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Airtanker Drop Guides

United States Department of Agriculture
Forest Service
Technology & Development Program

Ground Pattern Performance of the Western Pilot Services Dromader

Gregg Johnson, Project Leader, and Cammie Jordan, Project Assistant

The Wildland Fire Chemical Systems (WFCS) program tests a variety of fixed- and rotary-wing tankers to determine the parameters for optimal ground pattern coverage over a wide range of fuel and fire conditions. The Western Pilot Services Dromader is an aircraft designed for use as an agricultural sprayer. It can be used for fire suppression by installing either the Transland or Melex gating systems.

The Transland and Melex gates differ in the size of the opening. The Melex gate opens 656 square inches (41 by 18 inches) and has an average flow of 450 gallons per second. The Transland gate opens 390 square inches (39 by 10 inches) and has an average flow of 80 gallons per second. Both the Transland and Melex gates are mechanically operated. The aircraft's tank holds 500 gallons, all of which is released at one time. Tests included airspeeds from 74 to 96 knots (85 to 110 mph) and drop heights from 40 to 120 feet from the bottom of the door to ground. The drops were made with three different materials: water, foam, and gum-thickened retardant.

The Missoula Technology and Development Center tested the Western Pilot Services Dromader (Figure 1) with a series of drops over an array of plastic bowls much like Cool Whip containers. The quantity of material in each bowl was measured and the data were used to determine the drop pattern.

Flow rate, drop height, and airspeed all have an effect on the drop pattern. Since this type of airtanker is normally used over a narrow range of heights and speeds and because each gating system produces a single flow rate, information about an average drop is presented (Figures 2 and 3).

Figure 1–The Western Pilot Services Dromader.

The proper amount of gum-thickened retardant (expressed as coverage levels in gallons per 100 square feet) differs depending on the fuel model. Table 1 shows the coverage needed for specific fuel models using both the National Fire Danger Rating System (NFDRS) and Fire Behavior Fuel Model descriptions.

For additional Information contact: *Paul Solarz, Program Leader; Missoula Technology & Development Center; Building 1, Fort Missoula; Missoula, MT 59804-7294. Phone: 406-329-4719; Fax: 406-329-4811; E-mail: psolarz@fs.fed.us; Lotus Notes: Paul Solarz/WO/USDAFS*

Table 1—Retardant coverage levels needed for specific fuel models.

Fuel Model		Coverage Level (gal/100 sq. ft)	Description
National Fire Danger Rating System (NFDRS)	Fire Behavior		
A,L,S	1	1	Annual and perennial western grasses, tundra
C	2		Conifer with grass
H,R	8	2	Shortneedle closed conifer; summer hardwood
E,P,U	9		Longneedle conifer; fall hardwood
T	2		Sagebrush with grass
N	3		Sawgrass
F	5	3	Intermediate brush (green)
K	11		Light slash
G	10	4	Shortneedle conifer (heavy dead litter)
O	4		Southern rough
F,Q	6	6	Intermediate brush (cured), Alaska black spruce
B,O	4		California mixed chaparral, high pocosin
J	12	Greater than 6	Medium slash
I	13		Heavy slash

Table 2–Water tests producing the longest line at various door openings using the Transland gate.

Coverage Level (gal/100 sq. ft)	Drop Height (feet)	Drop Length (feet)
0.5	100	1198
1.0	40	743
2.0	40	100
3.0	40	14
4.0	40	1
6.0	-	0
8.0	-	0
10.0	-	0

Table 3–Foam tests producing the longest line at various door openings using the Transland gate.

Coverage Level (gal/100 sq. ft)	Drop Height (feet)	Drop Length (feet)
0.5	40	1214
1.0	60	686
2.0	60	52
3.0	-	0
4.0	-	0
6.0	-	0
8.0	-	0
10.0	-	0

The results of drop tests allow managers to estimate the length of line a specific airtanker produces at various coverage levels. Table 2 can be used to determine the maximum line length at each coverage level produced by water using the Transland gate. Table 3 can be used to determine the maximum line length at each coverage level produced by foam using the Transland gate. Table 4 can be used to determine the maximum line length at each coverage level produced by gum-thickened retardant using the Transland gate. Table 5 can be used to determine the maximum line length at each coverage level produced by water using the Melex gate. Table 6 can be used to determine the maximum line length at each coverage level produced by foam using the Melex gate. Table 7 can be used to determine the maximum line length at each coverage level produced by gum-thickened retardant using the Melex gate.

Table 4–Gum-thickened retardant tests producing the longest line at various door openings using the Transland gate.

Coverage Level (gal/100 sq. ft)	Drop Height (feet)	Drop Length (feet)
0.5	40	1308
1.0	40	715
2.0	40	89
3.0	40	30
4.0	40	10
6.0	-	0
8.0	-	0
10.0	-	0

Table 5–Water tests producing the longest line at various door openings using the Melex gate.

Coverage Level (gal/100 sq. ft)	Drop Height (feet)	Drop Length (feet)
0.5	80	366
1.0	100	339
2.0	80	266
4.0	80	223
6.0	100	163
6.0	120	92
8.0	120	49
10.0	120	15

Table 6–Foam tests producing the longest line at various door openings using the Melex gate.

Coverage Level (gal/100 sq. ft)	Drop Height (feet)	Drop Length (feet)
0.5	80	351
1.0	80	306
2.0	80	229
3.0	80	153
4.0	100	163
6.0	100	49
8.0	100	7
10.0	-	0

Table 7–Gum-thickened retardant tests producing the longest line at various door openings using the Melex gate.

Coverage Level (gal/100 sq. ft)	Drop Height (feet)	Drop Length (feet)
0.5	100	366
1.0	80	318
2.0	80	251
3.0	80	227
4.0	100	200
6.0	100	140
8.0	120	74
10.0	100	30

The ground drop characteristics for the Western Pilot Services Dromader were derived through controlled test drop procedures on flat ground (Figure 4). This information is to serve only as a guide in assisting field personnel to determine the proper drop height, airspeed, and door opening for delivering water, foam, or gum-thickened retardant. Actual coverage may vary depending on terrain, wind, weather, and pilot proficiency.

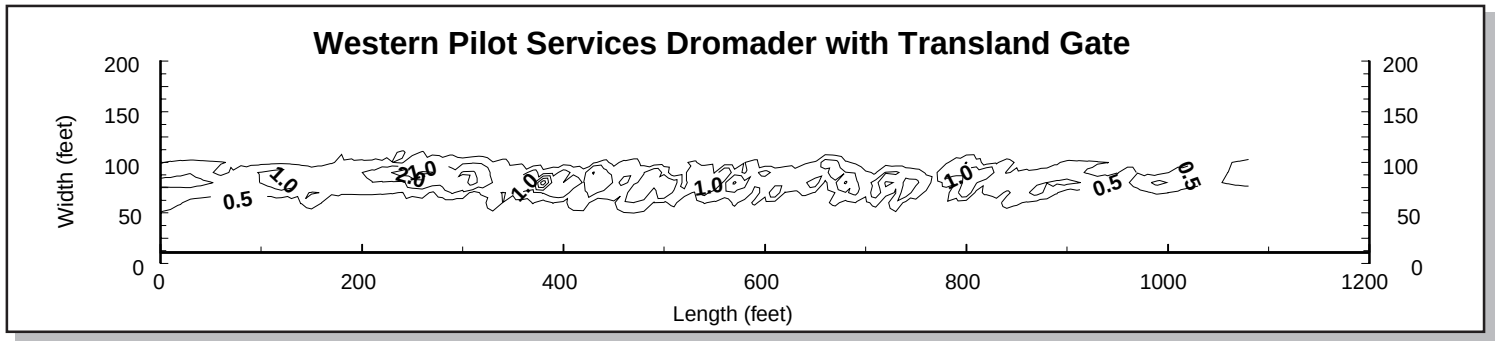

Figure 2–Drop pattern characteristics for the Western Pilot Services Dromader with Transland Gate at an airspeed of 92 knots (106 mph) and a drop height of 40 feet. The contour lines are at coverage levels of 0.5, 1, 2, 3, 4, 6, 8, and 10 gallons per 100 square feet.

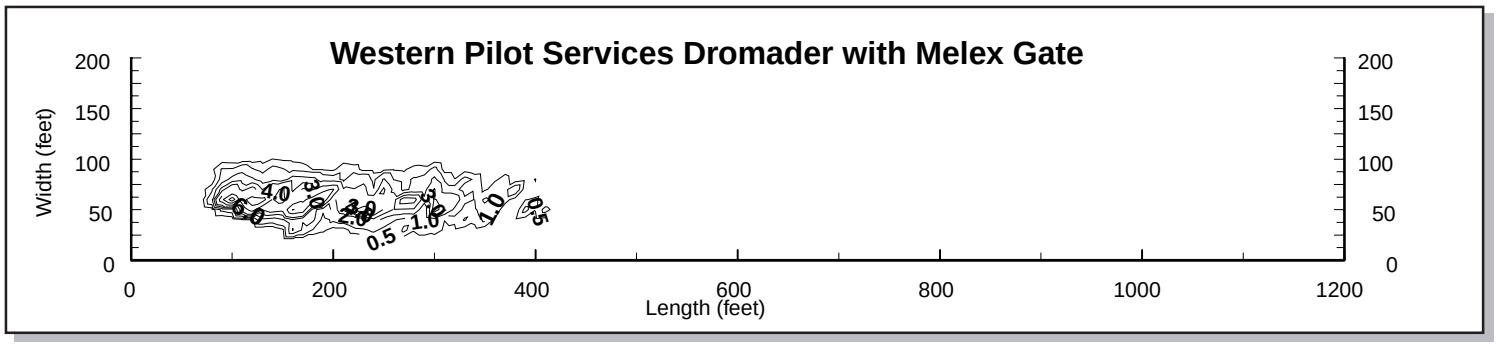

Figure 3–Drop pattern characteristics for the Western Pilot Services Dromader with Melex Gate with an airspeed of 91 knots (105 mph) and a drop height of 80 feet. The contour lines are at coverage levels of 0.5, 1, 2, 3, 4, 6, 8, and 10 gallons per 100 square feet.

Figure 4 – Drop test of the Western Pilot Services Dromader.

About the Authors...

Gregg Johnson is Project Leader of the Aerial Delivery Systems Project for the Wildland Fire Chemical Systems Program at MTDC. He received his bachelor's degree in chemistry from the University of Montana in 1969 and has more than 30 years experience in retardant chemical and aerial delivery systems research. He has worked for the Rocky Mountain Research Station's Fire Sciences Laboratory in Missoula and for MTDC.

Cammie Jordan is a Project Assistant for the Wildland Fire Chemical Systems Program at MTDC. She is an elementary education student at the University of Montana and has worked for MTDC since 1998.

Additional single copies of this document may be ordered from:

USDA Forest Service
Missoula Technology and Development Center
Building 1, Fort Missoula
Missoula, MT 59804-7294
Phone: (406) 329-3978
Fax: (406) 329-4811

For additional technical information, contact Paul Solarz at the address above.

Phone: (406) 329-4719
Fax: (406) 329-4811
Internet: psolarz@fs.fed.us
Lotus Notes: Paul Solarz/WO/USDAFS

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