Understanding Airtanker Use in Fire Program Analysis (FPA) Initial Response Simulation (IRS) Module IR_015_WP

Topic:

Understanding Airtanker use in Fire Program Analysis (FPA) Initial Response Simulation (IRS) Module.

Purpose

This paper describes how IRS models the behavior of Large Airtankers, Single-Engine Airtankers (SEATS), and Aerial Scoopers in order to partially or fully contain a fire's perimeter.

Terms

Area of Interest - Area of Interest (AoI) is a set of FWAs included in an analysis, for which the user can build several alternatives. FWAs do not vary between alternatives, only between analyses. To try a different AoI (e.g. collection of FWAs), the user must create a new analysis with explicitly identified collection of FWAs. Fire Planning Unit (FPU) analyses supporting the national budget request must fit within one of the agreed-to 139 FPU boundaries. Analyses for other purposes (e.g. "what if's" for analyzing possible effectiveness improvements by changing which FWA's are in which FPU) do not have that restriction.

Fire Program Analysis System (FPA) - A common interagency decision support tool for wildland fire planning and budgeting. This tool enables wildland fire managers in the five federal land management agencies to plan jointly. FPA also encourages the nonfederal wildland fire partners' participation.

Fire Workload Area (FWA) - An area or areas within an FMU that share an attribute that distinguishes it from the rest of the FMU, e.g. roadless portions of an FMU for which access to fires is by aerial resources and/or ground, significantly different resource values or fire workload.

Travel Time Point (TTP) - A system-calculated or user-defined point the system uses to calculate Travel Time from a Dispatch Location to an FWA.

Background

During the 2000 fire season, a significant number of Large Airtankers became unavailable to FPUs on a day-to-day basis for initial response because they could not safely perform their missions. Before 2001, there were 48 Large Airtankers available for dispatch. Today there are approximately16 Large Airtankers available nationally.

The use of Single Engine Airtankers (SEAT) and Aerial Scoopers (CL215 & CL415) in initial response has increased because there is a better understanding of when and where to effectively and efficiently use each of these fixed wing aircraft.

This paper does not discuss the effectiveness of aerial drops of retardant and/or water to contain fire spread, or to reduce the fire intensity level to improve ground force effectiveness. Instead, it focuses on how the FPA IRS module simulates the availability and behavior of Large Airtanker and Aerial Scooper drops of water and/or retardant when responding to a fire event during the initial attack phase of managing wildland fire. This process applies to any aerial drop by SEAT or helicopter with bucket and/or tank.

Discussion

IRS models how aerial drops of water and/or retardant by helicopters and/or fixed-wing aircraft help contain wildland fires. FPA models the extent to which fixed and/or rotor wing aircraft aerial drops contribute towards fire containment by modeling this behavior as if these aircraft build fireline. FPA measures their effectiveness in chains per hour per drop.

IRS models Large Airtanker behavior using a fleet of 16 to 20 Large Airtankers. FPA does not assign Large Airtankers to a specific Large Airtanker base. Instead, Large Airtankers end the day at their last loading location, unless the Predictive Service Group and/or Fire Managers request them to be at a different location the following day. Large Airtanker activity and location cannot be projected from day-to-day, so IRS uses the three Large Airtanker bases closest (in a straight line) to the Fire Workload Area (FWA) Travel Time Point (TTP) as part of the Large Airtanker Travel Time calculation. IRS calculates the Large Airtankers Travel Time by averaging the distance between the three closest bases and dividing that value by the Large Airtanker Producer Type Average Speed. The system adds the Travel Time to Dispatch Decision Delay and Resource Response Delay to produce the Large Airtanker Arrival Time. No more than three Large Airtankers are dispatched per day to an FPU regardless of the quantity defined in the FPUs Dispatch Logic. For each fire event occurring at Fire Dispatch Levels requesting Large Airtankers, there will be a draw made from a Large Airtanker availability distribution to determine if a Large Airtanker is available for that fire event. FPUs can use the same three Large Airtankers for all fire events per Day-of-Year per FPU, provided they are available.

IRS assumes that when helicopters and/or fixed-wing aircraft make aerial drops of water and/or retardant:

- Ground-based fire resources are already on the fire event before any aerial drops of water and/or retardant begin. No aerial drops of water or retardant will occur before fireline-ground based resources arrive at the fire event. An FPU's Dispatch Logic must request fireline-building resources to arrive prior to the model simulating aerial drops. When FPUs request ground-based fire resources, but their calculated arrival time is later than the aerial resources, the model delays the aerial resources until ground-based fire resources arrive at the fire.

- Helicopters and fixed -wing aircraft can operate only during civil daylight hours. IRS calculates civil twilight using the Day-of-Year and the location of the FWA TTP as defined by the United States Naval Observatory. The model calculates civil daylight prior to dispatching the requested aerial fire resource to the fire event. IRS does not dispatch aerial fire resources to a fire event when they are unable to complete a drop prior to the end of civil daylight.

IRS calculates Large Airtanker reload time using the distance from the FWA TTP to the closest Large Airtanker Dispatch location, and adding the Dispatch Decision Delay and Resource Response Delay for the calculated reload time. Dispatch Decision Delay and Resource Response Delays represent the typical time for a Large Airtanker to enter the airport traffic pattern, land, taxi to the pit, reload with retardant, taxi to run way, and take off. See Appendix A for further information.

FPUs enter SEAT and Aerial Scooper reload times into FPA based on their knowledge about the time needed to depart a fire, travel to a suitable refill site, load, and then return to the fire to make a drop.

Immediately following the calculated Arrival Time of an aircraft dropping fire resources, the drop will produce fireline at a rate of one chain per 100 gallons delivered. All drops last one minute regardless of the producer type's capacity for helicopters and fixed-wing aircraft. The amount of fireline that resources can construct per drop depends on these three factors:

- Gallons per load being carried,
- Surface fuel model, and
- Rate of spread for the fire receiving the drop.

IRS applies an effectiveness factor to some surface fuel model/rate of spread combinations in order to understand the potential fireline that could be produced. The effectiveness factor is a reduction in fireline containment due to retardant not reaching the ground because of the canopy cover or a variable rate of spread. This reduction in the effectiveness factor continues as the rate of spread increases. Eventually, the rate of spread increases sufficiently to cause the retardant to become ineffective. This effectiveness factor applies even with ground-based fire resources building fireline on the fire event. See Appendix B for further information.

See Also

- Understanding Helicopter Use in Fire Program Analysis (FPA) Initial Response Simulation (IRS) Module IR_006_WP
- Understanding Preproduction Delays in Fire Program Analysis (FPA) Initial Response Simulation (IRS) Module IR_005_WP

- Understanding Delays in Fire Program Analysis (FPA) Initial Response Simulation (IRS) Module IR_009_WP

Appendices

Appendix A: Large Airtanker Base Locations

Geographic Area	Base Name	State	City	Latitude	Longitude	Loading Pits	Owner Agency
Southwest	Alamogordo	New Mexico	Alamogordo	32 50.4N	105 59.4W	3	USFS
Southwest	Albuquerque	New Mexico	Albuquerque	35 02.5N	106 36.5W	2	USFS
Southwest	Fort Huachuca	Arizona	Sierra Vista	31 35.3N	110 20.6W	3	USFS
Southwest	Williams/Gateway	Arizona	Mesa	33 18.5N	111 39.3W	2	USFS
Southwest	Prescott	Arizona	Prescott	34 39.1N	112 25.2W	2	USFS
Southwest	Roswell	New Mexico	Roswell	33 18.0N	104 31.8W	1	BLM
Southwest	Silver City	New Mexico	Silver City	32 38.2N	108 9.4W	2	USFS
Southwest	Winslow	Arizona	Winslow	35 01N	110 43.4W	3	USFS
Southern	Kingston	North Carolina	Kingston	35 19.6N	77 37.0W	2	STATE
Southern	Knoxville ATB	Tennessee	Knoxville	35 48.7N	83 59.1W	2	USFS
Southern	Lake City ATB	Florida	Lake City	30 11.0N	82 34.8W	1	USFS
Southern	London	Kentucky	London	37 05.2N	84 04.6W	2	USFS
Southern	Tallahassee	Florida	Tallahassee	30 23.8N	84 21.0W	1	USFS
Southern	Staunton	Virginia	Harrisonburg	38 15.8N	78 53.8W	1	USFS
Rocky Mountain	Denver(JEFCO)	Colorado	Denver	39 53.5N	105 07.0W	1	USFS
Rocky Mountain	Durango	Colorado	Durango	37 09.09N	107 45.22W	1	USFS
Rocky Mountain	Grand Junction	Colorado	Grand Junction	39 07.3N	108 31.5W	2	BLM
Rocky Mountain	Greybull	Wyoming	Greybull	44 30.5N	108 04.5W	2	BLM
Rocky Mountain	Rapid City	South Dakota	Rapid City	44 02.7N	103 03.4W	1	USFS
Pacific Northwest	Kingsley ATB	Oregon	Klamath Falls	42 09.3N	121 43.9W	3	USFS
Pacific Northwest	La Grande ATB	Oregon	La Grande	45 17.4N	118.00.3W	3	USFS
Pacific Northwest	Medford ATB	Oregon	Medford	42 22.4N	122 52.3W	2	USFS
Pacific Northwest	Moses Lake ATB	WA	Moses Lake	47 12.3N	119 19.1W	4	USFS
Pacific Northwest	Troutdale ATB	Oregon	Portland	45 33.0N	122 24.0W	2	USFS
Pacific Northwest	Redmond ATB	Oregon	Redmond	44 15.3N	121 08.9W	3	USFS
Northern Rockies	Billings	Montana	Billings	45 48.4N	108 32.4W	2	BLM
Northern Rockies	Coeur d' Alene	Idaho	Coeur d' Alene	47 46.5N	116 49.1W	2	USFS
Northern Rockies	Helena AAB	Montana	Helena	46 36.4N	111 58.9W	2	USFS
Northern Rockies	Kalispell	Montana	Kalispell	48 18.7N	114 15.2W	1	USFS
Northern Rockies	Missoula	Montana	Missoula	46 54.9N	114 05.3W	2	USFS
Northern Rockies	West Yellowstone	Montana	West Yellowstone	44 41.3N	111 07.0W	1	USFS
Great Basin	Battle Mountain	Nevada	Battle Mountain	40 35.9N	116 52.4W	2	BLM
Great Basin	Boise	Idaho	Boise	43 33.9N	116 13.4W	3	USFS
Great Basin	Cedar City	Utah	Cedar City	37 42.1N	113 05.8W	3	BLM
Great Basin	McCall	Idaho	McCall	44 53.4N	116 06.0W	2	USFS
Great Basin	Minden ATB	Nevada	Minden	39 00.0N	119 45.1W	2	BLM/USFS

Geographic Area	Base Name	State	City	Latitude	Longitude	Loading Pits	Owner Agency
Great Basin	Pocatello	Idaho	Pocatello	42 54.8N	112 35.6W	2	BLM
Great Basin	Stead/Reno	Nevada	Reno/Stead	39 40.0N	119 52.4W	2	BLM/STATE
Great Basin	Hill Tanker Base	Utah	Ogden	41 07.4N	111 58.3W	2	USFS
Eastern	Bemidji	Minnesota	Bemidji	47 30.6N	94 56.0W	2	STATE/BIA
Eastern	Brainard	Minnesota	Brainard	46 23.9N	94 08.2W	2	STATE
Eastern	Ely	Minnesota	Ely	47 49.5N	91 49.8W	2	USFS
Eastern	Hibbing	Minnesota	Hibbing	47 23.2N	92 50.3W	1	STATE
California	Bishop	California	Bishop	37 22.7N	118 21.7W	1	USFS
California	Chester AAB	California	Chester	40 17.3N	121 14.3W	3	USFS
California	Chico AAB	California	Chico	39 47.7N	121 51.4W	3	STATE CDF
California	Fresno AAB	California	Fresno	36 46.5N	119.43.0W	4	USFS/STATE
California	Hemet	California	Hemet	33 44.0N	117 01.3W	4	USFS/STATE
California	Lancaster	California	Lancaster	34 44.4N	118 13.0W	4	USFS
California	Siskiyou County	California	Montague	41 46.9N	122 28.0W	2	USFS
California	Paso Robles	California	Paso Robles	35 40.4N	120 37.6W	2	STATE CDF
California	Porterville	California	Porterville	36 01.8N	119 03.7W	4	USFS/STATE
California	Redding	California	Redding	40 30.5N	122 17.5W	4	USFS/STATE
California	Santa Maria	California	Santa Maria	34 53.93N	120 27.44W	1	USFS
California	Sonoma County	California	Santa Rosa	38 30.8N	122 48.4W	4	STATE
California	Stockton Air Base	California	Stockton	37 53.7N	121 14.2W	3	USFS
California	San Bernandino	California	San Bernandino	34 05 43	117 14 55	6	USFS
Alaska	Wainwright (FBK)	Alaska	Fairbanks	64 50.2N	147 36.9W	3	BLM
Alaska	McGrath MCG)	Alaska	McGrath	62 57.2N	155 16.4W	2	STATE
Alaska	Palmer (PAQ)	Alaska	Palmer	61 35.7N	149 05.5W	2	STATE
Alaska	Tanacross (TSG)	Alaska	Tanacross	63 22.5N	143 20.0W	3	STATE
Alaska	Kenai (ENA)	Alaska	Kenai	60 34.4N	151 14.7W	1	STATE

Table 1: Large Airtanker Base Locations

Appendix B: Airtanker Fireline Production

Review History:

Date	**Initials**	**Change Summary**
July 17, 2008	DKS	APPROVED (note Appendix A table is too wide)
July 21, 2008	ED	Add section breaks to reorient table.
July 14, 2008	HR/KSH	Incorporated edits.
July 11, 2008	JLF	Edits
July 11, 2008	DKS	Edits for completeness and clarity.
July 9, 2008	KSH	Reviewed for clarity.
July 8, 2008	HR	Edits based on new information.
March 7, 2008	KSH	Edit for readability and clarity.
February 14, 2008	HKR	Initial Draft