Helicopter Simulation and Training Solutions

CAE one step ahead
Focus, Experience, Technology Leadership... Mission Ready

Helicopters serve a variety of roles for militaries around the world. There are specialized helicopters for a range of missions, including attack, tactical support, troop transport, search and rescue, reconnaissance, anti-submarine warfare and more. Today’s rotorcraft are highly complex aircraft configured with integrated avionics, mission computer systems, sophisticated weapon systems, and other advanced features.

The changing nature of warfare over challenging terrain and in demanding environments, combined with humanitarian support requirements, has made the flexibility of helicopters even more important for military forces. However, simulating rotary wing aircraft and designing a training program to meet training objectives is a major challenge. Helicopters maintain some unique characteristics in areas such as aerodynamics and vibration that make high-fidelity simulation a difficult task. The varied operational uses of the helicopter combined with specialized technical challenges place unique demands on helicopter simulation and training.

CAE is uniquely qualified to handle all your helicopter simulation, training, and mission rehearsal needs. From entry-level training devices and specialized helicopter mission simulators to the networking of joint, multi-mission training systems operating in an interactive threat environment, we’ve earned our reputation as the leader in helicopter simulation and training. Our focus, experience, and technology leadership helps deliver lower risk and cost-effective mission training to ensure your aircrews always stay one step ahead and mission ready.

CAE’s Helicopter Simulation Experience

- AW109
- AS365 Dauphin
- AW139
- AB205
- AW189
- AS332 Super Puma
- AS532 Cougar
- AB212
- AH-1
- AH-64A/D
- A/MH-6
- B212
- B412
- CH-3E
- CH-46D/E
- CH-47
- CH-53
- Dhruv
- EC135
- EH101/AW101
- HH-3F
- HH-52A
- Lynx Mk3
- Lynx Mk8
- Super Lynx
- MH-47
- MH-60K/L/M
Experience

CAE has an unparalleled breadth of experience in helicopter simulation, training, and mission rehearsal. In fact, no other company has designed training systems for a greater variety of rotary wing platforms. CAE has simulated helicopters from virtually all the major manufacturers, including AgustaWestland, Bell, Boeing, Eurocopter, Hindustan Aeronautics Limited (HAL), Kaman, MD Helicopters, NHIndustries, and Sikorsky.
CAE has thousands of engineers and technical personnel around the world focused on designing and developing the most advanced simulation technologies. Because of our focus on simulation, training, and mission rehearsal, as well as the skill and imagination of our people, we have pioneered many of the innovations related to helicopter simulation over the past several decades. Our technology leadership is evidenced in the following areas.

**Blade Element Rotor Model**
CAE’s Blade Element Rotor Model (BERM) is the basis for modeling the blade aerodynamic characteristics of all helicopters. The BERM models the complex airflow around the rotating airfoils and accurately simulates the blade hinge and hub articulation, as well as all of the power-drive linkages. In addition, the accurate simulation of blade malfunctions is a fundamental and integral part of the BERM.

**Vibration Platform**
When accurately stimulated, vibrations combine with visual and sound system cues to ensure that the aircrew develops proper control strategies while experiencing representative workloads. Vibrations in helicopters, in addition to creating a harsh operating environment, provide the aircrew with rotor dynamic feedback critical to their ability to control the aircraft.
CAE’s high performance 3-DOF (degree-of-freedom) vibration platform, installed under the cockpit, subjects the entire cockpit to vibration cues that are validated with actual helicopter recorded data.

**Visual Systems**
The CAE Medallion™-6000 series is the latest member in CAE’s powerful Medallion image generator family. The CAE Medallion-6000 series combines the proven, industry-leading feature set and image quality of previous CAE Medallion visual systems with the power and capabilities of the latest commercial-off-the-shelf graphics processors. The CAE Medallion-6000 provides a highly modular, scalable and portable visual solution designed to satisfy your full range of military training needs, particularly for low-level helicopter simulation applications.

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Technology Leadership

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Common Database (CDB)
The Common Database (CDB) was a CAE-led development that is designed to significantly reduce the timeline it takes to get a fully correlated database in operation within a range of training and mission rehearsal systems. Correlation of multiple databases in varying formats has been one of the major obstacles facing military forces wanting to practice and rehearse missions in simulation. The CDB architecture effectively removes this obstacle by allowing all users, or “clients,” of the data required to access the information from a common database source and do so in real-time. These clients include not only the out-the-window visual scene in a simulator, but also other systems in the simulator requiring data, such as sensors, computer-generated forces, and communications systems.

Ground Handling
Ground handling simulation has proven to be one of the most challenging aspects of flight simulation. To achieve simulation fidelity in crosswind takeoff, landing on sloping terrain, or taxiing on different surfaces, the interaction of the helicopter’s tires and landing gear with the ground must be accurately simulated. CAE has developed advanced ground handling models that faithfully simulate the helicopter’s on-ground directional stability and control characteristics.

Roll-On/Roll-Off Cockpits
CAE pioneered the development of a full-mission helicopter simulator with a revolutionary roll-on/roll-off cockpit design, which enables cockpits representing various helicopter types to be used in a “mothership”. The mothership simulator platform will include a common motion system (six degree-of-freedom), vibration platform, and visual display system. Different helicopter cockpits can then be “rolled on and rolled off” the mothership to provide ultimate flexibility and cost-effectiveness. When a cockpit is not being used in the full-mission simulator, CAE has also developed a docking station so the cockpit can serve as a fixed-based flight training device.

CAE’s Helicopter Simulation Technologies
- Blade Element Rotor Model
- Virtual cockpit models
- Air turbulence around ships
- Wind models over mountain peak
- 3D oceans
- Radar and weather models
- Motion, vibration and ground handling
- Visual and display systems
Introducing the CAE 3000 Series Helicopter Mission Simulator

The CAE 3000 Series helicopter mission simulator, developed for both the civil and military markets, provides an immersive and realistic training experience for helicopter aircrews. The CAE 3000 Series was developed with extensive input from CAE’s helicopter advisory board with a specific emphasis on providing helicopter-specific mission training for markets such as the military, offshore oil and gas, emergency medical services, and law enforcement. This new CAE simulation product was also designed to meet or exceed current and emerging regulatory requirements for simulation-based helicopter training.

Specifically for the military market, CAE has adapted the CAE 3000 Series helicopter mission simulator to meet the requirements for simulating medium to heavy military helicopters. CAE offers a dome display capable of an extreme 220 by 95 degree field-of-view, as well as the ability to utilize roll-on/roll-off cockpits to support mixed fleets. An enhanced tactical environment combined with weapons and sensor simulations will deliver the realistic mission training required for military needs.
### CAE 3000 Series features

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<td>Extreme field-of-view visual display</td>
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<td>Industry-leading visuals for enhanced realism</td>
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<td>High-fidelity vibration and motion cues</td>
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Military forces around the world must adapt to budgetary constraints, operational demands, personnel shortages, new threats and complex weapon systems, evolving operational doctrines, and shifting priorities. This has led a number of militaries to look to private industry for the provision of turnkey training services. Contracting for comprehensive, turnkey training services offers the military customer a cost-effective means to producing tactically and technically proficient as well as mission-ready aircrews. By leveraging simulation-based technology and shifting training system accountability to private industry, militaries are able to focus on operational demands and requirements.

CAE is the industry pioneer in designing and developing a comprehensive turnkey training service for helicopter training. We are a company focused on simulation and training delivery with the requisite experience, skills, and capability to design training programs, and then develop and support the complex integrated ground-based training systems and training environment. We have proven skills and a track record of exemplary results in a variety of training-focused disciplines, including: training needs analysis, media evaluation and optimization, knowledge and skills transfer, instructional systems design, courseware, training devices, instruction, learning management information systems, facilities, maintenance and logistics support, configuration management, technology insertion, and even financing.
Our Medium Support Helicopter Aircrew Training Facility (MSHATF) in the UK is a perfect example. At CAE’s MSHATF, which was the UK’s first military training private finance initiative, CAE provides a comprehensive training service for Chinook, Merlin, and Puma aircrews. We own the facility and assets while the Royal Air Force and third-party customers pay for a turnkey training service.

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<th>CAE’s Turnkey Helicopter Training Facilities</th>
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<td>NH90</td>
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<td>RotorSim (joint venture of CAE and AgustaWestland)</td>
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<td>Helicopter Academy to Train by Simulation of Flying (joint venture of CAE and Hindustan Aeronautics Limited)</td>
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<td>CAE Brunei Multi-Purpose Training Centre (joint venture of CAE and Government of Brunei)</td>
<td>S-70i, S-92</td>
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Program Highlights

CAE is responsible for the design and development of some of the most sophisticated and capable helicopter training systems in the world. Following are brief descriptions of some recent and current helicopter programs at CAE.

U.S. Navy MH-60S and MH-60R
The U.S. Navy is procuring 575 new MH-60 Seahawk helicopters to perform a range of missions. The MH-60S “Sierra” is used for vertical replenishment, search and rescue, and airborne mine countermeasures. The MH-60R “Romeo” is used primarily for anti-submarine and anti-surface warfare. For both helicopters, CAE is providing operational flight trainers (OFTs), which are full-mission simulators used to train pilots and co-pilots. CAE is also providing weapons tactics trainers (WTTs) to replicate the back-end of the helicopter for training sensor operators and airborne tactics officers. When integrated together, the front and back end trainers become a tactical operational flight trainer (TOFT) to provide the Navy with a comprehensive solution designed to train both flight and tactical skills together. CAE has delivered or is under contract to develop seven MH-60S OFTs, five MH-60S WTTs, eight MH-60R TOFTs and two MH-60R avionics maintenance trainers for the U.S. Navy. In addition, CAE is supporting the U.S. Navy on a range of foreign military sale opportunities for the MH-60S/R Seahawk.

NH90 Programs
The NH90 is the largest helicopter program ever launched in Europe with orders exceeding 500 aircraft from 14 countries. CAE is playing a key role in developing the NH90 training systems as well as delivering NH90 training services. In Germany, CAE is part of the Helicopter Flight Training Services (HFTS) consortium with Eurocopter, Thales, and Rheinmetall Defence Electronics that is providing NH90 helicopter training at three training centres to the German Armed Forces and other nations under a private finance initiative program. In Australia, CAE is the prime contractor responsible for providing two MRH90 full-flight and mission simulators (FFMSs), training facilities, and comprehensive engineering and support services to the Australian Defence Forces. For the Netherlands, the Rotorsim consortium – owned equally by CAE and AgustaWestland – has prime contractor responsibility for providing one NH90 full-mission flight trainer (FMFT) and an NH90 virtual sensor trainer for training rear crew sensor operators.
CAE was the prime contractor responsible for the development of the German Army’s Night-Time Low-Level Flight Training Facility (NTF), which is Europe’s largest helicopter training facility. CAE designed and manufactured 12 full flight simulators (two UH-1D, two CH-53, and eight EC-135) that are used for basic flight training as well as training in low level day, night, or instrument flight conditions. The NTF project features our revolutionary roll-on/roll-off convertible full mission simulator design, where a common motion base can receive a variety of cockpit modules of different helicopters. All of the simulators can be networked to participate in the same flying exercise or tactical operation. CAE currently provides comprehensive training support services on-site at the German Army Aviation School in Buckeburg.

**HATSOFF**

CAE and Hindustan Aeronautics Limited (HAL) established a joint venture company in India called the Helicopter Academy to Train by Simulation of Flying (HATSOFF). In 2010, HATSOFF began operations at a new helicopter training centre in Bangalore, India. The HATSOFF training centre includes a CAE-built full-mission helicopter simulator that features CAE’s revolutionary roll-on/roll-off cockpit design, which enables cockpits representing various helicopter types to be used in the simulator. The first training program offered at HATSOFF was for operators of the Bell 412 helicopter. This was followed in early 2011 by the civil/conventional variant of the HAL-built Dhruv helicopter – the first-ever simulator developed for the Dhruv and in 2012 by the Eurocopter Dauphin helicopter. The Bell 412, the Eurocopter Dauphin and civil/conventional variant of the Dhruv have all been certified to Level D, the highest qualification for flight simulators, by India’s Directorate General Civil Aviation (DGCA). An additional cockpit for the Indian Army/Air Force variant of the HAL-built Dhruv will be added to the HATSOFF training centre in 2014.

**Australian Army – S-70A Black Hawk Full Flight and Mission Simulator**

CAE developed a turnkey training system for the Australian Army, including a Black Hawk simulator, purpose-built facility, and maintenance support. The S-70A Black Hawk full flight and mission simulator was the world’s first military helicopter simulator to be accredited with Level D-equivalent certification. The simulator includes an eight-channel CAE visual system, vibration platform, 220x60 degree field-of-view, chin-window monitors, and night-vision goggles simulation for full day and night training.