AGES 8+

LEONARDO DA VINCI

Genius is Timeless

The Aerial Screw

DEVELOPING 500 YEARS OF DREAMS
DA VINCI

Instruction manual

Contents

Leonardo Da Vinci

(April 15, 1452 - May 2, 1519)

"Iron rusts from disuse; stagnant water loses its purity and in cold weather becomes frozen; even so does inaction sap the vigor of the mind."

Leonardo

Leonardo da Vinci *was born April 15, 1452 in Vinci, Italy. Da Vinci was an artist, scientist, mathematician, engineer, inventor, anatomist, sculptor, architect, botanist, musician and writer. He has often been described as a perfect example of a Renaissance man, a man whose unquenchable curiosity was equaled only by his powers of invention and observation. Da Vinci is widely considered to be one of the greatest painters of all time and perhaps the most diversely talented person to have ever lived.*

At an early age, Da Vinci's talent for drawing became evident, and his father apprenticed his young son to a noted period artist, Andrea del Verrocchio. Through the coming years, the young Leonardo learned much from his mentor and at the age of thirty, Da Vinci left Florence and settled in Milan and established a workshop of his own. During the following years, he earned his living painting commissioned pieces. He soon came to the conclusion that it was not possible for him to earn steady income doing this and began his search for employment. He began by writing a letter to the Duchy of Milan, Duke Ludovico Sforza, known by the nickname, the Moor. In this correspondence, Da Vinci stated that he had studied machines of war and had come up with improvements that would

strengthen the Moor's position in battles. The letter hinted at inventions that included portable lightweight bridges and improved designs for bombards, mortars, catapults, covered assault vehicles and weapons. The Moor eventually became Da Vinci's patron and kept him busy with everything from designing a heating system to painting portraits, to overseeing production of cannons and even decorating the vaulted ceilings in his castle.

It was during this time that Da Vinci began writing and drawing in his journals. These volumes became repositories of the outflow of Leonardo's gifted mind. He was a voracious student of the universe and his observations led to magnificent plans and concepts. Da Vinci's notebooks consist of more than 20,000 sketches, copious notes and detailed drawings. Some of his conceptual designs led to the greatest inventions of his day, while others came to fruition hundreds of years after his initial concepts were penned, simply because the machinery needed to build and power them were not yet invented. Leonardo's notebooks clearly illustrate his genius of not only improving upon existing inventions, but also conceiving a myriad of new ideas and designs.

Ultimately, the Moor was captured by the French and Da Vinci left Milan in search of a new patron. He traveled through Italy for more than a decade, working for several Dukes and rulers, including Cesare Borgia, a General intent on conquering central Italy. Leonardo traveled with Borgia as a military engineer, designing weapons, fortresses and artillery, but became disillusioned and quickly left his service with the General. It seems that despite Da Vinci's design for artillery and weaponry, he was actually a pacifist and detested war and its destruction.

Da Vinci later took positions with King Louis XII and Pope Leo X and ultimately with the King of France, Francis I. It was the King who offered Da Vinci the title, Premier Painter and Engineer and Architect of the King. Francis I valued Da Vinci's great mind and his sole function was to engage in conversations about Renaissance culture and art with the benevolent royal.

ARTISTIC MASTERPIECES OF LEONARDO DA VINCI

Virtruvian Man (circa 1487)

It is important to remember that Da Vinci is not only and great inventor, but is considered to be one of the most acclaimed artists to ever have lived, creating such masterpieces as The Last Supper (c.1498) and the Mona Lisa (c.1503). Leonardo's drawing of the Vitruvian Man is also regarded as a masterpiece. Unfortunately, only a small number of Da Vinci's paintings have survived. Leonardo experimented with new techniques, most of which did not yield long-lasting results. The master painter was also somewhat of a perfectionist with fastidious attention to detail. It is believed that when painting the Mona Lisa, the artist spent ten years perfecting the lips of this masterpiece.

The Mona Lisa (circa 1503)

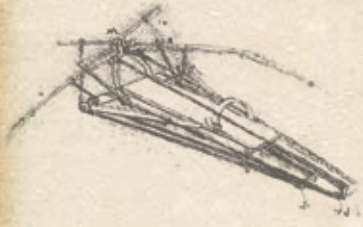
The Last Supper (circa 1498)

Da Vinci's Notebooks

Da Vinci's notebooks are now more than 500 years old. They are not bound the way a typical book would be today, but rather comprised of loose sheets of paper gathered into collections and wrapped with fabric. Paper was scarce in Da Vinci's time, so he used every available space in a page for drawings, observations, even recipes and shopping lists, making them somewhat difficult to interpret. Adding to the difficulty in deciphering his works was the fact that Da Vinci's scripted notes were written backwards, or in a mirror image, and read from right to left. His reason for this remains a mystery, but it is thought that Leonardo's theories sometimes went against church teachings and his secret writing could have been a way to avoid scrutiny. Da Vinci also might have feared that someone would steal his designs and publish them under their own name. Ironically, Da Vinci addressed an imaginary readership in the margins of his notebooks urging the reader to make sure his work was printed into a proper book. It is presumed that he meant for the notebooks to be published after his death.

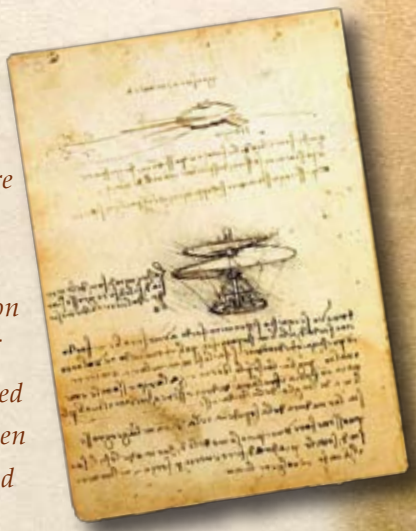
Leonardo Da Vinci

Several common themes recur in the now fragile notebooks: Nature, Technology (including gears, cogwheels, screws and pulleys), aviation and vision, to name a few. Upon the death of Leonardo Da Vinci, the notebooks were given to his long-time friend, Count Francesco Melzi. Melzi did not fully comprehend the value of the information and published only a portion of the volumes. He placed the notebooks in his home where they were viewed by guests who sometimes took pages with them as souvenirs.After Melzi's death, an additional 13 Da Vinci notebooks disappeared and soon pages were scattered across Europe. Da Vinci's notebook extracts were published in 1883 and about half of them have not yet resurfaced so far. It is easy to imagine that had the notebooks been published earlier, the history of science might have been completely changed.



In his drawings, Leonardo strived for saper vedere or "knowing how to see." Da Vinci's illustrations are unparalleled and some experts believe that no one has since been better.

Da Vinci's Concept: Aerial Screw



The Aerial Screw designed by Leonardo da Vinci was an early precursor to the principle of the modern day helicopter. The device, designed to compress air in order to obtain flight, measured more than 15 feet in diameter and was made from reed, linen and wire. The machine called for a four-man team to stand on a base and employ a pumping action to spin the rotary blade in order to lift the device off the ground. In Da Vinci's time, the technology needed to create a modern day flying aircraft had not yet been invented, but his concept of rotary wing aviation had unquestionably been conceived.

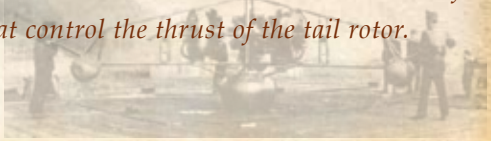
THE AERIAL SCREW CONCEPT HAS DEVELOPED INTO OUR MODERN DAY HELICOPTER

WHO DEVELOPED THE MODERN HELCOPTER?

In 1907 a French engineer, Paul Comu, managed to lift a twin-rotor model off the ground for just a few seconds. A little more than a decade later, another Frenchman, Etienne Oehmichen demonstrated a helicopter that flew for under 10 minutes. It wasn't until the late 1930s that helicopters became reliable machines of flight. Igor Sikorsky, a Russian-American designed and flew the Vought-Sikorsky VS-300, the first viable helicopter, which pioneered the rotor configuration used by most helicopters today.

HOW HELICOPTERS FLY

The rotary aircraft is lifted into the air by two or more wings on a central spinning rotor shaft. The helicopter's rotating wing assembly is called the main rotor. An engine powers the spin shaft and by slightly angling the moving wings downward, a principle called ***LIFT*** *is created. The lift however, needs to be controlled in order to keep the helicopter from spinning in circles once it is airborne. This is achieved with a force called* ***THRUST****, which is applied in a sideways direction to counteract the engine's inclination to continually spin the body. The usual way to provide a thrust force is to attach another set of rotating wings to a long boom. These wings are known as the* ***TAIL ROTOR****. The thrust of the tail rotor equals the reaction of the main rotor, thereby canceling each other out. This not only stops the helicopter from spinning, but also steers the machine while in flight. Although the pedals that a helicopter uses to steer are called* ***RUDDER PEDALS****, the machine does not in fact have a rudder, but rather has pedals that control the thrust of the tail rotor.*



STEERING SINGLE ROTOR AND TWIN-ROTER HELCOPTERS

Operating the rudder pedals to increase the thrust makes the helicopter turn in the same direction as the rotor blades. Decreasing the thrust of the tail rotor allows the reaction of the main rotor to turn the helicopter in the opposite direction. Some large helicopters have two main rotors that provide extra lift for heavy loads. No tail rotor is required for this type of helicopter because the two rotors spin in opposite directions. The reaction of one rotor cancels out the reaction of the other. To turn, the rudder pedals change the speed of the rotors so that one gets more power than the other. The reaction of this rotor increases and the extra force turns the helicopter. Each rotor is mounted at a different height and their rotation is staggered so that only one blade passes over the helicopter at any one time to prevent the blades from colliding.

Single Rotor

Twin-Roter

HELICOPTER BRIEFS

- *If a helicopter engine stops, its rotor continues to spin, allowing the machine to slowly land, generally without crashing to the ground.*

- *Unlike airplanes, helicopters can hover or stop, fly backwards or sideways.*

- *Helicopters are used for rescues in both peacetime and during wars. The first life-saving helicopter mission was carried out in 1944 and involved a sea rescue.*

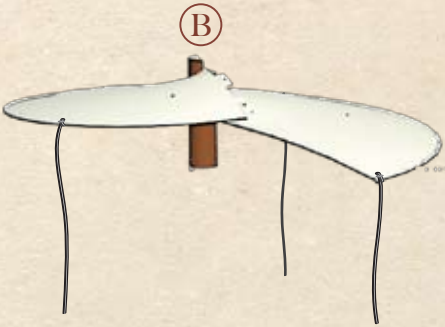
- *U.S. police and emergency rescue helicopters transport about 15,000 patients annually. The method of moving sick and injured people to the hospital saves thousands of lives each year.*

- *Helicopters can be flown across oceans if in-flight refueling is employed.*

- *If you want to travel 300 to 400 miles, the helicopter is often the quickest means of transportation.*

Components


A

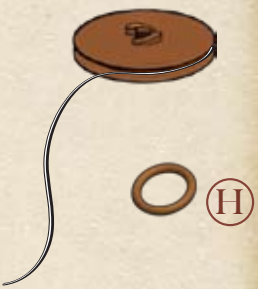

B


C


D


E x 4


F


G

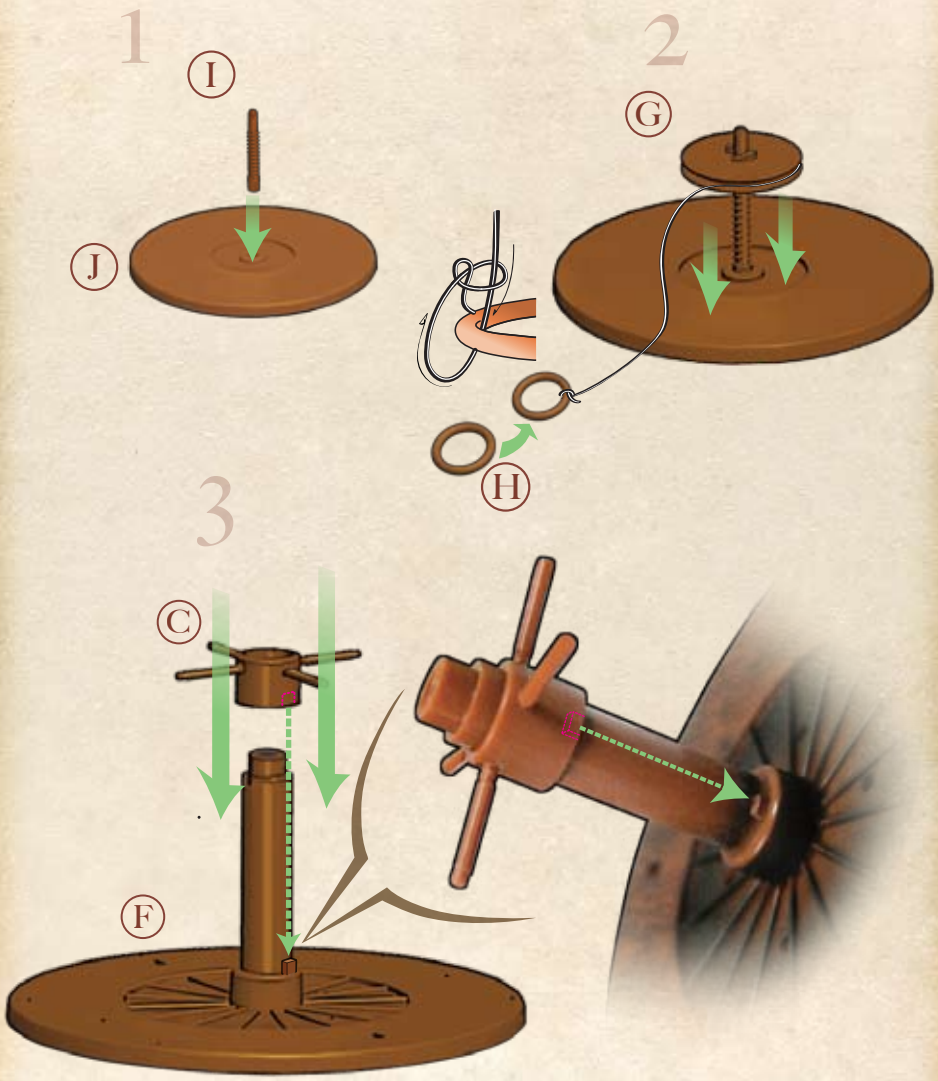
H


I

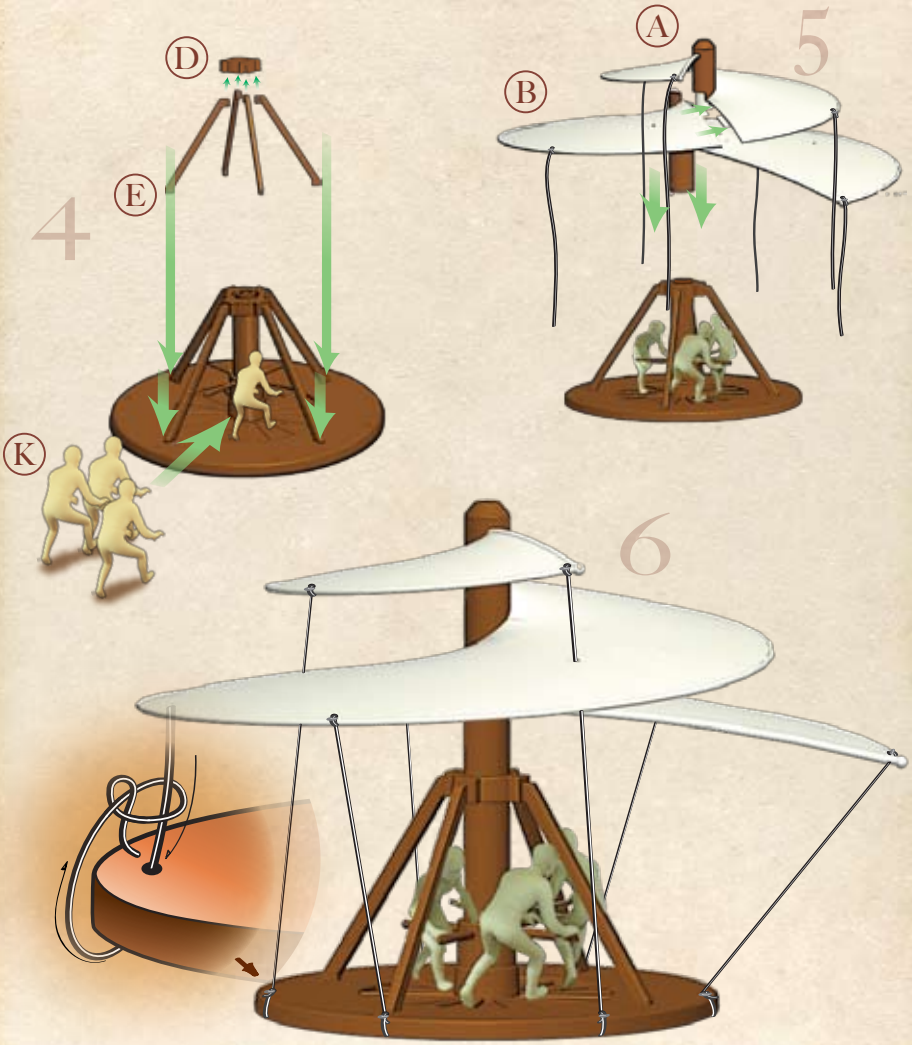

J

K x 4

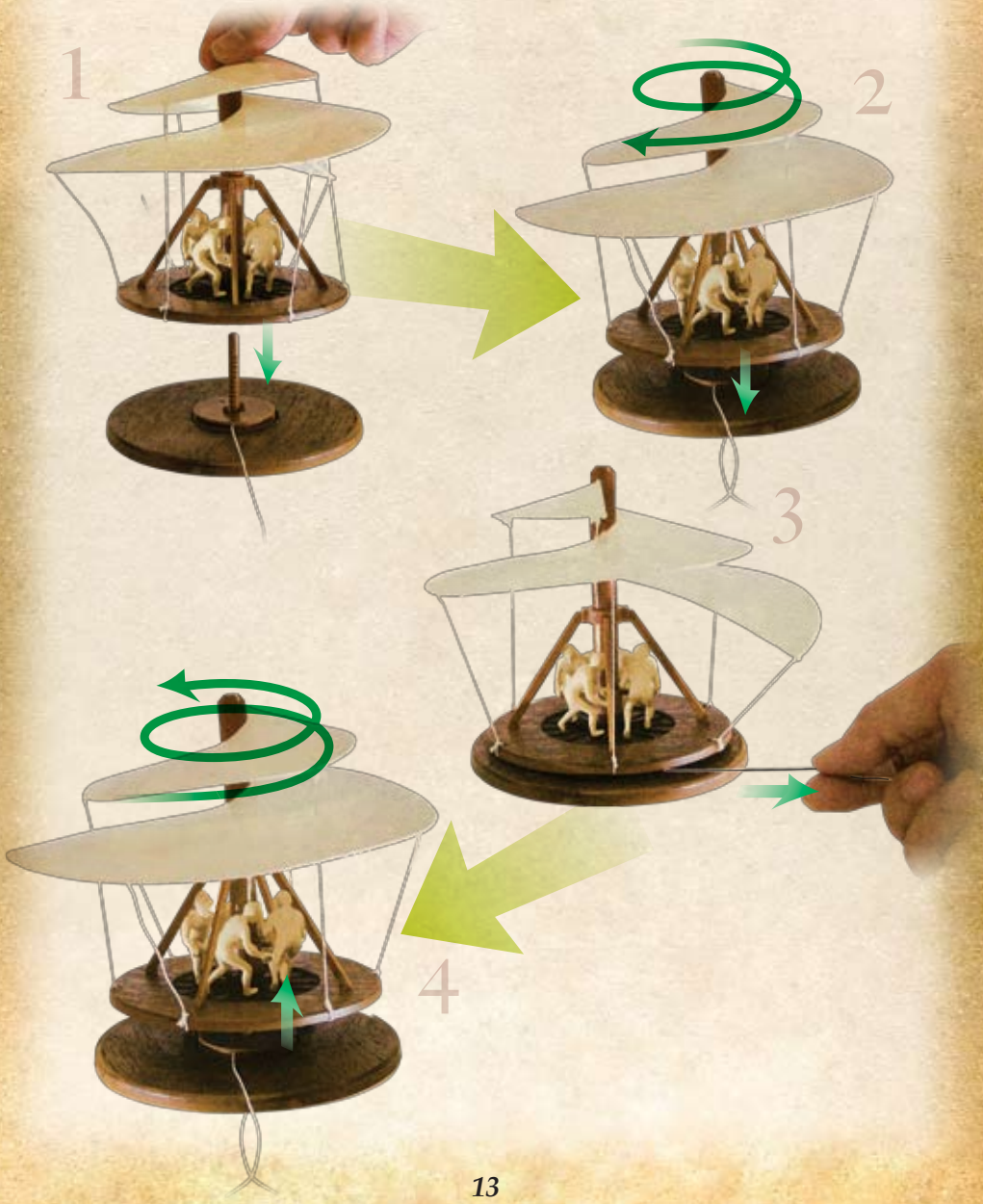
How to Assemble



How to Assemble



How to Operate the Aerial Screw



Leonardo Da Vinci

The scientific genius of Leonardo Da Vinci is brought to life through articulated models offered by Edu-Science. The inventions that inspired these snap-together replicas are taken from the pages of Da Vinci's priceless and awe-inspiring notebooks.

Edu-Science Da Vinci Series Kits

DV001

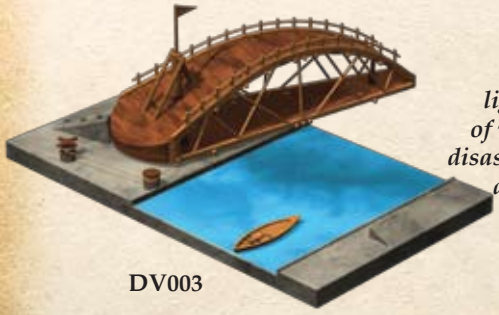
Mechanical Drum

Leonardo da Vinci's mechanical drum was designed as a cart equipped with an amply sized drum. When pulled by its handle, the gears turn the two lateral drums, which are fitted with pegs. The pegs move a total of ten drumsticks that cause them to beat the large drum.

Aerial Screw

The Aerial Screw design is a precursor of the modern day helicopter. The drawing of Da Vinci's concept illustrated the compression of air that was intended to lift the device off the ground.

DV002



DV003

Swing Bridge

The Swing Bridge was a portable, lightweight bridge intended to span a body of water for armies to cross, and then quickly disassemble in order to tow away. Equipped with a rope and wheels, the lightweight bridge was designed for easy transport.

Printing Press

Leonardo da Vinci studied the Guttenberg printing press and finely-tuned it for greater efficiency. In his design, he used a hand press with an automatic system that moved the type-saddle forward and back along a tilted surface, making printing faster and easier.

DV005

DV006

Multi-barreled Canon

The 12-barreled gun carriage was developed to give the traditional canon additional firepower and was a potentially effective weapon against a line of advancing troops.

Armored Car

A precursor to the modern-day tank, the armored car was capable of multi-directional movement and was equipped with cannons arranged in a 360-degree firing range around its circumference.

DV007

DV008

Paddleboat

In Da Vinci's time, nautical expedition was the most expedient method of communicating with the world and his design for a boat with large wheel-shaped paddles that would propel it through water offered a faster and easier method of water transportation.

Self-Propelled Cart

Da Vinci's self-propelled cart was the first to be capable of moving without being pushed or pulled manually. This precursor to the automobile was one of the many inventions that Leonardo created dealing with locomotion and transportation.

DV009

DV010

Catapult

Improvements were made to the age-old military launching device called a catapult. The new design employed a hand-crank that caused tension on the throw arm. The spring design produced a large amount of energy in order to propel stone projectiles or incendiary materials over great distances.

Bombard

This improved cannon was designed to include projectiles that contained a quantity of mini gunpowder shots packed into petal-shaped iron pieces that formed a ball. The device exploded into fragments that had greater range and impact than a single cannonball.

DV011

WARNING: CHOKING HAZARD-
Small parts. Not for children under 3 years.

EDU-TOYS

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