Donnelly Flats Staff Ride

Stand One: Orientation

Location: (N 63° 48.213” x W 145°46.700”)

- From Delta Junction take Richardson Highway south approximately 16 miles
- Turn right on Donnelly Dome Rd, approximately 2 miles, gravel pit on the left

Discussion Guide:

The vantage from this stand is an impressive display of the Alaska Range and Upper Tanana Valley. However beautiful this geological and glacial landscape may be, it is responsible for a significant influence on the weather patterns that flow into this valley. The Granites, a spur ridge of the Alaska Range, are the prominent ridgeline running to the east, with Panoramic Peak 5,150’ dominating its end. Further east of Panoramic Peak is the widening of the vast Tanana Valley. Working our way back along the Granites, with Jarvis Creek flowing in the valley below, several domes protrude. Ober Dome is to the east and Donnelly Dome where Stand One is located. Figure 1 consists of Donnelly Dome looking east with the Granites in the background. Isabel Pass, (Figure 2) to the south, is the gap in this range where the Richardson Highway runs. This pass is notorious for funneling the famous Delta wind. These winds are predictable, however, if a fire is established prior to this wind event this can be a precarious situation for firefighters and land managers. To the south, usually blanketed in a layer of clouds, are some impressive rock formations (Figure 3). The largest, Mt. Hayes (13,832’), near the head of Hayes Glacier, and slightly smaller Mt. Moffit (13,020’) near the head of a glacier named Trident. Altogether, these are some of the dominating features that are the main culprits for the severe environmental factors affecting this area. These need to be pointed out prior to beginning our day for a couple reasons; to bring the geographical influences into perspective, and set some

Figure 1 Donnelly Dome looking east with the Granites in the background, photo courtesy of the National Archives.

landmarks in your mind. In the valley below is a long gravel airstrip that should stand out against the vegetation. This is displayed on your map (Figure 4) as the assault airstrip. To the north of this airstrip is where Stand Two will be. Just east of Stand Two is Muskeg Hill and can be utilized as a reference point throughout the day as we move throughout this large valley. Muskeg Hill will be referred to as the point of origin for reference purposes from Stand Three.

Figure 2 Isabel Pass through the Alaska Range, courtesy of National Archives.

Figure 3 Alaska Range in background with Donnelly Dome in foreground, photo courtesy of Art Lenon.

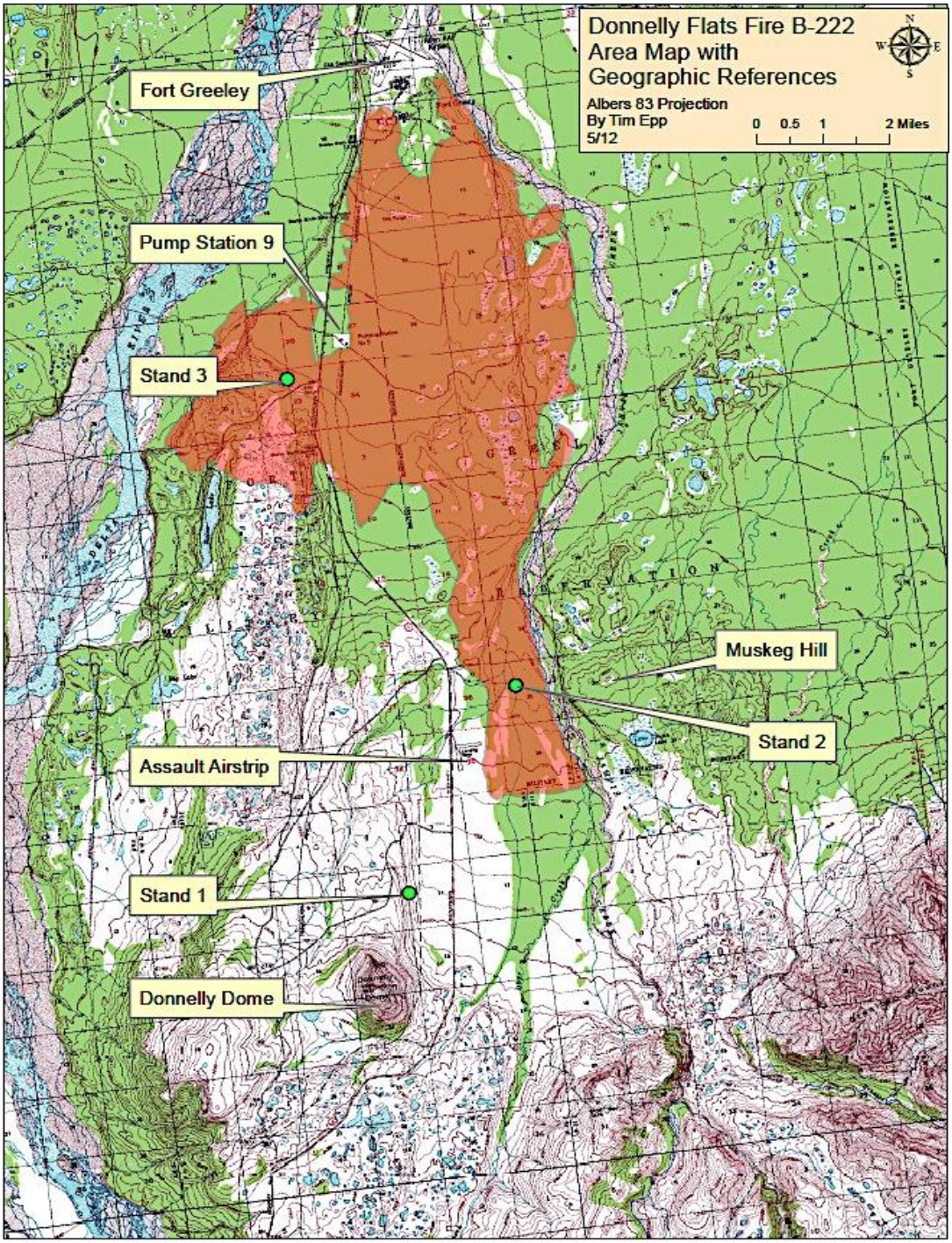


Figure 4 Map of Donnelly Flats Fire (B222), with geographical references and stand locations.

Fuel Conditions:

Imagine an early June day in 1999. There was very little fire activity in the State of Alaska, although the local area had been experiencing some initial attack activity. There were no other large fires staffed in the state. This area is known predominately for strong gusty winds, typically out of the south. The local weather was clear, temperature of 76°, winds light and variable, relative humidity of 26%. Table 1 lists the environmental readings from the RAWS station PABI for the dates of June 9th to June 20th. In the extreme fire behavior narrative the fire effects were described as, "not burning very deep and seemed to cool off fairly quickly with few hot areas remaining". The spring fuels were deceptively dry. With FFMC indices as high as it was this would be a fast moving surface fire with the potential for immediate and rapid growth of spot fires.

The Donnelly Flats Fire site, in respect of its location geographically and high wind events originating from the Isabel Pass area, result in higher rates of surface evaporation and plant transpiration leading to lower soil moisture and drier fuel conditions (Kasischke et al. 2007).

Figure 5 Delta Area Forestry personnel working spot fires, courtesy of Reb Ferguson.

Donnelly Flats Staff Ride

Table 1 Weather and indices from 6/9/1999 - 6/20/1999, with CFFDRS (Canadian Forest Fire Danger Rating System) information.

DATE	TEMP	RH	WIND	RAIN	FFMC	DMC	DC	ISI	BUI	FWI	DSR
06/09	71	37.8	4.6	0	91.3	37.8	282.6	7.5*	56.6	19.2	5.1
06/10	74	20.5	11.5	0	93.5	42.9	290.2	17.9	62.6	37	16.2
06/11	76	21.6	0	0	93.7	48.1	298.	7.2*	68.6	20.7	5.8
06/12	79	21.2	5.8	0	94	53.8	306.1	12.1	74.7	31.1	12
06/13	81	30.4	15.	0	93.8	59.0	314.4	24.7	80.3	51	28.7
06/14	74	35.5	8.1	0	92.5	63.1	322	11.8	84.7	32.4	12.9
06/15	74	38.0	8.1	0	91.8	67.1	329.6	10.7	88.9	31.2	12.
06/16	73	44.3	3.5	0.01	90.8	70.6	337.1	6.4	92.7	22.2	6.6
06/17	53	83.1	13.8	0.25	49.1	42.9	324.7	.4	64.5	.9	0
06/18	67	45.0	8.1	0.19	64.5	31.5	319.7	1.0	50.6	2.8	.2
06/19	66	46.6	9.2	0	82.1	34.3	326.5	3.0	54.4	9.3	1.4
06/20	55	96.4	3.5	0.06	63.1	33.5	332.2	.6	53.6	1.5	.1

	FFMC	DMC	DC	ISI	BUI
Low	0-80	0-70	<150	0-2	30-70
Moderate	81-86	70-80	150-350	2-5	70-80
High	87-90	80-90	350-400	5-10	80-90
Extreme	90+	90+	400+	10+	90+

1. The Fine Fuel Moisture Code (FFMC) represents the moisture content of litter and cured fine fuels, 1-2 cm deep. It expresses the ease of ignition and fuel flammability. FFMC is sensitive to daily changes in temperature, rainfall, relative humidity, and wind speed. Time lag is 2/3 day, which means that it takes two thirds of a day for the fine fuels to react to a change in the weather.
2. The Duff Moisture Code (DMC) represents the moisture content of loosely compacted, decomposing organic matter, 5-10 cm. deep, which determines resistance to control. DMC is sensitive to temperature, rainfall, and relative humidity. Time Lag is 12 days.
3. The Drought Code (DC) represents the deep layer of compacted organic matter, 10-20 cm. deep, which determines resistance to extinguishment. It indicates seasonal drought and smoldering fires in deep duff or large logs. DC is sensitive to temperature and rainfall. Time lag is 52 days.
4. The Initial Spread Index (ISI) represents a numerical rating of fire spread immediately after ignition without the influence of variable fuel quantity (the fuel type isn't considered). It fluctuates with wind speed and time of day. ISI is a combination of FFMC and wind.
5. The Build Up Index (BUI) represents total fuel available for combustion. In the absence of rain, BUI fluctuates little throughout the day. BUI is a combination of DMC and DC.
6. The Fire Weather Index (FWI) represents the intensity of a spreading fire. FWI is a combination of ISI and BUI.

Military Lands:

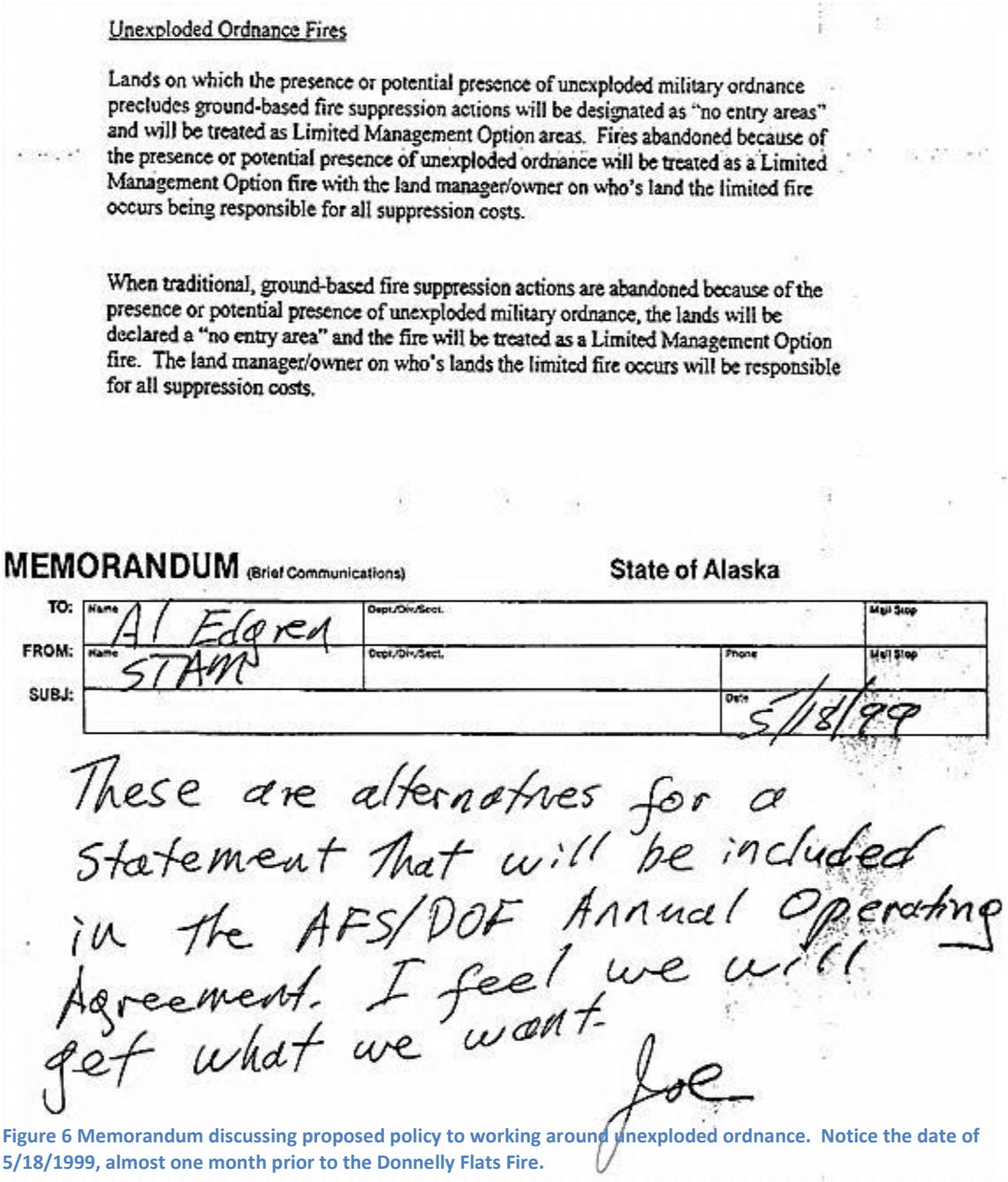
The Alaska Fire Service currently has a Military Zone responsible for the management of fire on military lands. In June 1999 the situation was similar, but the safety standards around UXO (unexploded ordinance) currently are different. The Donnelly Flats Incident originated on military administered lands, and at this time there was no clear training or definition of impact or no entry zones. In the final report that was included in the pre-reading the UXO issue was addressed. The report states, "*Unexploded ordnance policy needs to be clarified and re-emphasized with all firefighters. There was confusion on:*

a) How much, if any, ordnance is acceptable to work around.
b) What types of ordnance may be acceptable to work around.
c) What actions are to be taken around ordnance.
d) Who has the authority to determine actions taken around ordnance.

The AFS management team will develop a seminar for fire suppression tactics to be used on Military lands. This seminar will look at issues such as suppression options, special emphasis sites and ordnance issues. Interagency participation by DOF, US Army, NFO, and other appropriate agency will be solicited by invitation. The target date for this seminar is March 2000."

Eyewitness reports from Midnight Sun Hotshot overhead describe holding and improving dozer line through what appeared to be an impact zone. Saw Boss Jake Livingston described, "Craters knee to thigh deep about seven feet wide with splayed out black spruce were obvious and abundant as we cut out jack-straw spruce." Almost all line personnel involved in the Donnelly Flats Incident can describe a personal encounter with UXO. Everyone interviewed can recollect small arms munitions discharging regularly. Some personnel can recollect louder explosions being fairly common. Currently, there is policy for working on Military lands that include options and no entry zones. Regardless, Alaska was a range, and UXO is still present throughout the state, but relevant training for all personnel dealing with recognition and appropriate action is essential to mitigate this issue. The UXO issue

began in 1998 on the Carla Lake Fire. Personnel knew there needed to be policy for working around these lands, but addressing it formally in an open forum had yet to happen. The email below begins to address this issue, note the date.



Unexploded Ordnance Fires

Lands on which the presence or potential presence of unexploded military ordnance precludes ground-based fire suppression actions will be designated as "no entry areas" and will be treated as Limited Management Option areas. Fires abandoned because of the presence or potential presence of unexploded ordnance will be treated as a Limited Management Option fire with the land manager/owner on who's land the limited fire occurs being responsible for all suppression costs.

When traditional, ground-based fire suppression actions are abandoned because of the presence or potential presence of unexploded military ordnance, the lands will be declared a "no entry area" and the fire will be treated as a Limited Management Option fire. The land manager/owner on who's lands the limited fire occurs will be responsible for all suppression costs.

MEMORANDUM (Brief Communications) State of Alaska

TO: Name Al Edgren Dept./Div./Sect. Mail Stop

FROM: Name STAM Dept./Div./Sect. Phone Mail Stop

SUBJ: Date 5/18/99

These are alternatives for a statement that will be included in the AFS/DOF Annual Operating Agreement. I feel we will get what we want.

Joe

Figure 6 Memorandum discussing proposed policy to working around unexploded ordnance. Notice the date of 5/18/1999, almost one month prior to the Donnelly Flats Fire.

Talking Points:

- Terrain Influences
  - Alaska Range
  - Isabel Pass
  - Donnelly Flats
  - Wind
- Fuel Conditions
  - FFMC, ISI, FWI, DMC, DC
  - Weather
  - Complacency
  - Topographical Influences
- Military Lands
  - UXO
  - Current UXO Policy (reference IRPG) vs. 1999
  - Personal Encounters

Stand Two: Point of Origin

Location: (N 63° 50.862" x W 145°42.267")

- From Delta Junction take Richardson Hwy South approximately 16 miles
- Turn left into assault strip, follow gravel road approximately 2.5 miles to large open area at coordinates above.

Discussion Guide:

Initial Attack:

Alaska State Troopers reported a fire to Delta Forestry Dispatch on June 11th at approximately 0930 in the area of Donnelly Dome. Delta Forestry Dispatch Coordinator Mike Roos had just begun what was to be a busy day. He stated that, "This was one of the most trying days in my career". Roos continued, "that the fire weather indices (FFMC) in Delta were showing extreme, and there had been a very fast moving fire in town the day before. The location of this new start was one of the worst places for a fire to become established in the Delta Area". This was due to the continuous black spruce fuels and potential for high winds from the adjacent mountain pass. The fuel continuity (North/South) had the same alignment as the problem wind (Southerly Chinook). Normal staffing for Delta IA started at 10:00 and phone calls to employees' homes went unanswered, as they had already left. Cell phone communications were not as widely utilized during 1999 as they are today. As Delta personnel reported to work they were immediately dispatched to the new start.

Figure 7 Ft. Greely water tender responding to B222, visible in the distance, photo courtesy of Tom Lucas.

Initial Attack (IA) Incident Commander (IC) Mike Bobo responded with D-51, D-21 with Reb Ferguson, Ft. Greely FD, and Delta helitack (398) as it became available. He immediately ordered air tankers, crews (Type 1 & 2), smokejumpers, additional helitack, and several dozers. The initial size up from helitack reported 5 acres, 100% active in black spruce. Winds were light, North-Northeast and the column was standing almost straight up. IA forces, established an anchor point, and began a flanking action working to the south. In the early afternoon, the winds became shifty and variable. A shift from a North-Northeast to a Westerly and finally a steady Southern flow established. This wind shift was predicted and known by all resources. Since personnel were expecting this change, strategy and tactics were adjusted accordingly. Everyone believed they had good safety zones with adequate escape routes. It was reported that once an area burned it appeared that it was not burning very deep and seemed to cool off fairly quick with few hot areas remaining. Everyone felt confident in their actions and were making good progress in spite of concerns about exploding ordnance encounters.

Differing reports gave the fire size between 5 and 75 acres. Some reports and interviews state that retardant applications were marginally effective or miss utilized. At least 12 loads of retardant were used during Initial Attack. Additional retardant was ordered, however all tankers were on hold at Allen Army Airfield. Air Attack McKnight and Military Zone FMO Gould, both airborne above the fire in fixed wing aircraft, deemed retardant as ineffective and canceled any new orders for drops. The Initial Attack IC disagreed with this decision and ordered more. The Incident Commander requested through Air Attack air tankers loaded with water. This request was also denied, again deemed as ineffective. There are differing reports from ground personnel about the effectiveness of retardant. Some ground resources report that the retardant was too far off the edge to be effective and/or too far ahead of line personnel to be utilized appropriately.

Shortly after the air tankers were grounded, the fire began to come under the effect of a Southerly flow. At approximately 1600, it was reported that one or possibly two vortices developed at what was now the head of the fire.

Figure 8 Donnelly Flats Fire affected by southern wind shift, photo courtesy Steve DuBois and Sue Miller.

The wind change, coupled with these vortices, began to create erratic burning conditions that necessitated the preventative withdrawal of forces off the line. Air Attack McKnight notified IC Bobo that the wind has shifted around the compass and was out of the South. He in turn informed air attack that a tornado was hitting the ground at the North side of the fire. The airplane turned toward the North and Air Attack McKnight notices two distinct eddies on the East and West side of the column which lasted approximately 5 minutes.

Figure 9 Only known photo of the vortex in the area of the jump spot before vortex diminished.

Strange sounds were heard, described as a sort of "woofing". The sound was originally thought to be some sort of munitions or possibly fuel venting. Fire activity increased and resources working on both flanks made the decision to pull off the fire. Activity increased as the vortex began to form within the black portion of the fire. The

Figure 10 Dust devils are a common occurrence in the Delta Junction area, photo courtesy of Fronty Parker.

vortex rapidly increased in size as the firefighters retreated to safety zones. Eyewitnesses said the funnel quickly built to a diameter of 50-100' at the base and had very strong winds that picked up trees, debris, even a Shindaiwa pump kit still attached to a cargo chute. Updrafts increased to the point that hard hats were sucked off firefighters' heads, and a fire shelter was sucked out of the hands of the Delta crew boss.

The vortex rapid escalation and reduced visibility made personnel retreat to pre-identified safety zones and within the black. During retreat, one smokejumper was snagged on vegetation, unable to see where the remainder of the group continued. Winds increased and burned vegetation began to glow as the vortex began to overrun the individual. Utilizing a gloved hand to shield his face he moved to avoid inhaling superheated air. The Extreme Fire Behavior Account narrative describes the account into detail. The individual received first and second degree burns requiring medical attention, but sustained no permanent damage.

Resources believed to be on scene at 1630: 24 smokejumpers, 3 helitack loads, Delta Type 2 crew, Midnight Sun Hotshots, Denali Hotshots, 2 dozers, 2 medium helicopters, and 4 water tenders.

Transition:

At approximately 1800, Operations Section Chief Chip Houde, Operations trainee Kutzgar, and Situation Unit Leader Martin departed Fairbanks via fixed wing for a recon of the fire. The remaining Type 2 Team members drove to the fire area. Operations Houde immediately began to offer assistance to incident personnel. According to the Incident Narrative there was not a defined transition. However, by June 12th the Type 2 Management Team was officially in command of the incident.

Talking Points:

- Initial Attack
  - Leaders Intent
  - Fuels/Fire Behavior
  - Tactics/Assignments/Objectives
  - Communications
  - Weather (observed and predicted)
  - Attitude
  - Utilization of Retardant
- Multi-Agency Coordination
  - Issues
  - Command Presence
  - Communications
  - Command Structure
- Briefings
  - Adequate
  - Known by All Personnel
- Fire Whirl
  - Safety Zones
  - Accountability
  - Air Attack
  - Incident within an Incident
  - Current Burn Protocol
  - PPE/Fire Shelters
- Transitions
  - Type 3 to Type 2
    - Merge or Official Transition
      - Issues?

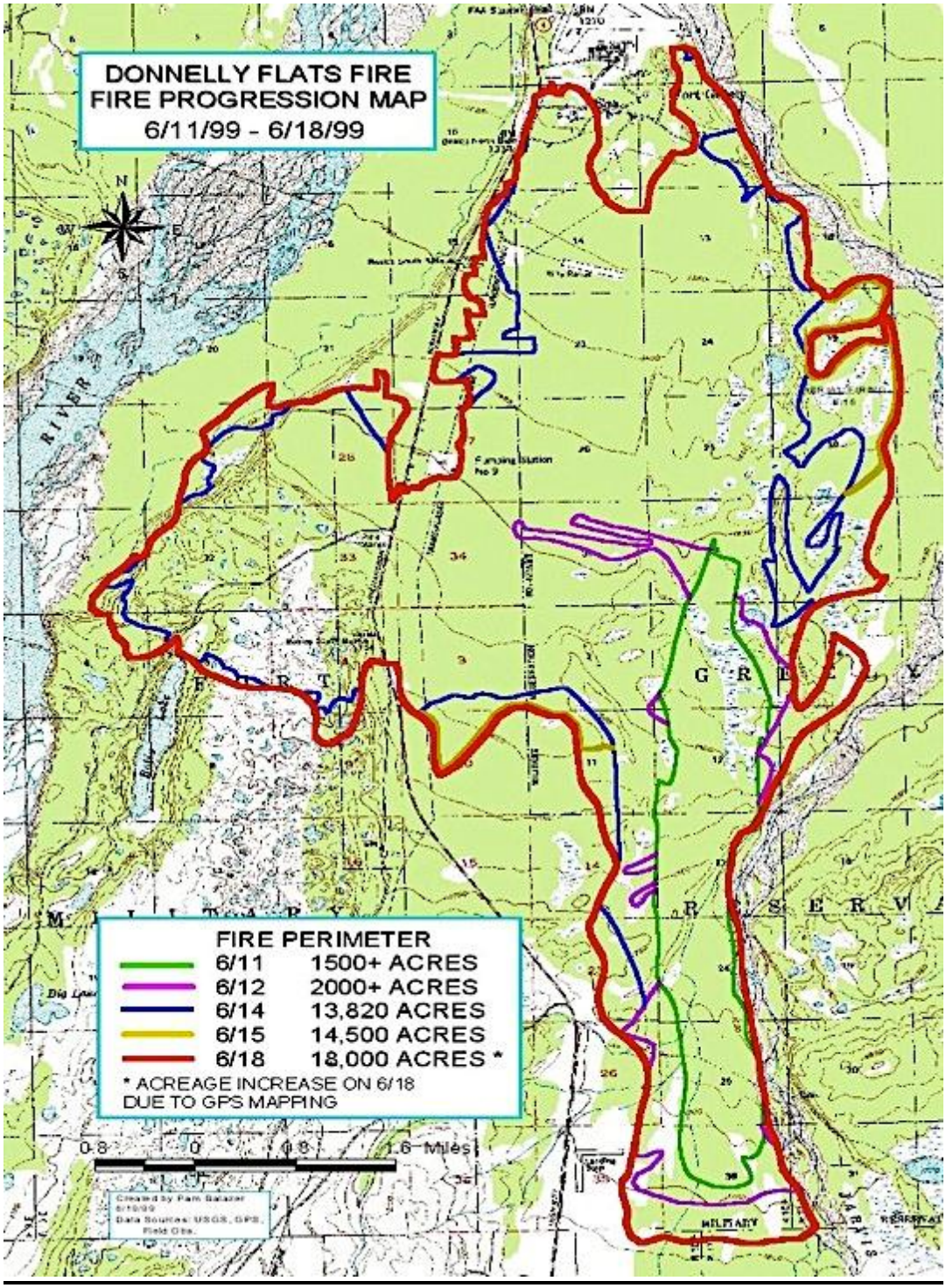


Figure 11 Donnelly Flats Fire progression map from 6/11/99 - 6/18/99, minus the blowup to the west on 6/13.

Stand Three: Shifty Winds

Location: (N 63° 55.399" x W 145°47.822")

- From Delta Junction take Richardson Highway South about 9 miles
- Turn right onto Meadows Rd, 100 yards, and turn on first right, 200 feet ridgeline is on the left, walk out ridgeline to coordinates.

Discussion Guide:

Reference the fire progression map (Figure 11), note the growth at the head of the fire on 6/12. Crews worked with dozers throughout the evening to put line around the slop over. The plan for 6/13 was to continue working and securing line on the South and West flanks with particular attention on the northernmost slop over. At 1000, a 10mph east wind began to blow. Afternoon temperatures were near 80° and relative humidity around 30% (refer to Table 1 for fuel conditions on 6/13) in combination with the east wind caused a significant increase in fire behavior that pushed the fire westward at approximately 30-40 chains per hour.

Wildland Urban and Industrial Interface:

June 13th at 1400, as east winds of at least 10 mph pushed spots near the head in a westerly direction towards the Richardson Highway. When the fire jumped the Richardson Highway structure protection measures were taken on four residences. The fire continued moving towards Alyeska Pump Station Nine. This facility is one of eleven positioned throughout the length of the Alaska Pipeline to adjust the pressure,

Figure 12 View of fire run to the west on 6/13/99 from Ft. Greely, photo courtesy of SPC Kerensa Hardy Ft. Greely Public Affairs.

Figure 13 Alyeska Pipeline Pump Station #9.

pump product, monitor flow and other transmittal information of product. Daily flow and storage can vary from 5,000 barrels per day to 120,000 barrels per day. Division Supervisor Bradley and the Chena Hotshots successfully completed a burnout operation around the facility at 1600. There was close coordination with staff at the station, the Incident Management Team, and personnel on the ground. Holes were cut in the outer perimeter fence to allow access and egress if and when necessary.

Figure 14 Reb Ferguson at the Waldo's residence off the Richardson Highway, photo courtesy of Reb Ferguson.

As for the residences along the Richardson Highway it is unclear if the Incident Management Team was ready for this push from the fire. According to Delta Forestry Dispatch personnel interviews, local resources were dispatched independently from the Team itself to assist the homeowners affected by this push. Fire behavior was described as extreme (Figure 12 and 14). No homes were damaged or destroyed during this push (Figure 15).

Reference the fire progression map (Figure 11); imagine a 4-mile long active uncontrolled Northern edge. Operations Section Chief Houde and the Management Team were in a predicament. After reassessing strategy and priorities the decision was made to begin aerial firing along the Southernmost, of the two-fuel breaks near Fort Greely. The idea was to create a black line buffer in the event the fire progresses to the north. Chinook winds, out of the South, were predicted in the forecast and

Figure 15 Aerial view of Waldo residence post fire.

occurred. The switch happened at approximately 2100 fanning the fire with winds of 50 mph out of the South. The fire was now heading in the direction of Fort Greely with a 4-mile wide front. The Type 2 Team placed an order for a Type 1 Team. Simultaneously, the Chinook wind knocked out power at Delta Forestry Dispatch. The only communication available was a handheld radio and a single landline telephone. At approximately 2130 the fire crossed the southern most fuel break. This was a predetermined trigger point for the evacuation of Fort Greely.

While on the topic of evacuation, let's discuss the Wildland Urban Interface issue and successes that were experienced during the incident. The Type 2 Team received a template evacuation plan from the Carla Lake Fire (1998) that was utilized on this incident. From eyewitness observations, when the fire jumped the pre-established trigger point, the base siren was sounded and the evacuation began with the discipline and efficiency that the military possesses. The military had marshals arranging vehicles in an orderly fashion. When accountability was verified, there was an organized train leaving the station. Simultaneously, Delta Forestry initiated the evacuation of areas South of Delta. At this time the fire was pushed by 50+ mph winds and laid the smoke directly onto Fort Greely itself. Visibility was zero as the fire approached. When the front hit, it split into two heads that wrapped around the base itself.

Figure 16 Fort Greely view to the north as head wrapped around base. Notice center left where hazard fuel reduction was complete, and center right with no fuels reduction.

Figure 17 Fort Greely view to the east. Notice spruce stringers wrapping around as the main fort resides in a stand of aspen and birch. Photo courtesy of the National Archives, 1972.

There had been some fuels reduction completed on the Southern end of the interface that was obviously effective (Figure 16). Figure 17 offers an excellent representation of the fuels available to the fire front. Fort Greely firefighters reported that seven structures were damaged. The Fort Greely Rod and Gun Club, an Environmental Protection Agency (EPA) monitoring station, and the main gate guard shack burned to the ground.

The last topic we will address is work to rest policy. When the fire hit and wrapped around Fort Greely, spots were thrown across Jarvis Creek, threatening areas of Southern Delta. Crews and equipment were needed to secure these spots, however none were available.

Figure 18 Fort Greely view to the southwest. Notice how fire progression halted at Jarvis Creek, the airfield, and large hardwood stand to the west. Photo courtesy of Michael Kingston, Army photographer.

Most crews were bedded down as fatigue from the last three evenings has caught up with personnel.

The following day, June 14th, the operational briefing consisted of;

- *Secure the following:*

1. *The areas around residences on the Richardson Highway*
2. *The areas residences at Fort Greely*
3. *Spot fires around Fort Greely*
4. *Spot fires on the east side of Jarvis Creek.*

Crews and dozers worked to secure miles of active perimeter and contain spots over Jarvis Creek. The Type 1 Incident Management Team assumed control of the fire at 2000 on June 14th. When the new Team took command of the fire, the large acreage gain was over. Favorable weather conditions moved into the region, bringing higher humidity's and wetting rain. These conditions allowed incident personnel to gain ground mopping-up in all divisions. On June 22nd the Type 1 Management Team transitioned to a local Type 3 organization at 1200.

Figure 19 Fort Greely Cantonment area looking west, at the head of the fire as the head split. Photo courtesy fire package.

Additional Perspective:

Past fire history is another element that is worth valuing. Historic fires surrounded the Donnelly Flats Fire in most directions (Figure 21). When studying burn severity (Figure 20) old fire scars may have acted as additional buffers assisting firefighters. These fire scars are separated by rivers and creeks along the perimeters, but may have acted as additional buffers.

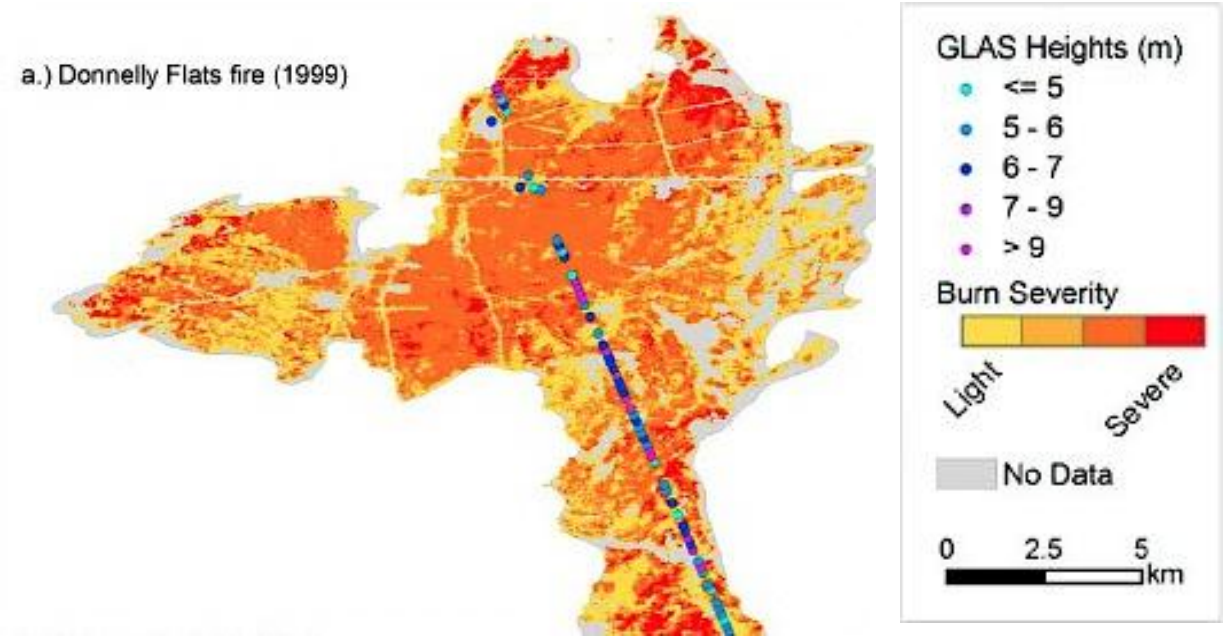


Figure 20 Donnelly Flats Fire burn severity classes (Williams and Kasischke, unpublished manuscript) with GLAS shot locations and canopy heights in meters. GLAS (Geoscience Laser Altimeter System) utilizes lasers to measure topography and vegetation characteristics, part of NASA's Earth Observing System ICESat (Ice, Cloud, and land Elevation Satellite).

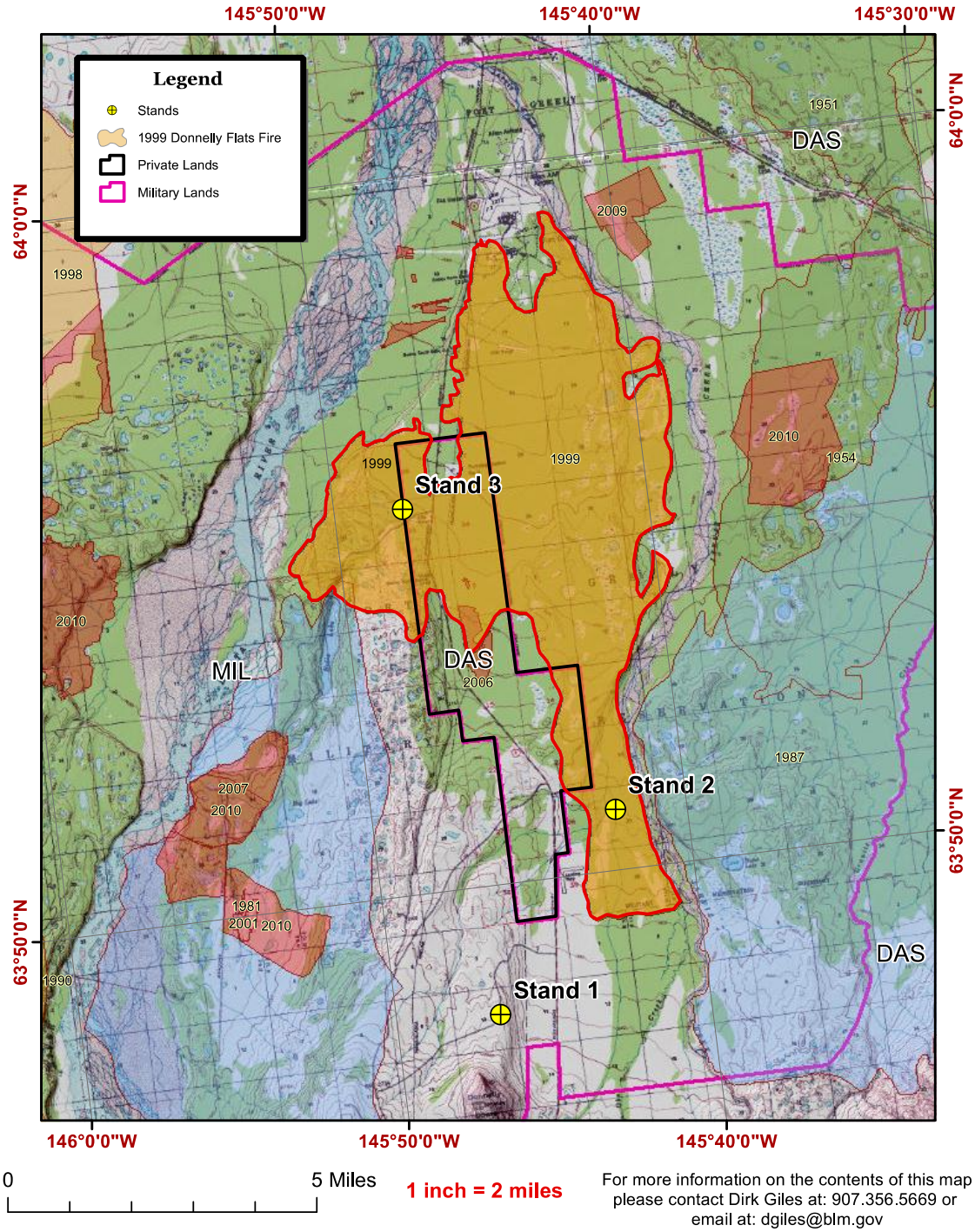


Figure 21 Donnelly Flats Fire perimeter, stand locations, and adjacent fire history.

Talking Points:

- East Wind
  - Geographical Influence
- Wildland Industrial Interface
  - HAZMAT
  - Current Issues (H^2S)
- Chinook Wind
  - Terrain Influence
  - Delta Dispatch Communications
- Evacuation
  - Military Post verses Civilians
  - Deficiency in Training
- Wildland Urban Interface
  - Fuels
  - Planning
- Work To Rest 2:1
  - Then and Now
- Transition
  - Clean Transition or Merger
- Fire History
  - Effective Buffers?

Conclusion:

The Donnelly Flats Fire was a dynamic, rapidly moving incident with numerous transitions, and significant events. There are numerous aspects that may be studied. The Donnelly Flats Fire was almost a repeat of the Carla Lake Fire from the year prior. However, there were many successes and some failures that were learned from and eventually changed policy affecting current fire suppression efforts. Nevertheless, it is necessary to attempt to understand all aspects of history, from human decisions to environmental aftermath, to be effective leaders in chaos.

References:

Kasischke, E. S., L. L. Bourgeau-Chavez, J. F. Johnstone. 2007. Assessing spatial and temporal variations in surface soil moisture in fire-disturbed black spruce forests in Interior Alaska using spaceborne synthetic aperture radar imagery – Implications for post-fire tree recruitment. Science Direct. **108**: 42-58.

Senkowsky, S. 2001. A burning interest in boreal forests: Researchers in Alaska link fires with climate change. BioScience **51**: 916-921.

Photo Credits:

Art Lenon
Final Fire Package
Fronty Parker
SPC Kerensa Hardy, Fort Greely Public Affairs
Michael Kingston, Army Photographer
The National Archives
Reb Ferguson
Steve DuBois
Sue Miller
Tom Lucas