Effective Use of Aviation Resources

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Incident Commander's Meeting
Color Country Fire Partners
Bryce Canyon, Utah
June 1, 2017

Hidden Decision Traps Affecting
Aerial Firefighting Use and Effectiveness

VLAT Example

What Is the Purpose of This Paper?

This paper is intended to articulate escalating concerns expressed by aerial supervisors and incident management personnel regarding decisions affecting the use of aerial firefighting resources. It is intended to convey a critical message to decision-makers at every level of the interagency wildland fire organization faced with choices that influence the use of tactical aircraft.

To exemplify these concerns, a recent wildland fire will be reviewed. The value of revisiting a *real* fire is to evaluate *real* decisions and *real* outcomes. This paper was NOT written to point fingers or place blame on individuals associated with the example; rather, this paper was written for a culture which claims to learn from unintended outcomes and encourages managers, supervisors, and employees to speak freely of errors without assigning blame.

The genesis of this paper was based upon a reluctance to use the Very Large Air Tanker (VLAT); a topic which, seemingly, could be resolved with a short discussion and an informational briefing paper. However, the basis for this reluctance runs much deeper and influences many other decisions related to the effective use of aerial firefighting resources. This paper is about making rational choices in a dynamic wildland fire arena by gaining awareness and understanding of the significant role cognitive bias plays on our decisions.

Who Should Read This Paper?

Incident Commanders, Aircraft Dispatchers, Dispatch Center Managers, Duty Officers, Fire Management Officers, Assistant Fire Management Officers, Agency Administrators, Air Attacks, Lead Plane Pilots, Helicopter Coordinators, Air Operations/Support personnel, Regional/State/Unit Aviation Managers, Fire Operations Supervisors/Specialists and any other fire/aviation management personnel that make (or influence) decisions regarding the effective use of aviation resources on a wildland fire should read this paper.

Why Is This Important?

Hidden Decision Traps Affecting Aerial Firefighting Use and Effectiveness

VLAT Example

Canyon Fire
7/4/2016 @ 14:00

East of Ogden, UT in Weber Canyon, north side of I-84

Air Attack arrives at 17:16

The Air Attack and IC discuss retardant needs.

Objectives:

- **Slow the fire's spread uphill and laterally.**
- **Provide safe ingress for ground firefighters.**

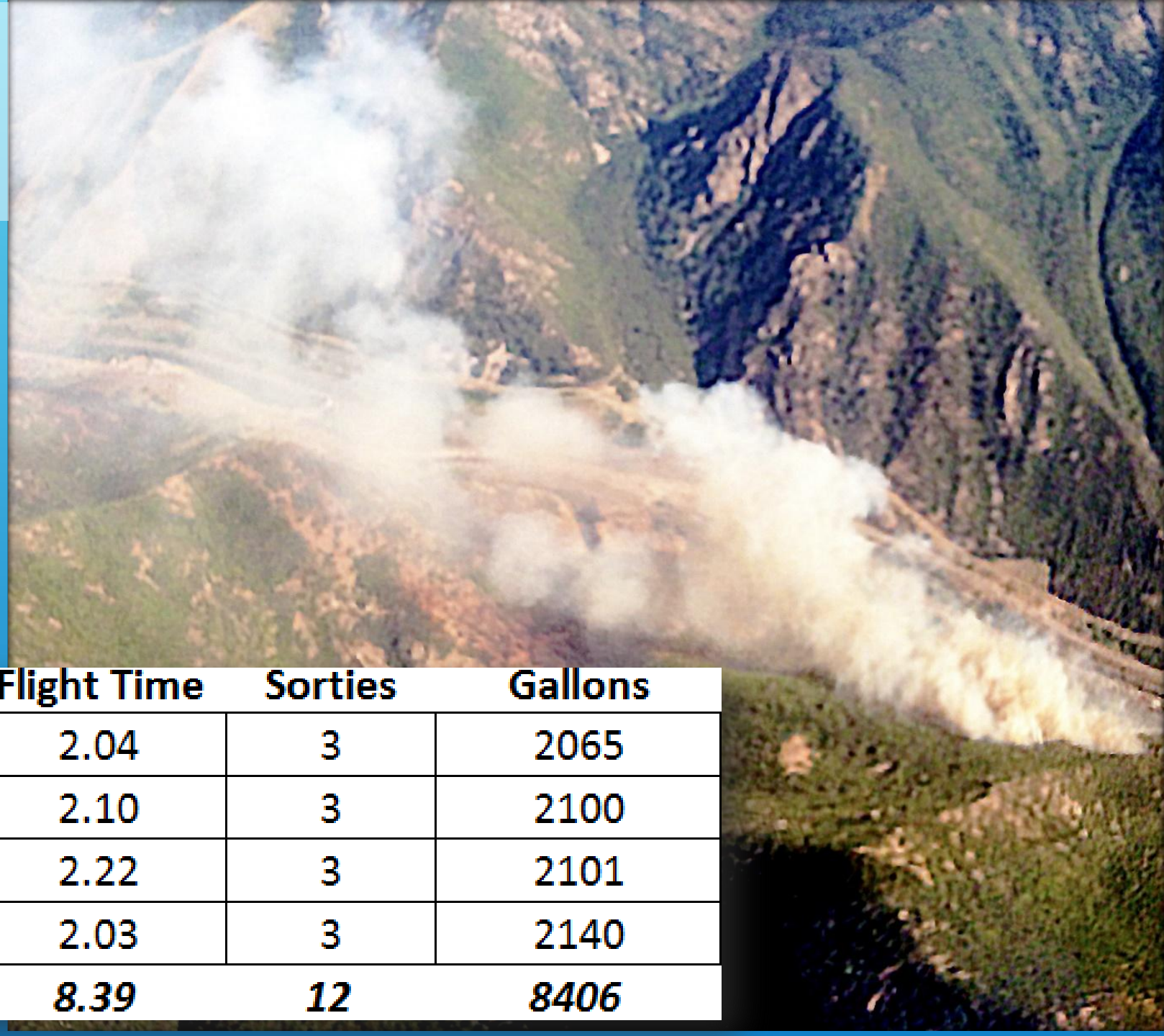
Four Options For Retardant Were Discussed:

1. **Two Large Air Tankers (LATs)**
   LATs were not readily available due to activity in other western states.
2. **Four Single Engine Air Tankers (SEATs)**
   4 SEATs were readily available from Tooele Valley Airport (TVY).
3. **Two LATs and 4 SEATs**
4. **One Very Large Air Tanker (VLAT)**
   T-912 was available from Pocatello (PIH).

17:30	Ordered 4 SEATs and 2 LATs
17:43	VLAT became an option
17:45	The IC declined the VLAT and cancelled the 2 LATs.

Canyon Fire
7/4/2016

Day #1

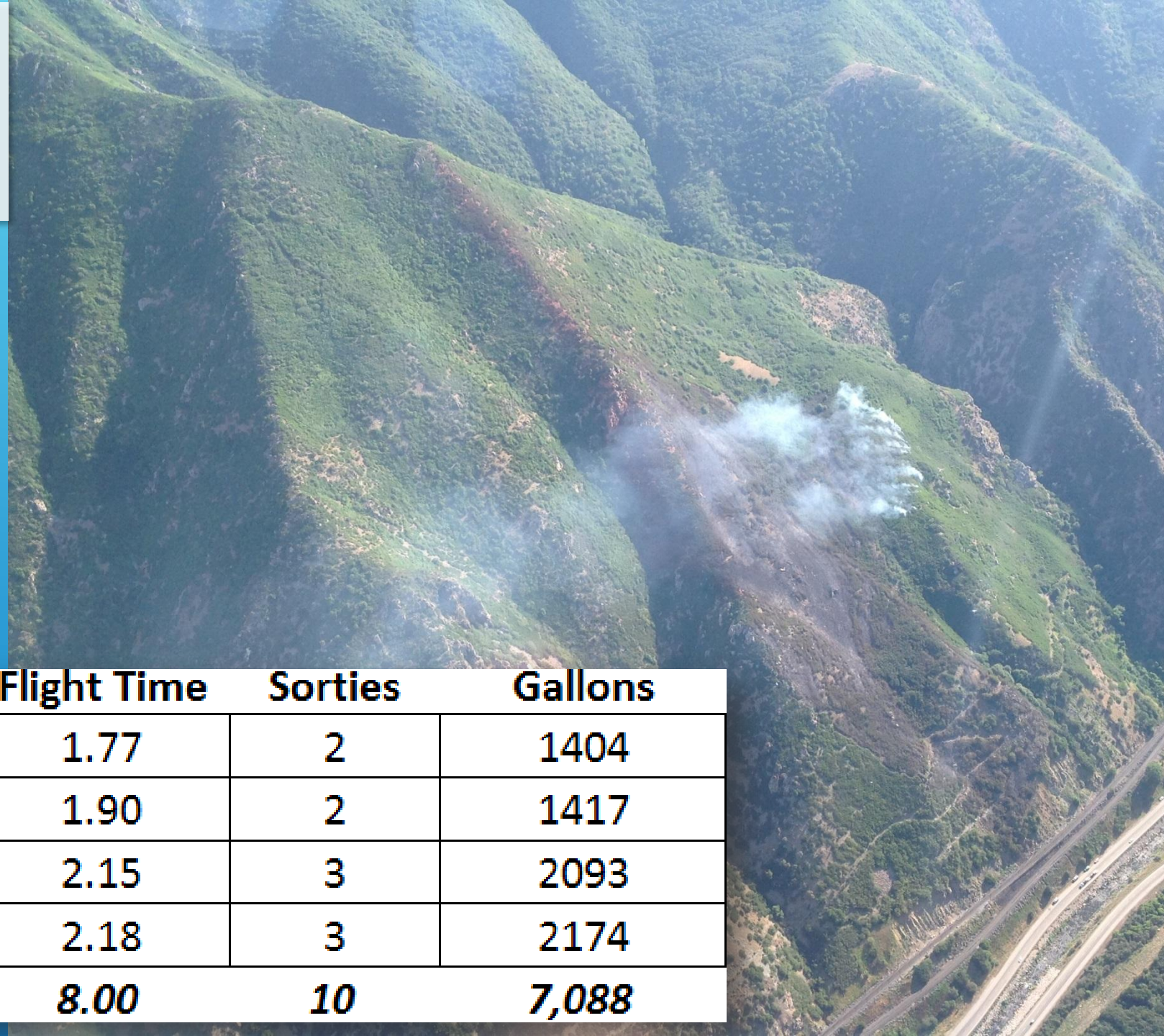


Day #1

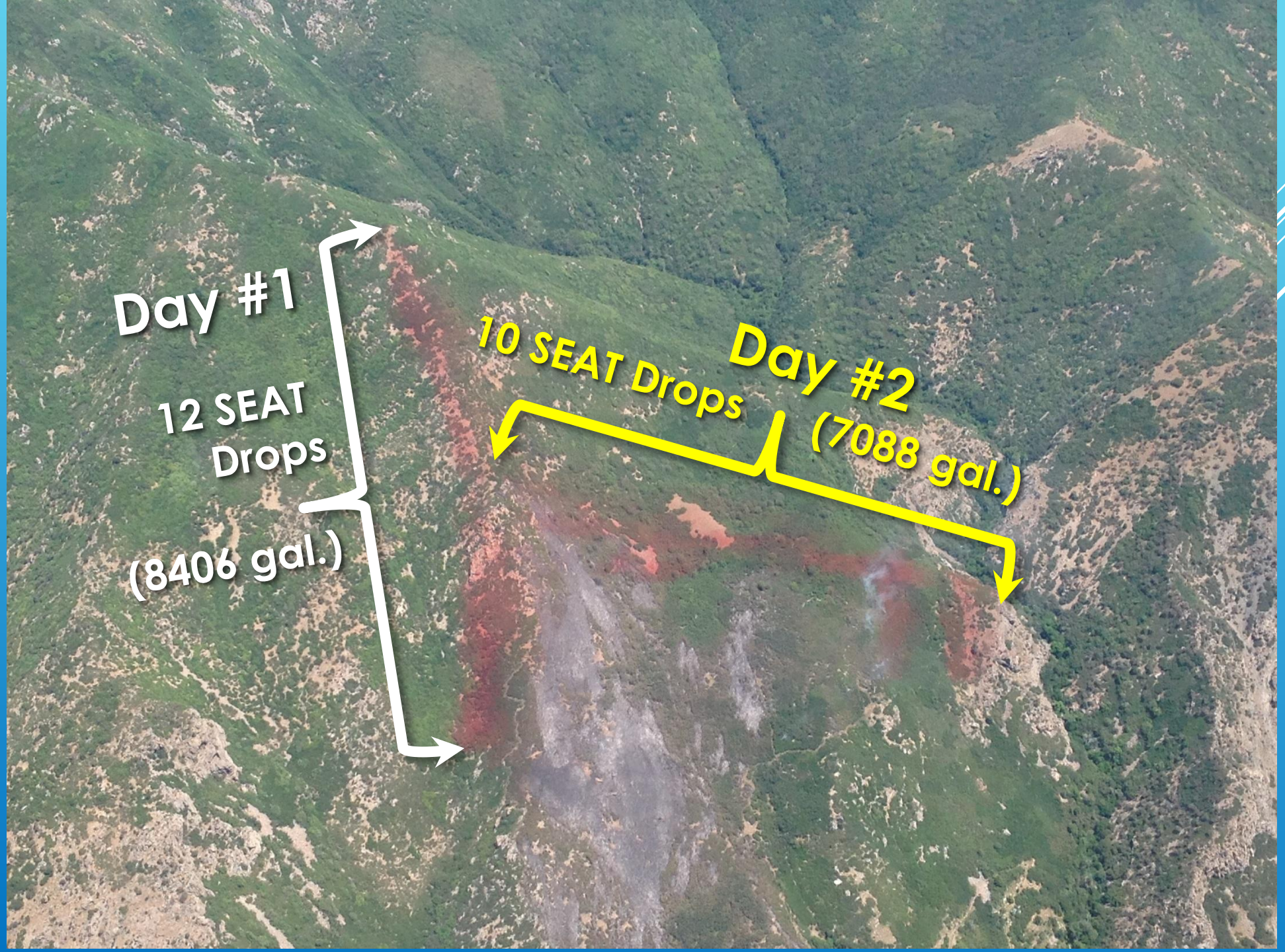
Date	Tanker #	Flight Time	Sorties	Gallons
7/4/2016	811	2.04	3	2065
	812	2.10	3	2100
	882	2.22	3	2101
	818	2.03	3	2140
Day #1 Totals =>		***8.39***	***12***	***8406***

Canyon Fire
7/5/2016

Day #2



	Date	Tanker #	Flight Time	Sorties	Gallons
Day #2	7/5/2016	811	1.77	2	1404
		812	1.90	2	1417
		882	2.15	3	2093
		818	2.18	3	2174
		Day #2 Totals =>	***8.00***	***10***	***7,088***


Day #1
12 SEAT Drops
(8406 gal.)
10 SEAT Drops
Day #2
(7088 gal.)

WHAT WERE THE POSSIBLE REASONS THE VLAT WAS DECLINED?

- *Cost?*
- *Terrain?*
- *Timing?*
- *Overkill?*
- *Perception?*
- *Authority?*
- *Drop Height?*
- *Effectiveness?*
- *Environmental?*
- *Risks?*

Anchoring Bias: The mind gives disproportionate weight to the first information it receives; the brain relies heavily on initial impressions, estimates, or data. We have a tendency to rely too heavily on the first piece of information offered when making decisions.

Sunk-Cost Bias: We have a tendency to make choices in ways that justify past decisions where time and/or money have already been committed, even when the past decisions no longer seem valid.

Overconfidence Bias: Most of us are overconfident about our judgment abilities and prediction accuracy, as we remember our successes and quickly forget our errors. Our mind is tricked into considering only a narrow range of possibilities as we are confident we will reach a successful outcome.

Egocentric Bias: is self-serving bias, in which one is biased toward taking credit for achievements and blaming external sources for losses. In addition, attributional theory, analyzes how people behave based on the information around them.

Distinction Bias: When we consider two options at the same time, we tend to view them as being more distinctive. However, when we evaluate the same two options separately, they tend to be less distinctive. The distinction bias suggests that comparing two options together makes even small differences between options more noticeable; evaluating each option in isolation makes them seem similar in comparison.

Confirming Evidence Bias: We are more likely to search for information that confirms our beliefs or point-of-view, while avoiding information that contradicts it. We tend to make choices that will support and validate previous.

Framing Bias: The first thing we do prior to making a decision is frame the question. A person might draw a different conclusion from the same information, depending on how that information is presented.

Overconfidence Bias: Most of us are overconfident about our judgment abilities and prediction accuracy, as we remember our successes and quickly forget our errors. Our mind is tricked into considering only a narrow range of possibilities as we are confident we will reach a successful outcome.

Status-Quo Bias: We are predisposed to perpetuate the status quo. The current baseline (or status quo) is taken as a reference point, and any change from that baseline is perceived as a loss. We tend to avoid change; change is uncomfortable. We tend to be self-protective and risk-aversive.

Framing Bias: The first thing we do prior to making a decision is frame the question. A person might draw a different conclusion from the same information, depending on how that information is presented.

Overconfidence Bias: Most of us are overconfident

Egocentric Bias: is self-serving bias, in which one is biased toward taking credit for achievements and blaming external sources for losses. In addition, attributional theory, analyzes how people behave based on the information around them.

option in isolation makes them seem similar in comparison.

support and validate previous.

Decision Traps

"Researchers have identified a whole series of such flaws in the way we think in making decisions. . . . What makes all these traps so dangerous is their invisibility. Because they are hardwired into our thinking process, we fail to recognize them—even as we fall right into them."

The Hidden Traps in Decision Making (Hammond, Keeney, and Raiffa)

What risks are involved?
Are the risks necessary?
How are those risks mitigated?
Who is responsible for mitigating the risks?

Would the VLAT be more expensive than using the SEATs?

SEAT Cost Summary Sheet

Fire Name: Canyon
Incident Fire Code: KDOZ

EP	$50
ET	$34
SM	$2.50
Ret/Gal	$4.40

	Date	Location	Tanker #	FT Rate	Daily AV	FT Time	FT Cost	Sorties	Gallons	Ret Cost	EP	ET	SM
Day 1	7/4/2016	TVY	811	$ 2,349	$ 2,475	2.04	$ 4,791.96	3	2065	$ 9,086.00	$ 250	$ 170	
	7/4/2016	TVY	812	$ 2,349	$ 2,475	2.10	$ 4,932.90	3	2100	$ 4,305.00	$ 250	$ 170	
	7/4/2016	TVY	882	$ 3,307	$ 3,779	2.22	$ 7,341.54	3	2101	$ 4,307.05	$ 150	$ 136	
	7/4/2016	TVY	818	$ 3,174	$ 3,500	2.03	$ 6,443.22	3	2140	$ 4,387.00	$ 150	$ 136	$ 1,277.50
Day 2	7/5/2016	TVY	811	$ 2,349	$ 2,475	1.77	$ 4,157.73	2	1404	$ 6,177.60	$ 150	$ 102	$ 775.00
	7/5/2016	TVY	812	$ 2,349	$ 2,475	1.90	$ 4,463.10	2	1417	$ 2,904.85	$ 150	$ 102	
	7/5/2016	TVY	882	$ 3,307	$ 3,779	2.15	$ 7,110.05	3	2093	$ 4,290.65	$ 150	$ 102	
	7/5/2016	TVY	818	$ 3,174	$ 3,500	2.18	$ 6,919.32	3	2174	$ 4,456.70	$ 150	$ 102	$ 187.50
							$ 46,160	22	15,494	$ 39,915	$ 1,400	$ 1,020	

Source: Tanker Base records.

Total Cost: $ 90,735

$90,735
– $61,802
≈ $29,000

VLAT Cost Summary Sheet

Fire Name: Canyon
Incident Fire Code: KDOZ

Ret/Gal: $4.17

Date	Location[1]	Tanker #	FT Rate[2]	Daily AV[3]	FT[4]	FT Cost[5]	Sorties[6]	Gallons[7]	Ret Cost[8]	EP[9]	ET[10]	SM[11]
7/4/2016	PIH	912	$ 13,265	$ 28,387	1.00	$ 13,265	1	11,600	$ 48,372	$ 165	$ -	
				Charged to the Fire =>		$ 13,265			$ 48,372	$ 165	$ 0	$ 0

Total Cost: $ 61,802

Was the terrain too steep for the DC-10 to be effective?

"*In our experience we have yet to encounter typical terrain that we have not been able to operate in. Operational limitations are more likely to be environmental and fire conditions that affect a safe and effective drop profile*." — DC-10 Pilot

Would the VLAT be over-kill for such a relatively small fire?

"Fires are easier and less expensive to suppress when they are small. When the management goal is full suppression, aggressive initial attack is the single most important method to ensure the safety of firefighters and the public and to limit suppression costs.

Aggressive initial attack provides the Incident Commander maximum flexibility in suppression operations. Successful initial attack relies on speed and appropriate force."

Interagency Standards for Fire and Fire Aviation Operations, Ch. 1

Who has the authority and responsibility for making the decision?

"The Incident Commander has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site. "

IS-0700A: National Incident Management System, An Introduction

Authority Bias:

The tendency to attribute greater accuracy to the opinion of an authority figure (unrelated to its content) and be more influenced by that opinion.

Who has the authority and responsibility for making the decision?

"Simply stated, the Incident Commander has complete authority and responsibility for the incident. If a higher-ranking officer wants to affect a change in the management of an incident, they must first be on the scene of the incident, and then utilize the appropriate transfer-of-command guidelines.

FireScope (California)

Federal Policy – Leader's Intent

"Subordinate commanders must make decisions on their own initiative based on their understanding of their commander's intent. A competent subordinate commander who is at the point of decision may understand a situation more clearly than a senior commander some distance removed. In this case, the subordinate commander must have the freedom to take decisive action directed toward the accomplishment of operational objectives."

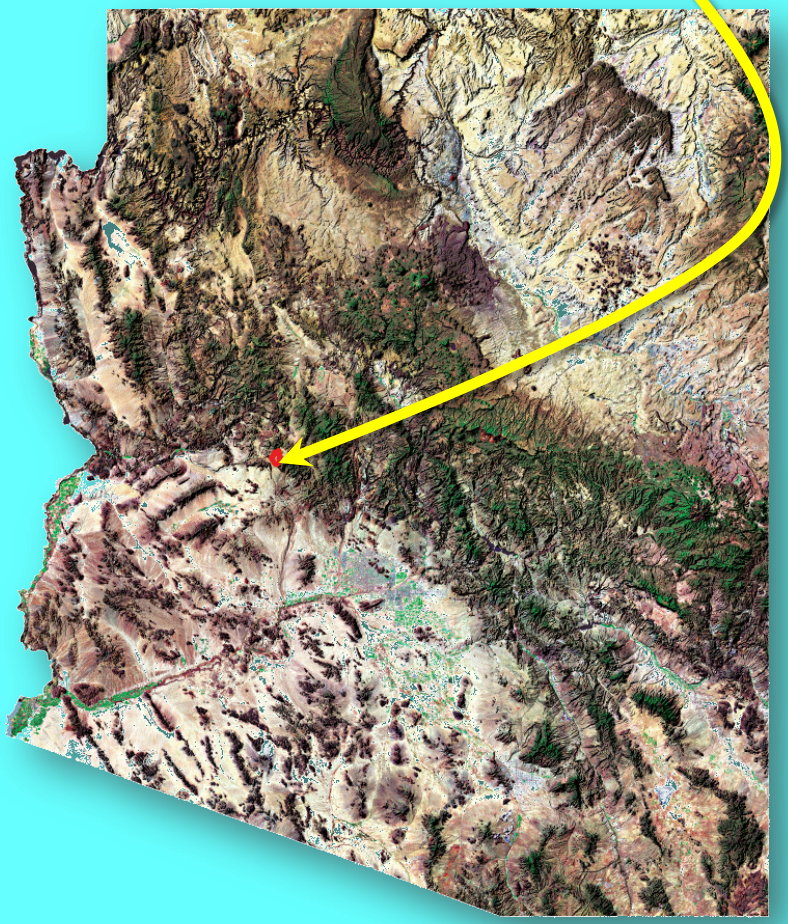
Interagency Standards for Fire and Fire Aviation Operations, Chapter 1

June 30, 2013

Arizona

Arizona State Lands

Yarnell Hill



Decision Traps at Yarnell??

"The IC requested a heavy helitanker and fixed wing heavy airtanker to assist with the slop-over. A helitanker was located in Prescott, but was unable to respond due to thunderstorm activity and high winds in Prescott. The nearest available heavy airtanker was in Albuquerque, but also unable to respond due to weather conditions.

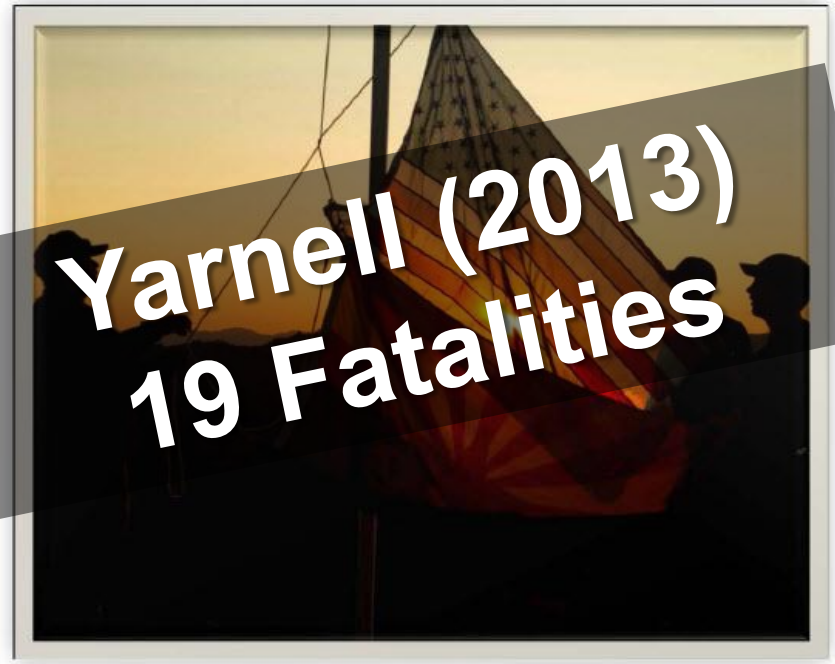
Later, a DC-10 very large airtanker (VLAT) was in Albuquerque and available, but was not ordered due to Air Attack's concern about effectiveness in steep terrain and inability to deliver retardant before cut-off time, due to darkness."

Initial Synopsis of Yarnell Hill Fire Resources Deployed (July 2013)

WHAT HAVE WE LEARNED FROM THE PAST?

Yarnell Hill Fire

June 30, 2013



Serious Accident Investigation Report

September 23, 2013

Action Item from Yarnell Investigation Report

"The Team recommends that the State of Arizona request the WFLC/NWCG to develop a brief technical tip for fire supervisors/agency administrators on the effective use of VLATs. These are new, emerging fire suppression tools that the ground-based fire supervisors may be utilizing regularly in the future."

VLAT to Large AT (P2V) Comparison

100 Nautical Mile Dispatch (2013)

1 Full Load from DC-10

11,600 Gallons of retardant:	$23,200
1 hour of flight time (round trip):	$12,500
FS Paid fuel (dry flight rate):	$15,300
FS Paid Daily Availability (est. 2 hours):	$6,000

Total User Cost : $35,700

User Costs / Gal = $3.00

Total cost is $57,000 per load or $4.90/gallon

4 P2V Loads to Equal 1 DC-10 Load

8,320 Gallons of retardant:	$16,640
FS Paid Daily Availability (est. 2 hours):	$12,000
4 hours of flight time:	$33,980

Total User Cost : $50,620

User Costs / Gal = $6.10

Total cost is $62,620 per 4 loads or $7.50/gallon

1 VLAT (DC-10) Drop on Large Fire at Coverage Level 4 = 1650 feet

4 Drops from P-2V = 1650 feet
3 Drops from MAFFS = 1700 feet
3 Drops from DC-7 = 1600 feet

VLAT normally responds to one fire

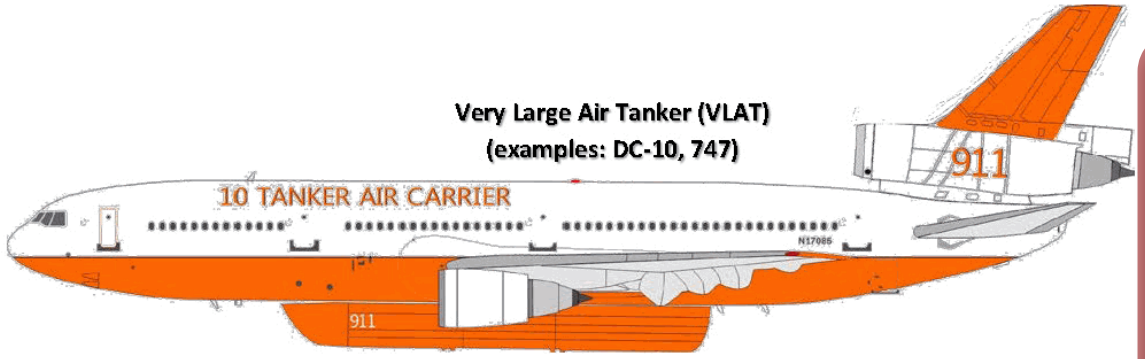
4 P-2Vs can respond to different fires

HOW MUCH RETARDANT IS NEEDED?

Air Tanker Comparison

Relative Capacity

Very Large Air Tanker (VLAT)
(examples: DC-10, 747)



Large Air Tanker (LAT)
Next Generation Air Tankers (examples: BAE-146, C-130, RJ, MD-87)

Large Air Tanker (LAT)
Legacy Air Tankers (example: P2V)

Single Engine Air Tanker (SEAT)
(example: AT-802)

1 VLAT

4 NextGen LATs

6 P2V LATs

15 SEATs

	Date	Tanker #	Flight Time	Sorties	Gallons
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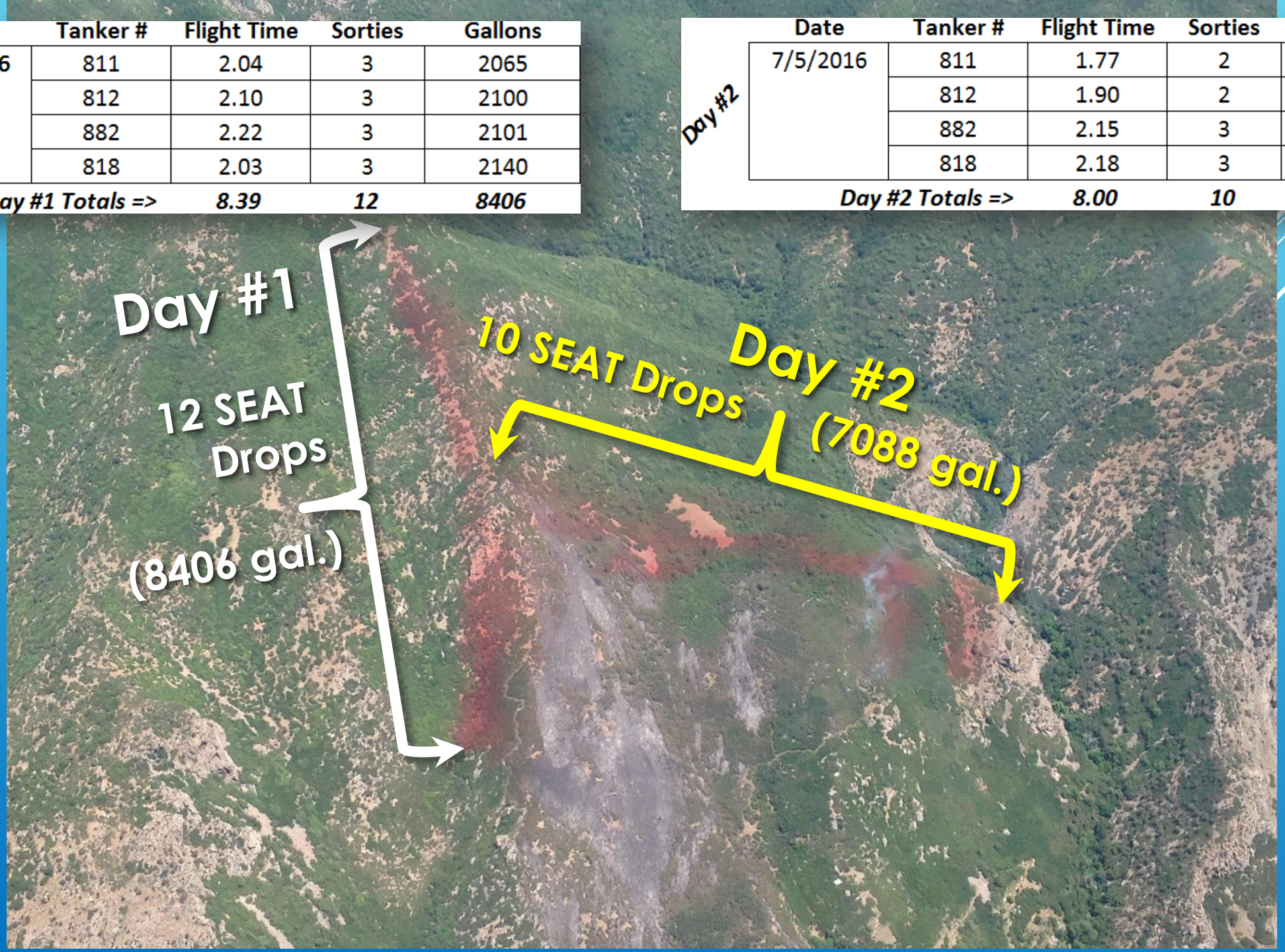
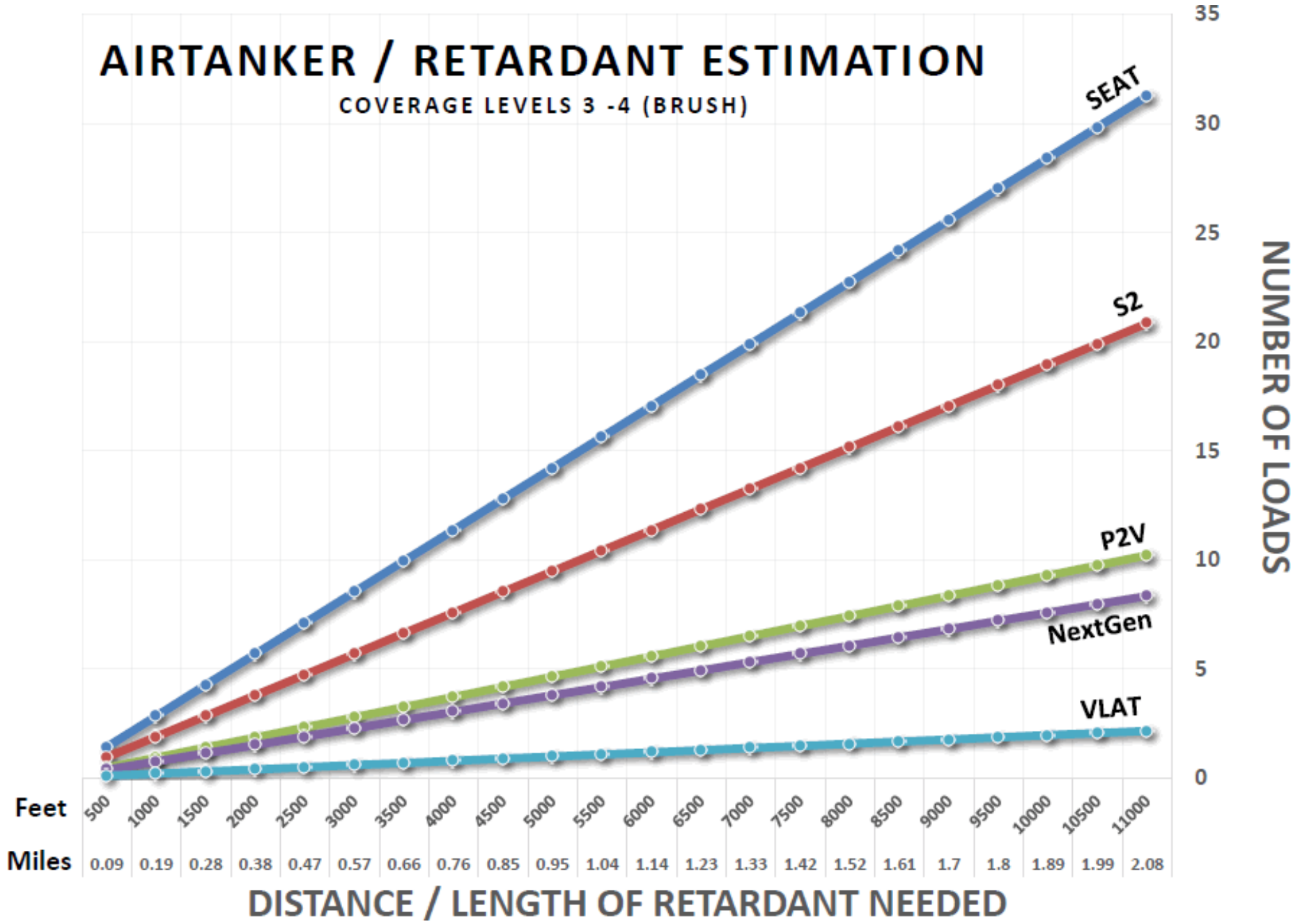
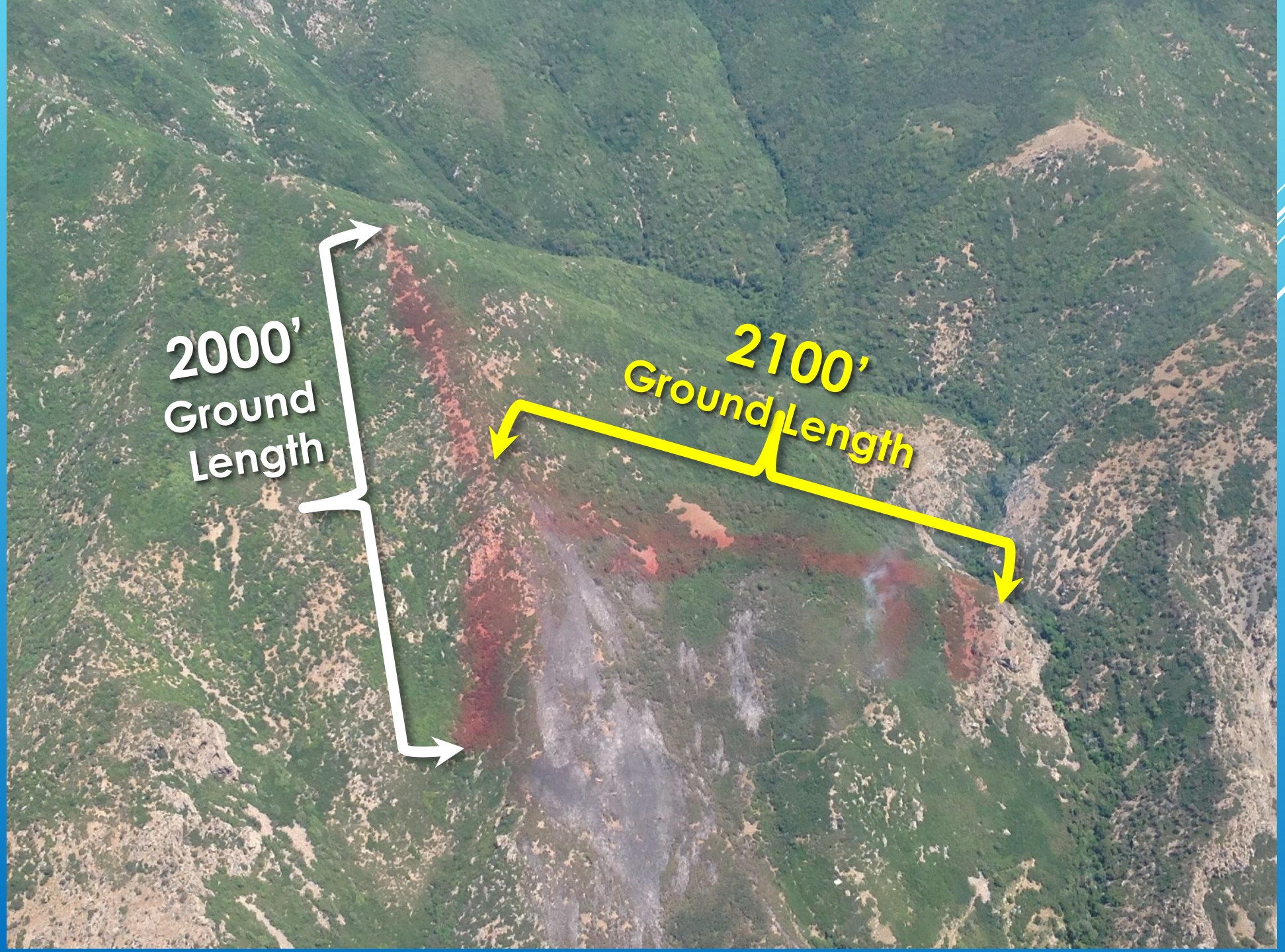
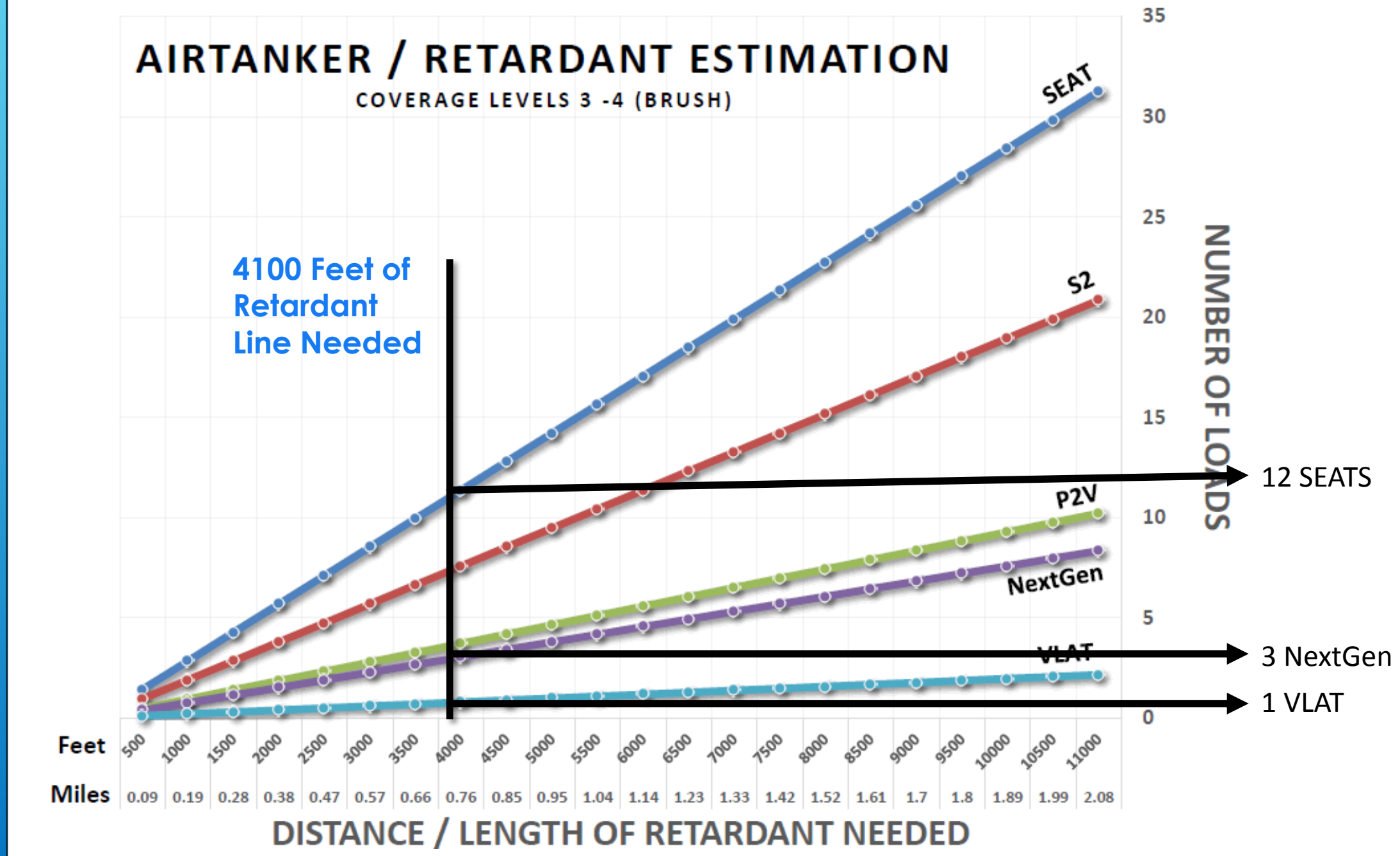



AIRTANKER / RETARDANT ESTIMATION
COVERAGE LEVELS 3 -4 (BRUSH)
SEAT
S2
P2V
NextGen
VLAT
35
30
25
20
15
10
5
0
NUMBER OF LOADS
Feet
500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000 10500 11000
Miles
0.09 0.19 0.28 0.38 0.47 0.57 0.66 0.76 0.85 0.95 1.04 1.14 1.23 1.33 1.42 1.52 1.61 1.7 1.8 1.89 1.99 2.08
DISTANCE / LENGTH OF RETARDANT NEEDED


2000’
Ground
Length
2100’
Ground Length


AIRTANKER / RETARDANT ESTIMATION
COVERAGE LEVELS 3 -4 (BRUSH)
4100 Feet of Retardant Line Needed
SEAT
S2
P2V
NextGen
VLAT
NUMBER OF LOADS
35
30
25
20
15
10
5
0
12 SEATS
3 NextGen
1 VLAT
Feet
500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000 10500 11000
Miles
0.09 0.19 0.28 0.38 0.47 0.57 0.66 0.76 0.85 0.95 1.04 1.14 1.23 1.33 1.42 1.52 1.61 1.7 1.8 1.89 1.99 2.08
DISTANCE / LENGTH OF RETARDANT NEEDED

WHAT CAN BE DONE?

- Awareness
  - Cognitive Bias
  - Decision Traps
- Learn from others:
  - Airlines
  - Medical
  - Military
- Crew Resource Management (CRM)


QUESTIONS?