft at an average speed of 2,401 km/h in a 100 km circuit). All seemed to confirm the common consensus that the E-266 is a version of the two-engine delta-wing assault fighter introduced in prototype above Tushino in 1961, bearing the NATO code designation Flipper and known worldwide as the MIG-23. However, this MIG-23 Flipper failed to show up at the Domodedovo show at all.

Additional news regarding the aircraft E-266 surfaced in autumn of last year. On 5 October it was again Alexander Fedotov who, using this aircraft, attained an altitude of 30,010 m (with a load of 2,000 kg). Undisclosed booster means were used in take-off. On 1 November Mikhail Komarov, using the same aircraft, flew a 500 km closed circuit at an average speed of 2,930 km/h, thus topping the record of the YF-12A of 2,644.220 km/h and, three days later, the E-266 again flew with a load of 2,000 kg a 1,000 km circuit. The attained average speed of 2,910 km/h represented another substantial topping of the speed record of the YF-12A (2,718 km/h) set by American pilots on an identical circuit and with identical load on 1 May 1965. Together with the news of the record performances there also appeared photographs of the record-breaking aircraft. They showed one of the surprises from Domodedovo -- a huge angular machine with two rudders, still ascribed to designer Yakovlev. However, a far greater surprise was the official text of the captions accompanying the photographs. Namely, it proclaimed that the depicted aircraft bore in the Soviet air force the service designation... Mikoyan MIG-23.

Old Friend from Tushino

So, a MIG-23. But we already know this designation, the readers are sure to object. After all, it belongs to a large, simply designed single-seater assault

fighter with a long fuselage terminated by exhaust pipes of two in-line engines, characterized by a large radar cone protruding from the intake ports in the nose and a not too large triangular wing carrying two large guided air-to-air missiles, which was demonstrated above Tushino in 1961. The E-266 Foxbat differs from it in its configuration to the point that in no case could it be one of its versions. After all, the MIG-23 is a direct, if considerably enlarged, developmental continuation of the popular "twentyone" shown in at least five photographs, even though very indistinct at times (e.g., see *Křídla vlasti*, no. 18/1961, p. 14 at lower right). After all, already sometime in 1964 there was commonly not a doubt that Flipper (MIG-23) formed a part of the weapons systems of the fighter equipment of the Soviet antiair defense. And also, after all, for this MIG-23 there is a large number of variously published reconstructions with relatively detailed (even though only approximate) three-view sketches and equally detailed estimated technical data.

The most reliable and credible of such reconstructions is probably contained in the article "MIG-23 Flipper", printed in the 9th issue of the 20th volume of the British monthly "Flying Review International" (published in May 1964). According to this article, the Flipper was to have a length of approximately 19.8 m, wingspan 9.1 m, wing surfaces 39 m² and a take-off weight of 17,500 kg. Two engines of the same type as those in the MIG-21, i.e., with afterburning each with an output of 5,700-6,000 hp were to provide the aircraft with a maximum speed of Mach 2.4 (allegedly limited only by use of aluminum alloys in the aircraft's design) and a maximum rate of climb of 180 m/s, i.e., performance still more than just acceptable even today. With its two two-stage (this allegation is also a very logical deduction made by the article's author R. M. Braybrook, B.Sc., of the A.F.R.E.S.) guided missiles the Flipper undoubtedly was "the best single-seater short-range assault fighter aircraft in the world."

It certainly was the best (known) interceptor aircraft in the world, but it hardly could have been the MIG-23 when now this identical designation is applied to an other vastly different aircraft. At any rate, what was the subsequent fate of that most mysterious aircraft from Tushino in 1961? In addition to the four-engine Boudier it was the only aircraft of the last Tushino show to ever appear in Domodedovo. Did it actually ever wind up in line service? That is disputed by the fact that its engines failed to thunder above Domodedovo.

What then did become of this high-performance aircraft which, allegedly, together with Tupolev's Fiddler (official designation allegedly TU-19) and anti-aircraft missiles was to form the backbone of Soviet antiair defense? Was it actually replaced by improved variants of its older brother -- MIGs-21PF and SPS?

It is not even possible to unequivocally refute the, at first sight rather incredible, contention that Flipper was "pushed out" by the newly demonstrated Sukhoi Su-11! On the contrary, such contention is borne out by several details. We do know that each Soviet routinely used type is the result of a competition participated in by several design bureaus with their projects. It is preceded by an announcement of tactical and technical conditions which, among others, do definitely specify the number (and probably also the type) of engines. Flipper and Su-11 are two-engine aircraft. Participation by Flipper and the absence of today's Su-11 in Tushino might have simply been due to the fact that the former already reached the prototype stage in the summer of 1961 while the latter did not. The Su-11 is already in line service; this is borne out by the overflight of a nine-aircraft formation of these fighters spanning the sky above Domodedovo by a wide band of red smoke from smoke generators (similar stunts were performed in Tushino in 1961 by MIG-21 aircraft). The thrust of both of its engines can amount to a total of 19,000 kg (in the case that the engines involved are actually the TRD-31 used in Su-9 and Su-7, as is believed by Western sources; to us the exhaust pipes of the Su-11 appear somewhat narrower), and somewhat less is still more than enough to attain a maximum speed in the vicinity of Mach 2.5. (Aviation Week even puts it at Mach 2.8.) Even though the Su-11 has a somewhat rough configuration (traces, no doubt, of a certain amount of improvisation in its development from the Su-9 from which it retained its wing and tail surfaces) it is almost remarkable how well they comply with the principle of surfaces. And the decisive reason for the Su-11's winning the competition could have been, at otherwise equal performance of both aircraft, its direct descent from the Su-9 in design as well as in production!*

* While Western commentators are of the opinion that the counterpart of the Su-11 was the original conventional version of Mikoyan's STOL fighter with delta wings, comparison of this single-engine, very suitably dimensioned type the fuselage of which is used also by the MIG aircraft with a variable wing geometry, with the Su-11 seems to be rather forced.

What still remains to be clarified is how did this designation as MIG-23 actually come about. The answer is much easier to find. It is sufficient to leaf through the relevant volumes of Jane's All the World's Aircraft. Volume 1963/64 shows a view of the Flipper from three sides still with the designation MIG-7. The next, 1964/65, states: "It is believed that MIG-23 is used by the Soviet air force as a standard defensive interceptor for short ranges." A somewhat different allegation is found in Jane's 1965/66: "Referrals to the Flipper as MIG-23 appear premature." And, finally, the subsequent volumes fail to list this type at all, meaning that if it still exists it probably does not play any significant role. The fact remains that official Soviet releases did not ever refer to it as a MIG-23. Thus, we are of the opinion that we can confirm that MIG-23 is actually E-266 (Foxbat).

MIG-23 versus YF-12A

Breaking of the record set by the YF-12A aircraft in May 1965 which Peter Ostapenko accomplished by almost 200 km/h assumes even more significance when we take into consideration the already mentioned average speed of 2,930 km/h achieved by M. Komarov on a 500 km circuit. The altitude record of A. Fedotov probably does not bear comparison with the record set by the YF-12A (24,450 m), because the American aircraft flew at that altitude horizontally, while in the case of the Soviet aircraft it was most probably the apex of a relatively steep curve begun by "zooming" at full thrust of both engines in which the lifting force of the wings played a minimal function.

Nevertheless, all records set by the Foxbat represent very high and impressive performances by a supposedly conventional interceptor, if we consider that they outperform such a highly specialized and aerodynamically sophisticated aircraft as is the American YF-12A. The record set in a closed 500 km circuit is made interesting primarily by the fact that MIG-23 was capable of maintaining its average speed of Mach 2.76 even in a cross bank of 40° (as 500 km approaches the minimally possible turn diameter flown at such speeds), i.e., at a lateral overload of 1.3 g. The American XB-70 Valkyrie's minimum turning diameter at Mach 3 and a 20° bank was around 250 km. From the fact that the YF-12A flew in absolute record (direct flight through a 15/25 km base) at a speed higher by 25% than it flew in closed circuits, it can be deduced that the E-266 could attain in straight horizontal flight speeds of up to Mach 3.4.

A truly amazing finding made in setting the record on a 1,000 km circuit was the fact that the new MIG-23 can maintain the speed of Mach 2.74 for more than 20 minutes, because, as is well known, almost 20% of fuel of the take-off weight is consumed during climbing and gathering speed. Thus, it appears probable that the flights started with additional pods of fuel tanks, which seems to coincide with reports that auxiliary means were used in take-off.

The E-266 was announced at the air show as an all-weather interceptor. Western sources describe it as a combination interceptor/assault/reconnaissance aircraft. Its closest design equivalent would most probably have been the twin-engine Hawker P.1129 the development of which was scrapped for the benefit of the later also scrapped TSR.2.

The E-266 approaches this British type by its take-off weight which is estimated at 45,000 kg (the maximum take-off weight of the VF-12 is alleged to be 61,500 kg). This allegedly corresponds to the utilization of two improved P.166 engines (known from the E-166) each of which is to have a normal thrust of more than 10,000 kp and another 2 x 5,000 kp are provided without a doubt by an efficient afterburning system. This roughly coincides also with the estimated maximum diameter of the engines (approximately 1.8 m) and their exhaust pipes (not quite 1.4 m) which almost exactly coincide with the dimensions of the J-58 engines with a thrust of 14,800-15,420 kp using afterburning of 19,050 kp each utilized in the Lockheed VF-12A. Computation of the preceding data is based on an overall length of 24.4 m, whereby the wingspan must be approximately 15.3 m and the wing surfaces 79 m². (Length and wingspan of the VF-12A are 29.5 and 16.9 m respectively.)

If we exclude application of variable sweepback, then the wing shape used for the Foxbat is one of the best designs for a multipurpose aircraft with good take-off and landing properties. The profile thickness of MIG-23's wing surfaces must be on the order of 4% (or even less) and can make good use of flap flow and leading edge tilting.

The shape of the fuselage indicates adherence to the principle of surfaces (particularly "flushing" at the intake port level). Suction of air for the power units occurs through two high ports with controlled input parameters. The lower ends of these ports are reinforced by braces protruding from the fuselage the remaining part of which is actually formed by a box of a rectangular diameter and

with bulging lower edges housing the main landing gear legs. The semi-imbedded combat load (most probably instrumentation) is located between them.

An interesting feature is use of two directional tail surfaces. Their use was necessitated by the huge and wide "box" of the fuselage. Namely, the vortices generated at large incidence angles behind such a large body not only cancel, but can even reverse the efficiency of the rudder. In the case of the Vigilante aircraft this loss in rudder efficiency is eliminated by its great height. Soviet designers availed themselves of less conventional, even though used possibilities, such as, e.g., in one version of the Hawker P.1134 (which, by the way, was to attain speeds of Mach 3.5). A pair of large auxiliary surfaces below the rear of the fuselage helps maintain directional stability. The large elevators obviously are of the floating type.

Far less clear is the problem of armaments. The demonstrated aircraft carried no missiles, but the dark stripes at the bottom side of the wings could be traces of external mounts. Also, the angular bodies protruding at the end of the wing over the leading and trailing edge strongly resemble guide rails for missiles. Of particular interest in this respect is the photograph showing the E-266 with relatively large "fins" at the wing tips. However, the photograph did unfortunately undergo some thorough retouching so that it is impossible to say with any amount of certainty whether they are stabilizers for large missiles, analogous to the American AIM-47A, or additional surfaces designed to further improve the possibly less than perfect directional stability of the aircraft.

The assumption also remains ^{unconfirmed} that the MIG-23 has a two-men crew. The number of demonstrated aircraft indicates that the E-266 is already in serial production. Three of the Foxbat aircraft that passed over had a laterally flattened nose (higher and narrower), the fourth aircraft, on the other hand, had a wider and lower nose, which would indicate that the aircraft were of pre-series origin. Differences were found in antennas and in the shape of rudder tips (the left one always shows a small protrusion, probably some type of identifier).

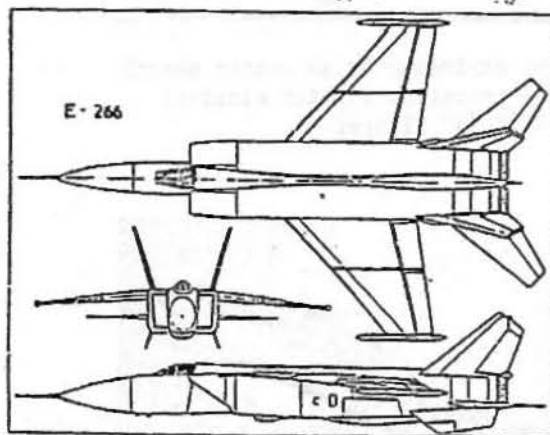
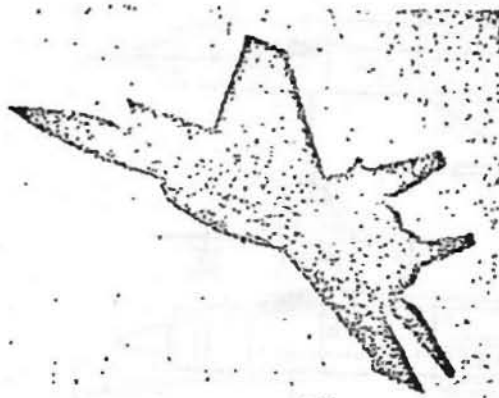
There are more of such uncertainties. But there also remain outright mysteries. The biggest one of them is the statement cited in the opening of the article as voiced by A. S. Yakovlev in Paris. Was his Mach-3 aircraft also only one of the participants in the competition as was Flipper some years ago? But

even if so, it just could not have been completely eliminated in the one single month that elapsed between Paris and Domodedovo...

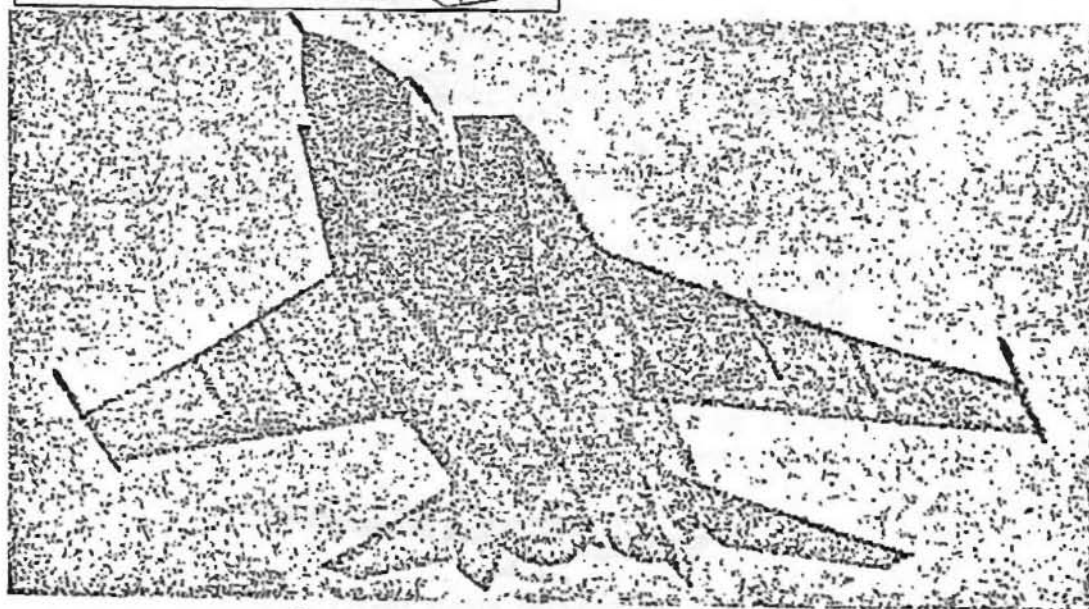
Another matter needing clarification is the record set by the E-266 in 1965. Did the speed of 2,401 km/h mean that the prototype of the Foxbat did not have at its disposal then the engines it uses today? But the E-166 used to fly with a power unit having a thrust of 10,000 kp already four years earlier. Did the development of an effective afterburning system take such a long time, or are the engines currently used by the MIG-23 much stronger than has been estimated?

We do not know. However, one thing is certain. The same as in space research, Soviet designers achieved results similar to those attained by Americans but by a much less demanding, simpler and also cheaper and more reliable approach. While it is true that this may not necessarily be the optimum future approach, we need not assume that MIG-23 is the last word of the Soviet concept of design.

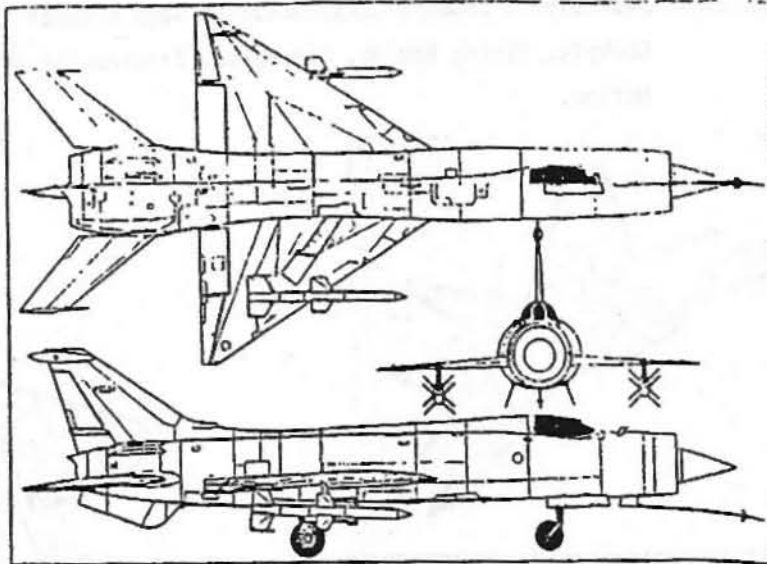
Photo Credits: Aviatsiya i kosmonavtika, Aviation Week & Space Technology,
Cockpit, Flying Review, Interavia, Interconair Aviazione i
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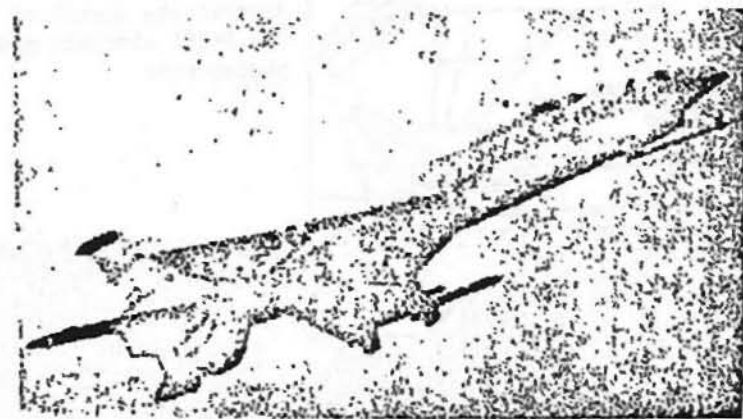
Approximate sketch of three views of
the E-266 aircraft made on basis of
photographs



The snapshot that caused a sensation



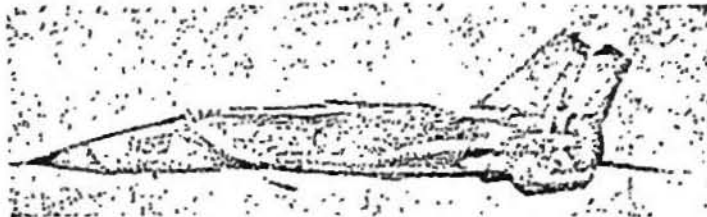
The probably most faithful depiction by an extant sketch showing three views of the prototype fighter aircraft bearing the designation "MiG-23" Flipper



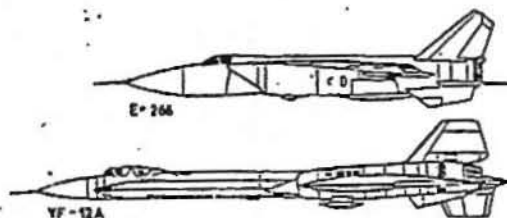
This not commonly known snapshot of the Flipper comes from the Dutch periodical Cockpit. It certainly replaced this high-performance interceptor...



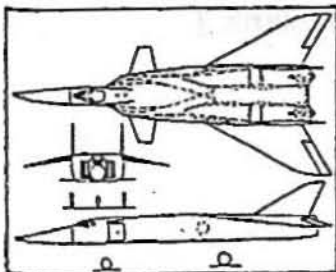
...or the twin-engine Sukhoy Su-11?



A relatively strongly retouched photo shows only one small surface area under the nose cone (other aircraft had two or none) and a different arrangement of antenna housings on the rudders



Side-view comparison of the MIG-23 (E-266) and Lockheed YF-12A which has already officially demonstrated its capability of exceeding Mach-3 speeds, drawn to same scale



Sketch of the first version of Hawker P.1134 which was in development in 1959-1962. The aircraft of an overall weight of 14,000 kg was to be powered by the Rolls-Royce engine RB.146 with a thrust of 5,990/7,530 kp and two ram-jet propulsion units. Its length and wingspan were 19.65 and 9.14 m. The one-seater aircraft was to be used for aerial surveillance at speeds between Mach 3 and 4



This snapshot appeared in issue 10/67 of Aviatsia i kosmonavtika, a monthly of the Soviet air force. Deserving of notice are the small vertical surfaces at the wing tips

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