



Safe Drop Height for Fixed-Wing Airtankers

Greg Lovellette, Project Leader

The Aircraft Use Triangle addresses cost effectiveness, use of the correct aircraft, and safety. While cost effectiveness and use of the correct aircraft are important parameters in choosing the drop height for an airtanker, safety must be the most important factor.

Low-altitude retardant drops from fixed-wing airtankers may injure firefighters. Injuries are caused by flying debris (such as treetops or rocks) or when firefighters are knocked down. If the retardant has lost all of its forward momentum and is falling vertically as a heavy rain, the danger to firefighters is minimal. Safe drop height can be defined as the distance below the airtanker at which the retardant begins to fall vertically. Figure 1 shows a drop that was released from a safe drop height, has lost all forward motion, and is falling vertically. Figure 2 shows a drop that was released below the safe drop height and still had considerable forward motion when it reached the ground.

Video and films of drop tests for a variety of airtankers dropping full and partial loads have been examined. The distance below the aircraft where retardant began to



Figure 1—Retardant drop released from a safe drop height.



Figure 2—Retardant drop intentionally released below the safe drop height during testing.



fall vertically was recorded and compared to the flight and release characteristics. From these data, a relationship between safe drop height, peak flow rate, and load size was developed. The relationship can be expressed as:

$$S = 101 + 0.0112 * L + 0.0202 * P + 50$$

Where S = Safe drop height in feet

L = Load size in gallons

P = Peak flow rate in gallons per second.

The additional 50 feet are a safety factor. The formula does not accurately represent constant-flow tanks and single-engine airtankers. The data table uses actual measurements for these airtankers.

Table 1 lists each type of fixed-wing airtanker approved by the Interagency Airtanker Board and the safe drop height for full and partial loads. The safe drop height

for trail drops depends on the interval between releases. To determine the safe drop height for trail drops treat the total volume being released as if it were a single release.

Airtankers are listed by the manufacturer of the tank and gating system rather than by the operator of the airtanker. Airtanker numbers are shown to help determine the type of tank on each airtanker.

Table 1—Safe drop heights for fixed-wing airtankers approved by the Interagency Airtanker Board. The fractions apply when a portion of a load is dropped.

				Safe drop height (feet above impact)							
Airtanker type	Airtanker numbers	Tank volume	Flow setting	Full Load	1/2 Load	1/3 Load	1/4 Load	1/6 Load	1/8 Load	1/16 Load	
ARDCO Aero Flite DC-4	65, 119, 151, 152, 160,161, 166	2000	High	319	235		192		172		
ARDCO Aero Flite DC-4	65, 119, 151, 152, 160,161, 166	2000	Low	231	191		170		161		
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	1/2	130	130		130		130		
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	1	137	137		137		137		
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	2	145	145		145		145		
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	3	150	150		150				
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	4	169	169		169				
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	6	185	185		185				
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	8	190	190						
Aero Union Corp. C-130	30, 31, 63, 64, 67	3000	9	249							
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	1/2	140	140	140		140			
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	1	149	149	149		149			
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	2	166	166	166		166			
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	3	175	173	173		166			
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	4	204	200	194					
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	6	223	215	204					
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	8	253	242						
Aero Union Corp. P3 Orion	00, 22, 23, 25, 26, 27, 21	3000	Max	310	244	196		192			
Aero Union Corp. SP2H	01, 03, 16, 18	2000	1/2	128	128		128		128		
Aero Union Corp. SP2H	01, 03, 16, 18	2000	1	135	135		135		135		
Aero Union Corp. SP2H	01, 03, 16, 18	2000	2	143	143		143		143		
Aero Union Corp. SP2H	01, 03, 16, 18	2000	3	156	150		150				
Aero Union Corp. SP2H	01, 03, 16, 18	2000	4	169	169						
Aero Union Corp. SP2H	01, 03, 16, 18	2000	5	196	173						
Aero Union Corp. SP2H	01, 03, 16, 18	2000	6	215	173						
Aero Union Corp. SP2H	01, 03, 16, 18	2000	ED	234	173						
Aero Union Conventional C-54 - DC-4	14, 15	2000	High	260	207		180		169		
Aero Union Conventional C-54 - DC-4	14, 15	2000	Low	202	180		171		161		
Aero Union Conventional DC-7	33, 60, 62, 66	3000	High	284	221		189		170		
Aero Union Conventional DC-7	33, 60, 62, 66	3000	Low	219	188		171		163		
Hawkins & Powers C-130	81, 83, 88, 130, 131, 133	3000	High	287	219		185		168		
Hawkins & Powers C-130	81, 83, 88, 130, 131, 133	3000	Low	241	196		173		163		
Hawkins & Powers KC-97	97	3200	High	323	237		196		174	162	
Hawkins & Powers KC-97	97	3200	Low	290	219		186		169	160	
Hawkins & Powers KC-97	97	4000	High	348	257		204		178	164	
Hawkins & Powers KC-97	97	4000	Low	298	228		190		171	160	
Hawkins & Powers SPB4Y2	121, 123, 124, 126, 127	2200	High	265	208		180		165		
Hawkins & Powers SPB4Y2	121, 123, 124, 126, 127	2200	Low	235	193		172		162		
Hawkins & Powers SPB4Y2	121, 123, 124, 126, 127	2000	High	254	203		177		164		
Hawkins & Powers SPB4Y2	121, 123, 124, 126, 127	2000	Low	223	187		169		160		
Marsh Turbo Thrush 60/40 Door		380	40% Door	80							
Marsh Turbo Thrush 60/40 Door		380	60% Door	90							
Marsh Turbo Thrush 60/40 Door		380	Both Doors	100							
Minden Air Inc. P2V-7	55, 99	2450	High	288	221	199		176			
Minden Air Inc. P2V-7	55, 99	2450	Low	231	170	145		123			
Minden Air Inc. P2V-7	55, 99	2000	High	283	217	196		175			
Minden Air Inc. P2V-7	55, 99	2000	Low	228	162	139		121			
Neptune, Inc. P2V-7 H & P P2V-7	08, 09, 10, 11, 139, 140	2450	High	288	219	199		175			
Neptune Inc. P2V-7 H & P P2V-7	08, 09, 10, 11, 139, 140	2450	Low	215	183	172		162			
Neptune Inc. P2V-5	05, 06, 07	2450	High	291	221	201		178			
Neptune inc. P2V-5	05, 06, 07	2450	Low	214	182	173		163			
Pierce Turbo Thrush		450		80							
Snow Airtractor 802	181, 182	800	1/2	92	92		92				
Snow Airtractor 802	181, 182	800	1	102	102		102				
Snow Airtractor 802	181, 182	800	2	123	123		116				
Snow Airtractor 802	181, 182	800	3	151	151		151				
Snow Airtractor 802	181, 182	800	4	179	179		144				
Snow Airtractor 802	181, 182	800	Max	186	186		144				
Western Pilot Services Dromader – Melex gate		500		140							
Western Pilot Services Dromader – Transland		500		100							

About the Author...

Greg Lovellette is a Physical Scientist at MTDC. He received a Bachelor of Science degree in Chemistry at the University of Montana in 1980. Before joining the Forest Service in 1989, he worked as an oil well analyst throughout Montana, Wyoming, and North Dakota.

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USDA Forest Service
Missoula Technology and
Development Center
5785 Hwy. 10 West
Missoula, MT 59808-9361
Phone: (406) 329-3978
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For additional technical information, contact Greg Lovellette at the address above.

Phone: (406) 329-4815
Fax: (406) 329-3719
Lotus Notes: Greg Lovellette/
WO/USDAFS
E-mail: glovellette@fs.fed.us

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