18th Airborne Brigade Combat Team, 10th Aviation Squadron

The Basics of Helicopters: Flight, Comms & Crews

Introduction

This handbook is intended as a basic guide for aspiring rotary pilots or beginners who are looking to strengthen their current skill set to meet the needs of the 18th ABCT's 10th Aviation Squadron. This handbook will cover simple flight controls and mechanics, navigation, aircrew responsibilities, long wave (LW) radio controls, and more. Although you are not expected to memorize everything you will learn by studying this handbook, you will eventually be required to have a firm understanding of all concepts within it and even to expand your knowledge outside of what is covered in this guide.

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Aircrew Roles & Responsibilities

- The **pilot (MOS: 153A)** is in total control of the aircraft and are in no way obligated to put their aircraft, crew, or passengers in danger. The pilot outranks anyone in his aircraft and has the absolute right to abort a landing or other operation at any time if they feel it is unsafe for anyone involved.

- The **co-pilot (MOS: 153A)** is generally responsible for navigation, assisting with radio communication, and overwatch. Co-pilots are required to understand the limitations and handling of the aircraft they are manning and must be able to execute emergency procedures such as autorotation or flight with damaged instruments. Put simply, the co-pilot is responsible for reducing the pilot's workload and allowing for more focus on flight and attacking. In some cases however, the co-pilot may also adopt an attacking role in cases such as attack helicopters (ex: AH-64D).

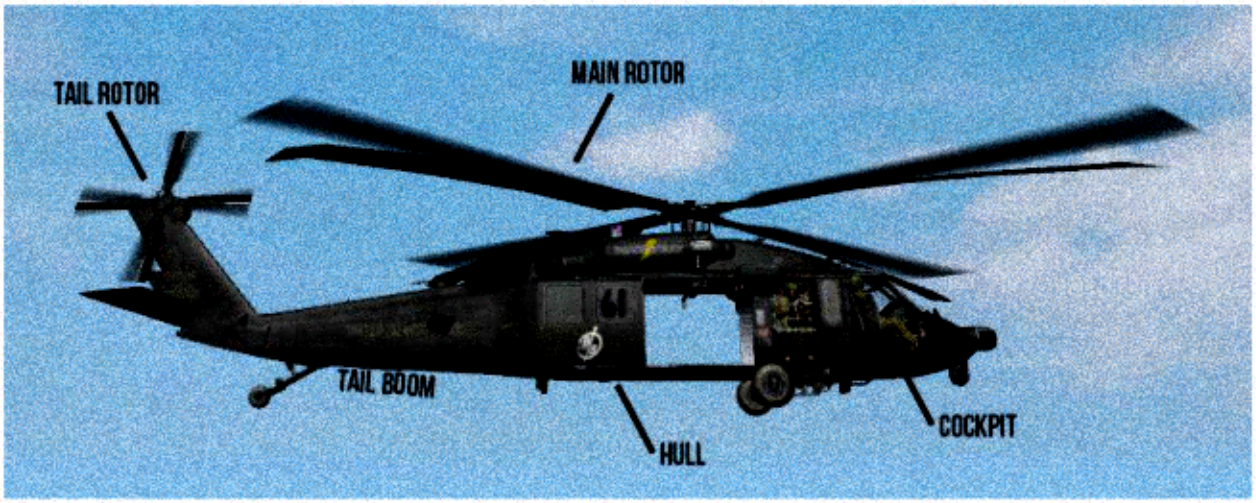
- The **crew chief (MOS: 15T/15U)** is responsible for keeping passengers and the vehicle safe by handling the Fast Rope Ins/Ext System (FRIES), ensuring riders are prepared to dismount the vehicle, giving the all clear to dismount, scanning outside the vehicle for obstacles as to prevent damage to the airframe, spotting LZ markers such as smoke or landmarks, alerting the pilots to enemy contacts that may be unknown, as well as notifying the crew of any other potential threats to the helicopter. The crew chief may be required to man a door gun if need arises but must follow the pilot's directions to open or cease fire at all times.

- The **door gunner (Voluntary)** is responsible firing the weapons mounted on the side of the aircraft and may be a role filled voluntarily by a passenger being provided transport if there is no extra member of the aircrew to fill the role. Although the role played as a door gunner will depend on the aircraft's tasking, a door gunner will generally be responsible for providing protection to otherwise unarmed craft such as MedEvac or transport birds. It is important to note that in most cases crew chiefs will man one gun at all times and the door gunner must obey a pilot or crew chief's orders to open or cease fire all times. Door gunners may also be required to open a second shortwave (SW) radio channel for the duration of flight in order to provide clearer communication with other aircrew.

- The **flight medic (68W*F*/Voluntary)** is a medically certified member of the aircrew who is responsible for pre-flight patient assessment, and may be deployed with MedEvac helicopters in order to stabilize and treat gravely wounded soldiers who have been evacuated from combat in critical condition. Flight medics must be trained in advanced life support (ALS) and ensure they are equipped with the proper medical equipment on board the aircraft and ensuring the patient is continually treated once received at a medical facility.

It is always important to understand that in some cases a bird may be deployed with as few as 2 members in the aircrew and although efforts will be made to accommodate one's preferences and primary roles, there may be cases where you are requested to fill any of the listed roles. (Ex: Co-pilot main can be required to pilot, crew chief main can be required to treat casualties, etc.) If you feel unprepared filling an assigned role it is your responsibility to speak up and address your concern while other roles are still being filled *or* before roles begin being assigned. You aren't expected to be a jack of all trades, but you will be held responsible for any complications caused as a result of refusing to speak up about being assigned a role you aren't prepared to fill.

Important Parts of a Helicopter



In Arma 3, helicopters have 5-6 parts that can be damaged. Each has a unique effect on the aircraft's handling, functionality, safety, and utility. The parts are visible in the top left corner of your heads up display (HUD) where levels of damage are indicated by color, white by default and red once no longer functioning. It should also be mentioned that the vehicle's fuel levels and system states (landing gear, lights, etc). In general it is a good idea for you and your co-pilot to check the systems regularly, especially after taking fire, to prevent being surprised by a system's cease of function.

Indication	Purpose/Location
HULL	Exterior of vehicle. More simply, the fuselage of the craft. Designed to sustain the most damage but it is still important to keep any damage to the craft at a minimum whenever possible.
ENG	The craft's engines. Critical damage to these will prevent the main rotor from spinning and result in unpreventable decent. Although it can feel similar to main rotor damage it is important to recognize the difference as MROT failure requires more rapid reaction than an engine failure.

INST	Instruments aboard the craft, normally inside the cockpit. This can include targeting systems, FLIR, on-board LW radio, collision lights, and any other electronic systems. Although hull damage is much more likely, instrument damage requires navigational skills using maps and the ability to judge airspeed and altitude without the aid of electronics.
ATRQ	Anti-Torque, or more simply put, the tail rotor. Damage to this system will result in the aircraft spinning uncontrollably similarly to a flat spin. Landing vertically with an ATRQ failure can be dangerous do to the tail boom swinging uncontrollably. Instead, a skid landing is highly recommended as the airflow caused by maintained forward airspeed allows for more predictable landing conditions.
MROT	The aircraft's main rotor(s). Even slight damage to this system can be catastrophic as it can greatly reduce lift similarly to an engine failure but can also cause the bird to uncontrollably lose altitude if too much damage prevents the rotor from providing sufficient lift to the craft.
SLG	Arguably the most expendable system on almost all helicopters. The sling system is used to sling load vehicles , crates, or other cargo. Damage to this system should be reported immediately if providing a support role that requires the use of the sling.

Basics of Helicopter Flight

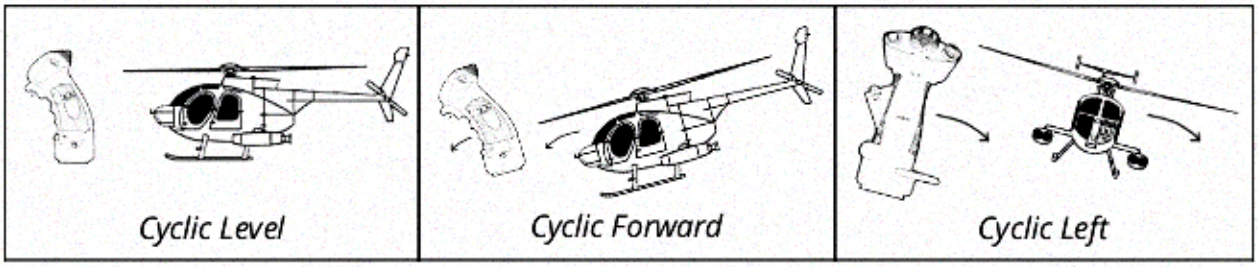
Helicopter flight can seem impossible the first time you attempt to take off. Tiny control inputs can initially have massive effects on how the bird behaves and once you've found out how raising and lowering collective works, you may find yourself lost as to what comes next to get you moving safely and effectively. Primarily, this lesson intends to provide you with an understanding of how all the controls at your disposal effect flight. For a more in depth explanation of any controls or to clarify how they affect flight you can feel free to ask members of the 10th Aviation squadron to clarify for you. It is also important to take note that this guide assumes you are flying without Arma 3's advanced flight model which adds more real-world problems associated with rotary aircraft such as vortex ring state (VRS) and stress to the airframe. The advanced flight model is not a requirement and isn't recommended for beginners as it results in much a much more sensitive and complex flight model.

First, we'll list the basic controls you have access to in Arma 3:

Control Name	Basic Effect on Aircraft
Cyclic	Pitch nose up, down, left, right and adjust speed.
Collective	Raise/lower altitude by angling rotor blades.
Anti-Torque Pedals	Yaw. Turn aircraft left and right.

As you can see, there isn't much required to manipulate a helicopter. A lot of learning flight is about gaining a sense of balance with the aircraft. To get started, we'll look at what all these controls look like and view how they affect the aircraft on the next page.

Cyclic



Cyclic Level | *Cyclic Forward* | *Cyclic Left*

First, we'll take a look at *cyclic*. This control is generally located between the pilot's legs and looks similar to the joystick of simpler fixed wing aircraft. Cyclic also is similar in function to the joystick of these craft in how it manipulates movement of the craft's nose. Pulling back on the cyclic will raise the helicopter's nose and pushing forward will drop the nose down. Movement to the left or right will cause the craft to roll, or pitch. It is important to note that moving the helicopter forward, backward, left, or right requires manipulation of cyclic as well as collective but we will get into that once all controls have been explained.

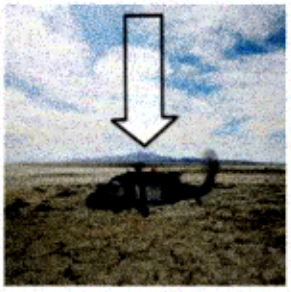
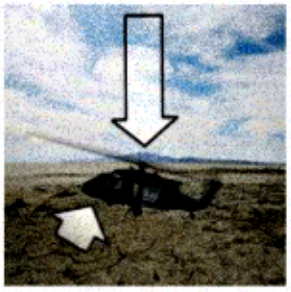
Collective

The second control on our list is *collective*. The collective lever is normally on the left side of the pilot which allows more fine control if the craft with the right hand while using the left hand for more rough adjustment. Collective changes the angle of the helicopter's main rotor blades to change the direction of airflow. Lowering collective causes the craft to lose altitude and raising collective causes altitude to be gained. Collective and cyclic are the two most important controls at higher airspeeds as both are necessary for level flight in any direction. If it is possible, it is highly recommended to bind collective to a trigger throttle in order to maintain pressure sensitivity of this control and thus finer adjustments to collective when landing or taking off.

Anti-Torque Pedals

The final control are the *anti-torque pedals*, also referred to simply as the pedals. They control the direction of the aircraft's nose but are only effective for minor adjustments at speed. The left pedal causes the helicopter to rotate left and the right causes the craft to rotate right. These pedals are most effective for adjustments when landing or to make a turn slightly sharper by pressing your pedals into a turn by using the right pedal for sharp right, and left pedal for sharp left turns.

Basic Maneuvers: Applying What You Know

			
Collective Raise By raising collective, the vehicle gains altitude. In most cases, simply raising collective without manipulating cyclic will result in a near perfect hover. Note that without auto-hover a perfect hover is difficult to achieve.	**Col. Raise + Cyc. Frwd** After raising (and maintaining) collective, the pilot can tip the cyclic forward to begin climbing at a forward angle. This is how to achieve forward movement. In this state, banking is used to make turns at higher speeds.	**Collective Lower** Lowering collective causes the aircraft to lose altitude. This is an essential step to rapidly lose altitude when landing. Can be combined with cyclic to continue in a direction while descending. A key step to reduce airspeed.	**Col. Lwr + Cyc. Back** Continuing to lower collective and pulling back on the cyclic allows for rapid speed reduction. This is known as a *flare*, and is also the best way to become stationary before touching down when landing. It is important to note that flares at high speed raise altitude.

Although there are more minute adjustments and combinations that can be made to accommodate more complex or omnidirectional flight, these images should help you start to grasp how a helicopter's flight works. In an attempt to simplify a very complex system, you can look at flying a helicopter as pointing something that always wants to go (ignoring adjustments to collective) up in a direction you would like it to travel. Flying straight is about finding the balance where the helicopter's blades pull it up, while it's weight pulls it equally down where it reaches a balance and maintains altitude while moving forward.