Aerial Application Methodology

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Federal agency land managers and other land management personnel looking to contract aerial applicators are encouraged to educate themselves in aerial application methodology so that they can be better prepared to select the best operator for the application of herbicide and other control methods. Aviation has played an important role in the delivery of pesticides for over 90 years and today, aerial application accounts for up to one fourth of the delivery of crop production products in American agriculture.

Aerial applicators are highly-trained professionals and utilize aircraft that are often purpose-built or have been converted from existing airframes. The aircraft range utilizes sophisticated precision application technologies such as GPS (global positioning systems) and GIS (geographical information systems), precisely calibrated spray application equipment, and flow controls to insure the pilot is accurate in applying the product to the crop. Aerial spraying also has the advantage of being able to treat large areas quickly and can be carried out when field conditions prevent wheeled vehicle access, which enables the timing of spray treatments to be improved and soil compaction reduced.

There are, however, certain disadvantages associated with aerial application which favor other methods of delivery, including ground based vehicles. Aircraft type, ground speed, weather concerns, fixed obstacles, chemical capacity, turning time, ferrying time, size and shape of the target field, value, and public concerns should be considered when choosing the best application vehicle for a particular job.

Aircraft Type

There are two basic types of agricultural aircraft: fixed-wing (airplane) and rotor-wing (helicopter). Each has advantages over the other and both are very capable of delivering product to the target area.

Fixed-wing

The most common agricultural aircraft are fixed-wing, such as the Air Tractor, Cessna Ag-wagon, Gippsland GA200, Grumman Ag Cat, M-18 Dromader, PAC Fletcher, Piper PA-36 Pawnee Brave, and Rockwell Thrush Commander. These aircrafts have been specifically designed or converted for agricultural use and are sometimes referred to as crop dusters.

Rotor wing

Helicopters represent approximately 13% of agriculture aircraft, but that number is expected to increase as the tolerance for airplanes continues to decrease and the demand for more precision application continues to increase. Although they are more expensive to operate on a per hour basis, they do have a number of advantages over fixed-wing aircraft which, at times, make the selection of a helicopter a better choice. Helicopter manufacturers include Bell, Eurocopter, Hiller, Schweizer, Kamov, Kazan, McDonald Douglas, and Robinson.

Application Factors

Ground Speed

Airplanes and helicopters can accomplish more in one hour than ground equipment can in one day. Airplanes' true airspeed varies from 100 to 160 mph, but normal speed is about 120 mph. Helicopters, on the other hand, fly from 30 to 80 mph, and normally fly around 45 mph. This allows airplanes to dispense product nearly three times as fast as helicopters. Airplanes, however, take longer to turn around, and must travel back to a suitable landing strip that is generally some distance from the target field. Also, higher speeds produce more "fines" (fine droplets of chemical solution) which increases unwanted drift, and results in less product being applied to the target area.

Timing

The timing of application is often critical, and if the target field is treated outside the effective plant cycle, the effects of the chemicals can be greatly reduced if not rendered completely useless.

Weather

The treatment of an area with chemicals is conducted in a dynamic environment. Chemical companies have strict application parameters that are enforced by the department of agriculture. Many chemicals cannot be applied by aircraft when the wind speeds exceed velocity. Airplanes are required to operate in certain weather minimums and are not allowed to take off when the visibility and cloud ceilings are too low, even if the target field has acceptable weather conditions. Helicopters are allowed to operate in lower weather conditions,

but are still affected by weather and will not fly under certain conditions for safety reasons.

Chemical Capacity

Fixed-wing aircraft carry from 300 to over 800 gallons of product, whereas helicopters generally carry between 40 and 220 gallons of chemical, depending on the aircraft. Higher capacity airplanes require less ferry time, and less takeoffs and landings, but also require longer runways which generally increases ferrying distances.

Smaller capacity tanks are not always a disadvantage and can represent a superior value when working with smaller fields or when different chemicals need to be applied to different fields. Researchers and land managers that wish to experiment with several different chemical formulations, application rates or products will often select a helicopter with a mixing/loading truck that can mix chemicals on site.

Turning Time

At higher speeds it takes longer to turn an aircraft around to make another pass. The more time the aircraft spends off the field, the less productive it is. Helicopters are able to safely make much tighter turns than airplanes and therefore spend more time over the target area.

Ferry Time

The time from which the aircraft departs the ground to the time it is over its target is nonproductive time. Many helicopter operators drive a support vehicle to the target field and land on top. This allows chemicals and fuel to be loaded on site, thereby reducing the ferry time.

Shape and Size of Target Field

Long square or rectangular shaped fields require less turns. These types of fields favor fixed-wing aircraft due to the airplane superior speed of delivery.

Value

There are a number of factors that are taken into consideration in order to determine which type of application offers the best value. The lowest cost is not always the best value. A number of land managers have blamed the chemical as not being effective when it was actually applied under the incorrect conditions.

Public Concerns

Airplanes, especially of the radial engine variety, are loud and generally do not fly low to the ground. So when an Ag airplane "buzzes" a field next to a housing development, people get concerned. On the other hand, the general public sees helicopters close to the ground all the time. News channel and Medevac helicopters fly at low altitudes all the time, so when an Ag helicopter is working a field, many spectators are more curious than upset.

The Federal Aviation Administration (FAA) does not allow airplanes to fly over "congested areas" but does allow helicopters to operate in areas that airplanes cannot.

Best Management Sourcing and Contract Services

Aviation involves risk, and flying low increases that risk. The best management sourcing and contract practices put a special emphasis on agricultural aviation companies that demonstrate a high level of professionalism and strive hard to minimize these risks. When selecting a contractor, it is important to look at their business practices, equipment, certifications and emergency plan.

Professionalism

With over 1,350 aerial application businesses and approximately 2,700 agricultural pilots in the United States, one of the top considerations is the contractor's membership and participation in the National Aviation Agricultural Association (NAAA) and its programs. The NAAA works with the federal government in investigating, researching, developing, and testing aerial application technologies to strengthen the safe application of crop protection products from the air.

Even though the low-level flying and quick turns may appear risky, these pilots are highly-trained professionals who are very serious about their work.

FAA Requirements

Title 14 of the Code of Federal Regulations gives the FAA governing authority of all aviation activities in the US. The Federal Aviation Regulations, or FARs, are the rules pertaining to a wide variety of activities such as aircraft design, pilot training activities, and operational requirements. The rules are designed to promote safe aviation, and protect pilots, passengers, and the general public from unnecessary risk.

14 CFR Part 137 pertains to agricultural aircraft operations and the issue of commercial and private agricultural aircraft operator certificates for these operations. In order to obtain a certification under Part 137, an operator must have at least one qualified pilot, suitable aircraft equipped for agricultural operation, and pass a knowledge and skill test.

Rotorcraft that conduct external-load operations fall under 14 CFR Part 133. These regulations certify the aircraft and the pilot to operate "sling load" type missions. Although most liquid spray systems are attached to the helicopter and not considered external load, there are several dry material spreaders that are suspended underneath a helicopter and are operated under Part 133. Also, fire fighting activities dispensing water using a Bambi Bucket® fall under this part as well.

Part 137, however, does include a provision that allows operators to conduct agricultural operations with a rotorcraft with external dispensing equipment in place without a rotorcraft external-load operator certificate. Part 137 also includes

a provision that allows pilots that only hold a private pilot certificate to operate as a "Private operator – pilot".

Pilot certifications fall under 14 CFR Part 61, and with the exception of "Private operator – pilot," every pilot must hold at least a US commercial or airline transport pilot certificate and be properly rated for the aircraft to be used.

US Department of Transportation (DOT) Requirements

Support vehicles carrying fuel and chemicals are required to be placarded and follow DOT regulations. Drivers are required to have a commercial driver's license with a HAZMAT endorsement if they transport more than a minimal amount of chemicals or fuel.

State Agriculture Applicator's License

Each state has its own department of agriculture that oversees commercial and private pesticide application, and every applicator must be certified in the state where the applicator wishes to work. Aerial applicators also undergo regulatory inspections on a routine basis to ensure the protection of public health and safety.

Emergency Preparedness Plan

Pesticide application and aviation both have their own set of risks, and combined they present even more opportunity for mishaps to occur. Planning ahead for hazardous situations can help to minimize the impact and speed the recovery process in the event of an accident. The US Environmental Protection Agency and other local agencies have programs designed to prevent and prepare for chemical emergencies, respond to an environmental crisis, and inform the public about chemical hazards in their community.

Organizations like the National Agricultural Aviation Research and Education Foundation are taking steps to educate all FAR Part 137 member and non-member operators. They recently sent out the training video, "First Response: Responding to a Pesticide-Related Aircraft Accident." This potentially life-saving DVD is tailor-made for operators and Ag pilots to educate emergency first responders about what to expect if they are called to an agricultural aircraft accident.

The NAAA developed the Professional Aerial Applicators Support System (PAASS) to educate pilots about safety, security and drift mitigation. Agricultural aviation accidents have decreased by more than 20% since the PAASS system began.

Conclusion

Although airplanes are more productive and more cost effective under ideal situations, helicopters have a definite place in aerial application and the percentage of use is on the increase. A number of aerial operators now offer both fixed- and rotor-wing services.