Two More Chains

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Look Up. Speak Up. Stay Connected.

By Travis Touchette, Director
Wildland Fire Lessons Learned Center

Aviation is an integral part of wildland fire. Even if you are not assigned to an aviation crew, **you are still part of aviation operations.** If aircraft are working your fire, what is happening in the air cannot be separated from what is happening on the ground. Your awareness, communication, and actions matter.

This issue of *Two More Chains* looks at several aviation incidents involving water and retardant drops, communication challenges, and overhead hazards. Different aircraft, different missions, different circumstances—but the lessons continue to point in the same direction: **know what is happening above you, communicate clearly, and speak up when something doesn't look right.**

As Erik Apland reminds us in his new "Clear Text" column, expertise doesn't mean moving beyond the fundamentals. Elite performers rely on the fundamentals for clear communication, simple tools, candid feedback, and disciplined debriefs.

That same theme comes through in the "One of Our Own" conversation with Dan Reese. Dan makes an important distinction: much of our aviation training has focused on **what** aircraft are and what they can do. Just as important is understanding **how to work with them**.

In "Shop Talk" Matt Holmstrom provides a great example of *thinking outside of the box* with a common aviation communication tool.

The people in the aircraft have a perspective we don't have. But those of us on the ground also see things the pilot cannot. Good aviation operations depend on those perspectives coming together. Whether you are on a helitack crew, engine, handcrew, dozer, or working anywhere on the fireline: **Aviation safety includes you.**

In this Issue

Cover Photo

Crews pull off the line as a single engine airtanker (SEAT) makes a retardant drop on the Kinsley Fire near West Wendover, Nevada, on July 19, 2024. Photograph by Jon Blalock.

Clear Text

Erik Apland
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With the retirement of longtime Lessons Learned Center Analyst Travis Dotson, we decided to retire his long-running "Ground Truths" column and put its jersey in the rafters. This is the inaugural column of the new "Clear Text" column, written by Field Operations Specialist Erik Apland.

"Elite Performance"

Enriching Your Risk Management Thinking Via the Aviation Industry

Students of accident prevention and risk management can benefit immensely from reaching outside of their specific work areas and finding applicable lessons, processes and philosophies in other fields that also have inherent risk, and learning cultures.

Over the years I have come back—again and again—to the aviation industry as a source to enrich my thinking in risk management.

Richard McSpadden

The video **"Peak Performance: Flying the Fire Boss,"** first posted by the Aircraft Owners and Pilots Association's Air Safety Institute on June 2, 2023, is a beautiful example. It features this association's then-Vice President Richard McSpadden visiting the training facility of Dauntless Air, a Minnesota-based operator of AT-802F Air Tractors, also known as "Fire Bosses."

These single engine scoopers have become prevalent in U.S. wildland fire suppression operations, delivering up to 800 gallons of water in quick turns from nearby bodies of water. They are the scooper version of the AT-802 which is common as a single engine airtanker dropping retardant loaded at an airport.

I recommend watching this video all the way through for a great lesson in the difficulty and high level of skill required to operate an AT-802F in this challenging mission. But what really sold this video to me is McSpadden's closing summary, that begins at 16:33:

"I appreciated that they are exceptional pilots, but humble. They didn't consider themselves above simple tools like challenge-and-response calls for confirmation between each other, and checklists. Elite performers eliminate small mistakes by leveraging simple tools consistently. And they're not embarrassed by these simple tools.

Their debriefs were specific, detailed, and candid so there was no misunderstanding about where mistakes were made and the proper corrections. A tenet of 'elite performance' is setting high standards and holding yourself and your team accountable to those standards."

Recent accidents have taken the lives of several AT-802F pilots, including the loss of Fire Boss Pilot **Juliana Turchetti** in July 2024. These tragedies

underscore the exceptional challenges of this unique mission in wildland fire and the inherent risk that these pilots routinely encounter and accept.

Everyone in fire operations can and should aspire to elite performance. Elite status isn't in a crew name or mode of transportation or a logo or a number of pull-ups. It's in the execution of fundamentals and commitment to learning and improving.

Are we in the greater wildland fire community ever "embarrassed by our simple tools?" A backer when parking the engine? A jig to get the chainsaw file angle right on the numbers?

Juliana Turchetti

Commitment to fundamentals and humility in giving and receiving real, useful feedback are signs of a true elite performer.

Sadly, Richard McSpadden lost his life in an **aviation accident** in October 2023, only a few months after this video was released.

Like many of our departed mentors and teachers, McSpadden's work lives on through those who watch and engage with this important video and his other work over the years. I encourage you to click through and reflect on the simple lessons that this man has shared with us.

Single engine scooper filling on the Brock Road Fire in Alaska in 2021. Photo Credit: Rebecca Manbeck.

Hickok Fire Airtanker Near-Miss Incident

https://lessons.wildfire.gov/incident/hickok-fire-airtanker-incidents-2009

There is a lot going on in this incident. During initial attack, a retardant drop impacted the upper portion of a power pole, pushing the electrical current to the ground and causing a transformer/fuse assembly to fail one pole away.

Another retardant drop comes in too low, creating a 200-foot trench where it sheared, broke, and uprooted six- to eight-foot-tall manzanitas. The tail end of that same drop shattered the front cab glass and the left "chin-window" (the lower-corner or bottom-slant window panel in the operator's cab) of a bulldozer that was pushing dozer line.

A third airtanker drop, due to some miscommunications, narrowly misses crews working on the ground. Luckily, the Air Attack and airtanker pilots were able to abort this drop shortly after it started.

This one fire seems to cover all the bases for potential mishaps with retardant drops and provides good awareness and lessons for what to look for.

Key Lessons

- Review policy regarding minimum drop height (150 feet) of airtankers relating to aircraft and ground safety and proper height for retardant speed dissipation for safety and maximum retardant effectiveness. Retardant is most effective against fire when the retardant speed is near zero at the top of the vegetation and "rains" down vertically into the fuel.
- Provide training tips to field, Air Tactical Group Supervisor (ATGS), and airtanker pilots reinforcing what a proper retardant drop is supposed to look like (heavy, vertical rain, not high-speed impact), and educate on ways user feedback should be reported to the tactical aircraft (via Air Attack, or your line supervisor).
- Remind that communications discipline is more important than ever and communications overload can have direct—and indirect—consequences to efficient and safe tactical operations. Be aware when aviation tactical frequencies with the ground are on the common ground TacNet, or on a separate frequency. Each has its own benefits and drawbacks. Line personnel need to be aware of which frequency management plan is in effect.

Apple Incident Airtanker Drop Injury

https://lessons.wildfire.gov/incident/apple-incident-airtanker-drop-injury-2012

In this incident, a fire apparatus engineer is working along a steep hillside when they are struck by a retardant drop. The impact causes the engineer to roll approximately 50-60 feet downhill.

This "Retardant and Water Drop" 6 Minutes for Safety—https://www.nwcg.gov/6mfs/aviation/retardant-and-water-drop-safety—reminds us of the safety protocol for when an individual is caught in a drop zone:

- Hold hand tools away from your body.
- Lie face down with hardhat in place and head toward the oncoming aircraft.
- Grasp something firm to prevent being carried or rolled about by dropped liquid.
- Do not run unless escape is guaranteed.
- Get clear of dead snags and tree tops.
- Be aware of rolling debris below the drop site in steep terrain.

Tecuya Fire Hit by Helicopter Water Drop

https://www.lessons.wildfire.gov/incident/tecuya-fire-hit-by-water-helicopter-incident-2023

As ground resources moved farther into the Division, completing direct line, the Type 1 helicopter may have been unaware of the crew coming into this area in which this helicopter had been working.

In this incident, a hotshot crew and helicopter are working together to deliver bucket drops to an initial attack fire when a helicopter water dropped on eight of the hotshot crewmembers.

Radio difficulties hampered efficient communication. Several prior drops needed to be aborted due to personnel on the ground being too close to the drop site.

Because of all the difficult communications experienced on this IA fire, an After Action Review (AAR) was conducted post incident. One of the lessons that came out of this report was a reminder to use the Incident Response Pocket Guide (IRPG) to direct retardant and bucket drops.

The IRPG provides standard terminology for use in many of these situations.

Directing Retardant and Bucket Drops

Page 74 of the IRPG states the following for directing retardant and bucket drops:

- Give general location on incident to aerial resource—division, head, heel, flank, etc.
- Identify any flight hazards to the Air Tactical Group Supervisor (ATGS), Aerial Supervision Module and Lead Plane (ASM/LP), airtanker pilot, or helicopter pilot.
- Finalize location with:
  - ✓ Clock position from pilot's perspective.
  - ✓ Description of prominent landmarks.
  - ✓ Target position on slope—lower 1/3, upper 1/3, mid-slope, top of ridge, etc.
  - ✓ Utilize signal mirrors [or strobe lights] whenever possible.
  - ✓ Utilize panels or flagging to mark target as needed. (See this issue's "Shop Talk" section to learn another way to use panels.)
- Describe target from your location and explain mission. The pilot will decide drop technique and flight path.
- Know the pilot's intentions prior to the drop. Clear the area to avoid direct flights over ground personnel and equipment.
- Give feedback to pilot about drop accuracy. Be honest and constructive. Let pilot know if drop is early, late, uphill, downhill, on target, too high, too low, etc. Report low drops immediately.

Two Primary Mitigations

In water drop missions with ground resources in the area, there are two primary mitigations that can avoid the hazards of these drops onto crews on the fireline. The first mitigation is clearing the area to avoid the drop and communicating that clearance. The second mitigation is to drop at an altitude that dissipates the water to a point at which, if it contacts a resource on the ground, it does no injury.

Slope and Topography

Slope and topography may make the drop height variable and difficult to maintain. In addition, there is variability in what clearance distance for an aircraft drop can mean—depending on the size of aircraft, terrain, and fuel type.

Lessons

Many Great Tips

There are too many lessons in this RLS report to include in this issue of *Two More Chains*. We recommend that you read these lessons in their entirety to learn many great tips on directing bucket or retardant drops and communicating feedback and appropriate drop zone clearance.

Idaho Longline Training Helicopter Autorotation

https://www.lessons.wildfire.gov/incident/idaho-longline-training-helicopter-autorotation-2024

On May 17, 2024, while supporting RT-219 (Helicopter Transport of External Cargo Refresher Training), a Bell 205 A1++ Helicopter was forced to perform an autorotation due to low rotor RPM (revolutions per minute).

While an autorotation is a maneuver every helicopter pilot must practice and be able to perform, it is rare that they are forced to do this in the operational environment. The Rapid Lesson Sharing (RLS) report on this incident shares several important lessons for those of us who are not pilots—but benefit from the use of rotor-wing assets.

In this incident, a helicopter was participating in a longline training exercise with a helitack crew. As the helicopter was moved from unloading the longline load to pick up an outgoing load, helitack crew members saw the helicopter shudder and suddenly pitch nose downward.

The helicopter started descending rapidly, then pitched nose up as it flared its rotors and settled to the ground in a slightly swampy area located approximately 200 feet away from the helispot.

During this incident's AAR, the pilot explained to the crew that they had experienced low rotor RPM and that due to being in a low-and-slow flight profile, there was little time to troubleshoot. The pilot therefore initiated a "power-on" autorotation. (For more information about autorotations, check out this short, nine-minute video: https://www.youtube.com/watch?v=BTqu9iMiPIU.)

Key Lessons

Lessons from this RLS regarding ground resources operating safely around aircraft

- A good rule of thumb is if you can see the helicopter, look for anything wrong; if you can hear the helicopter, listen for anything wrong.
  - *Under ideal conditions, it takes two to four seconds for an aircraft 150 feet above the ground to land from the time a pilot initiates an autorotation.*
  - *How tuned in to the operation are you when working with bucket drops or external cargo?*
- Crash rescue equipment is often located in an area where the pilot may have to ditch the aircraft in an emergency. This could present a safety concern to the rescuers. Often, this equipment is positioned with the Radio Operator at a 45-degree angle from the front of the helicopter, in full view of the pilot. In a low hover, or during takeoff and landing, a likely zone to set the helicopter down in the event of an emergency will be near that same area.
  - *Where do you position your personnel and equipment during helicopter ops? Do you consider the worst-case scenario?*
- External cargo attached to a helicopter is designed to be jettisoned, either at the remote hook on the end of a longline or at the cargo hook on the belly of the helicopter. This can result in hundreds—even thousands—of pounds falling out of the sky, putting anyone below at serious risk.
  - *What steps can you take to minimize exposure time below a helicopter with an external load?*

If you would like to channel your inner rotor head and dissect the technical side of this incident, check out the associated "SAFECOM #24-0339."

Elk Fire Fatal Helicopter Crash

https://lessons.wildfire.gov/incident/norcross-helicopter-crash-elk-fire-2007

Communication between air and ground resources can be complicated. Often, the air resources are reliant on ground resources for information on hazards and feedback on operations.

In this incident, a helicopter is ordered to drop off and backhaul blivets (collapsible, heavy-duty flexible containers used to transport water by helicopter to remote areas).

A panel is placed by a Division Supervisor to mark a general area for a future drop zone. In this incident, the drop area is on a steep slope surrounded by 75- to 200-foot tall trees. The Division Supervisor does not intend for the panel to mark the exact spot, rather, to serve as a general starting location for assessment. That spot is never assessed.

The next day, when the helicopter is finally ordered, ground crew members are staffing the drop zone that is marked by the panel. They are unaware that the panel is not the actual drop zone. One successful blivet drop off is made, although the ground crew is nervous the entire time.

Then, on the following day, two new ground personnel are assigned to the drop zone. They are so concerned about the location that they go over a safety action plan three different times—in the event an accident occurs. Over the course of both days, these concerns are not relayed to the pilot.

Dennis Davis, the Bell 205 Helicopter Pilot who was killed when his helicopter crashed making water drops on the Elk Fire.

During the second blivet drop off, as the blivets are being set down, witnesses observe the helicopter drift right, impacting a tree with its main rotor blades. This causes the helicopter to run left, stop, and then descend rapidly, impacting the ground and fatally injuring the pilot.

Key Lesson and Discussion

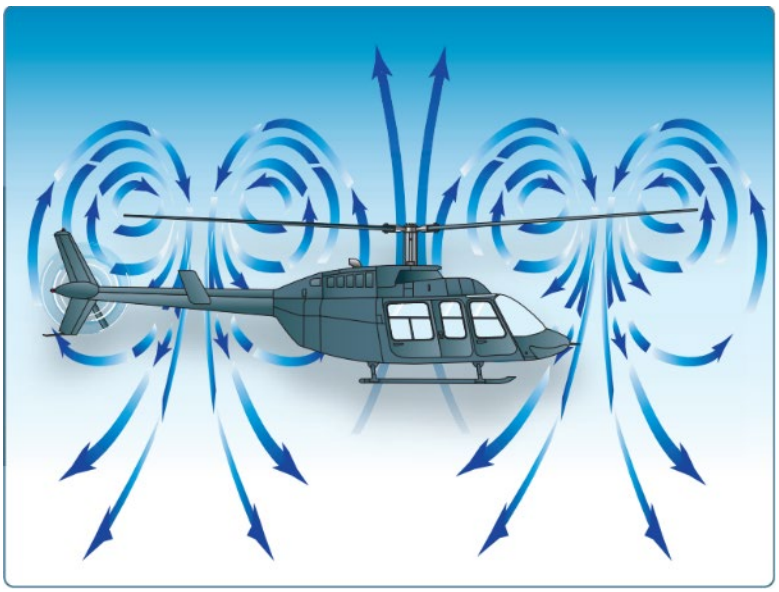
- Though the pilot might be the subject matter expert, ground resources serve as another set of eyes.
- Do you always speak up when you see something that makes you uncomfortable?
- What has prevented you from speaking up in the past?
- Moving forward, how might the events of this incident change how or when you speak up?

Are you aware of the dangers associated with being too close to a bucket or retardant drop?
Check out this video that illustrates the risk:

https://www.youtube.com/watch?v=RAgLRssYzVs

Vortex Ring State

Most of us probably have never heard the term “vortex ring state.” Yet it is a known phenomenon in the aviation world. This occurrence has impacted wildland fire aviation operations more than once. While a vortex ring state event is rare, it is something we should all know about.



Vortex ring state in which airflow is upward on the inner blade section, producing a secondary vortex in addition to the normal wingtip vortices. Turbulent airflow results in loss of rotor efficiency. If allowed to continue, uncommanded pitch-and-roll oscillations may occur, with a large descent rate.
Illustration from “Helicopter Flying Handbook – FAA-H-8083-21A”

Aviation Explanation

If the rate of descent exceeds 1/4 of the hover induced velocity, the flow conditions are such that the air is going both up and down through and around the rotor in a disorganized and unsteady manner. This is known as “vortex ring state.” It exists until the helicopter is descending at about twice the hover-induced velocity.

Plain Language

In the vortex ring state, helicopter pilots can find themselves in the unusual situation in which pulling up the collective pitch does not slow the rate of descent. This is known as “settling with power.”

The helicopter settles into its own rotor wash and the application of power to the rotors can't make the helicopter climb.

Check out the following reports to learn more about Vortex Ring State events in the wildland fire environment:

Big Elk Helicopter Accident 2002 (Vortex Ring State) – **https://lessons.wildfire.gov/incident/big-elk-helicopter-accident-fatality-2002**

Pine Fire Helicopter Crash 1991 (Vortex Ring State) – **https://lessons.wildfire.gov/incident/pine-fire-helicopter-crash-fatality-1991**

Shop Talk

Using Signal Panels as Arrows to Communicate with Aircraft

By Matt Holmstrom
Regional Risk Management Officer
Region 6 and 10 Fire and Aviation Management
U.S. Forest Service

This is a simple and effective communication tool for you that fosters additional dialogue on sharing lessons and learning—not when we have near misses or accidents, but more frequently with best practices and tools.

The communication between aircraft and ground resources is one of the most important and challenging tactical elements of wildland firefighting. Crowded radio channels, confusing perspectives from very different views of the same terrain and same fire, as well as compressed time frames, all contribute to this communication difficulty.

This Shop Talk (that originally appeared as an RLS in the Wildland Fire Lessons Learned Center's Incident Review Database) provides a simple best practice to share—and hopefully begin a dialogue—on this communication issue.

During my time on Interagency Hotshot Crews, I realized that some ideas such as this one were shared between crews at drop points and lookout points. Now, in my current role, I thought it would be worthwhile to share this with a wider audience.

Simple Steps to Provide Better Target Identification

The mirror, signal panel, and strobe light can help to mark and make clear who a helicopter or other aircraft are talking to over the radio.

[An aircraft signal panel is a high-visibility, dual-sided fabric marker—typically fluorescent orange and pink or cerise—used by ground personnel to signal, identify positions, or communicate visually with overhead aircraft.]

Rather than the constant confusion of: *"Your right or my left?"* or *"I'm in a yellow shirt and waving my tool at you"*—using the following tools replaces the dependence on similar unclear and confusing questions and descriptions. Most importantly, they provide better target identification.

Many of us have a length of this aircraft signal panel rolled up in our line gear. As we know, they work great to mark a ground position or target for the aircraft.

However, a very simple cut and fold to a rectangular signal panel creates an even better version of this tool.

By running a cut about halfway across the short axis of the rectangle for a few feet of length, you can create two "legs" on the panel. These can then be folded back at 45-degree angles to create an arrow. (See the three Steps that begin below and continue on the next page.)

An arrow is much better for pointing out a target and communicating your intent to the pilot above.

Step 1 – Unroll a 10-foot-long signal panel and cut on the line shown above.

[Continued on Next Page]

Step 2 – Fold the cut "leg" back at a 45-degree angle.

Step 3 – Fold the second "leg" at a 45-degree angle and orient at target. Pin down with rocks for rotor wash or bucket drops.

Final Thoughts

Now, instead of saying: *"Try to put the drop uphill of the panel"* or *"Drop east to west"*—you can simplify your communication by saying: *"Arrow is pointed at the target"* or *"Drop in the direction of the arrow."*

I've found that oftentimes pilots will acknowledge the arrow and simply ask if the arrow is aimed at the target drop.

Of course, by not folding back the "legs," you will still have the standard rectangle. It might just mean a few more rocks are necessary to hold down the different corners of the legs due to rotor wash and winds.

Important Note: There are limits to this creativity. I'd advise not using it in all situations, especially around landing zones or sling sites. Different panel configurations can mean different things and the arrow "drop here" message may not convey your intent for a logistical mission. The standard panels are much more useful for those assignments.

Dan Reese

In this conversation between Erik Apland, Field Operations Specialist with the Wildland Fire Lessons Learned Center (LLC), and Dan Reese, they reflect back on Dan's impressive career in wildland fire and aviation. Dan transitioned from trauma care nurse to various aviation positions—including Rescuer on a CAL FIRE helicopter, Helibase Manager, Air Operations Branch Manager, Air Tactical Group Supervisor, Chief of Operations for CAL FIRE and head of the Region 5 Helicopter Training Course. As you will see, Dan has always promoted training—with an emphasis on improved communication between the ground forces and aviation component.

Erik: Dan, thank you so much for taking the time to talk to me. To start this off, why don't you tell me about yourself.

Dan: I started my wildland fire career back in 1985 as a firefighter for the Nevada Division of Forestry.

I got into this work because the year before in college, I had tried to burn my family's ranch down by unsuspectingly dumping a hot barrel into the dump at the ranch—which fired off several thousand acres.

When the cavalry showed up, my dad said: *"Well, you started it, you show them the gates."* And, so, I did. And they said: *"Hey, you want to fight fire?"* And I said: *"Sure."*

Ironically, I ended up meeting up with that same group of firefighters later on that winter while going through an EMT class. And they said: *"Hey, you really should come to work for us."*

Dan in a CAL FIRE OV-10 Bronco Air Attack plane as an ATGS in 2003.

So that's how I got my start in the fire service.

I put myself through college fighting fire seasonally. I worked for the Division of Forestry in Nevada under a U.S. Forest Service Humboldt-Toiyabe National Forest contract. My supervisors were actually federal Forest Service folks on the Nevada/Idaho border.

I graduated from Southern Oregon University with a Bachelor of Science in Nursing and became a critical care trauma nurse.

I did some flying as a fixed wing flight nurse while I was a trauma nurse. Finally, based on my previous experience in fire and trauma medical care, in 1997 I was offered the opportunity to take on a full-time position with CAL FIRE's Butte Unit, based in Chico, California. I ran their emergency medical services program for much of my duration there. Then they moved me into their municipal arena, which got me into the rescue world.

Dan (circled) during CAL FIRE Helitack Training in 1999.

Next, I was recruited to go work on a helicopter to be a Rescuer. I was part of Butte County's Rescue Team.

In 1998-99, I went through Basic Helitack Training, followed by CAL FIRE Short Haul Training. That became my gateway into aviation—a Rescuer on a CAL FIRE helicopter.

I became a CWN manager *[a Call-When-Needed (CWN) aircraft is held on a contract with the government but only called when a need arises. Managers for these aircraft are often government employees]*, a Helibase Manager, a Helitack Captain, and then my career just morphed into straight aviation.

In 2002 I became an Air Tactical Group Supervisor (ATGS), and in 2007 I became the Chief of Tactical Operations for CAL FIRE. In that capacity, I was privileged to be a part of building many different programs and a lot of training programs.

Aviation Training

Aviation training was under my purview. When I had been a Tanker Base Manager, that training was absent. It was just "folklore" passed on by stories. Therefore, the first thing I did was build a tanker base school for California—which also had the Forest Service intimately involved in this joint-agency program.

That program is still running today as part of the Region 5 Air Attack program.

I also had the California Region 5 Helicopter Coordinator (HLCO) training course developed due to hardships that were identified in our program. There is a marked difference between coordinating multiple helicopters operating at a lower level versus airtankers working at higher altitudes. Although many of the responsibilities were the same, the ATGS world and experience didn't provide enough fidelity in the helicopter world.

Examples would be the type of missions and capabilities based on helicopter performance. Flying in a helicopter at low level for the entire mission was very different than the flight profile of an ATGS. The amount of experience needed with helicopters and knowledge of their limitations was essential. Expecting a new ATGS that had never been in or around a helicopter or the workings of a helibase to coordinate complex helicopter operations was not prudent.

Helicopter superintendents and helitack captains had great awareness due to their intimacy within the helicopter world. However, the additional training and expense to train someone to the ATGS level was cost and labor prohibitive.

There were many fires needing HLCOs that didn't necessarily need an ATGS. Due to the shortage of qualified ATGSs and those with experience with helicopters it became clear, based on performance in the field, that a stand-alone course was needed, and for qualified ATGSs wanting to perform the role, to at least have a bridge to the position.

The Retardant Color Study—and Implementation

Developing this course became the gateway for me to build the DC10 Airtanker Program. I was on the State of California side of that program, assuring the DC10 aircraft met the standards needed to join the airtanker fleet. And I was also deeply involved in the Interagency Wildfire Chemical Committee Program.

On that committee, we ran the retardant color study out of the Chico Air Attack Base. Because we couldn't see the previous retardant color very well from the air, we chose the color of retardant that you now see today on wildland fires.

Erik: Oh, really? That bright pink color?

Dan: Yep. They dropped 14 colors and between these 14, there were two that popped out. One was kind of a blood-red and one was a pink-red. I loved the blood-red. It really did show up nicely. But I believed that it would compete with the purple colors that we get in the chamise brush here in California in the fall. So we went with the pink-red.

Erik: That's fascinating. I had no idea what that process looked like. And, yes, that pink-red color really pops.

Dan: Yeah. It pops and we could see it from the air really easily.

The other piece that I was proud to be a part of was the changes to the viscosity of that retardant—so we could actually get it through the canopies. That was also done at the same time as the sulfate-based retardants were evolving.

The amount of ammonia going into the environment with retardant was also problematic—as identified by the environmental reviews going on at that time by the federal agencies.

In trying to shrink that ammonia footprint, they went to a phosphate-based salt, which was more expensive, but you didn't need as much. So that's where we came up with the new phosphate-based retardants that we're using now.

Erik: So these changes occurred at the same time? In the early 2010s?

Dan: Yes, it was right around then. This transition all happened about that same time. While I was working on that program, I was still in active air operations running with multiple IMTs. And then I went into the Area Command style where we would go into the Geographic Area Command Centers and assist them when there were multiple teams deployed.

While I was enjoying my retirement, I got recruited to run the private Global Supertanker Service's program, that adapted the 747 aircraft into an airtanker. I ended up running the 747 program—and that was a lot of work.

Dan as President of the Global Supertanker Services program in front of the 747 airtanker in 2019.

I could identify with the challenges of change in the fire service as a result of the earlier DC10 program. It took the DC10 program many, many years—despite heavy federal use—for it to actually be accepted as a righteous aerial firefighting tool.

It was an attempt to educate firefighters on how to use, recognize, and communicate in a way that would make it safer for not only the firefighters on the ground, but also for the firefighters in the air. We're all exposed to risk.

Therefore, I wasn't ignorant of the difficulties of enacting change.

And then fast-forward, I got recruited again to run Blazetamer USA, the water additive suppressant company.

How the Aviation Component Interacts with the Ground Forces

Erik: Wow. That is an extensive career!

Could you talk about your thoughts on aviation safety and some of the details of the Firefighter Safety During Aerial Operations course that you put together for new and existing firefighters?

Dan: Its content was really to educate firefighters about how the aviation component interacts with the ground forces. Not so much about what the air resources can do. So, not like: *"This is a Type 1, this is a LAT . . . It can take this many passengers."* That really wasn't the message I think that our membership collectively as wildland firefighters needed to know.

It was more about the *how* versus the *what*.

It was an attempt to educate firefighters on how to use, recognize, and communicate in a way that would make it safer for not only the firefighters on the ground, but also for the firefighters in the air. We're all exposed to risk.

And together, as a team, it's important to really realize those risks. Therefore, in short, that program covers how and when to best communicate. It also covers what appropriate aircraft drops should look like. If they're not seeing the results that they need on the ground, how do you effectively communicate that to the air component?

I still have this program that I've provided to many Safety and Training Bureaus.

Erik: It seems like in my wildland firefighter career I had much more training in what the different kinds of aircraft were and less training in how to effectively work with them. So that makes a lot of sense.

Dan: Here's how I came to believe that training was needed. At the time, I had recently been promoted and I was an Air Operations Branch Director (AOBD) during a particularly busy fall down in Southern California. We had multiple IMTs deployed—all in San Diego County.

We spent most of the fall there in Southern California—as well as Thanksgiving. I remember having turkey on the beach with the naval unit—which was interesting.

As a result of the fire behavior, the region was saturated with resources. I mean, if you can imagine multiple IMTs and everybody on edge and flinchy about the fire weather. It had everyone a little bit on edge. When a dispatch occurred, it was often double or triple the resources and people would easily trip over themselves.

One particular fire that occurred down there was very near to an airtanker base. And because it was in such close proximity to the air base with so many different resources, it was dynamic right out the gate. There were resources that were concerned and actually didn't come off the ground.

Erik: Because they were worried about congestion in the airspace?

Dan: Right. Congestion. While I wasn't at that fire, I was nearby. And I'd heard there'd been a tanker drop that impacted an engine, injuring firefighters who were taken to the hospital. The timing worked out that I was able to go

Accidents do and will happen. And so I wrote a curriculum to help keep firefighters safe during aerial operations to help the ground really understand what they're witnessing in the air.

out to that fire to see it on the ground myself. It had just been contained, but was still hot. I was able to take a lot of pictures, ask a lot of questions.

In the end, nobody wants to be hurt when we're on a fire. We're there to have fun. We enjoy what we're doing.

Erik: Absolutely.

Dan: And on the other end of the spectrum, nobody wants to be the one in the position in which you actually hurt someone. It's gut-wrenching. I mean, I've seen the look of horror on people's faces—just as many of us in the fire service have seen—when you do something where you accidentally hurt somebody. We don't intentionally go hurt someone.

Accidents do and will happen. And so I wrote a curriculum to help keep firefighters safe during aerial operations to help the ground really understand what they're witnessing in the air.

Common Mistakes Firefighters Make Navigating Ground-Air Resource Relationships

Erik: I really appreciate the use of an accident like that to spur you to try to make positive change. That's definitely what we believe in here at the LLC.

What do you see as common mistakes that firefighters make when navigating ground-air resource relationships?

Dan: Mostly, it's a matter of not recognizing situations. Not knowing when, not knowing who, not knowing what, or not knowing how to communicate with the Air Branch side. If I've never been trained and I see a drop, well, all I see is a drop. I just know it's happening.

The questions we should ask are: *"Is it effective?"* and *"Is it doing what I need it to do?"*

The most common thing I experienced is ground forces not recognizing good drops from bad drops.

And if they did recognize them, then how important is it that they be communicated and to whom should the information be communicated to? Those are all unknowns if we've never been trained to do that.

That's why the curriculum I built was an attempt to try and make that happen.

Many people don't know that Comms can happen on a guarded frequency as well as in the Air-to-Ground Command and Tac. Those all kind of handcuff firefighters if they don't know that those options are there. Scanning and having those frequencies at one's fingertips are really essential.

Erik: It's funny, back in 2014 I was working on a wildland fire module and then a job vacancy came up: "Aerial Firefighting Use and Effectiveness [AFUE]." I saw one of those jobs and I was like: *"Oh, that looks pretty cool."* I got on with one of the AFUE modules, the one that was based out of San Dimas, down there in LA County.

And, to what you were saying, I saw more and understood more from that program than I had in the previous 10 seasons as a wildland firefighter. Exactly what you're talking about: retardant that doesn't penetrate the tree canopy; or shadowing, when drops are partially blocked by vegetation and coverage isn't even on the ground; or drops that are too high, too low, too fast—all of those things. I had never known any of that before getting on the AFUE module.

Dan: We have still done a terrible job educating our membership globally. This is not just happening here in the United States.

This is a global issue. And it's not with one particular federal agency or state or local agency. It is across the entire spectrum of the entire global fire service. And that is my quest—to increase our understanding and capability in using aerial assets of all types.

Erik: So you identified some issues you frequently saw: not being able to judge drop quality; not knowing how to give feedback—or who to give it to. What about some best practices?

Dan with his son, Cooper, at the Chico Air Attack Base in 2005.

Effective Drops are Key

Dan: In the end, effectiveness is key. It's critical.

If the air resources aren't being effective, then why not? And if this isn't being communicated, why not? Not being directly under a drop is probably the most critical—if you have enough warning to get out of the way. But it's not just about the drop being on line and on target—it's really all about whether or not the drop is being effective.

If significant fire is impacting the retardant, that retardant could be rendered ineffective due to the temperature at which the fire is burning.

I mean, significant fire can volatilize the retardant just as if it's not there. In those cases, it's critical that suppression occurs where suppressants can be used to cool a fire to a point in which the retardant can actually work.

Sometimes we can get helicopters in and around the retardant if the fire is running up to it, to try to take some heat out of the fire that is going to impact the retardant.

But, far too often, our retardant lines are either too close and not being supported where the fire's being cooled, or they're too far indirect where we're basically gambling on successful, effective drops.

We're playing a little Russian Roulette.

Is the fire going to take off and crash into the retardant with such force with the thermal flux that it's going to burn through it? Or, is it going to spot over it first? In which case, do we have the resources to capture the spots on the downside?

Onboard Injection

Direct suppression can be done with water or with enhanced water, water that is mixed with a chemical to increase its firefighting ability. It just depends on where the fire service is. And this is the first year that the federal agencies have been able to use onboard injection – where a chemical is mixed into the water while onboard the aircraft – across all federal lands. That just happened this year for the first time.

The U.S. Wildfire Service is now using onboard injection. The U.S. Forest Service wants to study it a little bit more before they engage. So, while the Forest Service doesn't onboard inject right now, they can load and utilize enhancers that have been mixed and then loaded either manually at the air base, or into tanks where they can be snorkeled or dipped.

Recognizing that all agents being dropped have a thermal window in which they can be optimally used, is essential. And this is a piece of education that we have failed, globally, to teach our membership.

Recognizing the fire conditions you are in, and how to use the aircraft you have in the most effective way is critical. That's a big deal. And, that's why it's important for firefighters to know that it's for their own safety. And also realize that depending on unsupported retardant alone to save you—that's a mistake.

Just as important is the exposure and risk involved to repeated low-level drops on the fire, as well as having those air crews repeatedly go into the dip: hover to fill their bucket or fixed tank. We've lost a lot of aircraft in the dip.

It all comes down to risk exposure. Exposure to the firefighter on the ground, exposure to the firefighter in the air. How do we mitigate the risk? It's done best by being educated: making educated, well-informed decisions. And it really should be all of our agencies' goal to control the fire as quickly as possible. And, thereby, we limit the exposure to the firefighters on the ground and in the air.

Or maybe the call that needs to be made is that an engine can get into the area and attack the fire from the ground—and a drop from aircraft isn't needed at all.

How Can Ground Resources Best Communicate with Aerial Resources?

Erik: Do you have any thoughts on how ground resources can best communicate with aerial resources?

Dan: Let me give you an example.

If the fire's burning in the understory and the drops aren't penetrating—or they're too low, or they're shadowing—all this needs to be communicated. The question becomes: Who do you communicate that to?

So you have to ask yourself: Is it only to the pilot, because that's the only aircraft there?

Is it, maybe, to a Helicopter Coordinator?

Is it to an Air Tactical Group Supervisor?

Or is it to the tanker pilot, because it was an IA tanker that made the drop and there isn't an Air Attack to talk to?

In any of these cases, know which air-to-ground frequency they are using and provide feedback through the proper chain of command. As I said, that chain might be to the pilot themselves, or maybe through someone coordinating the aerial operations.

The more efficient we are in these communications, the safer we are and we're doing our best to mitigate that risk. Increasing the margin of safety for both the ground and the air resources.

A Funny or Interesting Story from Your Fire Career?

Erik: We always try to end "One of Our Own" conversations with a funny or interesting story that you can share from your career.

Dan: It's difficult for me to think about that. Because, in reality, I've got more tragic and sad events that I can speak to.

Really, outside of seeing friends rolled up with retardant from a drop, I mean, it's funny to watch—but could there have been danger there? Could they have broken something? Absolutely.

And there's been multiple examples of firefighters really being injured badly from a drop, if not killed.

Sure, I know that firefighters love to be covered in red retardant. It's kind of a badge of honor. It's a nonverbal way to say: *"Look at me. I was in the battle when it was bad."*

Erik: Yeah. You were right in the thick of the fight.

Dan: *"If I'm covered with retardant, man, I was in it."* Right?

Of course, it's really not a place one wants to be—if that can be helped. Low drops happen. And even if it's not a low drop, if we're in timber, you never know about the stability of the trees around you—all those limbs and the branches next to or above us.

Unfortunately, as we all know, fatalities have resulted from retardant drops or from trees that were impacted by retardant drops.

But, for a funny story:

When I was a young firefighter, I was on my first timber fire. This was in the late '80s. So, remember, I started with the Nevada Division of Forestry and I was out there in the sagebrush. During my first couple years as a young firefighter, my exposure to fire was just sagebrush, right?

“Spotting.” I heard about spotting, but it really hadn't dawned on me about what spotting really was and how critical it is. That is, until you're faced with your first timber fire.

There I was on my first timber fire. I’m a firefighter on the ground working with a helicopter. And I need this helicopter to smash a small spot fire that I'm on.

I'm talking to the pilot on the radio. And it’s taking me forever to get the water drops close. In total exasperation, I'm like: *"Oh, my God, I cannot get this pilot close to this fire."*

So, I finally popped a fusee.

It was really bright, really red. And I stuck it in the brush over the fire. I'm lighting more fire outside of the fireline trying to get this helicopter pilot's attention.

Erik: Oh, my God.

Dan: It worked, right?

But, it wasn't without me putting everybody at risk for a minute, which I did.

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