Aeronautic Science Swiftly Developed In Quarter Century

Fundamental Principles Worked Out By Wrights Stand Test of Time

MUCH METAL USED IN MODERN PLANES

By CHETWYN SINCLAIR
N. A. C. A. Staff, Langley Field

The Wright brothers were two clever and painstaking young men. They had studied the theories and experiences of others who had tried to conquer the air; they carried on experiments of their own and they had enough mechanical skill to put into practice what they learned. So in building their first craft, designed to fly under its own power, they wrought according to a scheme that was fundamentally sound and worked out to a sufficient degree of exactitude. They constructed two parallel, fabric-covered planes to serve as wings and mounted on them an internal combustion engine to turn air screws, which propelled the machine through the air at such a speed that the air flowing against the curved wings exerted a lifting force strong enough to raise the machine from the ground and sustain it in the air. The craft was maneuvered and balanced in flight by means of movable control surfaces placed fore and aft of the wings.

That the Wright brothers had at last hit upon a workable system for mechanical flight was verified by their remarkable success, the significance of which is now known and appreciated by all the world. On December 17, 1903, their machine, named the "Flyeo," actually flew straight through the air for a distance of 852 feet and stayed in the air 59 seconds. Man had entered a new realm.

Swift Science

Today the world's fastest plane flashes by the pylons at a speed of 319.57 miles per hour, the long nonstop flight covered 4,475 miles across the South Atlantic Ocean, a plane has remained in the air for a period of 65 hours and 31 minutes, and every day, all the world over, huge flying boats, land transport planes and amphibians carry immense loads safely and swiftly across the skies. Truly no science has advanced more rapidly than that of aeronautics and the greatest tribute standing to the honor of the Wrights is the fact that the phenomenal advancements and success has consistently depended on the use of the fundamental principles of flight originally employed by these two pioneers in the field. Just as athletic records are continually being broken, not by any improvement in human physiology, but by improvements in technique, in like manner the developments in heavier-than-air craft have not yet brought forth any substitutes for the mechanical system which first proved its worth on the North Carolina coast. The combination of engine, propeller, lifting planes, and movable control surfaces is still the basis of all successful heavier-than-air navigation today. The improvements have been made by means of a more accurate knowledge of these underlying principles and more finished technique in applying the knowledge to construction.

The great strides that have been made in the adaptability and performance of airplanes in the 25 years of their existence have been due undoubtedly to the close relations existing between the methods of design and *the findings of scientific research. The acceleration given to this research* by the occurrence of the World War put the industry years ahead. At the time of the war the governments of the world realized the value of military aviation and made large appropriations for the establishment of research laboratories. The investigations carried on at these places and in the technical schools of America and Europe have determined current practices in the design of aircraft of all kinds.

Problems of Power

The lack of a suitable power plant was for a long time the chief deterrent to the success of mechanical flight. When the Wrights built their four-cylinder water-cooled motor and C. M. Manly constructed a very light two-cylinder, air-cooled motor for Dr. Langley's machine, a standard in engine design was set which was not bettered for a long time. Engine development from then on progressed or retrogressed in many different directions, particularly during the war—water-cooled, air-cooled, steam-cooled types; radial, rotary, vee and vertical arrangements of cylinders; increases in unit horsepowers, some motors having as high as 1,000 h. p., and in many instances ungainly increase in weight per horsepower. The definite improvements in aircraft engines have been due mainly to the use of lighter and stronger materials, refinements in design leading to elimination of surplus material in overstrength parts, more precision in balance of moving parts and construction of bearings, simpler and more reliable ignition systems, more thorough lubrication, refinements in air-cooling of cylinders which has led to the more widespread use of the air-cooled engine, a type that seems the best adapted for use in airplanes. The only radical change in power plants has been the development of oil-burning, auto-ignition engines, which promise to eliminate troubles due to electric spark ignition and deliver more horsepower for the weight of fuel. This type is still in the experimental stage.

The design of the Wright propellers was another item remarkably advanced for its time. They developed an efficiency of 66 per cent, a value which was not exceeded for many years. Today the propellers of racing planes have efficiencies as high as 85 per cent. For a long time a flight in rainy weather meant a completely shattered propeller or at least, in the case of later hardwood models, frayed tips. Now they are made of moulded bakelite, steel and duralumin. Some of the metal propellers have blades detachable from the hub, permitting a change of pitch. Extensive experimentation has made it possible to calculate much more accurately the dimensions and characteristics of airscrews best suited for various uses, with various engine speeds and horsepowers, and with various cowling, wing cell and fuselage forms. Propellers with automatically variable pitch for more constant efficiency under varying conditions of flight are in process of development.

Wind Resistance Enemy

One of the first tendencies of refinement in airplane design was to reduce the parasite drag or resistance to the wind. It was found from wind-tunnel experiments that a given volume offered the least resistance to the air when it was shaped something like an elongated teardrop, the blunt end pointing into the wind. This form was taken as the ideal streamline shape. Consequently, the passengers and engine were removed from their exposed places in the slipstream and placed in a streamlined fuselage, thus cutting down the air resistance considerably and contributing to the comfort of the passengers. The open cockpit body was succeeded by the still more efficient and comfortable cabin type and lately the great amount of head-on resistance offered by an air-cooled engine has been much reduced by the use of a newly-developed cowling which completely covers the engine and admits only the amount of air required to cool the cylinders. All wires and struts left exposed are streamlined whenever practicable. Even the landing wheels are sometimes partly enclosed under streamlined fenders.

The wings of the early flying machines were little more than curved slats covered with cloth on the top sides. They were flimsy and required a lot of bracing and the bracing was all exposed in a manner guaranteed to ensnare all the passing wind which should have slipped by unmolested. In a modified form, the streamline shape was applied to the airfoil section (shape of the wing cross section). The greatest amount of experimenting on airplane and wing models in wind-tunnels has been for the purpose of determining the best shapes of airfoils, not only for reducing drag, but also for getting the greatest amount of lifting force out of the wind and for other desirable characteristics. One of the results of this research was the discovery that thick wing sections of certain shapes were as efficient in many respects as thin ones. By usnig these thick wing sections it was possible to place saprs and bracing of sufficient size all inside the wing covering out of the wind. Some were even thick enough to contain gas and oil tanks. These internally-braced wings could be built to withstand such heavy loads that it was unnecessary to divide the load among tw oshort wings. Instead, one wing of long span and of area equal to the two short wings together could be used more economically on heavy planes. This accounts for the prevalence of cantilever and semicantilever monoplanes engaged in commercial work. Short span biplane will probably always be preferred where maneuverability is a prominent factor, a sin military ships.

Spinless Planes Invented

During the last 25 years masses of data have been collected on the relative efficiencies and characteristics of all the various combinations of design elements—wing span, chord, angles of incidence, dibedral and sweepback; gap, stagger, and relative span of biplane wings; placing of fuselage or engine nacelles in relation to the wings and many other variables. Pressure-distribution tests have shown more accurately the distribution of loads so that the designer knows more about what parts of the structure to make strong and what parts to lighten, thereby saving much weight in materials. Other tests have provided much information about questions of stability and shed some light on the causes of spinning. Airplanes which can not stall, and hence can not go into a spin, are already existent.

Many an early flight was nipped in the bud by untimely collapse of the landing gear before the plane could even get off the ground. The Wrights' flimsy landing skids have given place to split-axle landing gear with oversize balloon-tired wheels and oil piston or rubber disc shock absorbers which are capable of handling several tons of airplane landing at speeds around 50 or 60 miles an hour. The wheels are often equipped with brakes to facilitate landing in small areas. Skis instead of wheels have been used successfully in landing on snow. Great improvements have been made in the design of seaplane floats and the hulls of flying boats, effecting quicker take-offs, easier landings, and more stability on water at changnig speeds. The use of metal has made floats completely water-tight. Retracable landing-wheels in combination with flying-boat hulls have been in practical use on amphibians for many years.

More Metal Used

The increased use of metal in all parts of the airplane has been one of the most important factors in the growth of the industry. Duralumin and other light, but strong, alloys are rolled, cast, forged, welded, drawn and stamped to form wing ribs, spars, fuselage framework, engine mountings and practically all parts of the plane. Corrugated metal has in some places replaced fabric as a covering for the wings and fuselage. Metal construction is quicker than wood, the strength of metal parts can be more accurately calculated, in the case of non-corrosive alloys the upkeep of the plane is much less than if fabric were used. It is often possible to save weight in some parts by using metal instead of wood and fire hazard lessens in proportion to the increase in metal used.

Numerous inventions have been employed to add to the convenience of pilot and passengers. Compressed air, electric and inertia self-starters have removed the necessity of a ground crew to spin the propeller in starting. Improved flying instruments make "blind" flying in bad weather a surer art. Radio receivers, transmitters and direction finders are being improved for use in aircraft.

The system of control, the control column and rudder bar or pedals was standardized early in the game. Now enough is known about the balancing of control surfaces, the forces exerted by various plane shapes in various locations, to design fairly accurately for the desired amount of controlability and maneuverability in a ship.

The net results of all the experiments on models and full-size ships in full flights, sometimes involving the sacrifice of men's lives, have given aeronautical engineers the means of knowing in a more quantitative way what characteristics to expect from design elements already in use and more about their causes. He is bettre equipped to collate new practices in design to cope with the problems which he now understands better. He is finding less difficulty in translating his ideas into actual construction, due to improvements in materials and technique of construction.

Kelford

Kelford, N. C., Dec. 15.—The Woman's Missionary Society met in the Fidelis Class room of the Baptist Church Monday. Certificates for the mission study work recently finished were presented by Mrs. J. I. Kendrick.

The ladies of the Baptist Church gave a bazaar in the Old Fellows' Hall Wednesday. A tidy sum was realized for the benefit of the church.

Youth Who Witnessed First Airplane Flight Waits For Mr. Wright At Kitty Hawk

John Moore Remembered By Inventor As Boy Who Came Up From Nags Head

Kitty Hawk, N. C., Dec. 15.—(AP)—John Moore, whom Orville Wright remembers as the "little boy who came up from Nags Head on the morning of the flight," is now a full-grown man anxiously awaiting the return of the genial Mr. Wright.

Moore, just a boy whom people along the beach knew as "Johnny" 25 years ago, came trudging up through the sand on that chilly December morning, a few steps behind the members of the Kill Devil Life Saving Station whom the Wrights had called to aid in launching their plane.

The biting cold and the stiff wind that swept across the sand were not inviting, but a youth's urge to see something new and exciting spurred him on.

Moore, because of his youth, probably had greater hope for the Wright brothers' success in their "impossible" venture than the older and more-hardened members of the life saving station crew. Orville always impressed young Moore as a kind and genial man; and the boy took a real interest in the work which his elders had called "pure foolishness."

Those Who Saw Flight

Four men, J. T. Daniels, W. S. Dough, A. D. Etheridge, and W. C. Brinkley, were present with young Moore when Orville prepared for the first flight. The motor was warmed up, a wire was released, and the machine started down the track against a stiff wind.

The little group waited anxiously. Wilbur ran alongside the plane, holding the wing to balance it on the track. The plane finally lifted into the air and flew 450 feet in 12 seconds before landing. It was a short hop, but man had flown and the little group was happy.

Three of the five spectators at that first flight survive, Moore, Etheridge and Dough. In company with William S. Tate, the three men have marked the spot from which the first flight was made. A memorial, planned by the National Aeronautical Association, is being erected there to mark the historic spot for the benefit of future generations.

Moore, still a relatively young man, is anxiously awaiting Mr. Wright's return to Kitty Hawk December 17 for the twenty-fifth anniversary of his flight. They can then talk over the experience, which was the richest of young Moore's boyhood days.

Laughs At Incident

Mr. Wright always gets a good laugh out of an incident involving Moore which occurred just after the first flight. The little group that had watched the exhibition in the biting cold, placed the machine back on its track and retired to a little building in which the Wrights had a stove.

Young Johnny, seeing a box filled with eggs under a table, asked one of the station men where the Wrights got so many eggs. Moore knew that his people had a hard time eking out a living during the short fishing season, and had never seen so many eggs together at one time in his life.

The life station man jokingly asked "Johnny" if he hadn't noticed a little hen running around the outside of the building.

"That chicken lays eight to ten eggs a day," the man exclaimed, trying to restrain a smile.

Young Moore, having just seen a piece of machinery lift itself from the ground and fly around, a thing at that time placed in a class with perpetual motion, was ready to believe almost anything. He went out and took a good look at the fowl and returned to the little group about the stove.

"Why it's only a common-looking chicken!" he exclaimed.

Dendron

Dendron, Dec. 15.—After one of the most interesting and best-attended prayer meetings at the Methodist Church this year, members of the church assembled Wednesday night at the parsonage and gave their pastor, the Rev. A. W. Linthicum, and family one of the largest "poundings" they have ever received. Mr. Linthicum is in his third year as pastor of this church.

The Woman's Missionary Society of Surry Methodist Church in monthly meeting Wednesday afternoon elected the following officers: Mrs. Wallace Edwards, president; Miss Salabel McAllister, vice president; Mrs. Raymond Galloway, corresponding secretary; Mrs. T. N. Crymes, recording secretary; Mrs. Putnam Chapman, treasurer; Mrs. Lemuel White, superintendent of mission study; Miss Hope Drewery, superintendent of young people; Mrs. C. T. Hamlin, superintendent of children; Mrs. Eva Fuqua, superintendent of supplies; Mesdames C. M. Ellis and Raymond Galloway, superintendent of local work, and Mrs. E. S. Spratley, publicity.

Civic Leader Slain

Hall Davis (above), of Atlanta, Ga., auto dealer and civic leader, who was slain recently under mysterious circumstances. One man is being held for questioning in connection with the murder.
(International Newsreel)

Hertford

Hertford, N. C., Dec. 15.—Mrs. Clyde McCallum was hostess to the Bridge Club Friday night at her home on Front street. The drawing room was attractively decorated with cut flowers and evergreens. Four tables were arranged for playing. Mrs. H. A. Whitley won high score for ladies, and Emmett Winslow, high score for the men. Each received a prize. The hostess served a salad course. Her gueses were Mrs. and Mrs. E. J. Broughton, Mr. and Mrs. H. G. Winslow, Mr. and Mrs. J. Emmett Winslow, Mr. and Mrs. H. A. Whitley, Mr. and Mrs. Will Hudson, Mesdames J. L. Tucker and Clyde McCallum, Misses Mollie Parker, Anna Whaley Smith, and Mae Wood Winslow, and Leigh Winslow.

Mrs. R. T. White entertained her Sunday school class Friday night at her apartment on Dobbs street. The drawing room was attractive with cut flowers and evergreens. Three tables were arranged for rook. The hostess served a salad course. Those entertained were, Misses Mildred Nachman, Marjory Heffren, Frances Fowler, Hilda Knowles, Elizabeth Stephens, Daphney Stephens, Dorothy EElliott, Mary Helene Newby, Lizzie Brown Shannonhouse, Helen Vick, Lilli[illegible] beth Jackson.

Circle 4, [illegible] ary Sa[illegible] Mrs. J[illegible] house, [illegible] present read[illegible] study book, [illegible] until Jan[illegible] freshments.

James Shannonh[illegible] Mrs. Jake Basnight, [illegible] Mrs. T. S. White an[illegible] tenburg.

Members of the a[illegible] Perquimans County [illegible] der leadership of E. [illegible] ty supervisor, entertai[illegible] at a dinner at the C[illegible] Tuesday night, served [illegible] Club. Covers were laid [illegible] Mansfield, of Bethel, presid[illegible] ed. J. S. Howard, district supervi[illegible] vocational agriculture, was the speak[illegible]

Mr. and Mrs. E. S. Douglas announce the birth of a daughter December 5.

Mr. and Mrs. T. R. Winslow announce the birth of a daughter December 9.

The Young Woman's Auxiliary met Monday night with Mrs. Shelton Sutton at her home on Grub street, Mrs. J. D. Pritchard, leader, presiding. Many attended. The hostess served dainty refreshments.

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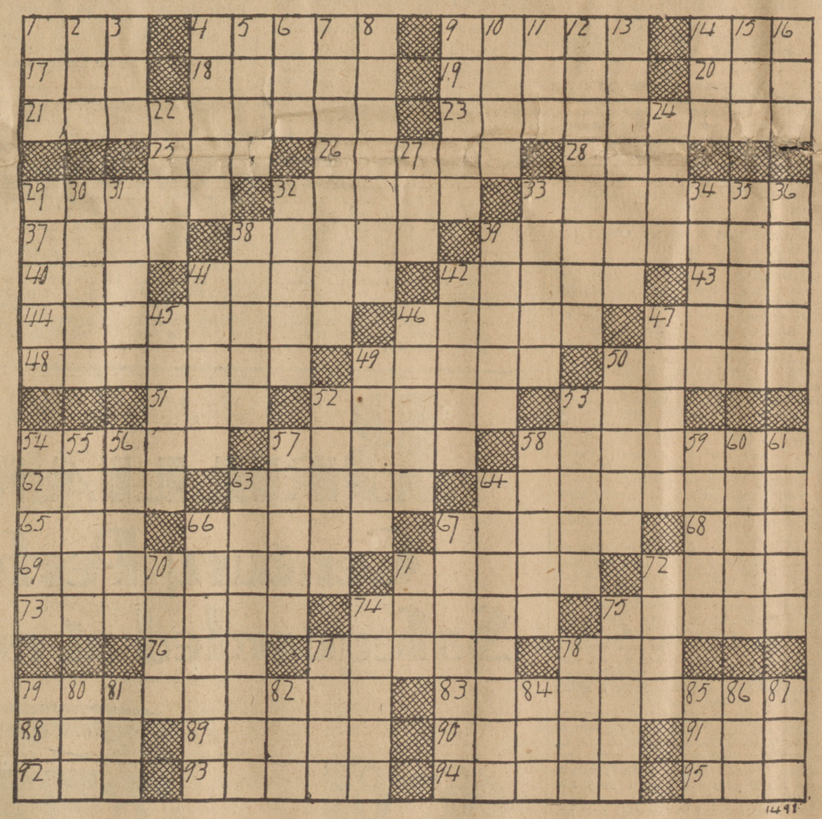
Sunday Cross Word Puzzle

By Richard H. Tingley



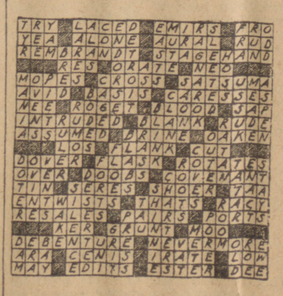
ACROSS

1—Endeavor
4—Entwined
9—Any descendants of Mohammed
14—Away
17—Verily
18—Without equal
19—Pertaining to the ear
20—Spawn of toads and frogs
21—Dutch painter noted for his etchings
22—Scene-shifter
25—Thing or things (law)
26—Declaim
28—New (comb. form)
29—Is melancholy
32—Peevish
33—Japanese district noted for its oranges and ware
37—Greedy
38—Fundamental principle
39—Fondles
40—Born
41—Author of a thesaurus
42—Kinship
43—Any vital fluid
44—Came where not wanted
46—To damn
47—Ill-mannered
48—Undertook
49—Tears
50—The kind of bucket that "hung in the well"
51—Part of name of large city in California
52—Border
53—Fashion
54—Capital of the "Blue Hen's Chicken's State"
57—Small bottle
58—Turns on axis
62—At an end
63—Dog-tooth or Bermuda grass
64—Promise
65—A metal
66—Dries up
67—Person who tries on foot gear
68—A pagoda of Japan or China
69—Weaves
71—That is (cont)
72—Piquant
73—Sales at second hand
74—Groups of two of a kind
75—Harbors
76—Personification of hate (Gr. myth)
77—Murmur or complain
78—Noise made by kine
79—Government pay-order
83—The one word in the vocabulary of Poe's raven
88—Southern constellation
89—High mountain peak
90—Wrathy
91—Bellow
92—To have permission
93—Conducts a newspaper
94—Animal fat
95—River in Wales and England

DOWN

1—Norse god for whom Thursday is named
2—Portuguese coin (var)
3—Variety of sweet potato
4—Roman household gods
5—Expression of regret
6—Against
7—Vouched for
8—City in Michigan
9—Orientates
10—Silent
11—One of David's warriors (2 Sam'l xx-26)
12—The twilight of the gods-doomsday (Norse myth)
13—Precipitated frozen rain
14—Brother (Monk's title)
15—Brook
16—Occasional
22—Reared
24—An equine (Oliver Wendell Holmes)
27—Stupid person
29—Form of mental unsoundness
30—Heated chambers
31—Magpies
32—Imprisoned
33—River in France
34—A bearded seal
35—Union general at Gettysburg
36—Poplar tree
38—Portends
39—Sharp metallic sound
41—Unverified report
42—Twinkle
45—Straight-edge
46—Alloy of zinc and copper
47—Stem of palm
49—Repeats inadvisedly
50—External
52—Large masses of floating ice
53—Small bays
54—Senile person
55—Sheep-like
56—Outlets
57—Defensive works
58—Extirpates
59—Person of savage temper
60—Perform
61—Remains
62—Forsook
64—Documents granting special rights
66—Stillness
67—Game like hockey (var)
70—Resuscitate
71—Greek letter equivalent to "t"
72—Lodge
74—Dense throng
75—Person who reads with close application
77—Courage
78—Apportion
79—Restrain
80—Epoch
81—To bark at
82—Prefix: "one"
84—Cistern
86—Immemorial
86—Deer
87—Sheep

Solution for the above puzzle.



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