



SIM SHOWCASE

Thrush's 510AS simulator was a popular attraction at the 2017 Ag Aviation Expo in Savannah. The aviation training device now resides, sans shoulder straps, at the Thrush Training Center in Albany, Georgia.

Sims' Time

Flight simulators designed specifically for agricultural aviation offer ag pilots an added training dimension

*By Jay Calleja
Manager of Communications*

The aerial application industry is suddenly flush with ag flight simulator training options. Whereas at best one simulator program used to be available for ag training in the U.S., three ag flight simulator-based training organizations exist now. Customized simulators are available at Turbine Training Center in Manhattan, Kansas, the University of Nebraska-Lincoln Pesticide Application Technology Laboratory in North Platte, Nebraska, and the Thrush Training Center at Thrush's factory in Albany, Georgia.

Although far from the only ag flight training offerings available, ag flight simulators can make training more accessible because they generally cost less than training in a live ag aircraft. Ag pilots also build muscle memory by repeating individual procedures in a controlled environment. Almost all ag flight simulator training is offered in conjunction with some form of ground school instruction with the exception of renting sim time by the hour.

Ag flight simulators elevate initial and recurrent training, especially when it comes to practicing emergency procedures. Available during initial and recurrent training sessions, instructors can simulate a full range of emergency scenarios and repeat them to reinforce emergency avoidance and survival skills. Some emergencies like flying into inadvertent

instrument meteorological conditions (IMC) are impossible to practice in a real aircraft. Turbine ag planes are too expensive and IMC weather is too dangerous to put the pilot and the aircraft at risk in those elements for the sake of practice. Ag flight simulators are a safer and better way of replicating emergencies you would never attempt in a real ag aircraft.

An ag flight simulator provides another layer of training during turbine transition training that enhances classroom familiarization of the turbine engine by reinforcing that knowledge in the simulator. Being able to practice normal operating procedures and react to problems increases pilots' comfort level when they enter the cockpit of a new turbine ag aircraft. Pilots coming off a long layoff can derive similar benefits from a day or two of recurrent training in an ag simulator, proponents say.

Simulators won't replace the necessary and valuable component of covering critical engine and aircraft concepts in a classroom setting, but they can reinforce them in a tangible way. They aren't meant to eliminate in-aircraft training either, but they can help fill in crucial gaps. Pilots are able to take the intermediate step of getting repetition with key procedures in a controlled environment before getting into their actual aircraft. Those three things, along with mentoring from experienced pilots, are important pieces of the complete training puzzle.

"If you're really interested in training and bettering your skills and your knowledge, you really need to incorporate all that. But up until recently, particularly looking from the ag side, there really hasn't been an opportunity to get into simulators," says Jason Wolcott, Turbine Training Center's vice president.

Agricultural Aviation spoke with the point person at each of the three facilities in the U.S. with simulators



COURTESY OF TURBINE TRAINING CENTER

SOME VIEW Turbine Training Center's full-motion, state-of-the-art 502/802 Air Tractor simulator has drawn praise from pilots for how closely it resembles piloting an actual Air Tractor.

designed specifically for turbine ag training to find out how they fit into their training program. We'll explore their simulator offerings and then delve deeper into emergency procedures, where these aviation training devices truly shine.

TURBINE TRAINING CENTER

Turbine Training Center (TTC) was founded in the late '90s to provide turbine transition courses to ag pilots. Its sister company, GATTS Inc., or General Aviation Training and Testing Service, specializes in instrument ratings and commercial certifications. Today TTC provides turbine training and transition programs for pilots and operators of turbine Air Tractor models and Beechcraft King Air series aircraft.

Although TTC had other simulators for Cessna Caravan and King Air planes, about three years ago Jason and his father, Dale Wolcott, who founded both companies, started thinking about getting a simulator configured specifically for low-altitude agricultural flight training to enhance their turbine transition program for ag

pilots. Before getting the 502/802 Air Tractor simulator, TTC would usually give transitioning ag pilots time in its Cessna Caravan simulator. "It wasn't ideal, but at least they could get an idea of how that stuff works," Wolcott says.

The company set its sights on creating a much more realistic ag-specific flight simulator. TTC worked with a simulator manufacturer to create a state-of-the-art Air Tractor 502/802 simulator. The full-motion sim is set up to fly like an AT-502 or 802 aircraft. It is configured with most factory options from Air Tractor, with the exception of a Kawak throttle quadrant TTC opted for instead. The simulator has been in operation for a year now and has drawn raves from ag pilots over how realistic its flight characteristics are.

Eric Klindt is a senior pilot flying for Wilbur-Ellis Co.'s Wahpeton, North Dakota, agricultural aviation division. Last year he accompanied Alex Viger, a Wilbur-Ellis pilot he trained, to Turbine Training Center to observe the turbine transition course Viger would be taking and to try the simulator. Klindt had

FLIGHT SIMULATOR

trained in an ag flight simulator in 2000 and was impressed with TTC's new 502/802 simulator. "I couldn't get over how the flight characteristics were exact for Air Tractor. It was just the way it handled, the way you would turn, the way you would take off loaded versus empty. All of that was right on," he says.

TTC's simulator program was excellent out of the box, but over the past year the company has continued to refine the simulator based on input from high-time 502 and 802 pilots who have flown in it. As a result, "it just gets better and better," Wolcott says. "Sims will never do everything identical to the aircraft. They can be close and we're sticklers with ours. We have spent a lot of time, energy, effort and money getting this unit to fly and act and react from a numbers standpoint, a feel standpoint, as closely as possible to what a 502 and an 802 would be like."

With the new simulator in place, TTC overhauled its classroom curriculum to focus primarily on Air Tractor models. TTC's standard training programs for the ag flight simulator include turbine transition, initial and recurrent Air Tractor training, an intro

to aerial application course and 802 type rating exemption endorsement training courses, but Wolcott can tailor a program to suit any pilot's needs.

The training remains applicable no matter what kind of turbine ag plane someone is flying, Wolcott says, but since TTC's system is set up like an Air Tractor, the simulator is going to be especially valuable to pilots transitioning into a turbine Air Tractor model and pilots who already have experience in Air Tractors.

"We've got experience with all the different turbines, so we can help anybody," Wolcott says. "A lot of this is simply getting the knowledge of the inner workings of the turbine engine itself."

Adam Way, an experienced AT-802 pilot, is TTC's main ag instructor. He is the primary trainer for the 802 simulator program. Ken Godfrey, a retired designated pilot examiner and ag pilot, is another trainer. Dale Wolcott, a former ag operator, trains less frequently now that he is semi-retired. Jason Wolcott also does some of the training in the 502 simulator for pilots transitioning into an AT-402 or 502.

With a name like Turbine Training Center, the turbine transition program is still its bread and butter, but the addition of the AT-502/802 simulator has opened a dormitory's worth of new doors for the company.

"We've had people everywhere from super high-time guys that fly 802s for a living that simply have wanted to come through because they've never had a chance to get in the classroom and get any kind of structured training. They've never had a chance to get into an 802 sim," Wolcott says.

As mentioned, simulators are terrific tools for learning procedures that would be impossible to replicate in an actual ag aircraft. The scenario-based possibilities ag simulators can generate are virtually endless.

They help users become safer and better pilots, but in general the emphasis is more on flight systems and characteristics and less so about specific aerial application techniques used for making applications. Those skills are best mastered under the tutelage of a trusted operator and ag aviation mentors, Wolcott says.

"We really try to make it clear to people, we're not here to teach people to be ag pilots," he says, noting TTC's customers include both fledgling and experienced ag pilots. "We're here to get them repetitions with normal and emergency procedures."

Klindt and Viger went through numerous scenarios in TTC's 502 simulator. "There were so many things that you could do on that simulator that you'd never want to try in real life," Klindt says. "We did the engine fire. We did engine out. Tried to restart. Smoke in the cockpit. But the best thing that I liked was to be able to go into IMC and try to figure out how to get out alive."

TTC had ag pilots in mind when it commissioned the AT-502/802 simulator, but it is also drawing interest from other 802 pilots. Single Engine Air



COURTESY OF TURBINE TRAINING CENTER

READY FOR TAKEOFF Instructor Ken Godfrey works with Cody Chapman. Chapman completed Turbine Training Center's turbine transition/502 initial course and is flying an AT-502 in Colorado.

Tanker (SEAT) pilots working in the fire sector have trained in the simulator.

“From the ag standpoint, it’s such a small industry. Making an investment in a simulator, obviously it’s not cheap,” Wolcott says. “We’re excited to be able to incorporate this into what we’re doing.”

In fact, the 502/802 Air Tractor simulator is just the beginning of the aerial application simulator enhancements Turbine Training Center has planned. TTC’s ag simulator came equipped with a TracMap guidance system, but pilots will soon be able to choose between working with a TracMap, Satloc or Ag-Nav guidance system in the simulator as part of TTC’s new guidance system-specific courses. “There again, the simulator is a wonderful place to work guidance systems,” Wolcott says.

Another cool feature: TTC’s Air Tractor simulator (like the other simulators in this article) has a worldwide database that allows instructors to pull up airports and airstrips from around the world.

To beef up its aerial fire training, TTC is equipping its simulator with two fire gate systems—Air Tractor’s Generation II Fire Response Dispersal System and the Vondran Hydromax—and adding Wipaire’s amphibious floats to simulate water scooping. The fire equipment is expected to be in the simulator by the end of the summer. “We’re going to have built-in fire scenarios as well to where you will have multiple aircraft working a particular fire,” Wolcott says.

TTC will also be adding a Bell 206 helicopter simulator designed for ag and aerial firefighting training. “We wouldn’t be the only people in the world with a 206 sim, but there’s not any place at the moment that really specializes in the rotorcraft from the ag standpoint or the fire standpoint,” Wolcott says.

“Obviously, we’re big believers in sims,” he adds with a chuckle.



HIGH-DEF UPGRADE The UNL Pesticide Application Technology Laboratory recently installed new high-definition projectors to enhance the scenes shown on the 235-degree screen of its AT-502 simulator.

UNL PESTICIDE APPLICATION TECHNOLOGY LABORATORY

The University of Nebraska-Lincoln (UNL) Pesticide Application Technology (PAT) Laboratory in North Platte, Nebraska, has been offering ground and simulator ag flight training since December 2018. It has an AT-502 flight simulator it acquired from Simcom Aviation Training in Orlando. The simulator uses a midsection of fuselage with a cockpit in combination with a 235-degree computer-generated out-of-the-window scene to simulate flight. The cockpit includes standard flight controls, turbine engine controls, a fully controllable propeller with reverse thrust and feathering, flight and engine instrumentation, GPS guidance, a hopper dump lever and a standard liquid spray system.

Tom May from Flying M Applicators in Holdrege, Nebraska, conducts the simulator training for the university. Alan Corr, a Nebraska Operation S.A.F.E. analyst and longtime extension specialist at the University of Nebraska-Lincoln’s West Central Research

and Extension Center, recommended and recruited May, who structured the training program. May has an advanced ground instructor rating and experience in several makes and models of aircraft, ranging from Pawnees to AT-802 ag planes.

The UNL PAT Lab offers one, two and three-day courses featuring classroom instruction and time in the simulator with an emphasis on safety and turbine transition training. Training on proper application techniques is also available, including swath guidance GPS training, obstruction awareness and avoidance, target crop and sensitive crop recognition, and proper drift mitigation practices.

Various environmental factors, including temperature, pressure, altitude, humidity and wind speed, can be changed to simulate their effect on aircraft performance. The simulator can also simulate a thunderstorm with lightning. “It’s not a full-motion simulator, but when you’re actually sitting in it you really get the feel that you’re flying,” says May.

FLIGHT SIMULATOR

Hayden DeBlicek is a third-year ag pilot with Agri-Tech Aviation in Indianola, Iowa, entering his first full season flying an AT-402. He spent his first two seasons flying a piston powered Cessna 188. He went through May's turbine transition course with Tyler Evans, a more experienced Agri-Tech pilot who was already flying the 402, in January 2019.

As a new turbine pilot, the classroom time spent going over the engine manual and talking things through with May was DeBlicek's favorite part of the turbine transition course, even more so than working in the simulator. Being able to reinforce key operational and emergency procedures was extremely useful too, but the personal instruction seemed to strike the biggest chord with him. He appreciated May's knowledge and ability to relate to his students. "He flew the Cessna 188 a lot, which Tyler and I both flew, so he's very knowledgeable about transitioning from both and the similarities and the differences," DeBlicek says.

May likes to cover mechanical issues in the AT-502 simulator that can't be replicated in a real aircraft. DeBlicek was all for it.

"Agri-Tech was great about giving me experiences, but these airplanes are made to make money," he says. "There is a whole lot of training, but you're training to be a good applicator in the airplane. You're not necessarily going out and training [for] different failure scenarios. So that was a big advantage to go into the simulator."

Andy Gjerswold, an ag pilot from Minnesota, took the three-day turbine transition course at the UNL PAT Lab's flight simulator in March. He documented his experience in a pair of videos on his Valley Ag Pilot YouTube channel. (Visit tiny.cc/AT502-sim-part1 and tiny.cc/AT502-sim-part2 to view them.)

During a debrief session with Gjerswold, May pointed out that a turbine



YOUTUBE-SCREENSHOT

WHITEOUT Ag pilot Andy Gjerswold attempts to work his way out of "zero-zero" instrument meteorological conditions in the UNL PAT Lab's AT-502 simulator. In zero-zero conditions, the pilot has no forward or ground visibility.

engine accounts for basically 50% of the cost of the aircraft. "Insurance companies definitely don't like it when you have an engine burn up due to pilot error or a startup error. So that's the one thing we really try to hammer in on this course is the startups and the things that can go wrong during a startup and being able to recognize that."

That was important to DeBlicek. "For me, one of the most intimidating parts of the turbine transition was actually starting the aircraft," he says. "There's a high possibility of doing damage [if the engine doesn't start correctly]. So being able to go to the simulator and do 20-plus starts was really beneficial."

The simulator lessons resonated with Gjerswold as well. "The best thing about the simulator is that you do get to experience the failure—the hung or the hot start—but then you also build the muscle memory to react to the situation," he said in his video. "I think even for the older pilots out there that are well versed in a turbine engine, if you haven't practiced this before or you haven't had to deal with this situation, it's definitely a good brush-up on recognizing and reacting properly to the situation."

The training partnership between May and the UNL PAT Lab has been a great fit to date. "I like sharing my experiences with other people. Good, bad or indifferent experiences," May says.

With well over 20 years in the aerial application industry and 5,000 hours of ag flight time, he has plenty of experience to draw from. "It's fun for me to be able to relay that to other people and help them build their careers in the business, and hopefully be able to make them safe, productive pilots."

THRUSH TRAINING CENTER

Thrush Aircraft opened the Thrush Training Center at its factory in Albany, Georgia, in December 2017 with course curriculums that include classroom and simulator time in the Thrush 510AS built by Redbird. The 510AS simulator's interface can be swapped out to feature the display screen, throttle and start quadrants for either a Pratt & Whitney Canada PT6-34AG engine or the General Electric H80 engine.

Whereas the simulators at Turbine Training Center and the UNL Pesticide Application Technology Lab were based on Air Tractor models, Thrush's 510AS flight simulator serves as a general familiarization tool to acquaint

pilots with the Thrush cockpit, as well as a procedural trainer addressing real-world scenarios and emergency procedures pilots may encounter.

Terry Humphrey, Thrush Aircraft's flight operations manager, is pleased with how well the classroom and simulator training has gone in the two and a half years the training center has been open. When it opened Thrush had its own dual-cockpit, dual-control 2018 Thrush 510P for flight instruction. It eventually sold the two-seat aircraft but is still able to provide dual-cockpit instruction for those who want it in the dual-cockpit Thrush of local ag pilot and CFI Matt Peed. Humphrey is Thrush's lead trainer, handling the ground school instruction and simulator training. Peed does most of the flight training.

There was a temporary hiatus in in-aircraft training until Peed offered the use of his two-seater, but Humphrey says Thrush never really stopped providing classroom instruction and sim time before or during its transition to new ownership in 2019.

"You see it more and more with Air Tractor and us and some of the schools out there. I really think this kind of

training is really good—recurrency training of some kind," he says. "All other phases of aviation, particularly the airlines, the safest flying in the world, recurrency training is a huge part of the reason they've got such a good safety record, and it adds to professionalism of the business."

As an enhancement to its transition course, which includes ground school and several hours of actual flight time, Thrush uses its simulator for normal and emergency procedures training. "It is an excellent tool for reinforcement of pilot skills in these areas," Humphrey says.

Thrush's recurrency course is primarily ground school. It focuses on procedures, recognition of hazards in agricultural flying and human factors that affect pilot performance and aerial decision-making. Here too Humphrey uses the simulator for normal and emergency procedures. Some operators elect to include, in addition, one or two hours of actual flight with an instructor to brush up on skills.

One of his favorite procedures to teach pilots in the simulator is the start procedure. "You really don't want to

start a real airplane up that many times to teach a guy start procedures."

For new turbine pilots, often the only option is to practice dry starts over and over without actually starting the airplane. "But they don't really get to see what's going on in the airplane unless they do some real starts in it," Humphrey says. "In the procedures trainer I can have them do numerous starts, and they can practice procedures for hot and hung starts. So the first time a guy gets in the real cockpit, he has the knowledge, understanding and experience to start the aircraft safely. It's fun to watch."

Humphrey can also simulate CFIT, or controlled flight into terrain, scenarios. CFIT accidents occur when an airworthy aircraft flies into terrain or an obstacle that originates from the ground such as trees, wires and towers. When he simulates hitting wires or objects on the ground, the airplane will still fly but only with minimal controls available to the sim pilot. Like many of the emergency simulations, CFIT scenarios reinforce the concept that an ounce of prevention is worth a pound of cure. They also give pilots at least

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the sense that they've been through the experience before should they clip a wire or tree in real life.

"We don't want to say, 'Look, we're teaching you how to fly through wires and survive.' We're teaching you, 'Look, this is what happens if you hit a wire and now you're in a tough situation,'" Humphrey says. "The emphasis is on keeping yourself out of dangerous situations too."

Pilots can also get valuable recurrency training in an ag flight simulator to help prepare for a new season of flying. That can be particularly useful for ag pilots in regions with shorter seasons. "For example, Canadians might not see an ag airplane for seven or eight months, and suddenly they're in an airplane and have to go to work, flying 12-plus-hour days. If they've had a chance to knock the rust off a little bit on procedures and

go through human factors training, it helps," Humphrey says.

It's one thing to hear about an emergency situation; it's another thing for pilots to experience it, Humphrey says. Simulating emergencies adds to the realism of their training while remaining safely on the ground.

Most of the pilots who have gone through Thrush's training program have been transitioning from a piston to a turbine aircraft. While many are going into a Thrush model, Thrush Aircraft has also transitioned pilots going into Air Tractors and turbine Ag-Cats. "The airplane is different, but the engine operations are the same. That's what they really want to learn, in addition to the differences in the flight dynamics and performance," Humphrey says.

All three schools' simulator programs are led by experienced ag flight instructors. That's something Thrush's training team has in spades. Humphrey has been in aviation and around ag aircraft for 50 years, and Peed has about 30 years of experience. "We're both highly experienced in the aircraft. We're not students teaching students, as you often see in general aviation schools," Humphrey said. "We know what we're talking about on our aircraft and our systems."

EMERGENCY IMC SCENARIOS

From 2010 to 2019, six Part 137 accidents resulted from flying into foggy or poor visibility conditions. Five of the six accidents were fatal. The sole surviving pilot was seriously injured.

Klindt made a point of practicing in IMC conditions and executing a plan to fly to safety in Turbine Training Center's simulator. He thought about ag pilots he knew or knew of who lost their lives flying into fog or instrument conditions. "The first time that you ever involve instrument conditions, you have a very, very high chance of not making it," he says.

Pilots who fly into instrument meteorological conditions can get disoriented quickly by the inability to see outside the cockpit. Panic can soon follow, putting the pilot in further jeopardy. "In IMC type situations, keeping them from panicking is really paramount," Wolcott says.

Just simulating IMC conditions was a nerve-wracking experience for Klindt, an experienced AT-802 pilot. "It took me a while to get back out of it, but by the time I was out I was sweating. I'm just sitting in the simulator and I was tired. I was like, 'Holy mackerel, this is a lot tougher mentally.'"

Humphrey also likes to show what happens when you go from visual flight rules (VFR) to instrument flight rules (IFR) conditions by simulating deteriorating weather conditions. The purpose is not to teach pilots how to fly in adverse weather, but more about emphasizing the need to avoid getting caught in those conditions in the first place.

"Most agricultural pilots have very little experience in IFR conditions in instrument flying, and there have been several CFIT accidents in the past few years related to weather. These are day/night, VFR only aircraft without the proper instrumentation for IFR. In the simulator, the pilot experiences how difficult it is to fly in those conditions," Humphrey says. "It reinforces the fact that you'd rather be on the ground wishing you're up there, than up there wishing you're on the ground."

Bad outcomes typically occur in the spring, when fog and low ceilings can develop rapidly. Impact with the ground can often happen in less than 30 seconds after entering zero-horizon, low-visibility conditions. "Pilots often lose control that quick," May says.

The beauty of simulators is they provide second, third, fourth and even more chances to eliminate mistakes.

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THRUSH TRAINING Instructor Terry Humphrey observes a pilot in the aircraft manufacturer's Thrush 510AS flight simulator.

In Wolcott's mind, the best feature of a sim is the pause button. "You get a person into a situation and obviously from the instructor standpoint you're watching them to see how they react, what they're going to do, and if they have a question or things are starting to get a little hairy, you pause it. You can walk up, talk them through it. 'All right, everybody's regrouped, let's go.' Unpause it."

"The pause button's a wonderful thing," Humphrey agrees. "If the guy ends up making a mistake, you can stop and start talking about the mistakes and help eliminate those. There's a lot of discussion that goes on during the sim training that you don't really get in the cockpit of an airplane."

LOW COST, HIGH VALUE

These courses generally start at around \$1,500 for a one-day course, \$2,500 for two days or more for longer courses. For example, Thrush's

recurrent training lasts two to three days. Its turbine transition training program, which includes at least three hours of in-aircraft dual-cockpit flight training, takes five days. All in all, it's a relatively low dollar amount for a high return on investment.

"The backseat training, the ground school on the systems, all the scenarios that we do in the simulator—that's where the value is," Humphrey says. "It makes them safer pilots, I believe, at least in the beginning, and then, hopefully, it'll continue throughout their career."

Simulator-based training is a good investment all the way around for ag operators and pilots. The UNL PAT Lab's website states that it substantially reduces the amount of time a pilot needs to reach or maintain a high standard of proficiency, and the operating cost per hour is far less than for an equivalent airplane.

For a one-day safety course, "The way I look at it is \$1,500 to be comfort-

able if you have a problem arise in the aircraft, to be able to potentially save that aircraft or not damage an engine or save yourself, is pretty cheap insurance," May says.

Ag simulator training isn't a substitute for training in an actual aircraft, but it will make pilots feel more comfortable when they slide into the cockpit of a turbine ag aircraft. "It's kind of apples and oranges. I wouldn't say that one is more important than the other. The way I view it is time in the simulator simply enhances your time in the actual aircraft," Wolcott says. "Is it a hundred percent necessary to get time in a sim? No. Let's face it, the bulk of the pilots out there, particularly from the ag side, they've never been in a sim before because they really haven't been available."

"There's no substitute for reality, but reality unfortunately is very unforgiving too. So being able to expose people to some of this stuff in a safe, more controlled and cost-effective environment is always going to be beneficial," he adds.

"I really do think that it will help if more guys would do it," May says of recurrency training for ag pilots. "You would probably see accident rates decrease some and hopefully fatality rates decrease."

"Aviation simulators themselves is relatively big business," Wolcott says. "But as far as accurate ag plane or spray plane sims, there's not many of them out there. It's a pretty rare deal, at least up until now." ■

For more information about flight simulator courses, visit Turbine Training Center at turbine-training.com, Thrush Aircraft at thrushaircraft.com/en/support/simulator-training, and the UNL Pesticide Application Technology Laboratory at pat.unl.edu/flight-simulator.