High-Performance, Twin-Engine, Multi-Purpose Helicopter H145//BK117 D-2

As the demand for civil helicopters is increasing in a wide range of areas, we are working on improving adaptability to performance requirements in these various applications.

The H145//BK117 D-2 is the latest model of the Twin-Engine, Multi-Purpose Helicopter series that Kawasaki and German-based MBB (now Airbus Helicopters Deutschland GmbH) have continued to jointly develop.

We have realized significantly improved performance by the adoption of new engines with improved transmission, reduced pilot workload with the four-axis autopilot in conjunction with new integrated instruments, and enhanced safety with reduced noise by adopting the Fenestron tail rotor.

Introduction

As the safety and reliability of helicopters have improved, demand for civil use of them keeps growing in a wide range of applications such as firefighting and disaster prevention, emergency medical services, police, broadcasting, and transport for people.

In this light, Kawasaki and Germany-based MBB (now Airbus Helicopters Deutschland GmbH) have continued to jointly develop the Twin-Engine Multi-Purpose Helicopter BK117 since 1977. Over 1,300 units of this model have been delivered around the world.

1 Background

In general, helicopter performance declines in the thinner air of high temperatures or high altitudes, and higher engine output is required to maintain the flight condition of zero forward speed, such as hovering and vertical climb. So, when assuming a high-load flight under any combination of these conditions, it is critical to reduce the helicopter's total weight (gross weight) before flying by restricting the equipment, crew, and fuel it will carry.

Medium-sized, twin-engine, multi-purpose helicopters like the BK117, are generally assumed to operate under high-load flight conditions, such as hovering at high altitudes in mountain rescues and vertical take-offs/landings in confined areas. In addition to adaptability to these flight conditions, the market has called for universal improvements to aircraft performance such as higher maneuverability, lower noise, and better safety.

We have further improved BK117 by boosting performance, reducing the pilot's workload, lowering noise, and enhancing safety. These upgrades have culminated in obtaining certification for the H145//BK117 D-2 (model D-2) in Japan in January 2016.

2 Specifications

Table 1 shows the specifications of the latest model D-2 and the conventional Kawasaki BK117 C-2 (model C-2). **Figure 1** shows an appearance of model C-2. The D-2 comes equipped with improved engines and a higher transmission power rating. Regarding the limitation of engine rated power output when one engine is inoperative (OEI), the D-2 applies significantly higher output on demand for 30-second/2-minute OEI power to the operating engine compared to the C-2 (2.5 minutes).

3 Features

The D-2 offers higher performance, reduced pilot workload, lower noise, and lower maintenance costs.

† Realized the world lowest level of noise in its class, better hovering performance and longer lifetime through adoption of a new tail rotor and other components.

Table 1 Specifications of the latest D-2 and the conventional C-2

		D-2	C-2
Length × fuselage width × overall height 〔m〕		13.64 × 1.73 × 3.95	13.03 × 1.73 × 3.96
Seating capacity (standard seat) 〔persons〕		10	10
Maximum gross weight 〔kg〕		3,700	3,585
Maximum speed 〔km/h (kt)〕		265 (143)	269 (145)
Transmission power rating 〔kW (SHP)〕	30 sec power/OEI	662 (887)	-
	2 min power/OEI	574 (769)	-
	2.5 min power/OEI	-	548 (735)
	Continuous power/OEI	441 (591)	404 (542)
	Take-off power/AEO <available time>	838 (1,123) <30 min>	776 (1,040) <5 min>
	Continuous power/AEO	653 (875)	633 (848)
Engine power rating 〔kW (SHP)〕	30 sec power/OEI	800 (1,072)	-
	2 min power/OEI	775 (1,038)	-
	2.5 min power/OEI	-	528 (708)
	Continuous power/OEI	710 (952)	528 (708)
	Take-off power/AEO	667 (894)	528 (708)
	Continuous power/AEO	575 (771)	516 (692)

OEI : one engine inoperative, AEO : all engines operative

Fig. 1 Appearance of model C-2

(1) Better performance

(i) Hovering performance

Although the D-2's maximum gross weight is higher than that of the C-2 by 115 kg, the D-2's out-of-ground-effect hover ceiling at the maximum gross weight is 2,316 m (7,600 ft) under atmospheric conditions where the surface temperature is 35°C (the International Standard Atmosphere Temperature + 20°C). This compares favorably to 2,103 m (6,900 ft) for the C-2.

(ii) Time available for using take-off power

The take-off power refers to the high power output used mainly for taking off, but it is frequently used while hovering and hoisting during rescue operations.

While the C-2's time available for using take-off power is five minutes, improving the transmission in the D-2 has stretched this out to 30 minutes. This improvement is a clear benefit in rescue operations involving difficult extractions and where several people are waiting for help.

(iii) Transport category A operation

The BK117 meets the requirements of Transport category A among the categories specified by the Civil Aeronautics Act. In compliance with the Act, this model is specified to use a safe take-off/landing method that assumes OEI at a location such as a rooftop helipad when other nearby emergency landing spaces are unavailable.

With its improved power rating under OEI, the D-2 can take off and land using this method with a higher gross weight than the C-2's. For example, at an altitude of 1,829 m (6,000 ft) and with a surface temperature of 35°C (the International Standard Atmosphere Temperature + 20°C), the D-2's allowable gross weight is 3,270 kg, which is 560 kg higher than the C-2's.

(2) Reduced pilot workload

The D-2 employs the four-axis autopilot, adding an extra dimension to the C-2's three-axis aircraft attitude control (pitch/roll/yaw). This extra axis is the additional collective pitch control that can alter the thrust. This increased the number of mode selections from the conventional 10 to 15, opening up new range of conditions where pilots can engage the autopilot.

The D-2 also features a new integrated instrument, Helionix (**Fig. 2**). While the C-2 uses seven separate displays to show instrument data, the D-2 reduces this to

Fig. 2 Helionix in the D-2

Fig. 3 Fenestron

three large multifunction displays (MFDs). Pressing bezel keys on the periphery of an MFD enables pilots to quickly select which data to display on the screen. This reduces the workload by providing pilots with operator-friendly visual information according to the situation.

(3) Quieter than ever before

Instead of the two-blade tail rotor installed on the C-2, the D-2 employs a Fenestron (**Fig. 3**). The shroud around the Fenestron's rotor cuts noise. Moreover, rotor blades that are intentionally arranged with uneven spacing, and ten stators with different angles, also reduce noise around the aircraft.

(4) Improved safety

Due to a higher power rating with its new engines, the D-2 has excess power for avoiding collision and improved altitude-maintaining capability at the time of one engine inoperative (OEI). In addition, it uses computerized engine control to offer a training function that simulates the behavior during OEI with all engines operative (AEO). Thanks to this function, the pilot can safely go through the emergency operation training in case of OEI.

Moreover, the four-axis autopilot and Helionix reduce pilot workload to enhance safety, and the adoption of the Fenestron tail rotor reduces the risk of the tail rotor getting in contact with an obstacle when operating in confined areas.

(5) Lower maintenance costs

The D-2 offers lower maintenance costs achieved through extended maintenance intervals arising from improved engine durability.

Conclusion

We are now promoting sales of the D-2, targeting firefighting, disaster prevention and emergency medical services. Various items of optional equipment for these applications are now under development to enhance this aircraft's value to its users.

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