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An emergency medical service helicopter preparing to depart from Kawasaki Medical School Hospital. See *Special Feature* for details (page 2).

The BK117 D-2 model

Life-Saving Wings:

Factors that Make the BK117 a Great Fit for Emergency Medical Services

A helicopter dedicated to emergency medical services (EMS) can transport a physician swiftly to a patient in peril and provides on-board medical care. Kawasaki's BK117 Series helicopters account for about 50% of the rotorcraft engaged in life-saving missions in Japan. What are the factors that make the BK117 a preferred choice? This issue of SCOPE focuses on Kawasaki's superior technologies that ensure reliable and safe operation of these EMS helicopters.

EMS Helicopters Reduce Patient Deaths by 40% Compared to Ambulance Transport

The history of EMS helicopters in Japan goes back to an encounter of two parties: a group of physicians who were distressed over the deaths of many patients during long-distance emergency transport, and public administrators troubled by a growing number of patients seriously injured in traffic accidents. The groups met for the first time through Dr. Sukenobu Kawasaki, the founder of Kawasaki Medical School in Kurashiki City, Okayama Prefecture, and out of this meeting came a project to establish a system for providing helicopter-assisted emergency medicine — the materialization of the EMS helicopter.

Next to the heliport at Kawasaki Medical School Hospital is a monument with a small plate with the inscription, "Birthplace of the EMS Helicopter." Here in April 2001, full-scale operation of Japan's first EMS helicopter was launched. In 2007, the Japanese government enacted the "Act on Special Measures Concerning Securing of Helicopter Emergency Medical Services," which stated the country's view on utilization of EMS helicopters and paved the way for them to be adopted nationwide.

An EMS helicopter is defined by the government's Act as a "system whereby a helicopter equipped with medical devices and pharmaceuticals transports physicians and nurses to an emergency site and then transports physicians and nurses to an appropriate medical institution after providing medical care on the spot." Flying 50-70 km or 15-25 minutes (one way) is considered a standard range for missions.

Emergency care is a race against time. According to a study by a group under the Japanese Ministry of Health, Labour, and Welfare, the average time between a dispatch request and a physician on an EMS helicopter reaching the emergency site and starting treatment is 14 minutes — an average of 27 minutes less than that of ambulance

An EMS helicopter (the BK117 C-2) standing by at Kawasaki Medical School Hospital.

transport. It is estimated that, compared to ambulance transport, the EMS helicopter can reduce patient deaths by 39% and severe injuries/sequelae by 13%.

As of March 31, 2019, such helicopters were operating at 53 sites in 43 out of 47 prefectures. They were engaged in about 25,000 dispatches in fiscal 2016, or 7.5 times the number in 2004.

Currently, of all EMS helicopters used in Japan, 25, including reserve helicopters, are BK117s. SCOPE's editorial team visited a hospital where one of these "life-saving wings" is in use, to find out how the BK117 is meeting the expectations of helicopter operators and medical professionals.

Dr. Ryukoh Ogino
Head of the Emergency Department and
Advanced Emergency Medical Center
Kawasaki Medical School Hospital

Physician-Patient Contact 68 Min. Faster in One Case

Kawasaki Medical School Hospital's Advanced Emergency Medical Care Center is home to Okayama Prefecture's EMS helicopter. The model used is the BK117 C-2, which can seat a pilot, a mechanic, and four other people, including a patient on a stretcher in the rear of the cabin. The cabin houses various devices, including monitors, a syringe pump for high-accuracy intravenous infusions, an artificial respirator, and a suction pump, in addition to pharmaceuticals. The team departs within five minutes after a call for dispatch and reaches the site within 30 minutes if the destination is located in Okayama Prefecture. In fiscal 2017, they handled 362 dispatch requests.

Dr. (Professor) Ryukoh Ogino, the head of the Emergency Department and Advanced Emergency Medical Center at the hospital, explains, "In terms of the type of disease that EMS helicopter service was requested for, traumatic injuries accounted for 55%, followed by cerebrovascular disorders at 15%, and cardiovascular diseases at 10%. To better accommodate these needs, we established a system to facilitate the coordination between the EMS helicopter service and medical facilities at the hospital, including a stroke care unit (SCU) run by the Stroke Department."

Some impressive cases of shortened travel time have been reported: In one, the medical team arrived 68 minutes faster than by other means to make contact with a patient who had an acute myocardial infarction while driving on the freeway. In another case, a patient who stabbed himself in the neck with a knife was transported to the hospital in 57 minutes, achieving a 37-minute reduction in accessing a physician.

The hospital's EMS helicopter is operated by Central Helicopter Service, Ltd., on a contract basis, which provides the helicopter and three staff: a pilot, a mechanic, and a communication specialist (CS). After receiving a dispatch call, the pilot and mechanic get in the cockpit, while the CS in the flight control room judges the feasibility of the flight, based on weather conditions and other factors, and selects a suitable landing site to retrieve the patient.

Manabu Yamasaki, team leader and mechanic, comments, "Everyone on board the EMS helicopter, including the pilot, the physician, and the nurse, works together as a team. I'm a mechanic, but I check the electrocardiogram monitor, and make sure that the IV tube doesn't get tangled, obstructing treatment. I also collect patient information needed by the physician before we reach the landing site, such as overall conditions, blood pressure, and respiratory status. It is also our responsibility as crew members to inform the destination hospital of the patient's name and condition."

United as a Team for Absolute Safety

"Absolute safety" is what the members of an EMS helicopter are called to strive for.

Manabu Yamasaki
Maintenance Enginer
Flight Operation Department
Central Helicopter Service, Ltd.

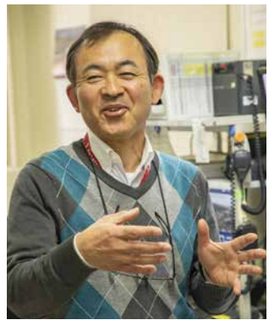
Needless to say, this takes meticulous maintenance of the helicopter by the mechanics. In addition, if the patient is stabilized during the flight, even the physician and the nurse are asked to pay attention to any changes in the surrounding environment.

Pilot Naoto Okabe comments, "I fly expeditiously, but never in a rush. We all have a strong desire to save the patient, but deliberately suppressing that sense of haste is a must in order to fly safely."

Throughout the mission, the CS plays a behind-the-scenes role of supporting safe operations and providing an optimal care environment for the patient. It is for this reason they are called "communication specialists" and not "flight controllers."

The CS receives the call for dispatch. Then, using the hospital's internal radio system, the CS shares the information with the Emergency Medical Center physician and the staff at the heliport (where the EMS helicopter is standing by). The CS then judges whether the flight is feasible, and if so, recommends to both pilot and physician a rendezvous point (with an ambulance that will take the patient to the nearest medical facility).

CS Hideaki Harayama explains, "The ultimate mission of an EMS helicopter is to safely bring a physician and nurse to a patient as quickly as possible. Valuable time is lost if the CS is unable to make a quick decision on whether or not a flight is possible. Even while standing by, the



Hideaki Harayama
Dispatcher
Flight Operation Department
Central Helicopter Service, Ltd.

The flight control room for the EMS helicopters. When a dispatch request is made via the hotline, the CS immediately contacts related parties through the hospital's internal radio system and selects a route and rendezvous point.

The EMS helicopter lifting off after receiving a dispatch call. On this occasion, the helicopter transported a patient to a different hospital, returning shortly before sunset.

CS is constantly monitoring the weather, simulating all possible scenarios to see which landing point would result in the least amount of time in reaching the patient, or whether it would actually be faster to request an EMS helicopter from a neighboring prefecture."

The CS is also responsible for ensuring that 1,100 rendezvous points, including ones in neighboring prefectures, are safe to be used in the event of emergency, and for mitigating any complaints from local residents in conjunction with the administrative departments of local hospitals.

"We inspect about 40 to 50 rendezvous points annually. If any changes occur, such as a newly-installed communications antenna in the nearby area or trees that have grown too tall, we must deal with them," comments Harayama.

These examples show how CSs are equipped with specialized communication skills to assist EMS helicopter operations. It has been five years since Hayarama, previously a pilot, began his CS career. His extensive knowledge of flying and air safety are fully utilized in his role as a CS.

Capability of the BK117 to Meet Diverse Needs

Why are so many units of the BK117 Series adopted as EMS helicopters? The answers are in the voices of professionals who are involved in EMS missions.

One of the features signature to the BK117 is its spacious cabin. Professor Ogino elaborates, "The cabin can accommodate five people, or four people aside from the patient, so two physicians and two nurses can be on board or a physician-in-training can take one of these seats. If the condition of the patient so requires, we have enough space to bring in optional equipment. This means that the BK117 allows for better medical intervention than other models."

Mechanic Yamasaki cites the functionality of the rear clamshell doors as another reason that the BK117 is preferred. "The clamshell doors provide enough room for loading and unloading a stretcher, and because of the slightly elevated position of the floor, the stretcher's legs can be stretched out securely. These may be small things, but they are some of the factors that ensure absolute safety."

Pilot Okabe stresses the fact that the BK117 is the only Category A, twin-engine EMS helicopter. Category A helicopters are multi-engine helicopters capable of safe flight even if one engine becomes inoperative. Okabe adds, "Even in such an emergency, it can keep flying safely. In addition, because the C-2 model has great engine output and offers highly-responsive maneuverability, it is capable of smoothly avoiding dangers. The BK117's instruments warm up quickly, which significantly reduces the time between the call for dispatch and the liftoff."

Kawasaki partnered with Europe-based Airbus Helicopters in developing the BK117, with Kawasaki in charge of developing and manufacturing the transmission and gearbox, which transmit engine power to the rotor, as well as the fuselage. Development of the spacious cabin and rear clamshell doors would not have been possible without Kawasaki's seasoned manufacturing expertise. The clamshell doors were made possible because the high-performance gearbox was compact enough to be installed on the ceiling, also resulting in a roomier cabin and the tail boom being in a higher position than in other helicopters.

EMS helicopters are "life-saving wings" and Kawasaki's technologies are behind their effectiveness.

Naoto Okabe
Pilot
Flight Operation Department
Central Helicopter Service, Ltd.

The cabin houses various medical devices. On the right side of the photo on the right is a stretcher for carrying patients. The photo on the left shows an avionics suite that greatly reduces the pilot's workload.

Rear clamshell doors secure enough space for loading/unloading the patient. The height of the cabin floor is configured to make it easy to stretch out the stretcher's legs.

A Leader's Voice

Katsumi Tamura

Deputy General Manager, Helicopter Project Division, Aerospace Systems Company

Ensuring the Continuity of Life-Saving Missions with Development/Manufacturing Technologies and After-Sales Support for EMS Helicopters

The BK117 is a multi-purpose helicopter with a spacious cabin and rear clamshell doors, which are unique features that have encouraged many operators to adopt the BK117 for EMS work. In addition to its usability, the helicopter offers high maneuverability, durability, and flight safety. Coupled with ease of maintenance, the BK117 has won overwhelming support from customers involved in EMS operations.

Supporting these excellent features are Kawasaki's development and manufacturing capabilities. The spacious cabin and clamshell doors were made possible because our design and manufacturing prowess resulted in a compact, high-performance transmission. The latest D-3 model adopts a system with five main rotor blades, which achieves less vibration and thus greater comfort when boarding. An increase in useful load was also achieved. These features translate to improved functionality of the BK117 as an EMS helicopter, allowing for safer and more reliable operations.

When it comes to EMS helicopters, I consider that it is the responsibility of the manufacturer to provide ongoing after-sales support, as our job doesn't end when the deal is closed. In addition to existing services, we began offering a Parts-By-the-Hour (PBH) program in April 2019, through which we ship spare parts immediately should a failure occur. This new program will reduce maintenance and flight downtime, and thus raise the helicopter's operation ratio.

Moreover, in May 2019, we launched a training center dedicated to training pilots and mechanics of the BK117 Series, and for advanced training of those who already have basic skills. The center is equipped with training equipment for the maintenance of the Fenestron tail rotor, which was adopted for the first time by the BK117 D Series, and for mastering the use of the cutting-edge avionics suite.

Kawasaki is committed to ensuring the continuity of EMS operations in Japan by contributing to the safe flying and operational stability of the operator which provides the EMS helicopters and staff — as well as operational services — to its clients, through technical support and development of human resources. We believe such an approach best reciprocates the confidence that those who are involved in EMS helicopter missions have in us.

Looking Forward to Tomorrow

BK117 D-3 Evolving to Achieve Even Higher Performance

Since delivery of the first unit in 1983, 178 BK117 helicopters have been delivered in Japan as of May 10, 2019. When deliveries by Airbus Helicopters are included, the number exceeds 1,500 units worldwide, making it a global best-seller. The latest model, the BK117 D-3, which made its debut in March 2019, inherits the features of the D-2 but adopts a cutting-edge system with five main rotor blades. As a result, compared to the D-2, its useful load increased by 150 kg to 3,800 kg, and the maintenance time for the main rotor system was shortened.

Please also see the feature story on the BK117 on Kawasaki's Brand Site "THE STORIES."

The site contains articles and videos introducing an array of Kawasaki products and how they are utilized, as well as the social contributions the company makes through manufacturing. **https://global.kawasaki.com/en/stories/articles/vol77/**