Development and use of Czechoslovak helicopters 1945-1971

Vojtěch HÁJEK

1 The Masaryk Institute of Advanced Studies, Czech Technical University, Kolejní 2637/2a, Prague 6, Czech Republic

vojtech.hajek@cvut.cz

Abstract. This paper focuses on the development and use of Czechoslovak helicopters, which at least reached the phase of unfinished prototypes. Czechoslovakia saw the development, if not always full-scale production, of a number of helicopters from the period after the Second World War. The story is of historical and technical importance because it demonstrates the missed opportunity of Czechoslovakian aviation technology. Though some of these designs did not make it beyond the so-called drawing board while others entered mass production, all the projects fell victim to Soviet political pressure, which ultimately lead to the end of the helicopter manufacturing industry in former Czechoslovakia.

Keywords

Helicopters, Svazarm, aircraft manufacturing, aviation history, post-war Czechoslovakia

1. Introduction

The development and use of Czechoslovak helicopters is until now a very little explored part of Czechoslovak aviation history [7]. Already during the Second World War, Ing. Jaroslav Šlechta, learned about German helicopters during his forced labour deployment in the German city of Halle between 1942 and 1943. After the Second World War, the development of helicopters in Czechoslovakia started under his command. The Czechoslovak first contact with helicopter technology took place already in the second half of 1940s when they managed to get two German helicopters (Focke Achgelis Fa-233 Drache, known as Avia VR-1 in Czechoslovakia) working [6] German helicopters provided basic experience with helicopter use and operation. The idea of purchasing foreign helicopters was already under consideration during 1947. The Bell 47 was chosen following a selection procedure [1]. However, the purchase was not carried to completion owing to the shortage of foreign currency and the growing power of communists, which came to its nationwide climax in February 1948.

2. XE-II

Typing the basic text, the style Basic has to be used. If the basic text is interrupted by an equation or by a figure, then the onward text should be of the style Continuing (the paragraph is not indented). The first of Šlechta’s projects, known as Praga I exp., came into existence in 1945. An interesting helicopter with two counter-rotating, side-by-side intermeshing rotors (7.4 m rotor diameter), whose axles were inclined from the vertical axis, got no further than the documentation. Šlechta’s next project, called Praga E-I, was designed as a two-seater, powered by an M-107 engine (81 kW), which drove two intermeshing rotors. A model and a
set of engine-reduction gear box-rotors were created. Development suffered from a shortage of workers and was subsequently moved to Aero in Vysokočany where work on a new type – the XE-II – began [9].

The XE-II project was to be based on a simple design because the existing completed projects borrowed too much from the complex designs of German helicopters, e.g., Flettner Fl-282 Kolibri ("Hummingbird") or twin-rotor helicopter Focke Achgelis Fa-233 Drache ("Dragon"). The easier solution was the design with a single main rotor and anti-torque tail rotor configuration, which was successfully used, for example, in American helicopters such as Sikorsky R-4 or Bell 47. In the immediate post-war period, there were no helicopter pilots in Czechoslovakia. František Janča was the first pilot in Czechoslovakia who passed his examinations (flying with Bell 47) and obtained a helicopter pilot licence in Sweden at the turn of 1947 and 1948 [5].

Owing to this fact, manufacturing was transferred to the National Centre for Research, Development and Testing in Aerospace (VZLÚ – Výzkumný a zkušební letecký ústav). From 1945 development accelerated. In March the first launch and helicopter ground testing took place. Capt. Václav Němeček performed the first real take-off on 3rd December 1954 and noted the good flight characteristics of the prototype. However, he did perceive the increased level of vibration from the two-bladed rotor as a shortcoming. This problem was solved by the installation of a three-bladed main rotor. Basic data about the helicopter is as follows: 8.8 rotor diameter, 10.5 helicopter length, 370 kg of empty weight, max. 560 kg take-off weight and max. 130 km/h speed in ground level [11].

Some of the helicopter test flights took place in the Danube delta in Romania in 1956, where the prototype assisted in the reed harvest. Operation in this demanding space verified the reliability of the individual helicopter units. The only objection was the absence of floats. The model enjoyed a relatively high public profile after it was introduced at the Brno trade fair in 1957. The landing of the helicopter on the Bílá labuť department store in Prague by Zdeněk Pondělíček proved a very popular stunt [5].

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3. HC-2/HC-102

The development and operation of the XE-II provided a lot of invaluable experience for the development of a new type of helicopter, the HC-2. The construction of the prototype started in Aero in Vysokočany already in 1951, but it was postponed because of the MiG-15 Soviet fighter plane production.

Fig. 2. A unique photo of XE-II-F helicopter. Source: Propriety of Vojtěch Hájek

Fig. 3. Landing of HC-2 helicopter on Bílá labuť department store. Stalin monument in the background – Letná (Prague). Source: Křídla vlasti journal 21/1957.

After the successful military tests flights of the HC-2, the helicopter started to be mass produced in Moravan Otrokovice in 1956 (producer of the world famous Zlin aircraft, 26 series or later the Zlin Z-50 acrobatic airplane). A group of technicians led by Jaroslav Dobrovolský came to VZLÚ, where they got acquainted with the new machine. Mass production began in 1957, and the first helicopter in the series was finished in mid-1958. The Czechoslovak army purchased helicopters because they wanted to use them for liaison and training purposes. Altogether 17 helicopters were manufactured. Beside the HC-2 helicopters, the Czechoslovak army also purchased the Soviet Mil Mi-1 helicopters in 1959 [4].
Fig. 4. HC-102 in Liberec aeroclub. Source: Propriety of Jiří Cicvárek.

After problems with motors in 1960, the HC-2 helicopters were given to 50th Liaison Air Regiment [10]. Following 50 hours of flying time, they were given back to the manufacturing facility for reconstruction into the HC-102. This was a new type of helicopter which was complemented by a more efficient engine, the M-110H (81 kW), and the performance of other modifications. The already existing HC-2s were converted into the standard HC-102 in addition to 21 further HC-102s built as new [8]. The army, however, modernised and did not take on the newly manufactured helicopters. On the grounds of standardisation of military air force armament and the need to prepare reserve pilots, it was decided to transfer the elementary training of liaison helicopter pilots to Svazarm aero clubs (Svaz pro spolupráci s armádou - Union for Cooperation with the Army) [2]. Svazarm was the largest paramilitary organisation in communist post-war Czechoslovakia. Owing to this fact, HC-102s were given to aero clubs where they were used until the early seventies. Then they were removed because of technical problems. HC-102s were replaced with Soviet Mil Mi-1, which were flown in aero clubs until 1975 [6].

Fig. 5. The second prototype of HC-3 helicopter taking a flight test. Source: Propriety of Ing. Ivo Pujman.

Even though the air force planned to count the HC-3s among its arsenal, Mil Mi-1 were prioritised. There were many reasons why HC-3 helicopters were not deployed in a military capacity. The first one was political pressure to use Soviet technology and also of the preference, as previously stated, which was given to helicopter production in USSR and Poland. The development of the HC-3 stopped in 1962 and in 1965, and the development of the HC-4 definitively stopped in the early seventies. Another reason was the unreliable M108 engine, which caused accidents of a few prototypes. In response to the problematic engine, it was decided to replace it with a Soviet AI-14 nine-cylinder radial piston motor (221 kW). The modification of the helicopter, carried out by Ing. Richard Schön, was known as the HC-3A. Furthermore, the second and the third prototypes that passed corporate and state testing and satisfied British BCAR Section G regulations were rebuilt. Helicopters received civil registration OK-VZA and OK-VZB and were gradually modified for medical, military (with Soviet UB-16 rocket launchers) or agricultural use. Helicopters gradually finished operations and at the beginning of seventies they were handed over to the aircraft museum in Kbely [5].

Fig. 6. The second prototype of HC-3 helicopter in an agricultural role. Source: Propriety of Ing. Ivo Pujman.

4. HC-3

After the successful development and launch of the HC-2 helicopter, a new idea for a prototype called the HC-3 came into existence. A multi-purpose helicopter with three (up to four) seats was created and its chief constructor was Ing. Jaroslav Šlechta. The first prototype, known as the HC-3 with test registration OK-15 and a defective M-108 engine took off on 16th May 1960 with test pilot Zdeněk Pondělíček. Subsequently, the second prototype, OK-16, which took off for the first time on 10th February 1961 with test pilot Jiří Bláha, was completed. The third prototype, OK-17 followed on 13th March 1961 with test pilot Zdeněk Pondělíček. A universal helicopter was made. It was designed to fulfil a wide range of civil and military tasks. The basic data about the helicopter are as follows: 11.6 m rotor diameter, 13.4 m length, M 108 DHK engine (202 kW), empty weight 1033 kg and take-off weight 1423 kg [5].
5. **XZ-35/XZ135**

In the late fifties, the HC-2/102 started to be manufactured in Moravan Otrokovice. The first experimental type was the XZ-35, unofficially called Helitrener. Owing to the high importance of HC-2/102 production, its production was delayed. The first prototype of the XZ-35 was flown with an M-332 motor. The first flight took place on 7th October 1960. This project was noteworthy for its unusual engine placement, namely in the lower part of fuselage. Ing. J. Mikula, who conceived the designed, received a patent for its originality and technical advantages. The helicopter was in service until the end of 1964. After transfer to a manufacturing facility, it was decided to rebuild it into the XZ-135 version. This reconstruction took place in the first half of 1965. The main modification was the installation of the M-337 motor, which had its power on land reduced to 117.76 kW. The helicopter ended its operation in 1974 and was finally handed over to an aircraft museum in Kbely [12].

![Fig. 7. XZ-35/135 helicopter. Source: Propriety of Ing. Ivo Pujman.](image)

6. **HC-4**

The last significant construction of a Czechoslovak helicopter that never took flight was the HC-4. Inspiration for its design came from a French helicopter called the Sud Aviation SE-3130 Alouette II. The original idea was to install the M-601 turboprop aircraft engine (which, for example, powered the L-410 transport plane) into a HC-3 helicopter, but in the end it was decided to design it from the ground up. Jaroslav Tekla’s design of six-seat helicopter with three-bladed rotor (10.60 m rotor diameter) was chosen from among the presented designs [5].

![Fig. 8. HC-4 fuselage. Source: http://www.vrtulnik.cz/](image)

Development of the helicopter took place between 1968 and 1971, when VZLU cooperated with Orličan factory in Chocen (glider and light sport aircraft manufacture). HC-4 development aimed to fulfil the requirements of the British BCAR Section G regulation, which would enable potential import to the West from behind the so-called Iron Curtain. In 1971 VZLU fabricated a full-scale wooden model of the HC-4 and Orličan factory started to produce this prototype. In autumn of 1971, the project was terminated for the same political reasons as the HC-3. The already manufactured components of the HC-4 (fuselage, rotors and reduction gearbox) were given to the aircraft museum in Kbely, where they are exhibited to this day [11].

<table>
<thead>
<tr>
<th>Helicopters</th>
<th>Number of build</th>
<th>Year of first flight</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>XE-II</td>
<td>1</td>
<td>1949</td>
<td></td>
</tr>
<tr>
<td>HC-2</td>
<td>17</td>
<td>1954</td>
<td></td>
</tr>
<tr>
<td>HC-102</td>
<td>34</td>
<td>1961</td>
<td>With HC-2 conversions.</td>
</tr>
<tr>
<td>Z-35/135</td>
<td>1</td>
<td>1960/1965</td>
<td>Only one prototype.</td>
</tr>
<tr>
<td>HC-3</td>
<td>3</td>
<td>1960</td>
<td>Three prototypes.</td>
</tr>
<tr>
<td>HC-4</td>
<td>1</td>
<td>X</td>
<td>One incomplete prototype.</td>
</tr>
</tbody>
</table>

Tab. 1. A list of Czechoslovak helicopters. Source: [5] and [12].

7. **Conclusion**

The development of helicopters is often a neglected constituent of Czechoslovak aviation. Helicopters were one of the sectors, where Czechoslovak industry already oriented on sport aviation since the inter-war period could be developed in a distinctive way and prove successful all over the world. The large number of unfinished projects testifies to this possibility. The completed projects: XE-II, HC-2/102, HC-3 XZ-35/135 and HC-4, on the contrary, demonstrated that in their time they were at the peak of nationwide helicopter development. On a number of counts, mass production of the HC-2/102 and its use in S vazarm aero clubs was a great success (a lot of trained pilots). With respect to technology, a subsequent development of the HC-3 and primarily the HC-4 is also important. High potential was assumed for the development of these prototypes, but it failed because of the political intervention of Soviet Union.

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About Author

VOJTĚCH HÁJEK was born in 1987. He’s studying Ph. D. program History of technology at the Czech Technical University in Prague. He studied at the Technical University of Liberec, Master Specialization for Second Stage of Elementary Schools (Master studies: History - Geography) and single-subject History. He has been focusing on historical geography and modern technical history. Currently, he’s working on history of post-war gliding and development of helicopters in Czechoslovakia.