HERE is no question in the development of aviation more interesting to the average observer than the relative value of the biplane and the monoplane. Types of both have so multiplied and differentiated that the man on the street can no longer distinguish at sight, say, a Nieuport from any other of the monoplanes to which Bleriot accustomed him, or pick out a Farman, a Sommer, a Voisin, from other biplanes, however they may show their peculiarities to the initiate, but the two main divisions of the flying-machine remain distinct and distinguishable to the most casual gaze.

Distinct they have always been, even in the impulse that brought each into being. The dream of man for ages had been to fly; his one model in nature had been the bird; mechanical genius first set about to build a flying-machine on the bird’s model. All birds are monoplanes, all insects, all flying-fish, all flying-squirrels are monoplanes, and the imitative genius of the mechanic seems to run naturally to the production of a machine of the monoplane type.

The biplane, on the other hand, starts from the kite. Originally a monoplane surface, the kite was developed and made more efficient by Mr. Hargrave, a well-known Australian scientist, who constructed the double-surface "Hargrave Kite," widely used for scientific purposes by the Weather Bureau, as well as by boys in their sports. This kite-form is not an imitation of anything in nature, but the creation of a scientific mind, worked out on engineering principles.

This fundamental difference extends all down the line of subsequent airplane construction. The monoplane is the development of mechanical genius,
the biplane is the product of engineering skill and knowledge of the principles of aëro-dynamics and construction.

Otto Lilienthal, a German, a man of poetic nature and an enthusiast, studied the stork and its manner of flight and built a monoplane gliding surface on resultant lines. This inspired Octave Chanute to repeat some of Lilienthal’s experiments near Chicago. Mr. Chanute was at that time chief engineer of the Erie Railroad, an engineer and scientist of the highest order, and just as Hargrave had improved the kite, Chanute finally improved the bird model of Lilienthal by building a "Chanute" gliding machine, founded on the basic principle of the Pratt truss used in all bridge building and engineering construction work.

The monoplane may thus be said to descend from Lilienthal’s poetic model glider, the biplane from the glider of Chanute, scientifically constructed on engineering principles. The Wright Brothers were also experimenting at the time with a glider built with practically the same construction, but made flexible at the rear edge for the better maintenance of equilibrium.

The poet is, as the word implies, the "maker," the doer, the empiricist; the scientist, as its derivation shows, the "Knower," one who works outward from basic principles. This shows not only in the types of machines but in the characters of the men who invent them. Bleriot, who has the best factory facilities and equipment in the world, is the typical monoplane inventor, the born mechanic; the Wrights created their biplane not so much in the shop as in the study, planning it out completely and working from data previously obtained.

The monoplane is, as everyone knows, an aeroplane with a single large supporting surface, while the biplane has the large or main supporting surfaces placed one over the other, usually strongly held together by struts and braced by cross-wires. However, I would put a number of machines into a third category, which I would call "double monoplanes" or "double planes," to include such machines as have two single planes tandem, or placed so that one follows the other, such as the Langley type. These have hitherto been considered monoplanes solely because all their surfaces were on the same general plane or level.

This class would also include machines with two single planes superimposed, which seem to be held apart from each other, but are not firmly built to-
geth er a s a unit. Such are the hydro-
aëroplane recently used by Ferber in his
experiments over the bay of Monaco, the
Goupy machine, and the machine built
by M. Louis Breguet, which has a monoplane
fusilage with engine and propel-
er in front and two supporting surfaces
held apart by single struts.

The case for the respective types, it
would appear, resolves itself into a com-
parison of the claims of each to superi-
ority in the qualities which flying-ma-
machines must possess—speed, adaptability
for altitude, weight-carrying and dura-
tion, usefulness, especially in cross-coun-
try flight in war or peace, and safety.
This may partly be indicated by per-
formances, but at this early stage in avi-
ation it must be forecast somewhat from
the construction and consequent limita-
tions of the types.

The speed record belongs to the mono-
plane and has done so from the begin-
ning. At this writing it is held by the
late E. Nieuport in a Nieuport at Mour-
melot, France, with a speed of 82 miles
an hour. Although the first Gordon
Bennett race was won by a biplane, all
others since have been won by mono-
planes, and even when the biplane won
the race, faster time was made in a single
lap by the contesting monoplane.

Speed Not the Whole Story

In short, if all there were to flying
were going swiftly straight through the
air, it would be a clear case for the
monoplane. But it is actually a debat-
able question whether in the final de-
velopment of the art of flying, extreme
speed is an entirely desirable quality.
Extreme speed in flight is all right while
in the air, and enables one to cut through
wind disturbances with less chance of
loss of equilibrium and consequent in-
crease of safety, but it complicates se-
riously the problems of landing and ma-
neuvering.

The altitude record shifts with sur-
prising rapidity. Some idea of this may
be obtained by a study of the records
since only the beginning of the present
year. Up to December 31, 1910, the
world’s record was held by Legagneux,
in a Bleriot monoplane, with a trifle over
9,975 feet. He had wrested this from
a Wright biplane flown by R. Johnstone
to 9,714 feet. Loridan won from the
monoplane in a Farman biplane at
Mourmelon in July with 10,761 feet,
and directly after Lincoln Beachey
raised the figure to 11,642 feet in a Curt-
tiss biplane at the Chicago meet. But
before the end of the season it passed
again to the monoplanes, and is now
held by Rolland G. Garros in a Bleriot
with 13,945 feet, over two and a half
miles.

A high altitude record depends upon
the ability to operate in air with not
quite half, or at least much less than,
the supporting power of air near the sur-
face, and consequently furnishes an ex-
cellent test of general efficiency. This
is one reason why altitude tests, to the
layman often so purposeless, are so im-
portant to constructors of aëroplanes, es-
pecially just now in the experimental
stage of building. The aviator’s reason
for exacting high altitude possibilities
is his desire to get into the major cur-
rents, which may be favorable to speedy
long-distance flight. If, to his tremen-
dous engine power he can add the speed
of the upper currents—well known to
balloonists—there is no reason why he
should not easily add to his machine’s
speed the velocity of upper air-currents,
which have been recorded as high as one
hundred miles an hour.

It also enables him to get out of dis-
turbed conditions at lower altitudes and
to cross high mountain ranges and—a
very important point—gives him a much
safer position for gliding down in case
the motor gives out. The ultimate pos-
sibilities of altitude are by no means
reached, and it is perhaps hazardous to
forecast that the greater supporting sur-
face of the biplane will finally count for
more in the higher air, though there is
reason for such a belief.

In weight-carrying, the biplane easily
leads. Breguet holds the record with
fourteen passengers, and though Bleriot
has built a monoplane that carried seven,
for demonstration purposes, this ma-
chine was not further developed.
Weight-carrying power is a most im-
portant quality, not, as might be imagined,
for possible passenger traffic, but because
LAUNCHING A CURTISS BIPLANE FROM A WIRE TO SHOW ITS AVAILABILITY IN NAVAL USE
it permits taking along a greater amount of fuel, much increasing the radius of action and permitting the aviator to stay up much longer. Aeroplane makers do not and will not consider passenger-carrying beyond a comparatively small number; it is the fuel, the life of the flight, that they wish to make possible to the aviator in increased quantity.

From this, it will not be surprising that the duration record should be held by the biplane—G. Fournay at Buc, France, September 2, 1911, flying a Maurice Farman biplane continuously for 11 hours 1 minute, and covering 720 kilometers, about 450 miles.

The aeroplane is now, roughly speaking, useful for two purposes,—military and naval uses in time of war and cross-country flight for sport or practical purposes in time of peace. For the army, both types may be, and are readily, utilized without encroaching upon each other’s special usefulness. The speedy monoplane is used for messages where rapid personal communication must be established; the biplane more for observation and reconnoitering, for locating important dispositions of the enemy’s troops, allowing by its lower speed an opportunity for passengers to sketch or photograph, something very difficult to do from a monoplane whose construction affords only a limited field of downward vision. This is a most important detail, and this is the position taken by all military officers and the Aeronautic Corps of France, England, and America, who have been training their military aviators for this kind of work. Biplanes have been the machines chosen for sketching or map-making, because by virtue of the position of the aviator, the field of vision is so much clearer below. The United States army has no monoplanes—which may or may not bear upon the question, according as one has had experience with the difficulty of getting American appropriations for military aeronautics—but the French army, with a remarkable governmental co-operation and a strong national predilection for the monoplane type, is equipped in about the proportion of sixty biplanes to thirty monoplanes.

For general scouting work, both machines are needed, and at the German
THE BREGUET BIPLANE HAS THE PROPELLER IN FRONT AND TWO SUPPORTING SURFACES HELD APART BY SINGLE STRUTS

maneuvers this year proved their efficiency so well as to earn the especial congratulations of the emperor. For wireless operations the biplane is better, on account of its construction, which is the reason why all experiments of this nature have been, as far as I know, conducted from biplanes. The biplane is able to make better landings on rough ground, an advantage in time of war, and though I have never known of actual experiments in such use, I do not see why the biplane could not be used to lay the "buzzer" wire, that marvelous development of field communication that comes nearest to actual wireless. The "buzzer" wire, now carried in a roll on the shoulders of a man who lays it as he goes, could be laid from an aeroplane over impassable ravines, swamps, or gorges in an incredibly short space of time.

As for naval uses, all the facts are on the side of the biplane, simply because it is the only type that successfully complies with naval conditions. These are that the machine should be capable of carrying the extra weight of pontoons or a boat for landing on water or for supplying flotation; that it should possess exceptional qualities of duration and reliability, not only for the character, but for the range of the operations involved; that for the same reason it should have greater altitude possibilities than military uses require; and, possibly most important, that it should be capable of landing on water and rising from it. To meet all these needs a new type has been evolved from the biplane,—the hydroaeroplane, whose powers of rising and landing have been so developed that it has been actually launched from a wire. This shows that it could be readily launched from a ship, gaining its start by sliding down one of the stay's of the vessel, aided by the ability of the ship to steer and steam into the wind. This launching from a wire was accomplished for the first time on September 17 of this year by the U. S. naval aeroplane built by Glenn H. Curtiss and operated by Lieut. Theodore G. Ellyson—one of the Hammondsport experiments at which I was so fortunate as to assist.

In the records for cross-country flight
NIEUPORT ABOARD HIS 28-HORSEPOWER MONOPLANE WITH WHICH HE ESTABLISHED THE WORLD’S SPEED RECORD—119 KILOMETERS AN HOUR

in Europe, the monoplane is pre-eminent, though some notable flights have been made by a passenger-carrying biplane, especially Renaux’s Circuit of Europe flight and that from Paris to Puy-de-Dom. In the Circuit of England,—nearly one thousand miles, accomplished in three days of actual flying,—where eighteen monoplanes and twelve biplanes entered, monoplanes took both first and second place. In fact, they so outstripped the biplanes as to inspire Lord Northcliffe to give some fervent advice to his countrymen to pay all their attention to
developing the single-surface machine as the aeroplane of the future, evidently in the belief that the biplane was already obsolescent. In the Paris-Rome race, there were only three biplanes out of over twenty entries, and these were far out-classed from the start. In the Circuit of Europe—France, Belgium and England, including two Channel crossings—monoplanes also made by far the best showing, though as already noted, one biplane did complete the course. A speedy machine may excel in such flights because it exposes the aviator to peril for a shorter space of time. For example, crossing Niagara River in a monoplane would
expose the aviator to its dangers for a lesser time than a slower machine, although this very feat has, as it happens, been accomplished by a biplane that successfully navigated the turbulent air-currents.

In cross-country flights in America, on the other hand, the biplane is far ahead. Atwood’s flight of over 1,200 miles from St. Louis to New York in a biplane establishes at this writing the world’s record for long-distance cross-country flying, so this record, first made in Europe by a French monoplane, is now held in America by an American biplane.

Other conditions, however, govern cross-country flights when carrying a passenger, and here monoplanes are at a disadvantage for reasons already explained. The wings must be made much larger and this makes them too frail to withstand the shock of the machine’s hard contact with the ground in a rough landing, such as cross-country flights often entail, and they are somewhat handicapped in landing by not being such good gliders, on account of lesser wing area.

It might seem as if the question of relative safety could be readily decided by comparing the number of fatal accidents to the score of each class, but it will be seen at once that such a course would have little value in this period of aeroplane building, which is still largely experimental. Our knowledge is not yet sufficiently exact always to determine whether a fall is due to structural deficiencies, to unusual strain, or—as is often the case,—to the recklessness of the aviator, or even to a momentary lapse of the constant, almost automatic vigilance required. However, the construction of the monoplane seems an evidence of greater safety because the engine is in front and the operator on top, and in case of a fall, it is on top of the engine that he falls. The biplane, unless the aviator is thrown to one side in falling, is likely to crush him under the engine. As a matter of fact, the machine is as likely to fall sideways as head-first, spilling the aviator free of the engine—and no direct fall from or with a machine is exactly what one would call safe. It is an interesting matter of record that the Wright Brothers started to experiment with monoplanes and gave it up because they could not get the factor of safety to a point that would satisfy them.

The evidence is in, as the case stands to-day, and the partisan of either type may—and will—use it to establish the claim of his own machine to pre-eminence, but there is no need for partisanship at all. Nor is there much among practical flyers, many of whom use the two types interchangeably, the monoplane being, according to the records of the French school, the easier for Frenchmen to learn, while Americans learn the biplane more readily. But the same qualities are needed to make a successful aviator in either, and every season the records shift back and forth with a rapidity that goes to show that there is no hard and fast line of demarcation, and that their uses do not develop so much along sharply diverging lines as students of construction believed at first would be the case. The main points of difference, as we have seen, develop from basic construction principles, but only the new age that produced the aeroplane, and that the aeroplane will in turn develop, can show which type will be better suited to its new civilization.