INTRODUCTION

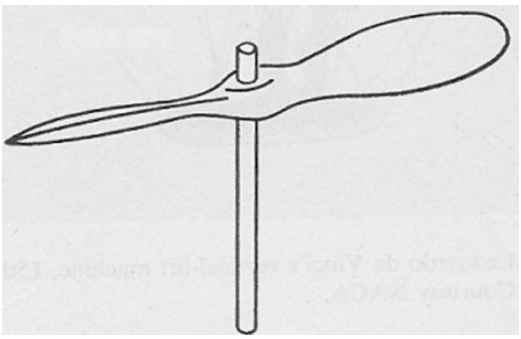
The wings of the airplane create a lift force when they move through the air. As we known, during flight, there are four forces acting on the helicopter and those are LIFT , DRAG , THRUST ,and WEIGHT. In order to make the wings to move through the air , of course, the helicopter itself has to move. A helicopter works by having its wings move through the air while the body stays still. The helicopter's wings are called Main Rotor Blades. The shape and the angle of the blades move through the air will determine how much Lift force is created. After the helicopter lifted off the ground, the pilot can

tilt the blades, causing the helicopter to tip forward or backward or sideward.

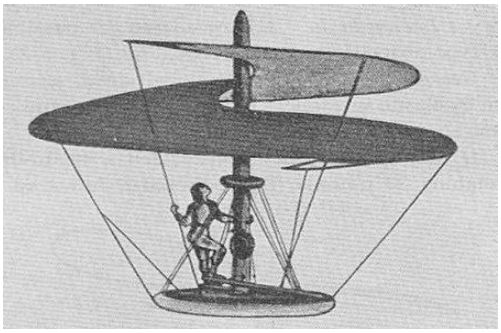
HISTORICAL BACKGROUND

The helicopter is arguably one of the earliest ideas for achieving flight. Over two thousand years ago, the Chinese constructed what are

known as Chinese Tops. These simple toys consisted of a propeller attached to a stick that would be spun rapidly through ones hands to spin the propeller and achieve lift.



Chinese top

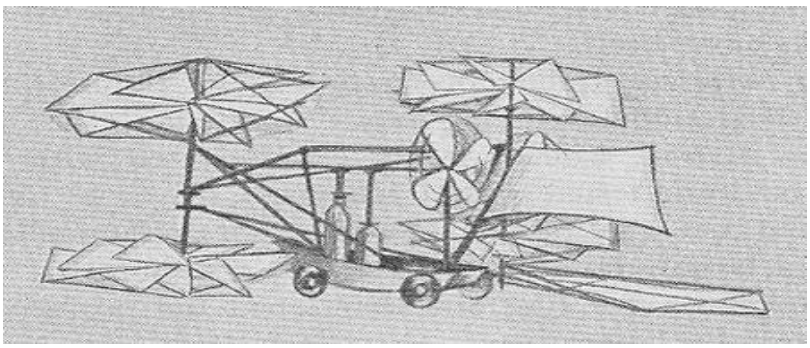


Leonardo da Vinci's "Helicopter"

Later, in the 15th Century, famed inventor and artist Leonardo da Vinci designed one of the most pleasing concepts for a helicopter, but such a craft was never actually constructed.

In England in 1796, Sir George Cayley constructed the first powered models of

helicopters that were driven by elastic devices which attained an altitude of 90ft. In 1842, fellow Englishman W. H. Phillips constructed a model helicopter that weighed 20 pounds (9 kg) and was driven by steam. In 1878, Enrico Forlanini, an Italian civil engineer, also constructed a steam driven model helicopter that only weighed 3.5kg.



Sir George Cayley's helicopter

The first manned helicopter to rise vertically completely unrestrained was constructed by Paul Cornu, a French mechanic, in 1907. Cornu's

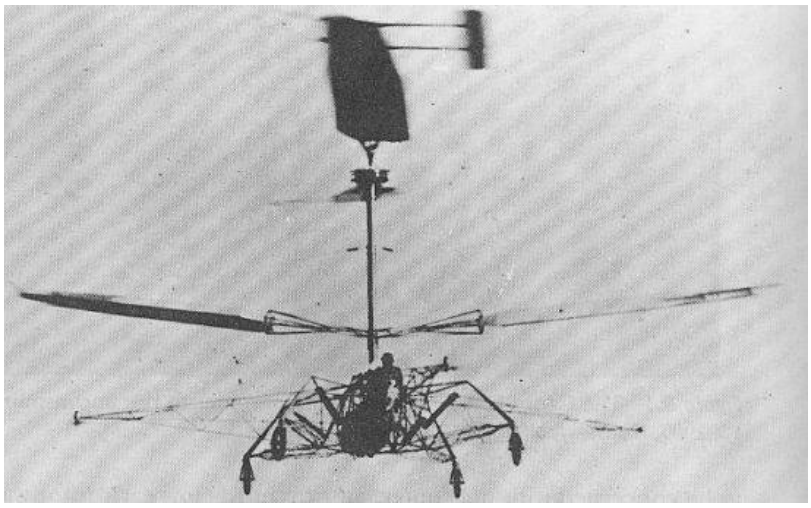
helicopter had two propellers that were rotated at 90 rpm by a 18 kW engine. Cornu was most probably the first helicopter experimenter who was concerned with control. While cornu's helicopter was historically significant, its performance and control was rather marginal and it was never a practical machine.

Cornu's helicopter

The next influential development in the field of helicopters was brought about by a man who never actually built a helicopter himself. In 1923, Juan de la Cierva successfully flew his

C.4 autogiro, an aircraft that has two propellers, a powered one to provide thrust, and an un powered rotor to provide lift. Cierva's autogiro was noteworthy because it was the first to use an "articulated" rotor that allowed its blades to flap up and down in response to aerodynamic forces on the blades during forward flight.The first recognized helicopter record was set in October 1930 by Italian Corradino D'Ascanio when he flew his helicopter over a distance of one half mile at an altitude of 59 ft (18 m) for 8 minutes and 45 seconds. D'Ascanio's helicopter had two contra rotating coaxial rotors (two rotors on the same shaft) that were

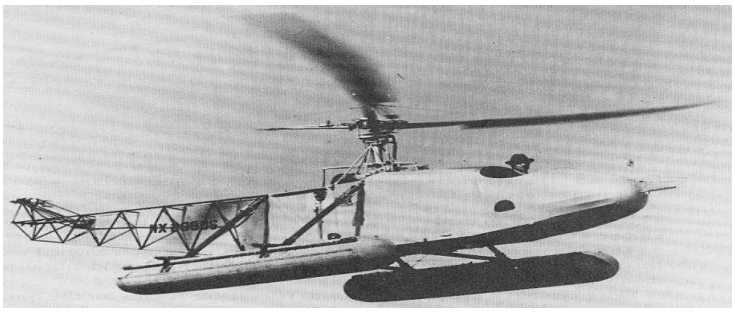
controlled by flaps on booms trailing each blade near its tip.



D'Ascanio's helicopter

Just before and during World War II, Germany made several large, significant steps in helicopter development. The FA-61 helicopter, designed by Heinrich Focke, first flew in June 1936, and was later used in publicity stunts by the Nazis. The FL-282 helicopter, designed by Anton Flettner, became operational with the German Navy, and

over 1000 of them were produced. This helicopter utilized twin-intermeshing rotors, had a forward speed of 145 km/h, and could operate at an altitude of 3,965 m with a payload of 360 kg.



Sikorsky's VS-300

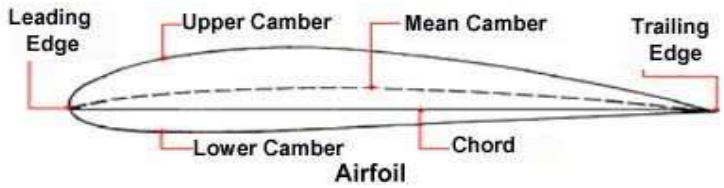
The first American helicopter was the VS-300, designed by Igor Sikorsky of the Vought-Sikorsky Company. The VS-300 was the first helicopter to use a tail rotor to counteract the torque produced by the main rotor, and it was this innovation that solved the last major hurdle

in making helicopters practical flying vehicles. This design is now the most common in today's helicopters.

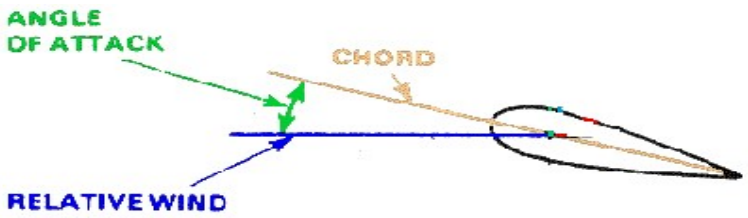
NOMENCLATURE AND TECHNICAL TERM

Bernoulli's principle: This principle states that as the air velocity increases, the pressure decreases; and as the velocity decreases, the pressure increases.

Airfoil: is technically defined as any surface, such as an airplane aileron, elevator, rudder, wing, main rotor blades, or tail rotor blades designed to obtain reaction from the air through which it moves.

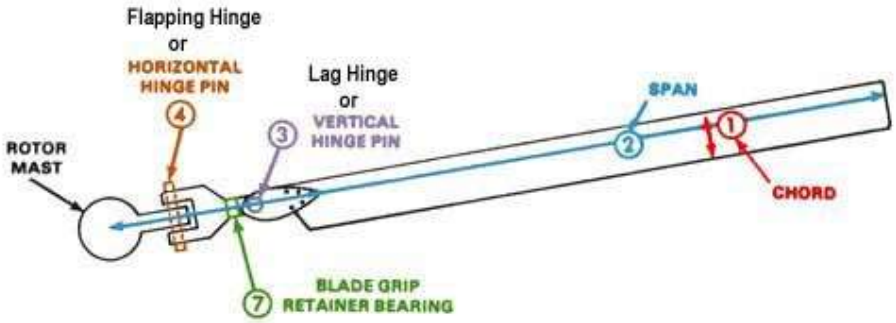


Angle of Attack: is the acute angle measured between the chord of an airfoil and the relative wind.



Angle of Incidence: is the acute angle between the wing's chord line and the longitudinal axis of the airplane.

Blades : The blades of the helicopter are airfoils with a very high aspect ratio (length to chord). The angle of incidence is adjusted by means of the control from pilots. The main rotor of the helicopter may have two, three, four, five or six blades, depending upon the design. The main rotor blades are hinged to the rotor head in such a manner that they have limited movement up and down and also they can change the pitch (angle of incidence). The controls for the main rotor are called Collective and Cyclic Controls.



Main Rotor Blade System

The **tail rotor** is small blades may have two or four blades and mounted on the tail of the helicopter, it rotates in the vertical plane. The tail rotor is controlled by the rudder pedals. Its pitch can be changed as required to turn the helicopter in the direction desired.

Blade Root: The inner end of the blades where the rotors connect to the blade gripos.

Blade Grips: Large attaching points where the rotor blade connects to the hub.

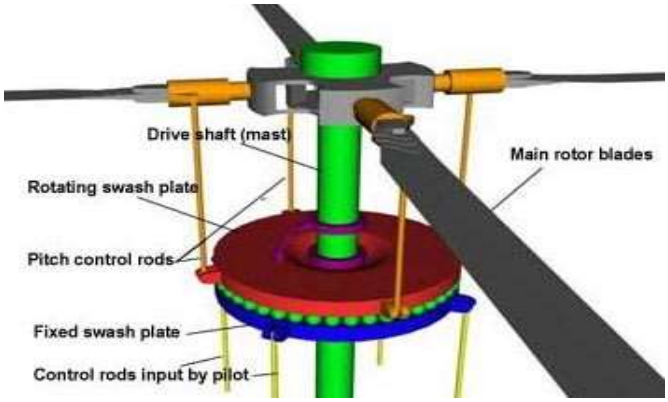
Rotor Hub: Sit on top of the mast, and connects the rotor

blades to the control tubes.

Main Rotor Mast: Rotating shaft from the transmission which connects the main rotor blades to helicopter fuselage.

Pitch Change Horn: to converts control tube movement to blade pitch. Control tube is a push-pull tubes that change the pitch of the rotor blades through the pitch changing horn.

Swash Plate Assembly: The swash plate assembly consists of two primary elements through which the rotor mast passes. One element is a disc, linked to the cyclic pitch control. This disc is capable of tilting in any direction but does not rotate as the rotor rotates. This non-rotating disc, often referred to as the Stationary Star is attached by a bearing surface to a second disc, often referred to as the Rotating Star which turns with rotor and linked to the rotor blade pitch horns.



Transmission: The transmission system transmits engine power to the main rotor, tail rotor, generator and other accessories. The engine is operated at a relative high speed while the main rotor turns at a much lower speed. This speed reduction is accomplished through reduction gears in the Transmission System

Lift: is produced by a lower pressure created on the upper surface of an airplane's wings compared to the pressure on the wing's lower surfaces, causing the wing to be LIFTED upward. The special shape of the airplane wing (airfoil) is designed so that air flowing over it will have to travel a greater distance and faster resulting in a lower pressure area thus lifting the wing upward. Lift is that force which opposes the force of gravity (or weight).