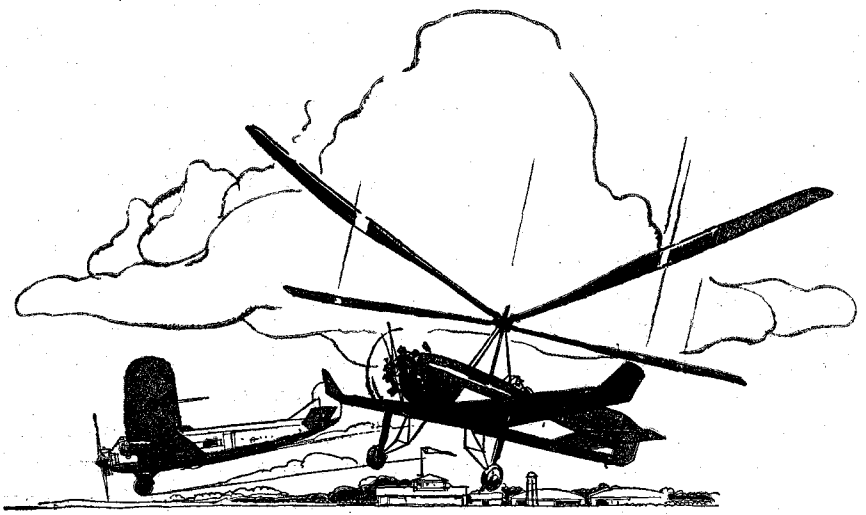
Wings of To-morrow



Drawings by Thomas Benrimo

by JUAN DE LA CIERVA

Inventor of the Autogiro

SPECULATION has done so much damage to the business of aviation in recent years that the rôle of aëronautical prophet is rather a thankless one. The industry has been overfed with promises, prophecies, and great expectations, and has paid for it with financial indigestion. But on the other hand, this is certainly no time for satisfaction with things as they are, or for complacent confidence that is unsupported by intelligent foresight and preparation for the future.

Between the devil of discouragement and the deep sea of unwarranted optimism, this may be a suitable time for a reasonable forecast and a realistic survey of the present condition of aviation, if the two can be kept in some sort of agreement. We must understand the present in order to anticipate the future with any accuracy. We must admit whatever is wrong with the wings of to-day in order to measure the wings of to-morrow.

It is no longer reasonable, I think, to allow imagination to have its own way with the prospects of aviation. We have had about enough of fantastic forecasts, based on very little science or none at all and supported by the single certainty that man has learned to fly. It must be admitted, moreover, that the dreams of swift progress inspired by certain memorable flights and feats in aëronautical history have largely ended in discouragement. The glory of their accomplishment has not dimmed, but subsequent events have not fulfilled their promise.

Such a statement seems to be born of a rather disillusioned mood, but disillusion is the present temper of aviation. Disillusion is not necessarily despair. It may be a very healthy state of mind, particularly if it encourages clear thinking and plain speaking. And since it is no secret that aviation has reached a somewhat critical point in its progress, this may be a proper time to apply a little honest realism to the present and future of the art, science, and industry of flying.

There are three principal factors to be considered in judging where aviation stands to-day — the plane, the pilot, and air traffic.

It may be said that the airplane is nearly a perfected machine. Current improvements to it are largely refinements and accessories. Engineering has eliminated practically all uncertainty in regard to structural strength, and experience has accurately determined what may be expected of any conventional type of plane. Performance, indeed, has become a matter of design rather than discovery. A plane can be built, for instance, to fly at a given speed, to climb to a certain ceiling, to carry a determined load.

THE BRIEF history of practical aviation is rich in figures of men and women who have won fame by remarkable flights in the new vehicle of civilization. There are pioneers aplenty, record-breakers of every species, and outstanding individuals who have captured the public imagination with some single bold feat of flying. There are those who have turned the mastery of the air to the service of science and discovery.

But behind this record of achievement there is the great company of scientists, students, designers, and engineers whose patient efforts have made possible the spectacular flights of the past twenty years. Few of them are known by name. A reason for this is that each man adds only a little to the sum of knowledge and experience which makes up the mass of aëronautical science. The inventor adds a single element of safety, a single improvement in structure or materials, a single modification in design as his contribution to the perfection of the plane and its performance.

One name is safe in history — that of the Wright brothers, who first succeeded in building a machine that would fly. Another may some day earn a similar distinction. It has been said by many experts in aëronautics, in America and elsewhere, that the autogiro or "flying windmill" is the only fundamentally new invention in aëronautical history since 1903, when the Wrights first flew at Kitty Hawk. Its inventor, Juan de la Cierva of Spain, is entitled therefore to be regarded as a pioneer in the science of aëronautics, and his opinions on the present status of aviation have more than ordinary interest.

Juan de la Cierva is primarily a scientist and engineer, trained to his trade and thoroughly skilled in the theory and practice of conventional aëronautical design. His contribution to aviation, the autogiro, cannot be considered as the product of an inspired guess or of haphazard experiment; it represents a scientific answer to a scientific problem. Many years of conventional aëronautical studies preceded its development, and Señor Cierva had already built gliders and planes of various design before he turned his attention to an entirely new theory of flight and its application to a new type of flying machine. He is, of course, a pilot of long experience and has flown the autogiro all around Europe and in many demonstrations in America.

Señor Cierva speaks English fluently, and on his recent visit to the United States he discussed frankly and at length his confidence in the autogiro and his estimate of its prospective effects on the progress of commercial aviation. These are embodied in his analysis of the present status of aviation, its pressing problems, and their promise of solution in the performance and possibilities of the autogiro.

— DONALD F. ROSE

While airplanes were comparatively crude, it was easy to suppose that they might develop into anything at all and be made capable of any performance. But science has exploded many of these early fancies. It has done so principally by defining with comparative certainty the limitations inherent in the heavier-than-air machine which flies on fixed wings.

It is not an unfair criticism of aviation to consider these limitations. It is a criticism of the airplane itself, but such criticism must be made for the ultimate good of aviation. We have no scientific right to base our expectations of the future on possibilities which are flatly opposed to present facts. We are proud of what the airplane can do; we should admit what it cannot do.

WHAT PLANES CANNOT DO

WHAT ARE the outstanding limitations on the prospective development and present performance of the conventional airplane?

We know there is a limit to the airplane's ceiling, determined by the needs of internal combustion motors and the depth of the ocean of air. It is a limit that is not of any great importance at present, since flying at extraordinary altitudes offers no particular advantage unless we reach the height of the great winds which blow against the rotation of the earth, which is not a present scientific likelihood. We may also say that there is a limit to speed, so long as we depend upon propellers to push or pull our airplane along; and we may say again that this limit is of no immediate importance. A commercial speed of two hundred miles an hour and more can be considered fast enough for the world's present aërial business.

But at the other end of the scale we face a more formidable limitation. We find there is a minimum speed for airplanes, below which they will not stay in the air. We find another minimum below which they cannot be controlled with certainty and safety. And we discover that these limits are of immense and immediate importance to the progress of aviation, to the public use of the plane, and to the business which depends on it.

The outstanding weakness of the airplane — a marvelous machine in a thousand respects — is its inability to fly slowly and to come under full control to a stop at the point of landing. Strictly speaking, the difficulty is one of landing, of bringing a heavy machine safely to earth at a speed suitable to whatever conditions are present when the landing must be made. This is a very practical problem. Every pilot faces it with every landing he makes. Nearly every passenger is aware of it as the plane descends to the airport and he sees the ground

going by at fifty miles an hour or more. Every airport engineer allows for it when he provides long and level runways, hard-surfaced and clear of obstructions, so that the planes may have space in which to touch the earth at high speed and come to a stop. And the vital statistics of aviation are full of illustrations of its importance, one evidence being the high percentage of accidents which are the result of bad landings or of loss of control in attempted landings.

It was twelve years ago that I was made keenly aware of this characteristic weakness of the airplane by watching an experimental plane of my own design smash to pieces in the hands of an overconfident pilot. It smashed because it went momentarily out of control while flying near the ground. It smashed because the pilot could not stop when he found himself in trouble. It smashed so completely and conclusively that it shook my faith in the conventional plane and started me in search of something better, though I had spent many years in study and experiment in order to become an aëronautical engineer and a designer of airplanes.

The autogiro, the machine which has lately been seen in flight at most of the Eastern airports of the United States, owes its successful development largely to the failure of more than one airplane which I built in Spain while a schoolboy and student. Their failure was due to no fault of their design or construction; they came to a bad end because of their likeness to all other airplanes which have been built since the Wright brothers flew at Kitty Hawk. Many other airplanes have met the same fate for the same reason. They could fly fast and high; they could not fly slow and low in sufficient safety or under proper control. They could not land in a small space and come to a quick stop.

When my tri-motored biplane, built in a national competition for prizes offered by the Spanish Government, ended its brief career in a heap of wreckage, I accepted the accident as an invitation to reconsider the theory of flight from its beginnings and seek another solution to its problems. The answer was the autogiro. My first models and machines were crude and clumsy and would not fly. Those of later design got off the ground and safely back again and little more. I tried various designs — types with two rotor vanes, with three and five — and many devices for control.

The machine developed, indeed, through more than seventy models to its present design and efficiency. But its fundamental idea is unchanged since its first discovery, just as the modern airplane is in essentials the same machine that the Wright brothers flew in 1903 and that Langley intended in 1898. The airplane is still a flying machine depending on the movement of a fixed airfoil against the air at an average speed of fifty miles an hour or more. The autogiro from the beginning has been designed to fly on what is really a revolving wing, whose blades or vanes are airfoils moving at sufficient speed to maintain flight and complete control, whatever the forward speed of the craft may be.

The best airplanes, in a word, must fly at fifty miles an hour or more and land at nearly the same speed; the autogiro can maintain flight at twenty miles an hour and land at no speed at all. The autogiro has eliminated the most serious limitation of the flying machine and the one which has been its most persistent handicap as a practical craft for business and pleasure.

The Human Element

The second main factor in the present status of aviation is the pilot.

Possibly the pilot's profession is the most exacting of all those that have been developed by the demands of the mechanical era. The airplane pilot is — or should be — a man of extraordinary skill, fine physical coördination, and a keen sense of responsibility. He must be trained by long and expensive practice. He must be cool, courageous, and resourceful. This is no less true to-day than it was in the earlier days of aviation; the tendency, in fact, is to demand more of to-day's pilots than sufficed for yesterday's. In the United States the licensing requirements have recently been made more severe; everywhere in the world a high premium is placed on long experience and practice.

The reason lies with the airplane itself. It is unnecessary to prove that there is no "foolproof plane"; if there were, the world would welcome it enthusiastically and fly it universally. The startling fact of present-day aviation is that there is no airplane which can be flown with consistent safety by anyone but an expert. Numerous protective devices have been added to the plane and to the airway along which it

flies, but it still needs a first-class man, well trained and experienced, to fly and land it under all conditions.

The preponderance of the human equation in the operation of an airplane has scarcely changed since the machine was invented. Its proportionate share in good flying is still high — too high for the successful development of aviation as a universal utility. American experts have recently stated that the safe and efficient operation of a modern plane depends ten per cent on the plane itself and ninety per cent on the man who flies it.

It is hardly necessary to argue the point that this is immensely in excess of the corresponding requirements of any other commercial vehicle. No ship, locomotive, or automobile is so little as ten per cent efficient for safety. Certainly none of them requires the most of its driver or operator in executing the simple maneuver of coming to a stop. And yet the most critical operation in handling an airplane is to bring it safely down to the ground and land it there, particularly if conditions are at all unfavorable.

The autogiro has demonstrated in hundreds of test and demonstration flights its ability to land at slow speeds, without forward roll and under complete control at all times. It can be brought down safely and confidently under conditions of terrain which would be highly hazardous to an airplane. It comes to a stop as it reaches the ground. In technical terms, it can be landed at low speeds without danger of stall, it has remarkable inherent stability, and it has no minimum flying speed to make every landing a problem in skill and experience. In practical and popular terms it may be said that it compares with the airplane very much as an automobile with four-wheel brakes compares to a car with no brakes at all. The latter can be driven by an expert chauffeur and stopped approximately at will by skillful handling. But the car with good brakes can be driven by a man of moderate ability and stopped short under ordinary conditions, and even in emergencies, without any remarkable skill or good fortune.

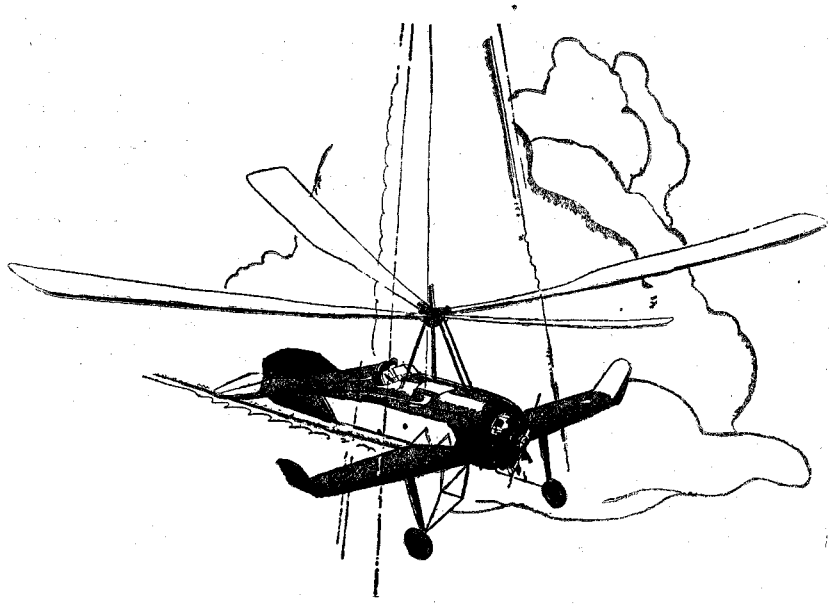
The autogiro, in a word, has made a comparatively simple maneuver of what is the most critical and difficult problem in managing an airplane. My own estimate is that the ratio of importance between the man and the machine has been reduced until the pilot's skill counts for considerably less than fifty per cent in the autogiro as compared with ninety per cent in the airplane. Furthermore, it is the testimony of experienced American pilots that a novice can learn to fly the autogiro safely and efficiently in about one-quarter the time he needs to master the plane.

The third respect in which we survey the present status of aviation is that of air traffic.

This need not be a matter of statistics, but merely of ordinary, everyday observation. Hundreds of thousands of miles of airways are spread around the modern world, but few airplanes fly along them. Compare, if you please, the mileage of one of your American airways with a similar length of railroad track and compare the traffic that uses them. Compare the passenger lists of ships leaving New York on a single summer's day with the entire air traffic of America for the same period. And for a final and formidable contrast, compare the world's investment in its airways with the present business that uses them.

The most apparent reason for the serious shortage of air traffic in comparison to aëronautical progress in other respects is the scarcity of private plane owners and operators. The automobile industry never reached its present

scale by reason of the demands of commercial traffic, and the automobile is the vehicle that can best be compared to the airplane. Millions of private cars use the roads, justifying the expense of building and maintaining them and thereby making possible a profitable commercial traffic. Aviation needs right now the private owner and operator of a flying machine built for business and pleasure.



At present he is a poor prospect for the airplane salesman. The reasons have been implied in considering the other factors in the present status of aviation. The ordinary skill of the average man is insufficient for the operation of an airplane, nor can he spare the time and money needed to make a competent pilot of him. Neither can he afford the overhead of owning a plane, since this means the possession of a private airport or proximity to a public field. I believe that the autogiro will answer the need of the private owner. It can be flown with less training and less natural ability than the plane, and it can be landed anywhere that there is an acre to spare. Some day, indeed, I expect there to be downtown airports in every town and city, some of them built above the rooftops so that autogiros may alight on them and take off again in entire safety. The mere mention of this possibility suggests what commuting may mean when autogiros are common.

A Renaissance in Aviation?

Three principal factors in the present condition of aviation have suggested in turn the autogiro as their remedy. The autogiro has overcome the inherent weakness of the airplane — its minimum requirement of speed for safety in flight and landing. The autogiro takes a substantial proportion of responsibility from the pilot, for it can be landed slowly and under a far wider variety of conditions than the plane. The autogiro promises to become a popular craft with the private owner and operator, multiplying many times over the demand for aëronautical products of all sorts, increasing air traffic everywhere, and creating many new customers for commercial aviation.

For these reasons and many others, therefore, I believe that the wings of to-morrow are not to be fixed planes like those which lifted the Wright brothers and other pioneers of flight, carried Lindbergh, Byrd, Chamberlain, Coste, and others across the ocean, and bear the burdens of to-day's aërial traffic. They will be revolving wings, swinging freely in flight, adjusting themselves automatically to the varied currents of the air and the load they carry, and coming down out of the sky to their destination in controlled certainty and safety. There will be thousands of such craft where one airplane cruises in solitude to-day; there will be airports wherever they are needed and small landing fields on countless country estates. There will be new wealth for industry and new work for those who handle and maintain a volume of air traffic far greater than that of to-day.

A word, now, as to how the autogiro works. Its theory and principle is fundamentally this: that all flight is by means of motion, which is not necessarily the motion of a fixed plane in a single direction. The autogiro is sustained in flight not only by its forward motion but by the free revolution of its four-bladed rotor. It needs less wing than a comparable airplane because in full flight its vanes or rotor blades (which are its wings) are swinging through the air in a circle as well as moving forward in the line of flight. For the same reason it can fly slowly, a speed of twenty miles an hour being sufficient to keep the rotor turning against the air with enough motion to sustain the craft. There is as

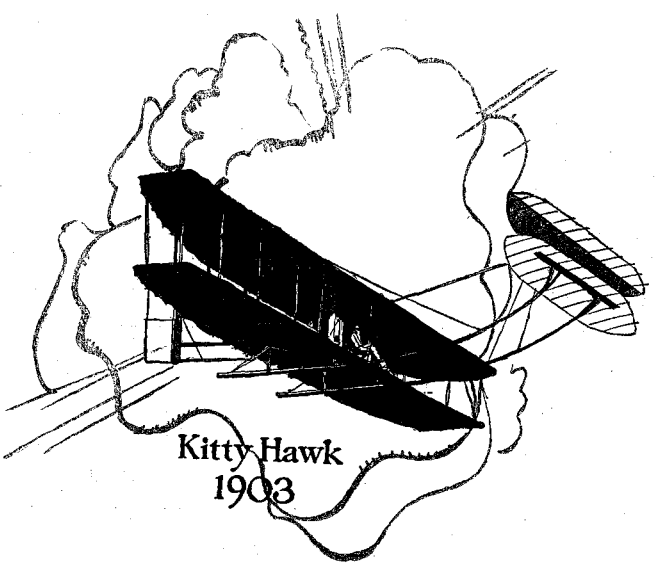
much motion in the flight of the autogiro as in that of the conventional plane, in proportion to its wing surface, but it is not all expended in a single direction. Therefore it is still flying when it is nearly at a standstill in the air, and still under full control in conditions which would cause an airplane to fall like so much dead weight.

What of its landing? Let us suppose that a similar weight and bulk were dropped from a considerable height. It would come down, of course, at a terrific and increasing pace. So would an ordinary airplane, deprived of its flying or gliding speed, which is why the plane must divert its descending speed into forward motion — a long glide or spiral — maintaining a pace of not less than fifty miles an hour until at the point of landing, and touching earth at thirty miles an hour or more. But the descending speed of the autogiro is automatically absorbed by the revolution of the rotor, so that it comes down no faster than a parachute, even in abrupt vertical descent. The speed is there, but it is transferred to the rotation of the "wings," which are still swinging through their arc as the autogiro touches the earth and stops "in its tracks."

The autogiro uses the ordinary airplane motor, the same materials and similar controls, the same instruments and accessories. It is flown in most respects like a plane; any competent pilot can handle it after a few minutes' instruction. It serves nearly every known purpose of the present type of plane; it flies at similar speeds and carries similar loads. But its wings are its own.

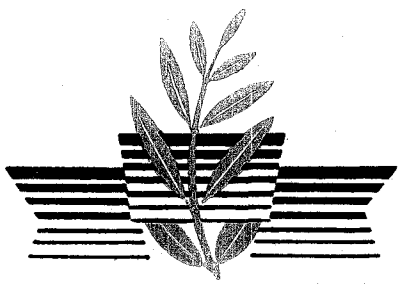
The time is ripe, I believe, for a renaissance in aviation, a new impetus toward its goal of usefulness to civilization. I think the approximate perfection of the autogiro will make a major contribution to this revival. Nothing of what has been done will be wasted, for the autogiro has appropriated to itself all the science of aëronautics and all the experience of aviation. It will use the airways which have been so boldly built to the scale of an air age. It will fill the waiting airports and crowd the schools with students who will have a real prospect of flying when their course is over. It will take its place in air traffic of all sorts, carrying passengers and cargoes wherever speed is an important consideration.

I dreamed of these things when I turned from the ruins of my last airplane to find a new application of the fundamental principles of mechanical flight. I was hopeful of them when the first successful autogiro lifted from the ground seven years ago and came safely down again. I am sure of them now that autogiros are flying successfully and in increasing numbers in America, England, France, and Spain. Because of its record of performance and the scientific certainties which safeguard that performance, and because it answers the outstanding needs of aviation as they are revealed in the present problems of the art and industry of flying, I am confident that the whirling vanes of the autogiro are the wings of to-morrow.



What I Believe

Living Philosophies XVII



Drawings by John Melching

by JOSEPH WOOD KRUTCH

Author of "The Modern Temper"

I

DURING THE COURSE of the Middle Ages it was, I believe, commonly assumed that man is an animal plus. No Darwinian researches were necessary to indicate the obvious fact that his body is constructed along the same general lines as the body of a cow or a pig, and that a very considerable number of his instincts and his desires are related in similar fashion to those of the humbler creatures. But something left out of the lower animals had, it was assumed, been put into man. A soul — something not only immortal but capable of desires and motives quite unknown to beasts — had been mechanically added. This soul came into frequent conflict with the animal part to which it was temporarily linked, but it should and it could (with the aid of God) triumph over it — indecisively in life, but definitively in some future when the troublesome body should have been completely cast off.

Now there are various reasons why it is difficult to accept this theory to-day. Indeed, very grave objections have been raised to even that modern variant called vitalism which assumes that life is something which has, in much the same way, been added to matter. But the theory itself is more than merely delightfully simple, for it serves to symbolize a problem quite as real just now as it ever was. We know even better than they knew in the Middle Ages how much of man is simple animal. We know that his body is, organ for organ and nerve for nerve, almost identical with that of the ape. And we know how much of his conduct can be explained in terms of animal behavior.

Yet try as hard as we may, we cannot quite succeed in bridging the gulf which still lies between us and the creatures whom, all too distressingly it sometimes seems, we so closely resemble. Even the most materialistic among us must distinguish, if only for the sake of convenience, between the human mind and the mind of the beast. We still desire passionately things which no animal could understand. We are still capable of motives unparalleled in animal psychology. And we still need very urgently to know what this difference means.

What of the values which we assign to love, to art, and to knowledge? What of the scruples which afflict us concerning duty, and right, and purity? It is true that the materialistic student of manners and customs may reply that morality cannot possibly exist, because every conceivable action has been at some two times and places considered both obligatory and forbidden. But the fact remains that man has the power and the need to conceive of those abstractions to which he has given the names of right and wrong, and it is that power and that need with which we must deal. Even if it be granted that there is nothing outside of man which corresponds to these conceptions, at least the conceptions are there. They are capable of modifying his conduct very profoundly indeed, and they are a part of the data which any adequate view of man must consider.

You may phrase as you like the question