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**Aerial Survey Flight Following: Potential Improvements to the
South Carolina Forestry Commissions Aerial Survey Program**

**Laurie Reid
South Carolina Forestry Commission
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Introduction

The South Carolina Forestry Commission is just one agency in South Carolina that regularly performs aerial survey. The Fire Management, Best Management Practices, and Insect and Disease program areas all rely on aerial survey for detection purposes. The Fire Management section has several pilots throughout the state who fly on a weekly basis detecting wildfires. The detected fires are reported to the dispatchers and are entered into the agency's Computer Aided Dispatch System. This aerial survey is used for the early detection of wildfires. Pilots are also available during a wildfire to assist with fire suppression tactics.

The Best Management Practices section uses aerial survey to detect areas where logging is occurring near streams or other water sources. Either surveyors fly with agency pilots or in contract airplanes, looking for active logging that is infringing on water sources. These logging sites are mapped and then ground checked to be sure that the sites comply with the state's Best Management Practices specifications.

The South Carolina Forestry Commission is charge by state law (1976 Code of Law 48-29-10 through 60) to detect and control forest pest outbreaks in South Carolina. The Insect and Disease section uses aerial survey to detect forest health problems. Surveyors fly either with agency pilots or with contract pilots. Trees impacted by insects, diseases, beavers, or weather are mapped and then, if needed, ground checked to determine what is damaging the trees. Forest Health surveys (ex. beetles, annosus root rot, beavers, fire damage, defoliating caterpillars) are made on a yearly basis, and weather damage (ex. hurricane, ice, wind, hail, and tornado) assessments are flown on an as needed basis.

With the various types of aerial surveys performed by the South Carolina Forestry Commission employees, there is a need for more safety and a need to look for areas of improvement. The purpose of this project was to survey various agencies throughout the United States about their aerial survey program in the hopes that any found improvements could potentially be applied to the South Carolina Forestry Commissions aerial survey program. Specifically, flight following was identified as a major component that is lacking in the Insect and Disease aerial survey program.

One implemented improvement by many federal aerial survey programs (ex. United States Department of Agriculture Forest Service) is the use of Automated Flight Following. Automated Flight Following uses GPS receiving equipment to determine the position of the aircraft and a transmitter in the aircraft to transmit the location on a frequent basis (often every 2 minutes). A web-based GIS system tracks the aircrafts location. The traditional form of flight following is radio contacts every 15-30 minutes, depending on the agency's policy, between the pilot and agency dispatch center. The dispatch center will then track the progress of the aircraft either on paper or in a computer system. However, many aerial survey programs that perform point-to-point aerial survey, the only contact between the pilot and dispatch center is at the beginning and the end of the flight.

Safety of the pilot and the observer(s) is the main purpose for the use of flight following, be it automated or not. In the event of an emergency landing, search and rescue is more efficient when more regular flight following is made. In point-to point survey work, often the aircraft

flight path is only known to the observer and pilot. This would cause the search and rescue area to be hard to define in the event of an incident.

Methods

A web-based survey, using Survey Monkey (<http://www.surveymonkey.com>), was sent to 43 individuals working for federal agencies, state agencies, or forest industry that use aerial survey as a detection tool. Of the 43 individuals sent the survey link, 17 individuals were state forestry employees, 23 individuals were federal (USDA Forest Service) employees, and three individuals were forest industry employees. Survey questions were open ended, single answer, multiple answer, or a combination (see Appendix, Table 1). The survey was available on-line for 2 weeks. Background information was gathered about the individual aerial survey program, as was the type of flight following used by the various agencies.

Results

Of the 43 individuals sent the survey link, 25 individuals responded to the survey (58% response rate). Of the 25 individuals who answered the survey, nine individuals were state forestry employees, 15 individuals were federal (USDS Forest Service) employees, and one individual was a forest industry employee. Please see Appendix 2 for Survey Question Answers.

Discussion

The Insect and Disease section of the South Carolina Forestry Commission currently has three individuals who perform aerial survey. Typically, the South Carolina Forestry Commission Insect and Disease section averages about 350 hours per year. Survey flight are performed in both agency owned (pilot is Forestry Commission employee) and contract aircraft, however mostly contract aircraft is used. Of the 25 agencies who responded to this survey, 44% have between 1-3 individuals flying aerial survey. The average number of hours flown per year was 419; the highest was 2000 hours per year and the lowest was 18 hours per year. Most of the agencies who responded to the survey (44%) performs aerial survey in contract aircraft (aircraft and pilot are rented on a per hour basis).

Approximately 42% of responding agencies use Automated Flight Following in their aerial survey program. Most of the responding agencies reported that if Automated Flight Following is not used, pilots typically check in with their agency dispatch or other dispatch every 15-30 minutes relaying their position (latitude and longitude). The aircraft is then tracked either on paper or in a computer system.

Currently, the Insect and Disease section does not use Automated Flight Following equipment in the aerial survey program. In fact, Flight Following is very limited or not used at all. In most instances, the contract vender is notified of the general area where the flight lines will occur (ex. which counties will be surveyed) and when the surveyor is expecting to return. In flight, pilots will communicate with airport controllers especially when flying near major airports (ex. Columbia, Charleston, and Savannah), county airports, or air restricted areas (ex. North Air

Base, Shaw Air Force Base, Savannah River Site). Once contact has been made with the controller, the aircraft is then flight followed by that controller until the aircraft is out of the controllers' airspace. Once the aircraft is out of the controllers' airspace, the flight following is terminated.

The majority (61%) of those who responded to the survey think that Automated Flight Following should be mandatory in all forestry or fire related aerial survey programs. Making the use of Automated Flight Following mandatory would provide consistency within federal and state programs. However, the issue of who will be in charge of tracking needs to be adequately addressed before Automated Flight Following is made mandatory.

The majority of survey responders stated that the underlying benefit of Automated Flight Following is safety. In the unlikely event of an emergency landing, an aircraft that is using Automated Flight Following will be much easier to determine where a search and rescue mission should take place. Time is of the essence in any search and rescue mission as the likely hood of surviving is greater with a quick rescue response. The majority of aircraft used in aerial survey have the ability of flying at a speed of at least 100 miles per hour. If flight following is manually performed by the pilot and dispatch center every 15-30 minutes, the airplane can cover a long distance between checkpoint times. If, as in the case with the Insect and Disease Section, there is little to no flight following, search and rescue will have a large area to search.

The use of contract aircraft by the Insect and Disease section may limit the use of Automated Flight Following unless it is determined to be mandatory in the vendors' contract, as many USDA Forest Health Protection flights have. However, the Automated Flight Following equipment is

expensive and, therefore, it is unlikely that the vendors will be willing to install and upkeep this equipment. Additionally, there is a need to determine who should be in charge of monitoring the flight following. The South Carolina Forestry Commissions dispatch centers are often overburdened tracking fires in the state and may not have the resources to track aircraft during aerial survey work.

Flight Following is the most important aspect to a safe aerial survey program. Automated Flight Following is easier for the pilot as the pilot does not have to make a regular radio check in with a dispatch center and can concentrate on the flight. Additionally, Automated Flight Following is easier on the surveyor as they can concentrate on observing. However, Automated Flight Following could possibly be a burden to an overly expended dispatch center. It also has the potential to be a financial burden.

Sky Connect, LLC offers several tracking devices that can be installed in aircraft. Of these models, the Sky Connect TRACKER-AFF package meets the USDA Forest Service AFF contract requirements and should be considered as the model for SCFC use. According to Sky Connects' website (<http://www2.skyconnect.aero/1100.xml>), this model consists of:

- Sky Connect Iridium Transceiver with Internal GPS
- Quick-release, aircraft mounting tray
- TSO'd 3.5" Iridium antenna
- TSO'd 3.5" GPS antenna
- Power connector components
- Total installed weight: Typically under 5 pounds
- Two- or Five-minute Position Reporting Intervals

The TRACKER-AFF system costs \$3,795 per aircraft and an activation fee and three months service of this device costs \$50.00. After three months, the cost is \$15.00 per month and there is a \$4.00 per flight hour, which covers reports every two minutes. The SCFC Insect and Disease

section uses three aircraft to fly in the months of May-July and typically flies approximately 300 hours. Therefore, the cost would be approximately \$1,400 for the first year (three months) of use by the Insect and Disease section, with a one-time cost of \$11,385 for the three units.

During the completion of this CPM project, the South Carolina Forestry Commission's use of contract aircraft for aerial survey changed; during state fiscal year 2008, all Forest Health flights are to be done in Commission owned aircraft and the use of contract aircraft is to be minimal. However, even with the use of South Carolina Forestry Commission owned aircraft, the use of Automated Flight Following should be evaluated during state fiscal years 2008 and 2009 for use during all forestry flights. This evaluation should include financial evaluation, if the AFF system will be able to be coordinated with the current dispatch system, and the additional work that the AFF system will put on the overextended dispatchers.

Traditional Flight Following (radio check in every 15-30 minutes) has been the standard for many years. If it is determined that Automated Flight Following is unable to be implemented within the South Carolina Forestry Commissions aerial survey program, I believe that traditional Flight Following should be mandatory on all Insect and Disease aerial survey flights.

Appendix 1

Table 1: Survey Questions

1. What is your job title and affiliation?
2. Do you perform aerial survey for your agency? (Choices were: Yes; No; Other)
3. How many people in your agency perform aerial survey? (Choices were: 1-3; 4-6; 7-9; 10+; Other)
4. How many hours of aerial survey per year does your agency perform?
5. Does your agency own its own aircraft for aerial survey or do you use contract aircraft for aerial survey? (Choices were: All aerial survey done in agency owned aircraft; All aerial survey done in contract aircraft; Some aerial survey done in agency owned and contract aircraft; Other)
6. Does your agency use Automated Flight Following (AFF)? Is the use of AFF a policy or procedure for your agency? (Choices were: Yes, we use AFF; No, we do not use AFF; Yes, it is a policy or procedure; No, it is not a policy or procedure; Other)
7. If your agency uses AFF, who is responsible for AFF monitoring? If your agency does not use AFF, who is responsible for monitoring flights? How often is the pilot required to check in?
8. How many years has your agency used AFF? (Choices were: We do not use AFF; 6 months or less; 1 year; 2 years; 3+ years; Other)
9. Do you think that AFF should be mandatory in all forestry or fire related aerial survey programs? (Choices were: Yes; No; Feel free to give your opinion)
10. What, in your opinion, are the greatest benefits of AFF?

Appendix 2

Tables 2- 11 Survey Questions Answers

1. What is your job title and affiliation?

USDA Forest Service - Rocky Mountain Region (R2) Forest Health Monitoring Coordinator I
oversee the Aerial Survey Program in R2 Aerial Forest Surveyor R2 Rocky Mountain Region
Lakewood Service Center Forest Health

Field Office Representative Forest Health Protection USDA Forest Service, Pineville LA

Aerial Survey Coordinator, R1/R4 USDA Forest Service

Biological Science Technician USDA Forest Service

Forest Health Specialist Wyoming State Forestry Division Cheyenne, Wyoming

Pest control forester nc forest service

Aerial Survey Coordinator/Specialist for the Alaska Region, USDA Forest Service

Forest Entomologist/Forester, State of Alaska, Dept of Natural Resources, Div of Forestry

Forest Health Program Supervisor. MA Dept. of Conservation & Recreation

Forest Entomologist Texas Forest Service

Biological Scientist, Aerial Survey Program Manager. USDA Forest Service, Region Six

Aviation Manager

Aerial Survey Specialist USDA Forest Service Forest Health Protection

Forest Health Specialist, Nevada Division of Forestry

Assistant State Forester Arkansas Forestry Commission

Pest Control Program Head

Forest Health Protection R8 Pineville, La. Biological Science Tech. DASM Trainer

Forest Health Coordinator Alabama Forestry Commission

Bio Science Tech USFS

Forest Health Specialist, Virginia Department of Forestry

Director Forest health Technology Enterprise Team USDA FS FHP. I will answer this survey
not as an aerial survey practitioner but as the keeper of the national dataset.

Chief Pilot

Forest Researcher, MeadWestvaco

Entomologist with USDA Forest Service Region 3, Southwestern Region

2. Do you perform aerial survey for your agency?

Answer	Response %	Response Total
Yes	72	18
No	20	5
Other	8	2
	Total Respondents	25
	# who skipped question	0
Other responses: - BMP Forester & County Foresters; - We maintain the national Database for Aerial survey		

3. How many people in your agency perform aerial survey?

Answer	Response %	Response Total
1-3	44	11
4-6	24	6
7-9	4	1
10+	12	3
Other	16	4
	Total Respondents	25
	# who skipped question	0
Other responses: - 10+ because of SPB foresters - 8 in the AK region - Depends on SPB outbreak (1 to 6) - 2 people maintain the Database		

4. How many hours of aerial survey per year does your agency perform?

511 Hours --- 6 of the surveyors are US Forest Service - R2 Forest Health Protection staff 4 of the surveyors are State Cooperators from Colorado and Wyoming
583
120
R1 - 584 hrs (MT, n.ID, Yellowstone NP) R4 - 476 hrs (s.ID, UT, NV)
25 hours of High Level Sketchmapping Overview Surveys for current mortality
Averages out to roughly 50 hours per year.
~200 hours/year currently. Mostly SPB flights (one in spring and one in summer). Goal: fly every county (doesn't usually happen). # inc. dramatically if spb is in outbreak status.
200
50-100 hours
20-30 Hours, Depending if special surveys are needed.
This is highly variable. With the absence of SPB in Texas for the past 8-9 years, very little has been done. The average number of aerial survey hours for SPB for the 14 year period 1984-1997 was 341.5 hours. The highest number of hours was 782.7 in 1985 (1985 was the worst SPB year on record in TX) and the lowest number of hours was 127.9 in 1988.
300-400 hours
50
300-400
80-100
Depends on SPB outbreak. Lately we do about 18 hours a year on SPB. Many days (about 20) were spent doing a 100% coverage locating logging jobs. We will do about 25% of this in the future every other year.
~150
In Region 8 we average around 100-200 hrs.
1500 to 2000 a year (include aerial surveying for wildfires)
100 - 200
10-25
5 solid Months 1 FTE to post process the data
2000n hours
~400

5. Does your agency own its own aircraft for aerial survey or do you use contract aircraft for aerial survey?

Answer	Response %	Response Total
All aerial survey done in agency owned aircraft	20	5
All aerial survey done in contract aircraft	44	11
Some aerial survey done in agency owned and contract aircraft	20	5
Other	28	7
	Total Respondents	25
	# who skipped question	0
<p>Other responses:</p> <ul style="list-style-type: none"> - 44% in US Forest Service plane 47% in 2 contract planes 9% in Civil Air Patrol of WY plane; - When Taking Aerial Photography we an agency owned aircraft. When Sketchmapping we use contract aircraft; All aerial survey conducted through an MOU with the Wyoming Wing Civil Air Patrol. Both pilot and aircraft provided by Wyoming Wing Civil Air Patrol; - We utilize existing rental agreements with the FS and other vendors. The rental agreements are not binding by either party but it does add flexibility; - The Texas Forest Service owns a Cessna 207 single engine aircraft that is outfitted for aerial photography. On rare occasions this plane has been used for SPB aerial surveys and fire patrol; - We have an exclusive use contract paid for by Challenge cost share agreement between Washington Department of Natural Resources and the Forest Service. We also have a challenge cost share agreement with Oregon Department of Forestry for use of their agency owned aircraft; - field folks, not us 		

6. Does your agency use Automated Flight Following (AFF)? Is the use of AFF a policy or procedure for your agency?

Answer	Response %	Response Total
Yes, we use AFF	41.7	10
No, we do not use AFF	33.3	8
Yes, it is a policy or procedure	20.8	5
No, it is not a policy or procedure	8.3	2
Other	20.8	5
	Total Respondents	24
	# who skipped question	1
<p>Other responses:</p> <ul style="list-style-type: none"> - AFF is mounted in agency owned aircraft. We have a portable unit for contract aircraft we have not used it extensively yet. Still a few problems; - It is a policy for our unit; - We will use flight following when we are flying in high traffic areas like around Houston IAH or Shreveport, LA. Contract aircraft used for fire patrol flights check in with a TFS dispatcher every 15 minutes; - Not sure; - We encouraged the std. 		

7. If your agency uses AFF, who is responsible for AFF monitoring? If you agency does not use AFF, who is responsible for monitoring flights? How often is the pilot required to check in?

<p>??? --- our surveyors check in with nearby airports --- I don't remember what these people are called that they "check in" with.</p>
<p>Forest Service Dispatch</p>
<p>Chris Stiener</p>
<p>Forest Dispatch for the area being flown monitors AFF. If AFF malfunctions, dispatch notifies aircraft and radio check-ins every 15 min are made until AFF is re-established.</p>
<p>When taking Aerial Photography we are tracked by the FAA. We check in every fifteen minutes, when using single engine aircraft or if it is requested by the Forest. We call in before we take off and when we land.</p>
<p>Responsibility for monitoring flights is shared between interagency dispatch centers and myself. Interagency dispatch centers provide flight following for all aerial survey flights. The dispatch centers I have used include Cody, Casper, Rawlins, Great Plains (Rapid City, South Dakota, and several in northern Colorado. Written requests for flight following are submitted to dispatch centers at least a month in advance of all flights. Either myself or my pilot check in every 15 minutes with lat/long, heading, amount of fuel, and geographical location (Shell Canyon, etc.).</p>
<p>Our pilots are supposed to check in with the district operations office by radio every 20 minutes, and give a lat/long at that time.</p>
<p>We use AFF and our FS dispatch monitors the flights. Status is checked every 15 minutes. Prior to AFF we would call in via radio every 15 minutes or 30 minutes depending on the forest policy we were flying on. When outside of radio coverage, in the interior of AK we filed a detailed flight plan and checked in at designated times (every landing) via landline or satellite phone.</p>
<p>The USDA Forest Service, Forest Health Protection, Region 10, Alaska monitors the AFF. USFS/FHP provides funding and aircraft contracting for most years, in addition to setting policy for safety and specifications of how the survey is conducted (e.g., use of tablet PC based DASM (Digitally Assisted Survey Mapping) for sketch-mapping of forest damage. AKDNR is the major cooperater with USFS for the annual statewide aerial forest damage assessments.</p>
<p>We rely on the air traffic controllers to monitor our flights, there is no specific requirement for pilot check in's.</p>
<p>Since the TFS does not normally use AFF, fire patrol flights are monitored at 3 or 4 TFS "dispatch" offices located in East Texas. The Chief Regional Forester for fire and the Regional Fire Coordinators determine when a fire patrol is to be made. Pilots will check in by radio to regional TFS dispatch offices, usually every 15 minutes. They will give their L/L and this information is recorded in a log noting the plane's location and the time of day.</p>
<p>We have been working to clearly define dispatch boundaries, so we're monitored by the dispatch office responsible for the area we survey. This can be accomplished by use of WebTracker or our own website for FHP flights at "Windstream".</p>

Our dispatch center monitors all flights and pilots check in at 30 minute intervals.
Interagency Dispatch
Dispatchers monitor on AFF, Surveyor or Pilot checks in every 15 to 30 minutes depending on area.
varies. pilots check in when they cross district lines. We use flight following consistently in fire control but less consistently with aerial survey
We cover many different states and usually require the local dispatch to monitor AFF.
The pilots must report to the region's Management Specialist. The region's Management Specialist and Regional Forester monitor flights.
AFF monitored by National Forest Dispatch office(s). 15 minute check-in optional if AFF is used. Radio contact, including monitoring air guard freq always required.
local dispatch organization when on FS and either local dispatch when radio communication is available or in combination with radio communication with landownership dispatch when they do not have AFF technology or training

8. How many years has your agency used AFF?

Answer	Response %	Response Total
We do not use AFF	31.8	7
6 months or less	0	0
1 year	0	0
2 years	27.3	6
3+ years	31.8	7
Other	13.6	3
	Total Respondents	22
	# who skipped question	3
<ul style="list-style-type: none"> - It is my understanding that AFF is seldom used because of checking in with TFS dispatch; - about 10 years, we were the first; - Not sure 		

9. Do you think that AFF should be mandatory in all forestry or fire related aerial survey programs?

Answer	Response %	Response Total
Yes	60.9	14
No	8.7	2
Other	30.4	7
	Total Respondents	23
	# who skipped question	2

Other responses:

- It depends on the terrain and the project. Some flights if are over sensitive areas do not wish us to use it and prefer to do there own tracking;
- AFF should not be mandatory. I believe that surveyors/pilots are still required to radio-check every 15 minutes anyway. I suspect dispatch centers have an entirely different opinion and want AFF mandatory;
- I'm not very familiar with this, so I don't want to commit to an answer;
- It depends on the situation, the extent of survey area, the remoteness of the survey and the availability of other communication. In AK I think it should be mandatory;
- I think it should be mandatory. However, this could cause problems for air traffic controllers if a very large number of extra aircraft are in a particular area;
- I do believe that whatever policy or procedure that is in place should be mandatory in forestry aerial survey programs so that everyone will be consistant;
- In VA, there is not too much remote country and we are in regular contact with local airports during the flight

10. What, in your opinion, are the greatest benefits of AFF?

This is dangerous work and it is good that the surveyors are monitored while flying.

In the event of a rescue or recovery the search party is able to find the aircraft more quickly. It reduces the workload for the pilot and dispatcher by the check in process being automated. The aircraft is able to cover a lot of ground between the old fifteen minute check ins

Knowing where the aircraft is at all times

Better location identification using AFF than verbal checkins when surveying. Reduces radio chatter. Detriments include inability to identify aircraft problems at back country airstrips. AFF shows aircraft at a strip whether there is a problem or not. Dependent on alert dispatcher to realize aircraft hasn't left airstrip in reasonable time. Harder for aircraft to know if other agency aircraft in the area w/out verbal radio checkins. Incumbent upon dispatcher to notify aircraft of other operations and pilot to maintain awareness.

It frees up radio chatter and in most situations tracking is very accurate

Although I do not believe AFF should be mandatory, this service is a great benefit. I have never used AFF but have learned of the benefits such as reduced response time to emergencies. I still have faith in the 15 minute check-ins though. An actual conversation with the dispatch center is comforting rather than solely relying on AFF without verbal communication. It's nice to know someone is still there!!

It reduces workload in the cockpit and the dispatch office. It gives very specific and continuous location information. It could save lives in the event of an accident.

AFF, or some other method for automated flight following during special aerial surveys should be mandatory. Primary reason is to add to the safety factor for the aerial survey participants. In addition, AFF is critical to Alaska's mission success in ensuring safety of our crews due to the remote nature of our forest damage surveys (most of AK is roadless). Also, we utilize satellite phones for daily route call in, since cellular service is not available in most areas, even for ground based communication.

I have no experience with AFF

Safety!!!

highly dependable position reports on a frequent basis has many benefits in insuring safe flight and rapid rescue response.

Since we do not use AFF, I do not know very much about it.

Dispatch is getting more comfortable with it, 15 minute radio check ins are often still required but depends on unit doing flight following; minimal voice contact enables us to focus on our work and continuous GPS positioning by AFF provides great comfort in terms of safety whether using AFF exclusively or along with voice

Safety - locating aircraft in case of emergency very fast compared to non-AFF means, tracking ease for dispatch and aircraft crew - just doing an Ops normal check in vs. position every 15 minutes.

consistency

Knowing someone has a record of the last place your aircraft was at, two ways of contact for dispatch, 1AFF, 2Radio. Safety is the biggest concern. There are lots of things going on in an aircraft while conducting surveys, we the FED's must contact dispatch every 15min, with AFF we contact every 1/2 hour which gives us more time to concentrate on the task.

One benefit in having AFF (or something like it) in place is that all procedures and policies pertaining to aerial surveying will remain consistent.

Greatest benefit for the aircrew is the much smaller area SAR crews search to find you! With AFF position updates every two minutes, an aircrew have a lot better chance of being rescued within the "golden hour". After that hour passes, their chance of survival, if injured at all, declines rapidly. Also, those who monitor AFF receive an alarm if signal is lost or you go stationary. If an aircraft goes in, there may not be time for the crew to make a radio call. If they do key the mike, chances are the info given would be incomplete/inaccurate. True inflight emergency procedures are just not practiced. The AFF alarm starts the clock, and SAR would soon follow.

You can be found more quickly if you go down!

the observer and pilot

SAFETY

knowing that folks are monitoring our location regularly and having exact coordinates, not garbled ones with poor radio contact, and that if there is an accident the gps coordinates of the downed aircraft would be available to search and rescue saving time which is important to survivorship.