Plastics Airplanes

Aviation history is being made daily. This particular phase of history of the development of plastics in the construction of planes is still in the making at this date.

Two years ago, Col. V.E. Clark, veteran designer who was chief aviation engineer of the U.S.Army during the World War, and Dr. Leo Hendrik Baekeland, the father of modern plastics, with the cooperation of the Haskelite Corp. built an experimental airplane with a Duramold fuselage. This type of structure is made by using heat and pressure to stamp out two half shells of the fuselage and mold them together. These shells are made of tripple laminated spruce plywood impregnated with phenol formaldahyde. Rather than using pure plastics composition like bakelite or just plain plywood, this combination is neither plastics nor plywood but a new composition. It is twelve times as strong as pure plastics and eight times as strong as plywood. It is as smooth as glass, thereby reducing skin friction to a minimum. It is estimated that at 300 mph. it will be possible to develope an extra 21 miles per hour because of the reduced resistance made possible by not using rivets and because it will not dent like metal will.

The "Clark 46" is made with a plastics fuselage and plywood wings to compare the results of wear and exposure on the two. For about two years it was flown around and deliberately exposed to rain, snow andsleet. The Duramold shows no indication of the strain, whereas the plain plywood wings show deterioration and signs of repair.

Duramold does not chip or corrode, resists water, oil and acids and is ten times as strong as stainless steel. It

is fireproof, being merely charred by a blow torch. Its basic ingredients are cheap and in part absurdly common. Duramold can be molded into any desired shape and will keep this shape, withstanding gusts without permanent set.

This type of plane is valuable for military purposes. Under gunfire it will fare comparatively better than metal planes because there are no intricate supports to be shot away. It will not crack. The shrapnel and machine-gun bullet holes may be readily repaired on the field with a pot of glue and a patch of plywood.

The revolutionary value of this type of plane is its speed of manufacture. At the Haskelite plant in Grand Rapids, nine men molded a half section of the "Clark 46" in one hour. Two hours for the whole fuselage. Five hours and 20 minutes were required to assemble the fuselage at the Fairchild factory. No filing or fitting was required. The halves were simply sealed together. In regular production, of course the time could be cut tremendously.

The great bottle-neck of airplane manufacture is in the thousands of man-hours of labor required to put in the millions of rivets on metal planes. But with ten sets of dies, 200 men in a factory could build enough shells for 300 planes a month. With 100 dies, 2000 workmen, only semi-skilled at that, could in one year mold and assemble 36,000 Duramold planes. Production last year was 15,000 planes.

Plastics propellers which are cheaper, lighter, and stronger than metal have been successfully produced in England and in the United States. Also plastics seaplane pontoons are now being tested by the Navy.

Another step in the development of plastics airplanes was taken at Van Nuys, California last Fall when Timm Aircraft Corp. produced a light plane made entirely by the plastics process. Conventional styles and design are used, both structurally and aerodynamically. This process saves 25% of the man-hours of labor that are ordinarily required for a metal covered plane.

This Timm Trainer is an open tandam two-place, low wing monoplane of army trainer type design. Its estimated performance is about 137 mph., Powered with a 160 h.p. engine, it will climb at a rate of 1000 feet per minute. Its service ceiling will be 17,800.

The construction of the plane is simple, doing away with seams and rivets. The wing is full cantalever. The skin is formed by fitting the upper and lower halves over spars and ribs. These halves, when fitted together are sealed with the phenol process.

The fuselage is semi-monocoque construction. Timm Corp. expects to make a military pursuit ship modeled after Howard Hughes' racer. The design rights for it have been purchased for $10,000. It will be equiped with a 1250 h. p. engine and should exceed 400 mph.

For a time it seemed that those who had the price to buy a plane and instruction did not, to a large extent desire to fly, Those who had the desire had not the money.

The airplane industry is now definitely Big Business with the terrific demands of foreign countries for the present World War. The U.S. Government, also, is placing orders for an increased air force. In 1939, sales came to 573,800,000.

Profits for some of the large manufacturers of airplanes last year were around five million dollars. Some of the companies lost money, but the general outlook is bright. Money will be attracted to this industry. In the past, when the airplame industry was getting started, money was easy because investors were optomistic from the profits from investments in the automobile industry. The general investment psycology of the public at this time was effected by the boom period. As a resuly of this easy money and investment psycology, many enterprises entered the field which had no chance to succeed but got along until the hard times set in. Then they folded up and many investors lost confidence as well as their money. Consequently the money conditions tightened up. This very fact helped some firms to succeed. As one manufacturer declared; "If I had $100,000, I would have failed, but the very fact that I had only $24,000 and had to strain every fiber to make ends meet made me establish ona a sound basis."

Money for a time was too scarce for the proper development of the aviation industry. Now conditions are bright and the industry is booming.

In calculating the relation of the efficiency of airplane transportation to the efficiency of railroads it is found that the airplane is 12% efficient, while the railroad carries a pay load of only 3% of its total dead weitht. An ocean liner is only 2% efficiant. The overhead is low for air travel as compared with railroads because of the bery high cost to the laying of tracks. True, airports and direction beams are expensive, but there is little more cost for a large number than for a few planes. If larger and more planes are used for passenger service, it is possible to reduce the rates to a level of or lower than railroad rates. With

cheaper planes made possible by the Duramold process, air-mindedness will increase and air travel will increase by both private planes as well as large airliners. Airliners cannot yet be made by the Duramold process in whole but at least airmindedness will be encouraged by cheaper, better and safer plastics planes.

If the price declines, a larger number of privately owned olanes will be purchased by private owners. Timm Corp. will probably aid this end considerably. It is figured that mass-production planes can be made for half the present cost. This greater production could be brought about by low prices which would be brought about by mass production. Somewhere this circle must be broken into. The Civil Pilot Training Program will increase airmindedness as well as the number of licensed pilots and as a result, the number of potential buyers. This will be supplimented by a cheaper plastics plane. It is probable that the near future will show a considerable change in air travel and airplane production.

Fred Diggles

History of Aviation

Lesson I

1. Man has always wanted to fly and has made up myths to make up for his shortcomings. Such myths have been handed down to us. Daedalus and his son, Icarus are the most notable. Also there were myths in conntries other that Greece. Peruvian mythology brings us the tale of Ayar Utso who grew who grew wings and flew about the country. Simon, the magician flew around Rome in his chariot. Also were Saracen of Constantinople and many others.

2. The early attempts to fly include Thomas Moy, who flew a light plane with a 3-horsepower steam engine at 12 mph. Edison experimented with helicopters, Hargrave made the first successful model ornithopter, Langley made a steam-driven Aerodrome which would have worked if the catapult had not failed. The Wright brothers used the data and experience of the previous attempts and made the first successful flight.

3. Otto Lilienthal made a glider fashioned after the flying process of birds. Launching himself from a springboard, he made early flight; later he took off from low hills. He was later killed when testing a new type of control. His brother was heartbroken and gave up flying without trying the power plane which they had designed and built.

4. Robert Ader was a French engineer. In 1886 he built a 20 horsepower steam driven, twin engined plane, called "AVion" which actually took off. Ader, fearing collision, cut off the power and the craft was wrecked.

Samuel P. Langleywas a self-educated American astronomer, architect, physicist, and civil engineer. He first practiced

with models of steam-driven planes. He succeeded in flying a 17' model three-fourths of a mile.

Langley, in 1903 completed a full-sized machine with $50,000 apropriated by Congress. It weighed 750 pounds. This plane he called "Airdrome" and attempted to catapult it from a houseboat from the potomac. However a defect in the catapult wrecked the plane. Langley repaired it and tried again in Dec. 1903 and again the catapult failed. At this time Langley was accused of wasting public funds. Brokenhearted at this, Langley died 3 years later at the age of 72.

11 years later some structural changes were made, enabeling the Airdrome to fly successfully. A bill was actually introduced in Congress to determine who really made the first flight.

6. Before making their successful flight, the Wright Bros. experimented with kites, helicopters, kites and gliders. Then they built a motor and installed it on their glider to make the first practical flight in1903. Their import innovation was a horizontal rudder in front for steering in the vertical plane.

7. On December 17, 1903, the Wright Flier carried Orville a distance lf 540 feet at a height of 12', lasting 12 seconds. This took place at Kitty Hawk, N.C. They had to build their own motor because no mfgr. could produce a light enough one with the power necessary for sustaining heavier-than air flight.

8. After their first flight, the same day, Orville flew again for 15 seconds, Wilbur also flew that day, one flight lasting

lasting 57 seconds and covering a distance of 850 feet. Then a gust of wind overturned the ship and completely wrecked it. The next year they built a new and better one and flew 1 hr. and 2½ minutes. Then in France, Wilbur flew 2hr. 20 min. After the U.S. Gov't. accepted the ship, the Wright Bros. organized the Wright Co. in 1909. Orville is still living.

9. Following the Wright's first flight, Dumont, Voisson and Farman made longer and longer flights around France. Bleriot flew across the English channel in 1909. This was significant in that it proved that the English were not so far away and isolated as they had hoped they were.

10. In the U.S. motors and planes were improved enough for the Government to realize this air transportation as a new and significant field. The Army bought the machine after it had passed several tests with success. The Wright Co. was organized with a capital of 1 million dollars. There was almost no demand for planes at this time.

Lesson 2.

Q1. When the World War broke out, airplanes were considered curios attracting crowds at fairs. At the outbreake of war the warring nations were not sure how to use this new weapon in war. It was soon discovered that they were vere useful in observation, bombing and scouting. When the aviators saw enemy planes, they felt they should fight but didn't know how. Finally they threw rocks into the other's prop. and shot at him with pistols. Observation planes photographed the enemy lines, bombers raised hell, dog fighting developed with the swift pursuit planes. Safety was not so important as maneuverability.

2. In the latter phase of the War, the guns were fitted with machine guns which fired thru the prop. The rear of the blade was protected by a metal sheet, allowing the bullets that did not passbetween the rotating blades to bound off of the blade. Dog fighting and mass formation flying developed later in the War.

3. This training of War pilots led to an enlarged demand for increased airport facilities and increased manufacturing capacity. To make a go of it, planes had to be safer, now that war was over to attract larger numbers to flying. Also planes had to be made cheaper or there would be little demand for them.

4. 1918- Start of commercial aviation in U.S. (air mail).

1919- First transatlantic flight

1924- The U.S. Army flew around the world.

1926 Commander Richard Byrd flew over the North Pole.

1927- Lindberg made his solo, non-stop flight to Paris.
Chamberlain and Levine flew non-stop from N.Y. to Berlin
Maitland and Hegenberger flew to Hawaii from Calif.

1928- First commercial transatlantic flight made by Graf Zeppelin
Kingsford Smith flew to Sydney, Australia from Calif. in 4 hops.

1929- Commander Byrd flew over the South Pole.

1931- Post and Gatty circled the globe in 8.6 days
Stainforth flew 400mph.
Herndon and Pangborn flew to Wash. from Tokyo, non-stop

1933- Wiley Post soloed around the globe in 7.7 days.

1934- Lt. Agello set speed record of 441 mph.

1935- U.S.S.R. flyers set a non-stop record of 6,300 miles

1938- Howard Hughes circled the World in 3.8 days.

5. Immediatly after the World War, cheaper and safer planes were built to reach the public and enterprises. Airmail started in 1926, Night flying was proven feasible in 1921. Instruments were made better. Passenger transport was started in 1926. Planes and airports were made much better.

6. In 1918 the U.S. Post Office inaugerated airmail from Washington to New York. Contracts were made and night flying made the airmail pay. Passenger air transportation was undertaken in 1926.

7. To expand air travel, the public had to get over its fear of the air and to get accustomed to this mode of travel. Also prices had to come down. To do this, more service and more passengers had to be handled. Good safety records had to be achieved and made known. It had to be advertised that flying was a means of transportation and not just a stunt.

8. The C.A.A. and Air Safety Bd. came into power in 1938. The airlines flew without a fatal accident a total of 51,700,000 passenger-miles.

9. There are scheduled flights from Marseilles to Hongkong, from Nome to Buenos Aires, and plans for more foreign airlines are in progress.

10. The increased number of licensed pilots and increased interest in aviation resulting from the civil pilot training program will bring about an increased consumption of light planes and more air travel. This will effect a boom in the aviation industry which will allow the production of planes more cheaply than is now possible. This will bring about futher demand because planes are now too costly for general consumption.

PLASTICS AIRPLANES

FRED DIGGLES

Feb. 3, 1940

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Two years ago, Col.V. E. Clark, veteran designer who was chief aviation engineer of the U. S. Army during the World War, and Dr. Leo Hendrik Baekland, the father of modern plastics, with the cooperation of the Haskelite Corp. built an experimental airplane with a Duramold fuselage. This type of structure is made by using heat and pressure to stamp out two half shells of the fuselage and mold them together. These shells are made of triple laminated spruce plywood impregnated with phenol formaldahyde. Rather than using pure plastics composition like bakelite or just plain plywood, this combination is neither plastics nor plywood but a new pressed and molded composition. It is twelve times as strong as pure plastics and eight times as strong as plywood. It is as smooth as glass, thereby reducing skin friction to a minimum. It is estimated that at 300 miles per hour, it will be possible to develop an extra 21 miles per hour because of the reduced resistance made possible by not using rivets and because it will not dent like metal will.

This plane made by Clark, known as the "Clark 46" is made with plastics fuselage and plywood wings. The purpose is to compare the results of exposure and strain on the two types of materials.

PLASTICS AIRPLANES

In July 1939 the plane had been put to every test for a year and a half, during which time it had flown 1600 hours, exposed to rain, sleet and snow. The plastics fuselage shows no indication of the strain. The plywood wings, however, show signs of rot, deteriation and repair.

Duramold does not chip or corrode. It resists water, oil and acids. It is fireproof. When subjected to a blowtorch it merely charred. It is ten times as strong as stainless steel. Its basic ingredients are cheap and in part absurdly common. Duramold can be molded into any shape and will keep this shape, withstanding gusts without permanent set.

This type of plane is valuable for military purposes. Under gunfire it will fare comparatively better than metal planes becaude there are no intricate supports to be shot away. It will not crack. The shrapnel and machine-gun bullet holes may be readily repaired on the field with a pot of glue and a patch of plywood.

The revolutionary value of this type of plane is its speed of manufacture. At the Haskelite plant in Grand Rapids, nine men molded a half section of the "Clark 46" fuselage in one hour. Two hours for the whole fuselage. Five hours and 20 minutes were required to assemble the fuselage.at the Fairchild factory. No filing or fitting was required. The halves were simply sealed together. In regular production, of course, the time could be cut considerably.

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in the metal surface. But with ten sets of dies, 200 men in a factory could build enough shells for 300 planes a month. With 100 dies, 2000 workmen, only semi-skilled at that, could in one year mold and assemble 36,000 Duramold planes. Production last year was 15,000.

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power engine and should exceed 400 miles per hour.

For a time it seemed that those who have the price to buy a plane and instruction did not, to a large extent, desire to fly. Those who had the desire had not the money.

The airplane industry is now definitely Big Business in contrast to those times when there seemed to be no market. With the terrific demands of foreign countries for the present World War as well as the U.S. Government demands to increase the air force, $574,000,000 was spent last year for airplanes. Profits for some of the large manufacturers of airplanes last year were around five million dollars. Some of the companies lost money. But the outlook is generally bright. Money will be attracted to this industry. In the past, when the airplane industry was getting started, money was easy because investors were optimistic from the profits from investments in the automobile industry. The general investment psychology of the public at this time was affected by the boom period. As a result of this easy money and investment psychology, many enterprises entered the field which had no chance to succeed but got along until the hard times set in. Then they folded up and many investors lost confidence as well as their money. Consequently the money conditions tightened up. This very fact helped some firms to succeed. As one manufacturer declared; "If I had had $100,000, I would have failed, but the very fact that I had only $24,000 and had to strain every fiber to make ends meet made me establish on a sound basis."

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In considering large airliners, the relation in figuring the efficiency of airplane transportation; comparing dead weight to service weight, this type of travel is 12% efficient. Railroads are 3% efficient and ocean liners are 2%. The overhead is low for air travel as compared with railroads because of the very high cost of laying a railroad. True, airports and direction beams are expensive, but there is little more cost for a large number than for a few planes. If larger and more planes are used for passenger service, it is possible to reduce rates to the level of or lower that railroad rates. With cheaper planes, made possible by the Duramold process, airmindedness will increase and air travel will increase by both private planes as well as large airliners.

If the price declines, and it will if Timm can produce light planes at half the present price, a larger number of privately owned planes will be purchased by private owners. If the number produced were increased the price could be decreased further. This greater production would be made possible by greater demand which would be inspired by lower prices. Somewhere this circle must be broken into. The Civil Pilot Training Program will increase airmindedness as well as the number of licensed pilots and as a result, the number of potential buyers. This will be supplemented by the cheaper plastics planes. It is probable that the near future will show a considerable change in air travel and airplane production.

Oct. 30, 1939

Plastic Plane Tests Set

'Stamped' Craft Nearing Completion Slated for Tryout Next Month

Los Angeles yesterday promised to become the testing grounds for "plastic" airplanes —craft built of a bakelite substance and literally stamped out like grandma's cookies.

At a Van Nuys factory a two-place tandem trainer stands within a few weeks of completion.

HUGHES IN FIELD

Howard Hughes, millionaire sportsman-aviator, was reported ready to begin experimental work independently on a much larger military-type aircraft made of a somewhat similar material.

Pioneering work in this unique aeronautical field was disclosed to The Times by R. A. Powell, vice-president and general manager of the Timm Aircraft Corp., Van Nuys, where the Southland's first "stamped out" ship will be test-flown late next month.

FEATURES OFFERED

This is what the new process offers, he said:

Airplanes that can be built for a small fraction of the cost of fabricating an all-metal ship.

Craft that can be repaired in a jiffy on the field with a strip of plywood and a pot of glue.

Planes, strong and light, that resist heat, salt water, and all the twisting strain of acrobatic flying.

MATERIAL USED

Through a process calling for impregnation of triple laminated spruce plywood with phenol—resinous chemical compound similar to bakelite—Powell said, a material has been evolved which permits producing "molded" aircraft of extreme strength, durability and lightness.

Fireproof, the stuff merely chars under the searing flame of a blowtorch, he added.

CONSTRUCTION METHOD

In construction, Powell continued, master dies stamp an entire wing in two shaped sections. The fuselage and tail call for a few more operations. Then the plane is assembled through the same "plastic" method of heat-treating and pressure, he said.

With this process, Powell, a chemical engineer, explained, a craft free of such aerodynamic hindrances as rivet heads or welding seams can be produced. Labor costs are incredibly low; materials are available wherever first-grade spruce grows.

MASS PRODUCTION

Use of the so-called plastic method would permit virtual mass-production in times of national emergency, Powell said.

Upon completion of the trainer—a small machine equipped with a 160-horsepower engine—Powell said the Timm company will embark on a highly significant project: manufacture of a more-than-400 m.p.h. pursuit plane with this same material.

RIGHTS PURCHASED

Several months ago the Van Nuys concern bought the rights to Hughes' military racer which currently holds the West-East transcontinental record of 7½ hours. This will be built as a "plastic" plane with a 1250-horsepower engine capable of driving it, according to engineers' estimates, better than 410 m.p.h.

Meanwhile Hughes himself is engaged in conferences with Col. Virginius E. Clark, New York aeronautical engineer and a developer of the "Duramold" process similar to the Timm system.

NEW VENTURE SEEN

Last Thursday Col. Clark departed for the East, and it was believed that Hughes had obtained the rights to develop a large experimental craft of the "plastic," while a Midwest firm held permission to make small ships with the material.

At all events, it was evident yesterday that the aviation industry has begun to take seriously the notion of producing "stamped out" airplanes in mass quantities—long the dream of airmen.