

LEFT: One of the Polish TS-11 Iskra prototypes; production aircraft are almost identical. RIGHT: The C.S.S.-12 "flying laboratory" assisted in development of the Iskra

# Jet Trainers from the East

by Jerzy B. Cynk

BEFORE THE WAR even the smaller countries tried to produce the whole range of aircraft types, military and civil, themselves. Some, such as Holland, Poland and Czechoslovakia, achieved a notable degree of success. Nowadays the complexity and high-development cost of modern aircraft have forced the smaller countries to be less venturesome and more selective in their choice of what to build.

With these factors and potential markets in mind, it is not surprising that the jet trainer is a type at which almost every nation is trying its hand. Three newcomers to this highly contested field—the Polish TS-11 Iskra, the Czech L-29, and the Yugoslav Soko Galeb—are worth a closer look, particularly as they emanate from the Communist world and as each machine represents the most ambitious and sophisticated post-war creation of its respective national industry. All three machines are now in quantity production, and it seems that they will all be put on the export market, competing with their western counterparts for orders from uncommitted countries.

## TS-11 Iskra

Perhaps the most advanced and interesting of the trio is the Polish TS-11 Iskra ("Spark") two-seat *ab initio* jet basic trainer, developed under the leadership of Dipl. Ing. Tadeusz Soltyk. Original studies for the aircraft began at the I.L.

(Aviation Institute) in Warsaw in 1956, at a time when the Polish industry was busy tooling up for the piston-engined TS-8 Bies trainer.

Various layouts were investigated, but selection of a suitable powerplant presented the most difficult problem. It was envisaged that the TS-11 would be powered initially by an engine of foreign manufacture and later by an indigenous light turbojet. The Viper was favoured from the beginning and serious negotiations commenced with Bristol Siddeley for the delivery of a few examples of this engine. Other possibilities were also considered, and both Russia and the French Turboméca firm were approached in this connection, but it was soon found that neither would be willing to provide a power plant. Talks with Bristol Siddeley eventually broke down and the future of the Iskra hung in the balance, depending on the successful development of the national turbojet, the design of which was broadly based upon that of the Viper.

Towards the end of 1957 the entire Polish aviation industry was reorganised and all design activities conducted at the I.L. were transferred to the newly formed O.K.L. (Aircraft Design Centre), established at the W.S.K. Warsaw-Okecie plant. Teams working on Iskra and its engine were enlarged, and during the following year detail design was completed and a full-scale wooden mock-up of the

machine was built. The first flight was planned for the end of 1959.

In the meantime the C.S.S.-12 twin-engined light transport, serving as a flying laboratory, was employed on an extensive test flight programme aimed at perfecting Iskra's design and equipment. The first Iskra prototype, powered by a Polish-designed axial-flow turbojet with a thrust of about 900 kg. (1,985 lb.), was moved from the assembly shop to the flight hangar in the last days of 1959. After some delays, the machine flew successfully in February 1960 with A. Ablamowicz at the controls. The machine was revealed to the public during the Aviation Days' flying display in September of that year.

Further prototypes were constructed at the Warsaw-Okecie factory and, as the result of very promising trials, the Iskra was ordered into production for the Polish Air Force as a standard *ab initio* basic trainer, from which pupils would graduate directly to MiG fighters. Quantity production is being undertaken at the W.S.K. Mielec plant and deliveries are now in full progress. The first Iskra (one of the prototypes) was formally handed over to the Polish A.F. in March 1963 and by July of that year some ten aircraft of this type had been supplied to military training centres.

Little has been said officially about Iskra's construction. Information released indicates that the machine is an all-metal mid-wing cantilever monoplane with retractable tricycle landing gear. The wings, of thin section, are provided with hydraulically operated ailerons, flaps and

## SPECIFICATIONS

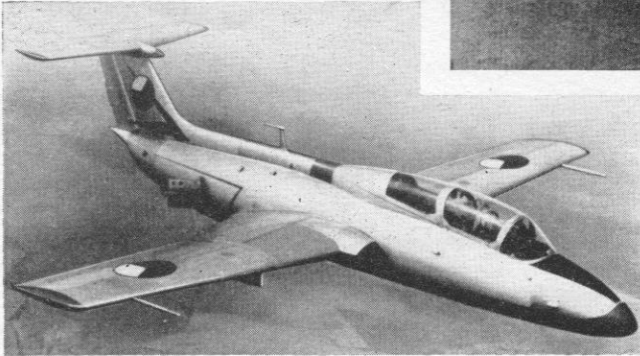
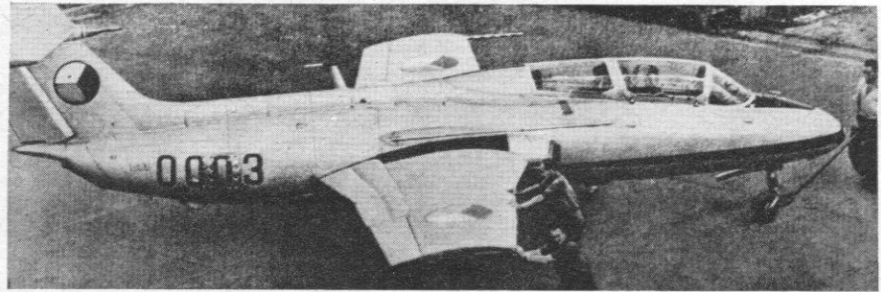
TYPE	ENGINE		DIMENSIONS				WEIGHT		PERFORMANCE			
	Type	lb.s.t.	Span ft. in.	Length ft. in.	Height ft. in.	Wing Area sq. ft.	Empty lb.	Max. Loaded lb.	Max. Speed at m.p.h.	ft.	Service Ceiling ft.	Max. Endur- ance
TS-11 Iskra	Unknown	2,000*	32 10	36 1	10 10	N.A.	N.A.	7,495	497	N.A.	39,370	N.A.
L-29	M-701	1,918	33 10	35 5½	10 2	213.1	5,070	7,912	423	16,400	39,700	2½ hrs.
Soko Galeb	Viper II	2,500	34 1†	34 0	10 10	209.1	5,485	8,200	505	20,340	39,370	2½ hrs.

\* Approximate value.

† 38 ft. 1½ in. with tip tanks.

N.A. Not available.

Two views of Czechoslovakia's L-29, known unofficially as the "Delfin". The top photo is of the third prototype which is representative of the production model. The L-29 is reported to be the winner of a competition with the Russian Yak-30 and Polish Iskra for a standard Communist bloc jet trainer



original military design to appear in Czechoslovakia since 1950. The XL-29, powered by an imported engine of undisclosed make and thrust, took the air for the first time on 5th April 1959, flown by R. Duchon. The ex-

resembling that of the MiG-15UTI, accommodates two in tandem, and is fitted with full dual controls and ejection seats. Power is supplied by a single M-701 turbojet with radial compressor and single-stage turbine. The early production variant of the M-701, which is the first turbojet of Czech design, develops 870 kg. (1,918 lb.) s.t. at 15,300 r.p.m., but the 950-kg. (2,095 lb.) version of this engine will be fitted to later L-29s.

air brakes. Fuel is carried in integral tanks in the wings and in a tank in the fuselage.

The pressurised and air-conditioned cabin, seating two in tandem in lightweight ejection seats, is enclosed by a one-piece, hydraulically operated rearward-hinged canopy. Complete dual controls and instrumentation are fitted and the rear seat is raised. The cockpit layout is modelled upon that of the latest MiG fighters to facilitate transition to operational types.

Although most published photographs of the Iskra are prepared in such a way that the armament of the aircraft remains obscured, it is apparent that the machine carries forward-firing armament in the nose and a pylon under each wing for stores such as bombs or rockets.

Pilots' reports indicate that the 500-m.p.h. Iskra has very good handling characteristics, including extreme tractability at low speeds, which, combined with high performance, make it sufficiently flexible to carry a trainee through primary and basic stages to an advanced standard. The aircraft made a profound impression upon representatives of air forces of several Warsaw Pact nations during its demonstration tours but it does not now seem likely that it will secure general adoption.

tensively modified second prototype, the L-229, powered by the indigenous M-701 turbojet, made its maiden flight in July 1960, and this machine was more representative of the forthcoming production model.

During the following year the third prototype, brought up to full production standard, joined the test programme and was eventually accepted by the Czech Air Force. Orders were placed for a substantial number of L-29s, and the first production aircraft was completed at the Kunovice plant in April 1963—a month ahead of schedule.

The L-29 is an all-metal mid-wing cantilever monoplane somewhat similar in general configuration to the Macchi M.B.326. The wings of NACA 64-2-A217 section at the root and NACA 64-2-A212 section at the tip, feature aerodynamically balanced ailerons and hydraulically operated flaps. The fuselage, of semi-monocoque light alloy stressed-skin construction, is structurally reminiscent of that of the MiG-15 and is provided with hydraulically operated air brakes on both sides at the rear.

The pressurised and air-conditioned cabin, enclosed in a two-piece canopy

Fuel is carried in the fuselage in two tanks of a total capacity of 1,030 litres (226.5 Imp. gal.) and these may be supplemented by two 150-litre (32.9 Imp. gal.) auxiliary tanks carried one under each wing. Armament comprises a camera-gun in the nose of the aircraft, and under each wing there is a set of attachment points to carry bombs or rockets, when auxiliary fuel tanks are not fitted.

The fortunes of the L-29 will undoubtedly play a significant part in the future of the entire Czech aviation industry. If the trainer fares well—as it is already reported to have done—the Czechs may decide to press on with their design activities more vigorously and their ambitious current projects, such as VTO machines, tilt-wing aircraft and air cushion vehicles, may stand a better chance of becoming flying hardware. A batch of early production L-29s was delivered to the Soviet A.F. in late 1963 for evaluation.

#### Soko Galeb

Yugoslavia, although a Communist country, has a different international status from that of Poland and Czechoslovakia and rightly or wrongly is regarded by the Western powers as an "uncommitted"

(continued at foot of page 181)

#### L-29

Another two-seat *ab initio* jet basic trainer, the Czech L-29—according to recent reports—has now been chosen as the standard trainer for Communist bloc countries. It appears that the L-29 and Iskra have been built to a very similar, if not the same, specification. Development of both types ran almost in parallel. However, the Czechs were more fortunate in obtaining a foreign turbojet for the first prototype of their trainer, the XL-29, and this permitted them to start flight tests almost a year earlier.

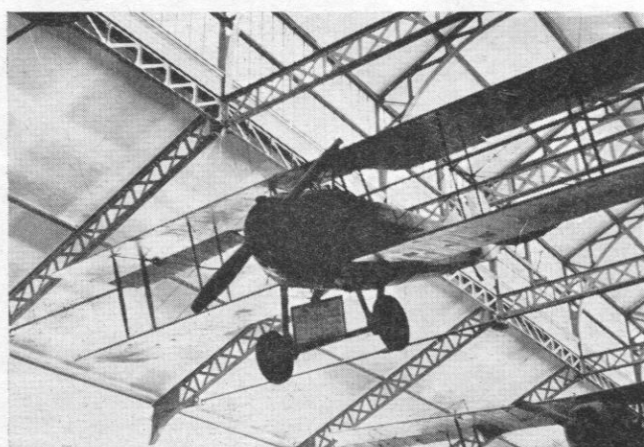
Evolved at the former Letov plant at Letnany under the supervision of the two best-known Czech designers, Zdenek Rublic and Karel Tomas, the L-29 is the first

Seen here at the 1963 Paris Air Show is the Yugoslav Soko Galeb, with two .5-in. guns in the nose and powered by a Bristol Siddeley Viper





Built by Clayton and Shuttleworth, Sopwith F.1 Camel B5747 became SC 11 in Belgian service



SPAD XIII C-1 Sp.49 was one of a batch delivered to Belgium's 10th Squadron in 1918

**Hawker Hurricane IIC.**—One of three Hurricanes delivered to Belgium after the war, it has no armament and no serial is visible. The code letters "ML-B" are not the original ones. One of the three aircraft was TH522.

**De Havilland Mosquito NF.30.**—Delivered to the Belgian A.F. on 4th September 1953, the c/n. is 4597 and the Belgian serial MB 24. It served with No. 11 (night-fighter) squadron of No. 1 Wing at Beauvechain.

**Percival Proctor Mk. IV.**—Delivered to the Belgian A.F. in August 1947, the R.A.F. serial was NP171 and the Belgian serial P4. It served with the communication squadron of No. 15 Wing at Melsbroek.

**Airspeed Oxford Mk. I.**—This aircraft (c/n. 936) arrived from England on 3rd September 1947, serial 016, and served with No. 13, and 7 Wing and also with the Coxyde O.T.U.

**North American Harvard T6-D.**—An ex-R.A.F. machine (Mk.III) with serial EZ256, it served at the Brustem A.F.S. as H21. Delivered on 11th March 1947

it was declared obsolete on 24th November 1959 and went to the museum at the end of that year.

**Stampe-Renard SV.4B.**—Serial V-56 (c/n. 1198), this aircraft was one of sixty-five orange-yellow trainers supplied to the Belgian A.F.; it was delivered to the E.T.S. in February 1954.

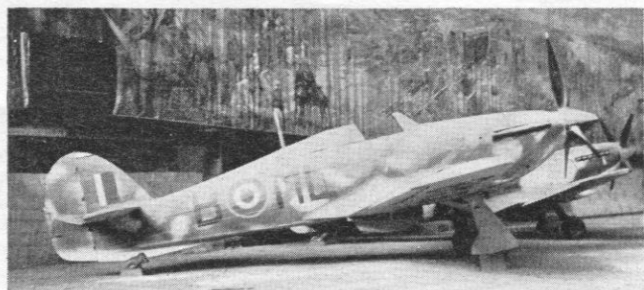
**Gloster Meteor F.8.**—Built by Avions Fairey, this aircraft (serial EG224) was the first of fifty-seven built in Belgium. Coded "K5-K"—13th Fighter Wing, No. 33 Squadron—it is camouflaged dark green and grey, with silver undersurfaces, and has a red arrow-head on the nose. It was pre-

viously used by the 1st Fighter Wing and the Fighter O.T.U.

**Republic F-84G-11RE Thunderjet.**—Ex-U.S.A.F. 51-10195, it sported the code UR-K of No. 2 Squadron from Florennes, serial FZ71. Delivered under M.D.A.P. on 25th August 1952, it went to the Museum in 1954.

**Hawker Hunter F.4.**—Built under licence by Avions Fairey (c/n. AF/HOF 59), its serial is ID46. It was delivered on 24th January 1957 and served with No. 7 Squadron of No. 7 Wing at Chièvres, coded 7J-F.

**Hurricane IIC** (serial unknown), one of three delivered to the Belgian A.F. in 1946



## Jet Trainers . . .

(continued from page 179)

nation. This privileged political position enables the Yugoslavs to acquire engines for their Galeb trainer from Britain or France without too much difficulty.

The work on the Galeb (Gull) began in 1958. The design, using a Bristol Siddeley Viper engine, was obviously inspired by the Macchi M.B.326. Three Viper A.S.V.11s, rated at 2,500 lb. s.t., were purchased initially, the first being delivered in the late autumn of 1959. The prototype Galeb flew for the first time in May 1961 and was joined the following year by a second machine, which was brought up to the production standard.

The production prototype was demonstrated at le Bourget during the 1963 Paris Air Show, and in the summer of that year the Galeb entered production at Mostar. Last November Bristol Siddeley

announced that they had received an order for a substantial number of Vipers through the purchasing agency, Jugoimport.

Like the Iskra and L-29, the Galeb is an *ab initio* jet basic trainer intended to fulfil requirements of the entire training syllabus from elementary to advanced level, including armament training and aerobatics. The machine is a low-wing cantilever monoplane with retractable tricycle landing gear. The wing, a two-spar metal structure with metal skin, is provided with ailerons with sealed aerodynamic balances and with hydraulically operated flaps. The fuselage, built in two main units—a forward assembly of nose and mid sections, and a rear section—is of semi-monocoque light-alloy stressed-skin construction. A hydraulically actuated air-brake is fitted below the forward part of the fuselage.

Two cockpits in tandem, equipped with dual controls and instrumentation, and

with Folland lightweight ejection seats, are enclosed by a two-piece canopy. The fuel is carried in two flexible tanks in the fuselage and in two droppable 220-litre (48.4 Imp. gal.) auxiliary tanks on the wingtips. Armament comprises two fixed 12.7-mm. Colt-Browning guns in the nose, and bombs or rockets carried underwing. Various armament combinations are being prepared to make the aircraft suitable for ground-attack duties.

The Galeb, which is expected to enter service with training elements of the Yugoslav Air Force this year, holds high promise of success. For obvious reasons the machine stands no chance of being adopted by any of the Warsaw Pact countries, but the reliability of well-proven Western powerplants backed by the aircraft's excellent performance, may well turn the scales in its favour among neutral nations seeking new trainers for their air forces.