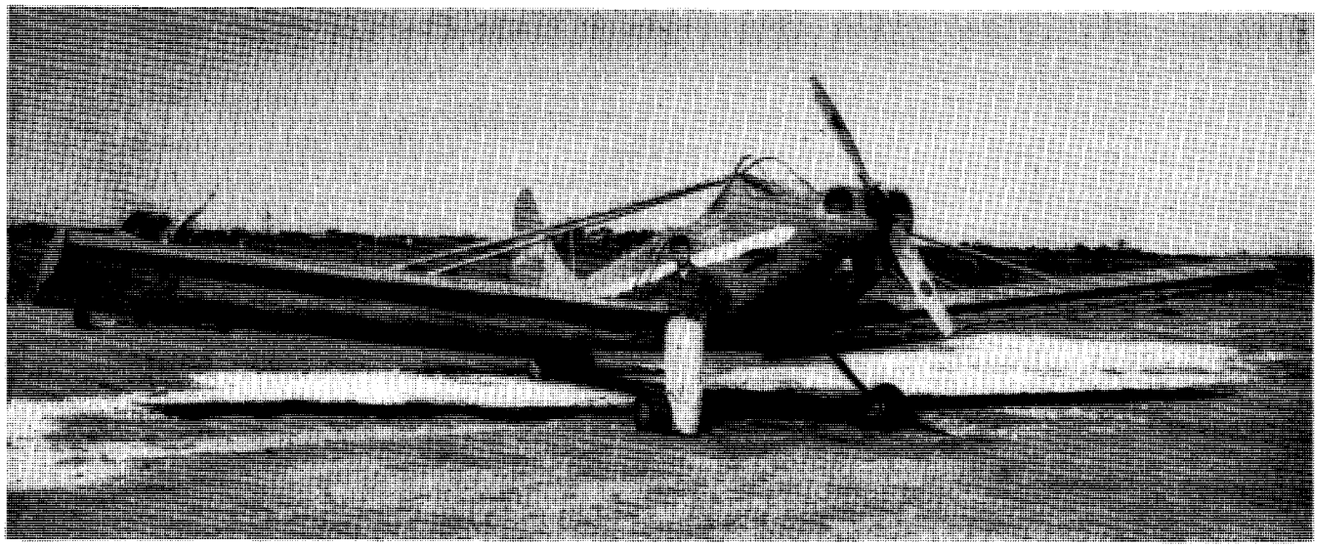


The Snow S-1 was designed and constructed by an aerial applicator incorporating many of the features of the experimental Ag-1. Powered by a 190-horsepower engine the plane can pull up at the end of a field, make a turn, and be back in position to dust in 17 seconds, with a 1000-pound load of dust

Airborne Custom Application

As chemicals for agriculture take to the air there is a need for planes designed as farm implements . . . A staff survey

AGRICULTURAL AVIATION accounts for about 10% of the total of all hours flown by aircraft included in the category of general aviation. General aviation includes all flying except that done by the scheduled airlines and the Government, is by far the largest part of civil flying in the U.S. In 1952 general aviation accounted for three times as many hours and two times as many plane miles as those flown by the entire domestic airlines system in the U.S. Last year agricultural aviators flew a greater number of hours—700,000 hours in all—than aircraft carrying passengers and cargo for hire. (Passenger and cargo carrying in the general aviation category includes the nonscheduled airlines as well as transportation of individuals and cargo on a contract basis exclusive of the domestic airlines). In fact agricultural flying accounted for five times as much air time as nonscheduled airlines. In 1951 the total number of hours flown by agricultural aviation equaled about 32% of the total hours flown by the domestic airlines.

Based on a general acreage rate the total business of agricultural aircraft operations in the U.S. is very roughly estimated at about $45 million. The use of aircraft in American agriculture has become bigger business than many think.

The history of agricultural aviation can be traced back to 1919 when the USDA started the first reported crop dusting experiments on orchards infested with caterpillars. Following World War I agricultural aviation expanded rapidly and passed out of the experimental stage. One of the first commercial crop dusting firms was organized in 1925. However, it was the end of World War II which gave crop dusting the boost into the big business bracket. Surplus aircraft were available from the Government at less than cost, and effective insecticides were available for controlling insects. In 1947 there were about 100 aerial applicator firms operating, at the most, 200 aircraft. By the end of 1952 there were more than 2000 different crop dusting firms operating 7000 aircraft and treating 40 million acres from the air.

Since 1947 agricultural aviation has grown from a relatively small segment of the aviation industry to the third largest single phase of civil aviation, exceeded, in total hours flown, only by executive aviation and domestic airlines.

New Techniques

Before World War II agricultural aviation was principally the distribution of pesticide dusts from aircraft, hence the term "crop dusting." Crop dusting has now become a generic term for most of the operations of aircraft in agriculture whether the material distributed is in dust or spray form. With the increase in crop dusting activities following 1947 thereh as also been a rather marked tendency to shift from dust to spray application of chemicals where possible. In 1946, there were 15 dry dust-dispersing planes for every one equipped with spray rigs. In 1952 this ratio had changed to the point where there were about three sprayer planes for every two dust planes. Generally, spraying seems to be gaining favor as a preferred method of application of agricultural chemicals. One explanation advanced for the increasing favor of liquids is the greater economy per unit of weight, a smaller weight of spray is required per acre to control insects effectively than the weight of dust. Another advantage of the spray technique is the ease of transportation and handling.

The increase in numbers of sprayer-rigged aircraft is also perhaps due to the increasing use of aerial application for herbicides. Herbicide application is especially important in the wheat- and cotton-growing regions of the West and South.

Another relatively new development which may increase rapidly in the future is the aerial application of fertilizers. The aerial application of nitrogen solutions seems to offer some special advantages and the application of urea and ammonium nitrate solutions by aircraft is considered to be almost as important a technological step in fertilizers as the recent development of direct injection of ammonia. Seeding from the air is also a relatively new technique. Most of the

aerial seeding is done in the rice fields of Louisiana and Texas and for pasture seeding.

Equipment

The rapid development of agricultural aviation after the war was partially due to the cheap availability of large numbers of aircraft which could be adapted to agricultural use. These aircraft were not originally intended for the requirements of the low altitude flight necessary for crop application. However, they were adapted by the operators to yield satisfactory results. The supply of these surplus aircraft has now been exhausted and the future of crop dusting is intimately tied up with the design and production of suitable aircraft.

The Stearman Trainer, SNJ-3, is probably the present workhorse of the aerial applicator. This biplane was originally designed as a primary trainer equipped with a 200-horsepower engine and two open cockpits. Aerial applicators have modified the plane by replacing the forward cockpit with a spray tank or duster bin and, in some cases, replaced the original engine with one of greater horsepower, 300 or even 450 horsepower. The larger engine is considered important to give the plane the necessary power to climb rapidly to avoid collisions with ground objects—trees, poles, and in some cases fences.

Another type of plane which was available after the war was the high wing liaison plane of the Piper Cub type. And in the rapid-growth phase of agricultural aviation the Stearman trainer and the Piper type liaison plane were the two principal aircraft used.

These surplus aircraft are now rapidly becoming unserviceable for crop dusting and the various aircraft manufacturers forsee an increasing demand for their products in agriculture.

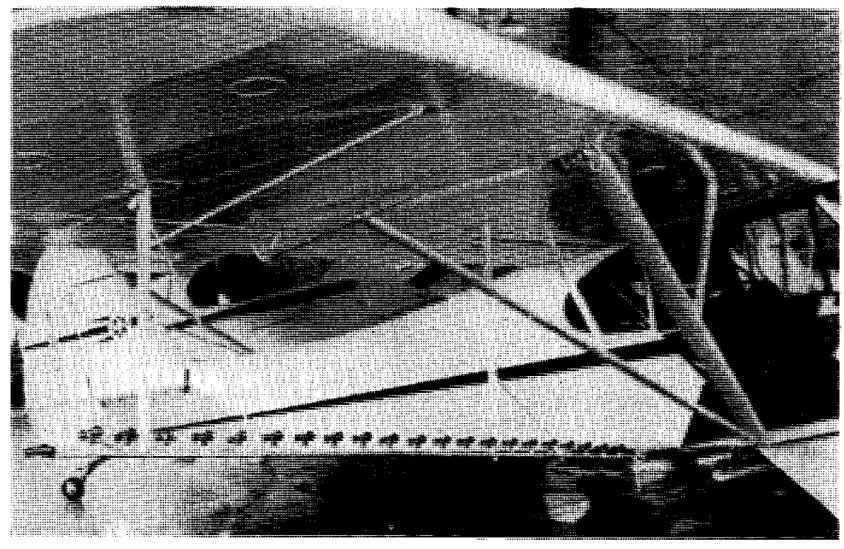
Various aircraft manufacturers and other research groups have been devoting considerable time and study to the design of an airplane for agriculture. The personal Aviation Center at Texas A&M is one of the outstanding research groups of this type. The Ag-1 described by Weick is an example of a plane designed for agriculture.

Ideally a plane for spraying and dusting field crops should probably be a low-wing monoplane with good forward visibility for the pilot, and a high power-to-weight ratio.

Piper Aircraft has developed a modification of the Supercub for crop dusting. Called the Piper PA 18-A, the plane features ease of conversion from dusting to spray equipment. The 18-cubic-foot hopper in the aircraft can carry up to 1000 pounds of dust or 110 gallons of spray material.

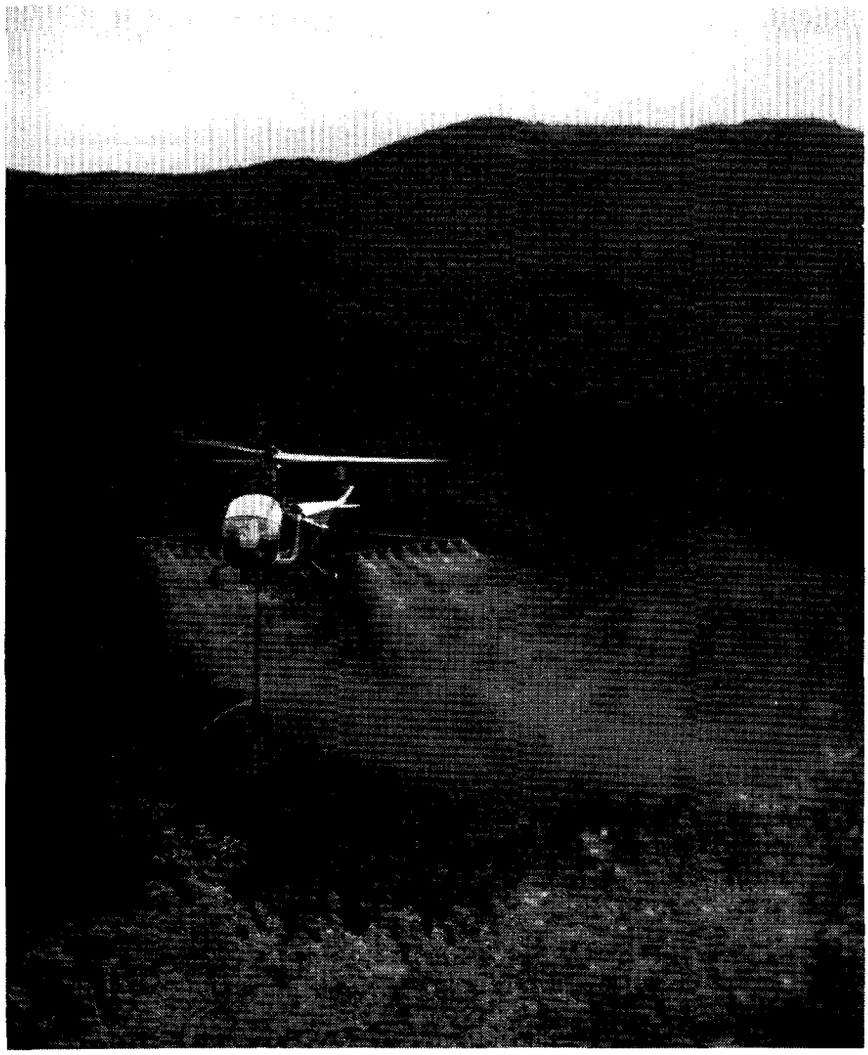
The Air Tractor has been developed and is now moving in production in

The Air Tractor is the type of aircraft that operators seem to believe may eventually develop for the future. An example of a utilitarian design with frills cut to a minimum. This plane is basicly an airborne farm implement, capable of carrying large payloads of either dust or spray



Spray boom with a total of 24 nozzles is available as factory installed equipment on the Piper PA 18-A. Nozzle size can be varied to get coverage from one half to five gallons per acre

Parts of this plane may look familiar. The Model-11, "stagger wing Cub," is a somewhat radical example of modification of existing planes for agricultural spraying or dusting



Helicopters have found only limited application as machines for commercial crop dusting or spraying. For small area applications or treating ponds for pest control helicopters offer many advantages over conventional fixed wing aircraft. However, the high initial cost and complicated maintenance problems of helicopters have been factors operating against their purchase by commercial operators

Yakima, Wash. This plane is being built by the Central-Lamson Corp., formed by Central Aircraft, one of the largest aerial applicator firms in the country, and Lamson Aircraft Co. of Seattle. The Air Tractor is unique in that it has apparently been designed for ease of maintenance, featuring interchangeable wing panels and tail panels. The plane is rated to carry 2500 pounds of cargo.

The Snow S-1 agricultural airplane is a low-wing monoplane incorporating many of the safety features of the Ag-1. The designer of this plane made a study of causes of crop dusting accidents and then attempted to provide maximum protection for the pilot of the plane in the event that a crash should occur.

In addition to the planes designed specifically for agricultural applications, there are also a number of firms and individuals who have proposed extensive modification of existing production type aircraft.

The Model 11, stagger wing Cub is an example of this type of modification. The plane is basically a Piper PA-18, with lower wings added and motor and engine cowling from a Fairchild trainer. The increased wing area gives a lower wing loading with increased maneuverability in turns and climbing.

Despite the need for a plane tailored for the job, cost will probably be a determining factor in the sale of agricultural airplanes for some time to come. Piper Aircraft Corporation now has the lions's share of the agricultural market, probably because its PA-18 can be produced as a modification of an existing production line aircraft. This means that relative to other agricultural airplanes the Piper is the least expensive.

Some aircraft manufacturers seem to think that eventually there will be a total of 10,000 planes in agricultural aviation in the U.S., and of this number about 500 to 700 will have to be replaced each year. However, there are now 7000 planes in agricultural aviation and the replacement rate has not yet approached 500 per year.

The aircraft operators, those who do the dusting and spraying, point out that they cannot afford to invest $2000 or more in a machine which they regard as a farm implement used for perhaps 500 hours per year.

High cost has been one of the factors limiting the use of helicopters for commercial operation, despite the fact that aircraft of this type have many characteristics which make them ideal for agriculture.

It appears that as a business agricultural aviation has now come of age, and with increasing research in the efficiency of pesticide chemicals, there will also be a greater utilization of the airplane as an air tractor. One research development which seems certain to give the aerial applicator a big boost will be the production of an effective fungicide, to control diseases as DDT controlled insects. A boost such as this will probably really get the custom applicator up in the air, and when the demand exists planes will undoubtedly be designed and made available for the job.

Modified Stearman Trainer, the workhorse of the crop dusting business. Here an auger truck is loading the dusting bin of the plane. Mechanized loading equipment of this type cuts ground servicing time to a minimum