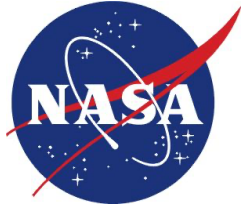


NASA/TP-20260001349



# **Wind Tunnel Performance Tests of a Full-Scale Proprotor on the Tiltrotor Test Rig Addendum: Numerical Data**

*C. W. Acree, Jr.  
National Aeronautics and Space Administration  
Ames Research Center  
Moffett Field, California*

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March 2026

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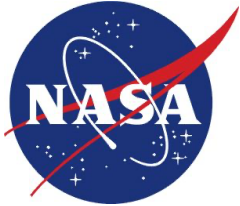
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Tiltrotor Test Rig  
Addendum: Numerical Data**

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Moffett Field, California

**Summary**

The Tiltrotor Test Rig (TTR) is a large-scale proprotor test system for the National Full-Scale Aerodynamics Complex (NFAC). The first wind-tunnel entry was completed in November 2018. The rotor tested was the Bell Model 699, an AW609 rotor modified specifically for wind-tunnel testing. The TTR and rotor were tested up to 273 knots in axial flow, which is the highest airspeed ever achieved by a full-scale proprotor in any wind tunnel. Extensive conversion-mode and hover/climb data were also acquired. Previous reports presented results for all test configurations, including numerical data for hover/climb conditions. The axial-flow and conversion-mode numerical data used for those reports are presented herein.

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## Nomenclature

Coll.	Collective angle, referred to $\frac{3}{4}$ radius
Lat.	Lateral (gimbal angle)
Long.	Longitudinal (gimbal angle)
NFAC	National Full-Scale Aerodynamics Complex
PLL	Pitch Link Load
TTR	Tiltrotor Test Rig

$A$	Rotor disk area
$c$	Rotor chord (thrust weighted)
$C$	Wind tunnel cross-section area = 2754.59 ft <sup>2</sup>
$C_P$	Power coefficient, $P/\rho A V_{tip}^3$
$C_T$	Thrust coefficient, $T/\rho A V_{tip}^2$
$FM$	Hover figure of merit, $Tv_h/P$
$M_{tip}$	Tip Mach number
$N$	Number of blades
$P$	Power
$P_i$	Rotor induced power
$q$	dynamic pressure, $\frac{1}{2} \rho V^2$
$R$	Rotor radius
$T$	Rotor thrust
$v$	Induced velocity
$v_h$	Induced velocity in hover, $\sqrt{T/2\rho A}$
$V$	Wind tunnel airspeed
$V'$	Glauert-corrected airspeed
$V_{tip}$	Rotor tip speed
$\mu$	Advance ratio, $V/V_{tip}$
$\Omega$	Rotor rotation rate
$\eta$	Propulsive efficiency, $TV/P = \mu C_T/C_P$
$\eta'$	Glauert-corrected propulsive efficiency
$\eta_c$	Climb efficiency
$\sigma$	Rotor solidity, $Nc/\pi R$
$\alpha_1$	Area ratio, $A/C$
$\tau$	Glauert thrust coefficient, $T/\rho A V^2$
$\rho$	Atmospheric density

### Rotor Balance Loads

AF	Lift (axial force)
NF	Thrust (normal force)
SF	Side force
PM	Pitching moment
RM	Rolling moment
YM	Yaw moment (torque)

# **Wind Tunnel Performance Tests of a Full-Scale Proprotor on the Tiltrotor Test Rig Addendum: Numerical Data**

C. W. Acree, Jr.

## **Background**

The first entry of the Tiltrotor Test Rig (TTR) into the National Full-Scale Aerodynamics Complex (NFAC) was completed in November 2018. It was considered a checkout test focused on operational safety and efficiency, but the opportunity was used to collect rotor performance, loads, and acoustics data for research. The checkout test used the Bell Model 699 rotor, which was built specifically for NASA by Bell and derived from the right-hand rotor of the Leonardo AW609. Figure 1 shows the TTR and 699 rotor in the NFAC.

Airplane-mode (axial flow), conversion-mode, and helicopter-mode (edgewise) conditions are the focus of the present paper. Reference 1 presents results of these tests in the form of performance and loads plots. The present report presents sufficient numerical data to recreate the plots in Ref. 1, supplemented with traditional rotor test data not previously published. Low-speed vertical climb (near hover) data were previously published in Refs. 2-3.

Development of the TTR/699 is described in Ref. 4 and the test program is described in Refs. 1-3 and 5-6. References 7-8 document analytical studies of TTR/699 aeroelastic stability, performance, and airloads. References 9-10 present correlations of measured TTR/699 loads and performance with analytical predictions.

Reference 1 is a revision to an earlier paper, Ref. 11. All TTR/699 data were reprocessed for Ref. 1; key differences include thermally corrected rotor-balance data and aerodynamic tare corrections throughout. The present report presents only the most recently processed TTR/699 data including all corrections.



**Fig. 1. TTR/699 installed in the NFAC 40x80 test section (the TTR is oriented at 45° yaw).**

### **Supporting Information**

To help interpret the data tables, key rotor data from Ref. 1 are repeated below. The detailed run logs in Ref. 12 may also prove useful to researchers.

#### **Rotor Characteristics**

Table 1 includes rotor data needed to recreate the data plots in Ref. 1, notably rotor diameter and solidity.

**Table 1. 699 rotor characteristics**

Diameter	26 ft
Solidity	0.0908
Taper	0.684
Precone	2.75 deg, flexure
Sweep	1.45 deg
Hover tip speed	775 ft/sec
Root	tapered
Controls	conventional

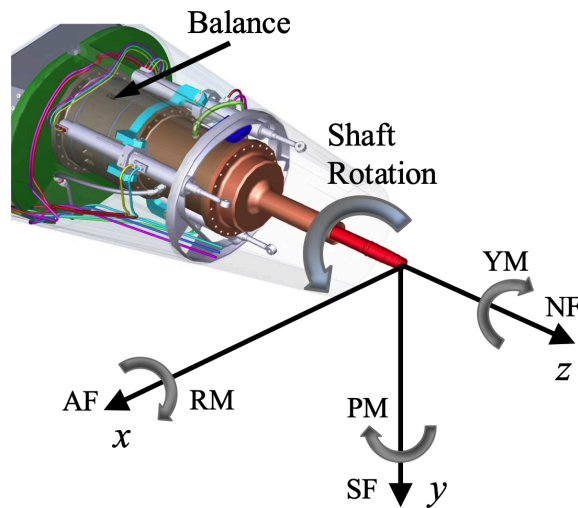
#### **Sign Conventions**

The balance data use the traditional NFAC rotor axis system, but rotated to align the rotor shaft horizontally with the rotor facing upstream at 0-deg turntable yaw. Table 2 gives the resulting rotor parameters and sign convention; see also Fig. 2. The rotor axis system rotates with the NFAC turntable, so rotor thrust is always positive. The rotor data reported here use the “B3” balance calibration translated to the hub center. The wind-tunnel scales were locked, so all rotor loads were

measured by the balance. Reference 13 details the procedures for computing rotor balance loads, including equations for the “B3” calibration.

**Table 2. TTR rotor balance sign convention**

Parameter	Load	Polarity (0-deg yaw)
AF	lift (axial force)	positive right
NF	thrust (normal force)	positive forward
SF	side force	positive down
PM	pitch moment	positive nose right
RM	roll moment	positive nose down
YM	yaw moment (torque)	positive opposite to rotation



**Figure 2. TTR/699 rotor balance axis system, referenced to the hub center.**

The rotor is pointing in the upstream direction at 0-deg yaw, and to the right (looking upstream) at 90-deg yaw.

The TTR/699 blade color code and azimuth reference is shown in Fig. 3. See Ref. 13 for further details of the TTR/699 hub geometry.

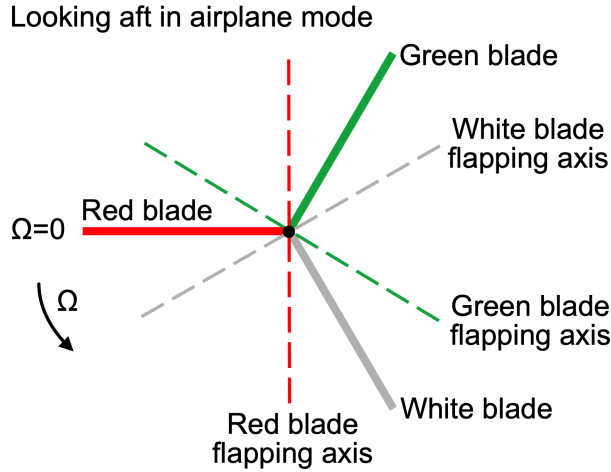


Figure 3. TTR/699 rotor hub azimuth reference.

### Efficiency Metrics

Traditional rotor thrust and power coefficients are defined as follows:

$$C_P \quad \text{Power coefficient, } P/\rho A V_{tip}^3$$

$$C_T \quad \text{Thrust coefficient, } T/\rho A V_{tip}^2$$

where  $P$  = power,  $T$  = thrust,  $V_{tip}$  = rotor tip speed,  $A$  = rotor disk area, and  $\rho$  = density.

Reference 14 gives the classic momentum-theory solution for minimum possible power for a rotor in axial flow:

$$P_i = T(V + v) = T(V/2 + \sqrt{(V/2)^2 + v_h^2})$$

$$v_h = \sqrt{T/2\rho A}$$

where  $P_i$  = ideal power,  $V$  = airspeed,  $v$  = induced velocity, and  $v_h$  = induced velocity in hover. In this paper,  $V$  is always the net wind-tunnel velocity generated by the rotor. Airspeed is here defined with respect to the rotor, so airspeed is always positive.

Rotor figure of merit is traditionally defined as

$$FM = Tv_h/P = T\sqrt{T/2\rho A}/P$$

We can define climb efficiency  $\eta_c = P_i/P$ , where  $P_i$  is defined above and  $P$  is measured power. As  $V \rightarrow 0$ ,  $\eta_c$  becomes rotor figure of merit, and for  $V \gg v$ ,  $\eta_c$  approaches propeller propulsive efficiency  $\eta = TV/P = \mu C_T/C_P$ .

The Glauert velocity correction was used for high-speed data; see Ref. 1 for details. The defining equations are given here. Let  $\tau = T/\rho A V^2$ , and  $\alpha_1 = A/C$ , where  $C$  = wind tunnel cross-section area. The Glauert correction is then:

$$V'/V = 1 - \tau\alpha_1/(2\sqrt{1 + 2\tau})$$

Given the equations above and key rotor data from Table 1, all data points plotted in Ref. 1 can be recreated from the numerical data presented below.

### Numerical Data

The wind tunnel test conditions are graphically summarized in Fig. 4. Table 3 summarizes the test conditions for the data given here. Numerical data for hover/vertical climb conditions are published in Ref. 15. See Ref. 12 for a complete list of all data runs.

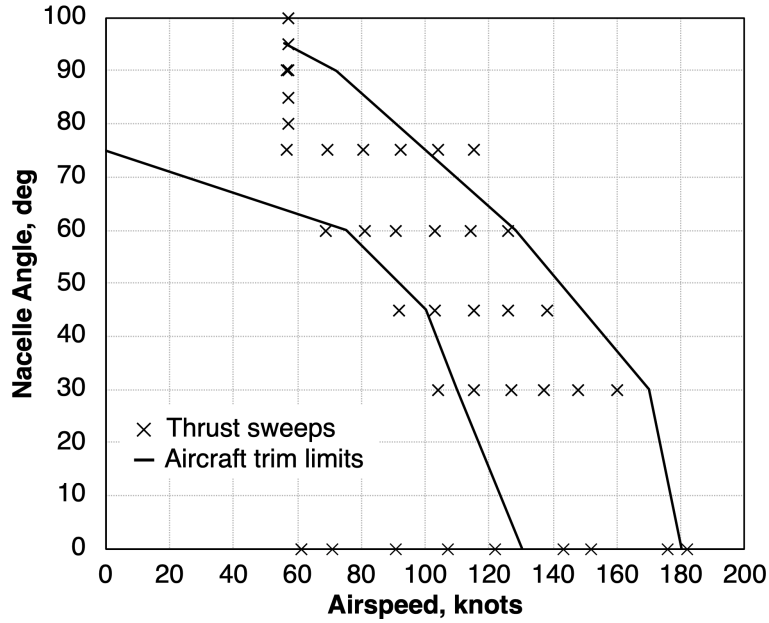


Fig. 4. Nominal conversion-mode envelope and test conditions.

**Table 3. TTR/699 performance data runs**

Run	Date	No. Points	Description
14	5/8/17	30	Spinner tares, $q$ sweep, 478 rpm, 0 deg yaw
28	5/12/17	30	Spinner tares, yaw sweeps, 569 rpm, $q = 12$ psf
31	5/17/17	43	Spinner tares, yaw sweep, 569 rpm, $q = 36$ psf
33	5/17/17	60	Spinner tares, yaw sweeps, 569 and 0 rpm, $q = 75$ psf
75	8/13/18	58	Airplane forward flight, 0 deg yaw, 478 RPM, 60, 90 knots
77	8/14/18	50	Airplane forward flight, 0 deg yaw, 478 RPM, 150, 180, 210 knots
80	8/16/18	53	Airplane forward flight, operator training, 0 deg yaw, 478 RPM, 60, 150, 210 knots
81	8/17/18	43	Airplane forward flight, operator training, 0 deg yaw, 478 RPM, 240-270 knots
85	8/27/18	42	Helicopter forward flight, 90 deg, 57, 80 knots
86	8/28/18	42	Conversion forward flight, thrust sweeps, 90, 75 deg yaw, 57 knots
87	8/29/18	71	Conversion forward flight, thrust sweeps, 75 deg yaw, 57, 70, 81, 92 knots
88	8/30/18	85	Conversion forward flight, thrust sweeps, 75 deg yaw, 104, 115 knots
89	8/30/18	56	Conversion forward flight, thrust sweeps, 60 deg yaw, 70, 81 knots
90	8/31/18	83	Conversion forward flight, thrust sweeps, 60, 45 deg yaw, 91, 103, 115, 126 knots
91	9/4/18	40	Conversion forward flight, thrust sweeps, 45 deg yaw, 57, 103 & 115 knots
93	9/5/18	81	Conversion forward flight, thrust sweeps, 45, 30 deg yaw, 104, 115, 127, 138 knots
94	9/6/18	65	Conversion forward flight, thrust sweeps, 30, 80 deg yaw, 57, 137, 149, 160 knots
95	9/6/18	26	Conversion forward flight, thrust sweeps, 90 deg yaw, 57 knots
104	11/8/18	48	Airplane forward flight, thrust sweep, 478 rpm, 120 knots
105	11/8/18	59	Airplane forward flight, thrust sweeps, 569 rpm, 61, 72, 107, 143 knots
108	11/13/18	37	Airplane forward flight, 0 yaw, 569 rpm, 176, 212 knots
109	11/13/18	62	Helicopter forward flight, thrust sweeps, 569 rpm, 80, 85, 95, 100 deg yaw, 57 knots

For ease of finding the run number for a given test condition, Table 4 lists the airplane-mode test conditions, organized by tip speed and airspeed. Table 5 lists the conversion-mode test conditions, organized by yaw angle and airspeed.

The TTR/699 database does not include provisions for computing measurement uncertainty. The data tables given here show numerical data as output by the database client, with the number of digits (significant figures) truncated for convenience in organizing the tables. Researchers requiring rigorous uncertainty statistics should consult Refs. 16 and 17. An extensive recalibration of test section flow conditions was performed after the TTR/699 entry. As of this writing, the results of that recalibration have not been incorporated into the TTR/699 database.

**Table 4. TTR/699 airplane mode thrust sweeps (Yaw = 0 deg)**

Tip Speed $M_{\text{tip}}$	Airspeed $V$ , knots	Advance Ratio $\mu$	Runs
0.583 (airplane mode)	61	0.156	75, 80
	91	0.233	75
	122	0.312	104
	152	0.391	77, 80
	182	0.468	77
	214	0.544	77, 80
	243	0.622	81
264	0.674	81	
0.684 (helicopter mode)	61	0.133	105
	71	0.156	105
	107	0.233	105
	143	0.311	105
	176	0.391	108
	211	0.468	108

**Table 5. TTR/699 conversion mode thrust sweeps ( $M_{tip} = 0.684$ )**

Yaw angle, deg	Airspeed $V$ , knots	$\mu$	Run
100	57.4	0.125	109
95	57.4	0.125	109
90	57.4	0.125	95
85	57.4	0.125	109
80	57.4	0.125	94
90	56.6	0.125	85
75	56.6	0.125	86
75	69.4	0.151	87
75	80.8	0.176	87
75	92.4	0.201	87
75	104	0.226	88
75	115	0.250	88
60	69	0.150	89
60	81	0.176	89
60	91	0.198	90
60	103	0.224	90
60	114	0.248	90
60	126	0.274	90
45	92	0.200	90
45	103	0.225	91
45	115	0.250	91
45	126	0.275	93
45	138	0.300	93
30	104	0.225	93
30	115	0.250	93
30	127	0.275	93
30	137	0.300	94
30	148	0.325	94
30	160	0.350	94

Most data were taken with the rotor trimmed to either  $M_{tip}=0.693$  or  $M_{tip}= 0.583$ . Within a given run, data were typically taken at fixed yaw angle where  $M_{tip}$ , and  $\mu$ , and collective were varied to achieved thrust sweeps. For those runs where yaw or  $\mu$  were adjusted within a run, the relevant parameters are highlighted in boldface.

The data plotted in Ref. 1 were not always collected in continuous parameter sweeps. The data tables presented here have numerous gaps in data point numbers; omitted data points include control-system checks, data-system diagnostics, operator training, etc., where either the wind tunnel or the rotor were not trimmed consistent with other plotted data. Such data points are not appropriate for parameter sweeps and were accordingly not plotted in Ref. 1 nor are they included here. Run 76 is omitted here because the data quality was poor.

Pitch link loads (PLL) are for the white blade. Gimbal angles are measured at the red blade and converted to the fixed system. See Ref. 13 for details.

**Table 6a. TTR/699 spinner tare data for run 14**

Run	Point	Yaw deg	$\Omega$ rpm	$V$ knots	$q$ lb/ft <sup>2</sup>	AF lb	NF lb	SF lb	PM ft-lb	RM ft-lb	YM ft-lb
14	6	0.0	478.5	0.0	0.0	-8.8	-25.9	12.8	57.4	-150.9	149.1
14	7	0.0	478.3	60.2	12.0	-5.8	-18.5	7.2	4.4	-112.7	136.5
14	8	0.0	478.4	95.4	29.9	-11.5	-7.8	16.1	20.7	-230.4	143.9
14	9	0.0	478.3	136.0	60.0	-8.1	-3.8	21.7	9.9	-278.5	148.1
14	10	0.0	478.3	168.0	90.1	-3.9	-22.2	10.1	-36.5	-261.7	153.5
14	11	0.0	478.2	195.4	120.2	-4.9	-55.9	3.7	-57.3	-223.5	152.5
14	12	0.0	478.2	219.7	149.4	-0.4	-78.5	-4.7	-43.6	-189.6	175.6
14	13	0.0	478.3	243.1	180.0	4.2	-96.3	-14.3	-16.7	-202.0	174.1
14	14	0.0	478.1	264.4	209.2	-0.5	-131.4	-17.3	24.8	-201.3	179.4
14	15	0.0	478.1	274.7	222.5	2.6	-159.4	-23.8	61.8	-146.0	179.0
14	16	0.0	478.3	266.6	210.4	0.6	-155.4	-25.6	50.4	-126.3	174.6
14	17	0.0	477.9	246.2	181.6	-3.6	-133.7	-21.4	61.2	-123.1	172.4
14	18	0.0	478.0	222.5	150.1	-11.3	-100.3	-10.6	69.0	-139.9	151.5
14	19	0.0	477.9	198.9	121.5	-14.0	-84.9	3.8	55.8	-160.4	146.4
14	20	0.0	478.1	170.7	90.7	-15.8	-66.5	7.8	61.5	-137.5	146.8
14	21	0.0	478.2	138.0	60.1	-14.1	-40.5	7.2	49.3	-111.9	144.6
14	22	0.0	478.1	138.0	60.2	-12.4	-45.1	9.1	32.6	-78.6	147.5
14	23	0.0	478.2	97.8	30.6	-9.1	-25.7	8.7	-1.4	-37.5	144.3
14	24	0.0	478.1	60.9	12.0	-9.7	-14.3	14.0	44.7	-110.8	135.8
14	25	0.0	478.1	60.9	12.0	-9.2	-9.4	13.0	40.9	-104.4	139.3
14	26	0.0	478.0	0.0	0.0	-9.4	-7.3	4.0	62.1	-28.7	129.0

**Table 6b. TTR/699 spinner tare data for run 28**

Run	Point	Yaw deg	$\Omega$ rpm	$V$ knots	$q$ lb/ft <sup>2</sup>	AF lb	NF lb	SF lb	PM ft-lb	RM ft-lb	YM ft-lb
28	7	90.3	570.3	60.5	12.1	75.2	62.3	-70.9	-14.6	-93.8	177.7
28	8	75.3	568.9	60.3	12.0	108.7	57.6	-55.3	29.1	-99.4	169.2
28	9	60.2	569.3	60.3	12.0	102.3	47.8	-28.6	29.4	-27.6	164.2
28	10	45.1	569.2	60.9	12.2	86.7	30.8	-13.5	55.5	4.3	172.4
28	11	30.1	569.4	60.7	12.1	63.1	17.6	-11.1	18.3	30.5	179.9
28	12	15.1	569.6	60.8	12.1	33.6	4.5	-5.5	-31.2	-21.1	195.3
28	13	0.0	568.9	60.7	12.1	-0.8	-6.9	1.7	-68.5	-82.1	193.3
28	14	15.1	569.0	60.7	12.1	30.2	-3.6	4.0	-6.9	-106.1	186.8
28	15	30.1	568.5	60.6	12.1	56.2	-3.5	1.8	76.0	-121.5	174.6
28	16	45.2	569.0	60.5	12.0	78.4	5.2	-1.9	98.8	-129.3	163.9
28	17	60.2	569.4	60.6	12.1	95.7	22.3	-20.2	64.3	-66.1	159.9
28	18	75.3	569.2	60.5	12.0	112.2	50.6	-60.3	-6.7	-7.5	162.4
28	19	90.3	568.9	60.6	12.1	86.1	46.6	-74.7	-90.4	-40.9	164.6
28	20	75.3	570.0	60.5	12.0	118.4	47.3	-63.9	-66.3	25.7	160.4
28	21	60.2	569.6	60.5	12.1	106.8	27.7	-32.8	-13.1	30.0	151.9
28	22	45.1	569.7	60.2	11.9	81.2	20.8	-9.6	60.7	-33.0	164.4
28	23	30.1	570.0	60.5	12.0	53.9	2.8	-1.8	89.1	-79.0	178.4
28	24	15.1	570.2	60.6	12.1	27.2	-7.0	0.7	17.3	-79.2	189.3
28	25	0.0	569.9	60.4	12.0	-3.5	-3.7	2.0	-48.9	-75.3	189.7
28	26	90.3	569.6	60.5	12.0	80.5	34.1	-68.6	-64.2	-99.4	159.5

**Table 6c. TTR/699 spinner tare data for run 31**

Run	Point	Yaw deg	$\Omega$ rpm	$V$ knots	$q$ lb/ft <sup>2</sup>	AF lb	NF lb	SF lb	PM ft-lb	RM ft-lb	YM ft-lb
31	12	0.0	569.6	104.6	36.1	-6.6	-23.9	19.0	-43.8	-317.4	207.2
31	13	0.0	569.4	104.6	36.1	-7.3	-20.9	22.3	-32.2	-339.0	208.3
31	14	15.1	569.4	104.9	36.3	89.3	-27.3	19.3	100.4	-323.9	218.9
31	15	30.1	569.1	104.6	36.0	184.0	-5.6	4.6	187.6	-212.0	205.1
31	16	45.2	569.2	104.8	36.2	256.2	27.0	-6.1	204.9	-124.8	189.7
31	17	60.2	569.0	104.9	36.2	309.6	71.9	-26.0	130.5	-123.8	176.2
31	18	63.2	569.2	104.8	36.1	314.0	91.8	-36.2	122.2	-146.0	170.5
31	19	65.2	569.4	104.6	36.0	317.3	101.3	-45.2	111.4	-189.5	176.5
31	20	67.2	569.7	104.8	36.1	319.4	125.8	-58.0	94.2	-202.3	174.1
31	21	69.2	569.8	105.1	36.3	322.1	127.3	-76.3	70.3	-203.7	173.4
31	22	71.2	569.9	104.7	36.0	320.6	147.2	-96.8	33.7	-218.2	176.2
31	23	73.2	569.6	104.9	36.1	326.1	151.5	-112.3	-5.4	-190.5	173.9
31	24	75.3	569.9	104.7	36.0	328.5	177.7	-117.1	-41.8	-155.1	177.6
31	25	77.3	569.5	104.7	36.0	329.0	174.3	-130.2	-78.1	-117.7	173.7
31	26	80.3	569.4	105.0	36.2	327.5	202.4	-126.3	-104.7	-102.8	171.3
31	27	82.3	569.6	104.8	36.1	319.5	200.7	-113.4	-130.2	-46.7	172.4
31	28	84.3	569.2	104.9	36.1	312.1	215.2	-104.9	-163.7	-33.2	170.1
31	29	86.3	569.5	105.0	36.1	296.0	213.1	-90.5	-154.3	-28.5	172.6
31	30	88.3	569.5	105.3	36.4	285.3	217.7	-77.8	-158.3	-41.9	166.6
31	31	90.3	569.4	105.1	36.2	216.0	135.8	-124.3	-188.6	-132.4	163.5
31	32	92.3	569.1	105.1	36.2	202.6	116.3	-118.3	-176.3	-152.6	164.8
31	33	94.3	569.5	104.9	36.1	184.1	119.7	-112.8	-186.1	-164.7	162.9
31	34	96.3	569.3	104.8	36.0	171.4	119.7	-108.3	-182.1	-165.5	165.5
31	35	98.3	568.9	104.8	36.0	159.3	103.6	-106.6	-190.8	-167.3	161.8
31	36	100.3	568.8	105.1	36.2	152.2	111.1	-106.1	-204.2	-181.3	164.3
31	37	90.3	569.0	104.9	36.1	250.5	183.3	-85.9	-76.2	-60.5	161.1

**Table 6d. TTR/699 spinner tare data for run 33**

Run	Point	Yaw deg	$\Omega$ rpm	$V$ knots	$q$ lb/ft <sup>2</sup>	AF lb	NF lb	SF lb	PM ft-lb	RM ft-lb	YM ft-lb
33	8	0.0	569.3	153.0	74.6	-12.1	-31.9	10.8	-8.3	-268.9	178.1
33	9	15.1	569.2	154.0	75.3	198.1	-42.9	4.1	213.2	-170.1	180.7
33	10	30.1	568.9	154.1	75.3	383.7	4.0	-13.5	471.6	-61.0	170.9
33	11	45.2	569.0	153.9	75.1	533.2	72.2	-15.8	558.2	-64.3	161.6
33	12	60.2	569.2	154.3	75.5	656.8	201.3	-35.8	442.7	-127.4	146.7
33	13	63.2	569.5	154.1	75.2	667.2	244.9	-60.5	389.6	-146.4	151.1
33	14	65.2	569.5	154.3	75.4	674.5	264.3	-104.5	354.0	-117.1	151.5
33	15	67.2	569.3	154.1	75.1	673.1	284.0	-161.2	305.0	-48.2	151.7
33	16	69.2	569.3	154.0	75.0	678.7	321.1	-213.3	199.9	107.6	151.9
33	17	71.2	569.5	154.5	75.4	682.1	358.3	-231.2	133.7	167.0	154.4
33	18	73.2	569.6	154.3	75.2	677.5	361.3	-247.8	72.2	218.1	149.4
33	19	75.3	569.7	154.3	75.3	669.4	375.3	-252.9	44.3	251.9	152.2
33	20	77.3	569.7	154.5	75.4	661.2	390.0	-248.2	23.9	259.8	152.5
33	21	80.3	569.7	154.2	75.1	644.4	418.7	-225.8	-1.5	243.6	151.3
33	22	82.3	569.7	154.3	75.3	633.3	413.9	-203.9	-15.1	210.1	156.8
33	23	84.3	568.9	154.4	75.3	618.1	439.8	-168.4	-24.0	196.8	153.4
33	24	86.3	569.0	154.6	75.5	605.0	444.8	-138.1	-41.7	174.7	153.6
33	25	88.3	569.3	154.4	75.3	578.8	442.4	-106.0	-25.7	137.4	154.0
33	26	90.3	569.5	154.4	75.3	544.2	439.0	-100.3	-29.7	104.6	156.1
33	27	92.3	569.5	154.1	75.1	368.9	234.5	-189.2	-180.9	-15.8	148.0
33	28	94.3	569.5	154.1	75.1	330.2	206.4	-180.0	-199.9	-10.4	150.7
33	29	96.3	569.6	154.2	75.1	300.8	210.2	-175.8	-215.0	-7.7	150.5
33	30	98.3	570.0	154.1	75.1	277.9	192.1	-178.2	-239.2	8.0	147.4
33	31	100.3	569.9	153.8	74.7	252.0	193.2	-184.2	-274.2	63.8	150.4
33	32	90.3	570.1	154.8	75.6	551.9	438.7	-113.2	-83.9	232.0	163.1
33	33	90.3	570.3	154.8	75.6	554.2	443.5	-115.8	-98.9	290.7	160.3

**Table 7a. TTR/699 performance data for run 75**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
75	18	0.0	0.002294	658.0	0.5828	<b>0.1556</b>	9.90	16	500	5	-242	37	1921	-0.025	-0.141	293.096
75	19	0.0	0.002293	658.6	0.5831	<b>0.1562</b>	10.84	18	1003	16	-327	-112	2959	-0.017	-0.102	304.255
75	20	0.0	0.002292	659.0	0.5834	<b>0.1569</b>	11.71	18	1450	38	-346	-356	3958	-0.013	-0.090	312.325
75	21	0.0	0.002290	659.1	0.5832	<b>0.1559</b>	12.48	2	1935	26	-187	-293	5001	-0.009	-0.009	316.369
75	22	0.0	0.002289	659.1	0.5832	<b>0.1563</b>	13.45	-3	2444	16	-199	-229	6228	0.006	0.018	322.769
75	23	0.0	0.002289	659.1	0.5831	<b>0.1570</b>	14.38	-7	2917	14	-179	-168	7417	-0.004	-0.001	329.841
75	24	0.0	0.002288	659.2	0.5830	<b>0.1561</b>	15.16	-11	3371	8	-145	-113	8554	-0.008	0.017	331.743
75	25	0.0	0.002288	659.2	0.5830	<b>0.1569</b>	16.12	-12	3858	0	-155	-63	9875	-0.003	0.020	332.778
75	26	0.0	0.002286	659.1	0.5828	<b>0.1574</b>	16.97	-19	4313	5	-151	-26	11129	0.022	0.008	333.177
75	27	0.0	0.002285	659.7	0.5832	<b>0.1562</b>	17.83	-21	4809	5	-92	-31	12508	0.018	0.009	333.885
75	28	0.0	0.002285	659.6	0.5830	<b>0.1564</b>	18.76	-27	5317	8	-89	-72	13986	0.036	0.003	340.397
75	29	0.0	0.002284	660.2	0.5835	<b>0.1568</b>	19.63	-50	5767	-2	-104	-177	15400	0.116	0.080	340.361
75	30	0.0	0.002283	660.3	0.5834	<b>0.1559</b>	20.47	-23	6249	23	-93	-270	16849	0.032	-0.005	331.677
75	31	0.0	0.002282	660.1	0.5831	<b>0.1563</b>	21.41	-8	6746	49	-184	-394	18428	0.013	-0.034	334.547
75	32	0.0	0.002282	660.1	0.5831	<b>0.1571</b>	9.96	15	478	40	-259	-451	1871	0.000	0.002	291.374
75	41	0.0	0.002268	659.7	0.5830	<b>0.2331</b>	16.00	-1	493	58	-171	-619	2357	-0.006	-0.069	420.193
75	42	0.0	0.002268	660.3	0.5834	<b>0.2339</b>	16.90	-6	1010	39	-153	-454	4008	0.023	0.003	427.564
75	43	0.0	0.002267	660.0	0.5831	<b>0.2328</b>	17.60	-8	1449	33	-178	-322	5420	0.009	-0.011	428.872
75	44	0.0	0.002266	660.8	0.5837	<b>0.2334</b>	18.44	-16	1930	16	-166	-203	7003	0.033	0.036	432.504
75	45	0.0	0.002266	660.6	0.5835	<b>0.2340</b>	19.24	-25	2376	19	-146	-114	8516	0.033	0.012	435.548
75	46	0.0	0.002265	660.4	0.5832	<b>0.2329</b>	19.98	-30	2859	7	-83	-85	10130	0.023	0.034	435.78
75	47	0.0	0.002265	660.6	0.5834	<b>0.2329</b>	20.87	-41	3384	0	-84	-62	11976	0.067	0.085	436.158
75	48	0.0	0.002264	660.6	0.5833	<b>0.2339</b>	21.74	-36	3851	16	-36	-26	13722	0.031	-0.013	436.929
75	49	0.0	0.002264	661.0	0.5836	<b>0.2343</b>	22.50	-29	4298	15	-10	-65	15364	0.002	-0.003	437.811
75	50	0.0	0.002263	660.9	0.5833	<b>0.2335</b>	23.35	-29	4812	20	-61	-232	17280	-0.005	0.010	431.216
75	51	0.0	0.002264	660.8	0.5833	<b>0.2327</b>	16.07	10	560	45	-273	-640	2595	-0.007	0.054	420.238

**Table 7b. TTR/699 performance data for run 77**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
77	10	0.0	0.002252	654.2	0.5825	<b>0.3901</b>	27.1	-5	502	-45	-5	418	3870	-0.038	0.029	614.3
77	11	0.0	0.002251	653.8	0.5820	<b>0.3905</b>	27.4	3	745	-6	-168	32	5068	0.007	0.006	611.2
77	12	0.0	0.002249	654.8	0.5825	<b>0.3903</b>	27.8	-20	1027	11	-35	-207	6488	-0.017	0.012	610.4
77	13	0.0	0.002246	654.8	0.5822	<b>0.3910</b>	28.1	-15	1186	10	30	-162	7306	-0.018	0.016	607.3
77	14	0.0	0.002244	655.5	0.5825	<b>0.3899</b>	28.5	-35	1507	1	123	-93	9019	-0.002	0.028	603.9
77	15	0.0	0.002243	655.3	0.5821	<b>0.3906</b>	28.8	-37	1685	-2	139	-40	9943	-0.003	0.034	602.6
77	16	0.0	0.002242	655.6	0.5824	<b>0.3899</b>	29.2	-32	1991	1	173	25	11549	-0.007	0.007	596.0
77	17	0.0	0.002241	656.6	0.5832	<b>0.3901</b>	29.5	-41	2162	-4	200	33	12514	-0.010	0.026	595.5
77	18	0.0	0.002240	656.5	0.5830	<b>0.3909</b>	29.9	-27	2457	8	225	20	14069	-0.054	0.000	589.4
77	19	0.0	0.002239	656.0	0.5824	<b>0.3913</b>	30.2	-47	2602	-10	195	-7	14940	0.020	0.057	585.1
77	20	0.0	0.002238	656.3	0.5826	<b>0.3911</b>	30.6	-37	2917	9	197	-46	16624	-0.023	0.010	579.4
77	21	0.0	0.002237	656.0	0.5822	<b>0.3924</b>	31.1	-36	3172	13	97	-180	18091	0.009	0.055	571.7
77	22	0.0	0.002238	657.1	0.5831	<b>0.3893</b>	27.0	-3	517	16	-110	-394	3888	-0.006	0.088	609.5
77	31	0.0	0.002200	656.4	0.5817	<b>0.4674</b>	31.7	-13	576	23	-50	-398	5140	0.005	0.042	704.9
77	32	0.0	0.002199	658.5	0.5835	<b>0.4665</b>	32.0	-13	798	20	44	-265	6469	-0.027	0.011	706.5
77	33	0.0	0.002199	658.5	0.5835	<b>0.4670</b>	32.3	-31	982	12	70	-193	7633	-0.006	0.012	703.6
77	34	0.0	0.002198	657.9	0.5829	<b>0.4674</b>	32.7	-31	1227	-8	158	-127	9175	-0.023	0.042	695.6
77	35	0.0	0.002197	657.9	0.5828	<b>0.4686</b>	33.2	-38	1532	-2	187	-63	11130	0.008	0.036	692.3
77	36	0.0	0.002197	659.2	0.5839	<b>0.4678</b>	33.4	-37	1750	-19	251	-74	12544	-0.020	0.081	690.0
77	37	0.0	0.002196	658.5	0.5833	<b>0.4682</b>	33.7	-41	1928	-5	280	-21	13617	0.004	0.017	679.9
77	38	0.0	0.002195	658.1	0.5828	<b>0.4692</b>	34.1	-47	2165	-6	278	-75	15122	-0.003	0.042	673.5
77	39	0.0	0.002194	657.9	0.5826	<b>0.4697</b>	34.4	-37	2357	-1	311	-134	16433	-0.021	0.051	668.1
77	40	0.0	0.002194	657.6	0.5822	<b>0.4686</b>	34.7	-34	2592	14	311	-234	17926	-0.022	0.019	660.4
77	41	0.0	0.002196	658.8	0.5834	<b>0.4680</b>	31.8	-9	606	21	-29	-375	5446	0.002	0.049	704.5

**Table 7c. TTR/699 performance data for run 80**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
80	38	0.0	0.002135	662.7	0.5829	0.5434	35.8	33	559	-59	-536	488	6241	0.005	0.033	841.2
80	39	0.0	0.002135	661.8	0.5820	0.5437	36.2	23	839	-79	-465	644	8245	0.012	0.043	832.4
80	40	0.0	0.002134	662.6	0.5825	0.5428	36.5	9	1093	-79	-376	810	10046	0.014	-0.020	827.4
80	41	0.0	0.002133	662.6	0.5826	0.5442	36.7	39	1221	-101	-355	792	11013	-0.048	0.073	824.0
80	42	0.0	0.002133	663.3	0.5832	0.5443	37.1	26	1481	-107	-364	857	12876	-0.015	0.083	820.1
80	43	0.0	0.002132	663.0	0.5828	0.5441	37.2	35	1629	-108	-326	899	13950	-0.031	0.070	813.8
80	44	0.0	0.002131	661.6	0.5815	0.5461	37.7	19	1896	-107	-320	874	16015	0.006	0.100	803.3
80	45	0.0	0.002132	661.7	0.5815	0.5454	37.9	31	2049	-97	-320	850	17117	0.000	0.075	796.4
80	46	0.0	0.002131	664.7	0.5842	0.5445	35.9	63	545	-85	-667	604	6322	-0.056	0.080	846.4

**Table 7d. TTR/699 performance data for run 81**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
81	22	0.0	0.002121	658.5	0.5824	<b>0.6191</b>	39.5	-23	607	1	124	-241	7560	0.036	-0.011	870.6
81	23	0.0	0.002121	658.5	0.5825	<b>0.6204</b>	39.7	-33	779	-15	156	-176	8883	0.066	0.033	867.3
81	24	0.0	0.002120	657.4	0.5813	<b>0.6213</b>	40.2	-41	1146	-11	227	-25	11822	0.076	-0.018	852.4
81	25	0.0	0.002118	657.8	0.5816	<b>0.6239</b>	40.4	-35	1228	-26	255	-68	12603	0.041	0.057	851.4
81	26	0.0	0.002116	660.1	0.5833	<b>0.6212</b>	40.7	-37	1517	-23	295	-121	14951	0.037	0.036	840.4
81	27	0.0	0.002113	659.2	0.5822	<b>0.6228</b>	41.0	-46	1728	-11	318	-214	16732	0.079	0.055	828.5
81	28	0.0	0.002111	661.4	0.5841	<b>0.6240</b>	39.6	-24	528	7	29	-330	7050	0.083	-0.005	881.0
81	35	0.0	0.002071	662.6	0.5835	<b>0.6709</b>	41.8	-13	661	-16	202	-363	9085	0.005	0.096	920.3
81	36	0.0	0.002071	662.2	0.5832	<b>0.6733</b>	42.2	-24	867	5	266	-242	10921	0.006	0.009	912.1
81	37	0.0	0.002068	661.7	0.5825	<b>0.6756</b>	42.6	-46	1151	9	296	-186	13453	0.082	0.003	899.2
81	38	0.0	0.002067	662.8	0.5835	<b>0.6760</b>	42.8	-45	1223	-5	292	-204	14157	0.094	0.024	897.5
81	39	0.0	0.002068	661.6	0.5824	<b>0.6750</b>	43.1	-13	1533	3	328	-337	16891	0.012	0.046	881.0

**Table 7e. TTR/699 performance data for run 85**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
85	13	90	0.002308	770.0	0.6840	0.1252	-3.6	187	1012	32	279	881	2752	0.04	-0.01	48.8
85	14	90	0.002306	770.0	0.6836	0.1251	-3.1	190	1253	20	261	825	2625	0.06	0.04	60.8
85	15	90	0.002305	770.1	0.6836	0.1252	-2.1	193	1948	-10	251	753	2364	0.04	-0.01	76.4
85	16	90	0.002304	770.5	0.6838	0.1253	-1.1	201	2575	-41	251	726	2262	0.01	0.00	89.6
85	17	90	0.002304	770.4	0.6836	0.1254	-0.1	203	3229	-72	258	727	2288	0.00	0.03	106.5
85	18	90	0.002299	771.0	0.6834	0.1251	-0.2	214	3191	-68	171	672	2283	-0.03	0.04	104.5
85	26	90	0.002295	771.7	0.6834	0.1249	-0.1	218	3254	-56	8	576	2288	0.02	0.01	103.5
85	27	90	0.002294	772.2	0.6837	0.1251	0.8	231	3839	-80	5	588	2395	-0.04	0.00	117.1
85	28	90	0.002293	772.2	0.6836	0.1253	1.9	220	4620	-116	-43	626	2658	0.03	0.01	132.0
85	29	90	0.002293	772.1	0.6835	0.1253	2.9	207	5233	-156	-42	610	2990	0.05	0.07	146.4
85	30	90	0.002293	772.1	0.6834	0.1255	3.9	210	5880	-173	-22	651	3364	0.00	-0.03	156.1
85	31	90	0.002292	772.2	0.6835	0.1253	4.9	201	6589	-200	-49	620	3851	0.02	-0.04	165.1
85	32	90	0.002292	772.3	0.6834	0.1247	-0.2	231	3202	-41	-114	446	2289	0.01	-0.02	101.1
85	26	90	0.002295	771.7	0.6834	0.1249	-0.1	218	3254	-56	8	576	2288	0.02	0.01	103.5
85	36	90	0.002286	774.0	0.6841	0.1244	-3.3	232	1228	87	-267	-32	2670	0.10	0.08	59.5

**Table 7f. TTR/699 performance data for run 86**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
86	23	75	0.002290	773.8	0.6840	0.1241	-1.11	209	659	103	-233	146	2685	-0.021	-0.022	127.3
86	24	75	0.002289	773.8	0.6838	0.1245	-0.07	214	1274	85	-220	129	2694	-0.003	-0.014	145.8
86	25	75	0.002288	773.7	0.6836	0.1248	0.94	220	1938	71	-247	77	2846	0.004	-0.012	164.0
86	26	75	0.002288	773.3	0.6833	0.1252	1.97	221	2593	57	-242	24	3127	-0.028	-0.003	177.1
86	27	75	0.002287	773.7	0.6835	0.1257	2.94	224	3212	40	-273	1	3491	-0.018	-0.010	186.0
86	28	75	0.002286	773.8	0.6836	0.1259	4.05	226	3881	26	-256	-101	4026	-0.039	0.003	197.4
86	29	75	0.002286	774.0	0.6836	0.1262	5.11	216	4583	20	-258	-323	4634	0.015	0.009	207.4
86	30	75	0.002285	774.3	0.6838	0.1268	6.13	208	5204	0	-237	-420	5320	0.056	0.049	217.0
86	31	75	0.002284	774.0	0.6835	0.1272	7.17	206	5900	-12	-180	-331	6077	0.044	-0.049	224.7
86	32	75	0.002284	774.7	0.6839	0.1254	8.19	218	6551	-52	-91	-299	6886	-0.036	-0.028	232.3
86	33	75	0.002283	774.5	0.6836	0.1258	9.25	203	7195	-86	-33	-276	7811	0.002	-0.001	239.3
86	34	75	0.002282	774.7	0.6838	0.1261	10.40	211	7867	-119	10	-240	8906	-0.052	-0.012	240.6
86	35	75	0.002282	774.6	0.6834	0.1237	2.99	218	3242	84	-233	-591	3511	-0.021	-0.018	183.5

**Table 7g. TTR/699 performance data for run 87**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
87	15	75	0.002255	778.2	0.6836	<b>0.1508</b>	3.40	225	3193	18	282	782	3613	-0.046	-0.040	235.3
87	16	75	0.002254	778.4	0.6835	<b>0.1495</b>	-0.55	219	541	93	232	610	2627	0.025	-0.025	182.2
87	17	75	0.002253	778.6	0.6837	<b>0.1496</b>	0.48	225	1259	76	218	588	2704	0.017	-0.007	203.1
87	18	75	0.002253	778.5	0.6835	<b>0.1499</b>	1.38	226	1922	60	225	613	2896	-0.025	-0.042	214.3
87	19	75	0.002252	778.4	0.6833	<b>0.1502</b>	2.36	226	2505	38	197	631	3189	0.020	0.022	225.4
87	20	75	0.002251	779.3	0.6840	<b>0.1505</b>	3.39	223	3239	19	197	710	3624	0.021	-0.009	235.9
87	21	75	0.002250	779.1	0.6838	<b>0.1507</b>	4.46	222	3893	1	189	766	4162	0.028	-0.031	246.1
87	22	75	0.002250	779.0	0.6837	<b>0.1513</b>	5.43	225	4521	-26	115	754	4744	0.026	0.002	255.2
87	23	75	0.002250	779.7	0.6842	<b>0.1506</b>	6.43	236	5239	-32	-53	464	5423	0.030	0.019	262.3
87	24	75	0.002249	779.4	0.6839	<b>0.1507</b>	7.50	240	5916	5	-27	-226	6205	-0.017	-0.009	270.2
87	25	75	0.002249	779.1	0.6836	<b>0.1513</b>	8.50	227	6490	-11	22	-224	7025	0.007	-0.003	277.3
87	26	75	0.002249	779.2	0.6836	<b>0.1514</b>	9.50	224	7117	-46	77	-212	7887	-0.024	0.009	282.4
87	27	75	0.002248	779.8	0.6841	<b>0.1516</b>	10.62	210	7775	-53	83	-166	8975	-0.012	-0.043	284.8
87	28	75	0.002248	779.8	0.6840	<b>0.1505</b>	3.36	255	3223	79	-155	27	3625	-0.006	-0.038	232.0
87	36	75	0.002243	779.8	0.6841	<b>0.1751</b>	3.94	293	3155	97	152	-663	3895	-0.145	0.403	241.3
87	37	75	0.002243	779.5	0.6840	<b>0.1753</b>	3.97	276	3140	175	96	-605	3909	0.006	-0.029	240.7
87	38	75	0.002242	779.8	0.6841	<b>0.1748</b>	-0.09	304	551	193	-60	-500	2626	0.012	-0.038	196.9
87	39	75	0.002242	779.5	0.6838	<b>0.1751</b>	0.85	308	1211	178	-72	-553	2739	0.023	0.025	215.2
87	40	75	0.002242	779.5	0.6839	<b>0.1754</b>	1.96	306	1917	164	-45	-571	3018	0.008	0.009	229.2
87	41	75	0.002242	779.6	0.6840	<b>0.1755</b>	2.90	307	2519	156	-57	-540	3359	0.002	-0.034	238.9
87	42	75	0.002242	779.2	0.6836	<b>0.1748</b>	3.86	297	3135	141	-48	-519	3790	0.029	-0.049	247.5
87	43	75	0.002242	779.2	0.6836	<b>0.1753</b>	4.85	289	3763	115	-61	-517	4324	0.068	0.024	258.9
87	44	75	0.002242	779.5	0.6839	<b>0.1754</b>	5.79	285	4435	96	-4	-475	4923	0.004	0.019	267.3
87	45	75	0.002242	779.9	0.6842	<b>0.1755</b>	6.82	277	5159	82	1	-412	5627	0.032	-0.028	273.5
87	46	75	0.002241	779.7	0.6838	<b>0.1751</b>	7.87	274	5754	54	8	-389	6413	0.010	-0.012	283.3
87	47	75	0.002240	779.8	0.6838	<b>0.1754</b>	8.84	275	6409	33	57	-335	7218	-0.048	-0.044	288.8
87	48	75	0.002240	780.4	0.6844	<b>0.1755</b>	9.93	263	7084	0	65	-306	8170	-0.025	-0.028	293.2

87	49	75	0.002239	779.9	0.6838	<b>0.1762</b>	11.07	250	7727	-20	103	-253	9298	-0.058	-0.054	296.3
87	50	75	0.002239	779.6	0.6836	<b>0.1758</b>	3.78	315	3203	139	-20	-596	3744	-0.108	-0.057	245.0
87	51	75	0.002234	779.7	0.6839	<b>0.2005</b>	4.47	364	3135	167	-177	-607	3980	0.009	-0.022	261.1
87	52	75	0.002234	779.8	0.6839	<b>0.1995</b>	0.47	379	396	224	-168	-693	2520	0.004	0.003	218.6
87	53	75	0.002234	779.7	0.6838	<b>0.1994</b>	1.55	372	1152	200	-213	-697	2747	0.104	-0.015	233.9
87	54	75	0.002233	779.8	0.6838	<b>0.1996</b>	2.52	375	1834	186	-137	-658	3076	-0.013	-0.027	243.2
87	55	75	0.002233	779.9	0.6838	<b>0.2003</b>	3.57	368	2530	178	-110	-636	3521	-0.023	-0.024	254.8
87	56	75	0.002232	779.6	0.6835	<b>0.1999</b>	4.42	350	3098	158	-129	-624	3952	0.052	0.035	264.0
87	57	75	0.002233	780.2	0.6841	<b>0.2006</b>	5.42	342	3638	167	-129	-551	4534	0.076	-0.026	277.0
87	58	75	0.002233	780.4	0.6843	<b>0.2005</b>	6.57	329	4451	128	-91	-489	5327	0.081	0.017	286.0
87	59	75	0.002233	780.1	0.6840	<b>0.2010</b>	7.42	334	5013	128	-52	-429	5928	0.006	-0.061	292.2
87	60	75	0.002232	780.1	0.6840	<b>0.1999</b>	8.47	319	5702	97	-35	-376	6773	0.025	-0.050	297.6
87	61	75	0.002233	780.0	0.6840	<b>0.1999</b>	9.51	328	6384	63	-10	-328	7627	-0.030	-0.050	301.8
87	62	75	0.002232	780.4	0.6843	<b>0.2002</b>	10.75	280	7026	47	-36	-285	8835	0.067	-0.041	311.7
87	63	75	0.002232	779.8	0.6837	<b>0.2000</b>	4.51	364	3150	172	-39	-572	4006	-0.097	-0.074	265.2

**Table 7h. TTR/699 performance data for run 88**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
88	13	75	0.002281	772.3	0.6841	<b>0.2249</b>	4.97	380	3034	76	409	810	4095	-0.015	-0.025	227.7
88	14	75	0.002277	772.7	0.6838	<b>0.2237</b>	1.06	402	457	132	328	473	2464	0.019	0.019	183.8
88	15	75	0.002277	772.7	0.6839	<b>0.2251</b>	2.20	398	1214	123	326	553	2781	0.069	-0.042	199.7
88	16	75	0.002276	772.7	0.6837	<b>0.2250</b>	3.00	390	1724	119	344	625	3080	0.013	-0.048	211.9
88	17	75	0.002275	773.0	0.6838	<b>0.2250</b>	4.10	394	2466	99	350	727	3601	-0.005	-0.035	221.8
88	18	75	0.002275	773.2	0.6840	<b>0.2252</b>	5.10	386	3196	64	360	849	4197	-0.027	-0.021	229.9
88	19	75	0.002274	773.1	0.6838	<b>0.2255</b>	6.04	382	3776	58	332	968	4791	-0.011	-0.040	237.4
88	20	75	0.002274	773.4	0.6840	<b>0.2260</b>	7.02	362	4330	54	258	1055	5450	0.090	-0.071	247.8
88	21	75	0.002274	773.1	0.6837	<b>0.2256</b>	8.15	359	5033	12	129	964	6323	0.087	0.065	254.6
88	22	75	0.002273	773.5	0.6841	<b>0.2262</b>	9.16	377	5663	73	-150	108	7174	0.091	-0.004	260.7
88	23	75	0.002272	773.4	0.6838	<b>0.2265</b>	10.24	363	6393	97	44	-143	8138	-0.035	-0.089	262.6
88	24	75	0.002272	773.6	0.6839	<b>0.2253</b>	11.39	302	6969	34	8	-197	9296	0.131	0.066	267.1
88	25	75	0.002271	774.0	0.6841	<b>0.2253</b>	5.06	405	3034	114	-32	390	4142	0.029	0.049	229.0
88	26	75	0.002263	774.0	0.6841	<b>0.2504</b>	7.36	476	4237	151	20	-309	5548	-0.014	-0.043	251.8
88	27	75	0.002262	774.2	0.6842	<b>0.2504</b>	8.62	462	4992	131	32	-256	6546	-0.010	-0.043	261.8
88	28	75	0.002261	774.6	0.6845	<b>0.2505</b>	9.63	456	5594	92	43	-230	7381	-0.010	0.017	267.1
88	29	75	0.002261	774.6	0.6844	<b>0.2510</b>	10.90	439	6335	75	62	-196	8545	-0.010	0.023	270.6
88	30	75	0.002260	774.4	0.6841	<b>0.2502</b>	7.52	481	4264	148	22	-347	5660	-0.058	-0.002	251.0

**Table 7i. TTR/699 performance data for run 89**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
89	14	60	0.002266	778.0	0.6841	<b>0.1509</b>	6.57	232	3220	-36	80	763	4982	-0.034	0.004	276.7
89	22	60	0.002264	777.8	0.6839	<b>0.1506</b>	6.61	247	3266	55	-116	-409	5036	-0.016	-0.003	278.7
89	23	60	0.002264	778.1	0.6840	<b>0.1501</b>	2.70	254	549	58	-141	221	2374	0.051	-0.039	240.4
89	24	60	0.002263	778.0	0.6839	<b>0.1504</b>	3.71	250	1281	39	-121	314	2930	0.051	-0.041	250.6
89	25	60	0.002264	777.8	0.6838	<b>0.1512</b>	4.68	247	1906	30	-143	342	3507	0.063	-0.038	261.2
89	26	60	0.002264	777.7	0.6837	<b>0.1505</b>	5.65	255	2624	31	-166	72	4251	-0.042	-0.009	270.0
89	27	60	0.002264	777.3	0.6834	<b>0.1506</b>	6.48	243	3166	35	-192	-143	4906	0.031	0.027	278.0
89	28	60	0.002263	777.7	0.6837	<b>0.1508</b>	7.50	232	3878	40	-153	-269	5839	0.057	-0.027	285.7
89	29	60	0.002263	778.1	0.6840	<b>0.1497</b>	8.51	226	4616	10	-55	-231	6848	0.002	0.009	296.1
89	30	60	0.002263	778.2	0.6840	<b>0.1504</b>	9.43	220	5216	4	-15	-176	7789	-0.008	-0.023	299.4
89	31	60	0.002262	777.7	0.6836	<b>0.1509</b>	10.41	211	5881	-33	20	-164	8876	-0.001	0.042	302.7
89	32	60	0.002262	778.3	0.6840	<b>0.1512</b>	11.45	188	6513	-34	19	-104	10082	0.039	-0.023	310.1
89	33	60	0.002262	778.3	0.6840	<b>0.1506</b>	12.40	188	7195	-59	49	-107	11299	0.018	-0.001	310.9
89	34	60	0.002261	778.4	0.6840	<b>0.1507</b>	13.34	157	7803	-90	44	-124	12535	0.075	0.039	310.2
89	35	60	0.002261	778.4	0.6840	<b>0.1501</b>	6.52	240	3243	65	-116	-356	4980	0.007	-0.065	273.8
89	36	60	0.002257	778.5	0.6844	<b>0.1747</b>	7.45	302	3218	76	-111	-405	5310	-0.034	-0.003	296.4
89	37	60	0.002257	778.1	0.6840	<b>0.1756</b>	3.73	334	511	103	-262	-181	2279	-0.003	0.006	265.2
89	38	60	0.002258	778.1	0.6842	<b>0.1744</b>	4.66	326	1186	97	-265	-286	2906	0.015	0.025	275.5
89	39	60	0.002258	777.8	0.6839	<b>0.1749</b>	5.61	320	1901	102	-218	-388	3676	-0.021	-0.002	282.0
89	40	60	0.002258	777.5	0.6836	<b>0.1756</b>	6.62	310	2620	93	-161	-447	4532	-0.002	-0.016	290.7
89	41	60	0.002258	778.0	0.6841	<b>0.1758</b>	7.50	300	3182	78	-141	-460	5323	0.001	0.041	299.5
89	42	60	0.002258	778.3	0.6844	<b>0.1754</b>	8.36	277	3766	60	-135	-396	6178	0.088	0.041	303.7
89	43	60	0.002257	777.9	0.6839	<b>0.1757</b>	9.37	277	4483	35	-45	-338	7275	-0.011	0.049	310.6
89	44	60	0.002257	777.9	0.6839	<b>0.1748</b>	10.39	264	5172	22	-23	-288	8437	-0.018	0.012	317.4
89	45	60	0.002257	778.0	0.6839	<b>0.1754</b>	11.38	246	5827	9	-2	-238	9602	0.029	-0.006	322.1
89	46	60	0.002256	778.4	0.6842	<b>0.1754</b>	12.30	234	6463	-21	17	-230	10776	0.023	0.050	325.9
89	47	60	0.002256	778.0	0.6838	<b>0.1758</b>	13.27	216	7059	-39	19	-212	12067	0.043	0.067	328.0
89	48	60	0.002256	778.5	0.6843	<b>0.1756</b>	7.46	312	3161	85	-144	-458	5292	-0.061	-0.007	299.4

**Table 7j. TTR/699 performance data for run 90**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
90	13	<b>60</b>	0.002304	769.5	0.6840	<b>0.2003</b>	8.74	353	3252	18	3	798	5796	0.005	-0.052	312.4
90	14	<b>60</b>	0.002302	769.6	0.6838	<b>0.2007</b>	4.96	376	515	63	169	514	2177	0.081	0.042	279.7
90	15	<b>60</b>	0.002301	769.4	0.6836	<b>0.2013</b>	5.88	371	1215	54	211	641	2969	-0.032	-0.009	287.6
90	16	<b>60</b>	0.002300	769.7	0.6837	<b>0.2019</b>	6.81	363	1846	46	177	750	3784	0.003	-0.004	297.1
90	17	<b>60</b>	0.002300	770.2	0.6841	<b>0.1999</b>	7.79	353	2614	27	153	794	4823	-0.023	-0.034	303.7
90	18	<b>60</b>	0.002299	770.3	0.6841	<b>0.1999</b>	8.59	346	3149	22	120	782	5648	-0.025	-0.040	311.1
90	19	<b>60</b>	0.002298	770.1	0.6838	<b>0.2003</b>	9.65	342	3915	23	9	484	6850	-0.004	0.005	317.1
90	20	<b>60</b>	0.002298	770.6	0.6842	<b>0.2007</b>	10.58	323	4474	54	24	-34	7885	0.031	0.020	321.6
90	21	<b>60</b>	0.002297	770.9	0.6843	<b>0.2013</b>	11.56	313	5151	37	116	-15	9118	-0.008	0.011	325.1
90	22	<b>60</b>	0.002297	770.2	0.6837	<b>0.2002</b>	12.62	280	5910	28	151	27	10561	0.007	-0.014	326.1
90	23	<b>60</b>	0.002297	771.0	0.6844	<b>0.2002</b>	13.40	277	6475	3	160	47	11683	-0.014	-0.002	327.2
90	24	<b>60</b>	0.002297	771.1	0.6843	<b>0.1997</b>	8.73	356	3276	88	-47	-133	5822	0.000	-0.036	310.2
90	25	<b>60</b>	0.002290	770.8	0.6843	<b>0.2257</b>	9.71	435	3147	115	-6	-263	6013	-0.004	-0.009	330.7
90	26	<b>60</b>	0.002289	770.7	0.6840	<b>0.2250</b>	7.77	465	1800	146	-125	-343	3866	0.003	-0.016	315.5
90	34	<b>60</b>	0.002286	770.9	0.6837	<b>0.2249</b>	7.84	460	1903	154	-67	-527	3996	-0.011	-0.014	315.7
90	35	<b>60</b>	0.002285	770.9	0.6837	<b>0.2248</b>	5.90	474	489	115	9	230	2044	0.040	0.003	300.0
90	36	<b>60</b>	0.002285	771.2	0.6839	<b>0.2254</b>	6.97	466	1200	98	4	391	2987	0.065	-0.032	310.9
90	37	<b>60</b>	0.002285	770.9	0.6837	<b>0.2257</b>	7.78	458	1795	95	21	368	3835	-0.030	-0.006	316.8
90	38	<b>60</b>	0.002284	770.8	0.6834	<b>0.2260</b>	8.84	453	2563	100	-27	13	5030	-0.035	0.006	323.4
90	39	<b>60</b>	0.002284	771.3	0.6838	<b>0.2248</b>	9.84	422	3242	119	25	-275	6198	-0.025	0.021	329.3
90	40	<b>60</b>	0.002283	771.1	0.6836	<b>0.2252</b>	10.57	402	3752	111	4	-286	7092	0.047	0.017	331.1
90	41	<b>60</b>	0.002283	771.5	0.6838	<b>0.2253</b>	11.22	402	4191	115	80	-214	7909	-0.049	-0.045	336.6
90	42	<b>60</b>	0.002282	772.2	0.6845	<b>0.2253</b>	7.79	467	1909	154	-4	-486	3985	-0.122	0.005	314.5
90	43	<b>60</b>	0.002274	772.2	0.6845	<b>0.2507</b>	8.85	565	1732	172	-102	-541	3880	0.044	0.021	338.9
90	44	<b>60</b>	0.002274	772.1	0.6843	<b>0.2496</b>	7.06	591	570	135	-110	-44	2054	0.012	0.016	323.3
90	45	<b>60</b>	0.002273	772.2	0.6844	<b>0.2503</b>	7.97	580	1185	125	-65	101	2964	-0.031	-0.015	331.6

90	46	<b>60</b>	0.002272	772.2	0.6842	<b>0.2505</b>	8.92	563	1760	130	-82	31	3929	0.029	0.004	341.7
90	47	<b>60</b>	0.002272	771.5	0.6836	<b>0.2512</b>	9.94	544	2472	137	-70	-150	5175	0.022	0.015	347.6
90	48	<b>60</b>	0.002270	771.0	0.6829	<b>0.2507</b>	10.78	511	3182	113	-32	-321	6412	0.042	0.067	345.6
90	49	<b>60</b>	0.002270	772.6	0.6842	<b>0.2498</b>	8.92	565	1843	162	-91	-464	4051	-0.004	0.003	338.9
90	58	<b>45</b>	0.002278	773.4	0.6837	<b>0.2002</b>	11.99	303	3194	113	85	-308	7227	-0.012	-0.007	398.3
90	66	<b>45</b>	0.002275	773.9	0.6839	<b>0.1998</b>	11.98	297	3172	114	130	-315	7190	-0.004	0.018	399.5
90	67	<b>45</b>	0.002274	774.3	0.6841	<b>0.1998</b>	8.39	376	531	151	-86	-604	2073	-0.030	-0.012	371.7
90	68	<b>45</b>	0.002274	774.8	0.6845	<b>0.2001</b>	9.44	353	1250	152	-21	-573	3351	0.007	-0.012	383.4
90	69	<b>45</b>	0.002273	774.5	0.6842	<b>0.2008</b>	10.30	338	1823	140	10	-506	4474	0.011	0.013	391.1
90	70	<b>45</b>	0.002273	774.1	0.6838	<b>0.1998</b>	11.15	317	2523	118	71	-405	5856	0.018	0.010	395.1
90	71	<b>45</b>	0.002273	774.0	0.6837	<b>0.2006</b>	12.10	298	3214	121	139	-284	7302	-0.004	-0.031	401.1
90	72	<b>45</b>	0.002272	774.2	0.6838	<b>0.2006</b>	13.03	284	3845	89	181	-209	8755	-0.008	0.019	406.3
90	73	<b>45</b>	0.002272	774.0	0.6837	<b>0.2016</b>	13.95	262	4520	80	161	-119	10319	0.041	0.010	408.3
90	74	<b>45</b>	0.002272	773.9	0.6834	<b>0.2003</b>	14.83	249	5174	49	147	-69	11895	0.022	0.045	409.3
90	75	<b>45</b>	0.002271	774.3	0.6837	<b>0.2004</b>	15.73	237	5819	46	123	-53	13509	0.006	0.017	408.5
90	76	<b>45</b>	0.002270	774.0	0.6834	<b>0.2008</b>	16.76	220	6535	39	87	-90	15428	-0.021	0.015	403.7
90	77	<b>45</b>	0.002270	775.3	0.6844	<b>0.1998</b>	11.94	318	3136	110	18	-298	7131	-0.016	-0.037	398.9
90	66	<b>45</b>	0.002275	773.9	0.6839	<b>0.1998</b>	11.98	297	3172	114	130	-315	7190	-0.004	0.018	399.5
90	67	<b>45</b>	0.002274	774.3	0.6841	<b>0.1998</b>	8.39	376	531	151	-86	-604	2073	-0.030	-0.012	371.7

**Table 7k. TTR/699 performance data for run 91**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
91	15	45	0.002274	771.1	0.6842	<b>0.2251</b>	13.40	361	3143	-61	178	2116	7782	0.030	-0.019	421.6
91	16	45	0.002271	771.4	0.6840	<b>0.2246</b>	9.93	443	675	49	121	834	2337	0.005	-0.042	396.8
91	17	45	0.002270	771.9	0.6843	<b>0.2252</b>	10.83	421	1240	26	203	1138	3516	-0.021	0.005	406.1
91	18	45	0.002269	771.4	0.6837	<b>0.2247</b>	11.73	396	1975	-10	244	1513	5064	0.007	0.034	409.7
91	19	45	0.002269	771.2	0.6834	<b>0.2245</b>	12.48	370	2527	-22	236	1837	6309	0.064	-0.035	414.2
91	20	45	0.002268	771.9	0.6839	<b>0.2252</b>	13.48	363	3229	-80	268	2115	7985	-0.002	0.061	419.1
91	21	45	0.002267	771.3	0.6833	<b>0.2253</b>	14.38	348	3927	-100	149	2392	9658	0.013	0.031	420.1
91	22	45	0.002266	772.3	0.6841	<b>0.2246</b>	15.12	338	4458	-110	17	2559	11033	0.027	-0.002	422.6
91	23	45	0.002265	771.9	0.6836	<b>0.2255</b>	16.15	342	5124	-106	-451	2630	12885	0.047	-0.051	418.0
91	24	45	0.002263	772.9	0.6842	<b>0.2247</b>	13.40	411	3192	-53	-352	2008	7891	0.015	-0.026	415.9
91	25	45	0.002256	772.7	0.6842	<b>0.2498</b>	14.90	494	3194	-43	-297	2082	8500	-0.005	0.019	444.7
91	26	45	0.002254	773.0	0.6841	<b>0.2502</b>	11.39	561	593	74	26	725	2160	-0.010	-0.010	429.5
91	27	45	0.002254	773.2	0.6843	<b>0.2498</b>	12.30	541	1295	38	46	1192	3754	-0.011	-0.036	435.6
91	28	45	0.002253	772.9	0.6840	<b>0.2509</b>	13.20	510	1811	9	4	1506	5035	0.089	-0.015	445.2
91	29	45	0.002253	772.7	0.6837	<b>0.2516</b>	14.26	506	2665	-39	28	1961	7143	-0.029	0.018	447.2
91	30	45	0.002252	772.8	0.6837	<b>0.2519</b>	14.89	496	3117	-39	-18	2204	8328	-0.056	-0.029	449.8
91	31	45	0.002250	773.3	0.6838	<b>0.2504</b>	15.93	470	3886	-82	-453	2381	10421	0.060	0.028	448.0
91	32	45	0.002250	773.7	0.6842	<b>0.2499</b>	14.88	505	3166	-54	-409	2127	8463	-0.035	0.001	445.6

**Table 71. TTR/699 performance data for run 93**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
93	13	<b>45</b>	0.002240	774.7	0.6841	<b>0.2762</b>	14.87	620	1952	20	187	1612	5606	-0.023	0.039	483.8
93	21	<b>45</b>	0.002233	776.9	0.6848	<b>0.2752</b>	14.68	622	1873	52	75	1550	5335	0.031	-0.020	485.2
93	22	<b>45</b>	0.002233	776.5	0.6844	<b>0.2740</b>	12.93	670	591	117	84	426	2018	0.052	0.029	475.6
93	23	<b>45</b>	0.002232	775.8	0.6836	<b>0.2750</b>	13.85	646	1245	96	112	856	3694	0.004	-0.047	479.0
93	24	<b>45</b>	0.002231	775.3	0.6832	<b>0.2755</b>	14.65	634	1866	72	59	1107	5333	-0.019	-0.019	480.8
93	25	<b>45</b>	0.002230	775.4	0.6832	<b>0.2765</b>	15.77	620	2595	132	-260	588	7374	0.015	-0.101	487.0
93	26	<b>45</b>	0.002230	775.3	0.6831	<b>0.2771</b>	16.52	587	3096	148	-268	19	8840	0.094	-0.030	487.9
93	27	<b>45</b>	0.002230	775.7	0.6834	<b>0.2756</b>	14.71	643	1884	176	-255	-150	5379	0.064	-0.022	480.5
93	28	<b>45</b>	0.002221	776.3	0.6839	<b>0.2984</b>	14.36	807	601	145	-25	340	1933	0.056	0.002	503.1
93	29	<b>45</b>	0.002220	776.0	0.6836	<b>0.2992</b>	15.28	783	1261	123	-40	637	3781	-0.001	0.036	507.1
93	30	<b>45</b>	0.002220	775.0	0.6826	<b>0.3000</b>	16.06	769	1821	122	-148	727	5377	0.013	0.006	508.2
93	31	<b>45</b>	0.002220	776.4	0.6839	<b>0.2986</b>	14.27	813	533	157	-58	276	1752	0.095	0.010	501.6
93	34	<b>30</b>	0.002242	776.9	0.6837	<b>0.2253</b>	14.65	322	1925	135	-50	-236	5924	0.019	-0.014	506.1
93	42	<b>30</b>	0.002242	776.9	0.6838	<b>0.2256</b>	14.73	321	1982	129	59	-239	6091	-0.039	-0.031	506.6
93	43	<b>30</b>	0.002242	776.8	0.6838	<b>0.2264</b>	13.22	360	746	89	-34	286	2828	0.009	0.005	498.0
93	44	<b>30</b>	0.002243	777.0	0.6840	<b>0.2251</b>	13.86	346	1329	95	-57	207	4356	-0.029	-0.004	500.1
93	45	<b>30</b>	0.002242	776.5	0.6836	<b>0.2255</b>	14.75	324	1968	104	1	19	6065	0.000	-0.013	505.7
93	46	<b>30</b>	0.002242	777.1	0.6840	<b>0.2246</b>	15.50	296	2586	99	58	-38	7756	0.035	0.052	509.8
93	47	<b>30</b>	0.002242	777.0	0.6839	<b>0.2258</b>	16.43	270	3277	99	102	93	9758	0.061	-0.006	513.1
93	48	<b>30</b>	0.002242	777.0	0.6839	<b>0.2257</b>	17.19	256	3860	84	136	133	11500	0.011	0.009	513.9
93	49	<b>30</b>	0.002241	777.1	0.6839	<b>0.2250</b>	18.11	235	4658	90	121	176	13831	0.054	-0.026	510.1
93	50	<b>30</b>	0.002242	776.4	0.6834	<b>0.2255</b>	18.92	229	5213	81	89	167	15642	0.009	-0.034	507.4
93	51	<b>30</b>	0.002241	776.1	0.6830	<b>0.2259</b>	19.56	218	5654	80	3	81	17071	0.053	-0.029	504.8
93	52	<b>30</b>	0.002241	777.2	0.6840	<b>0.2249</b>	14.69	321	1926	128	-21	-211	5942	-0.003	-0.017	505.3

93	53	<b>30</b>	0.002234	776.4	0.6835	<b>0.2508</b>	16.39	409	1927	151	-47	-214	6369	0.015	-0.004	544.7
93	54	<b>30</b>	0.002234	777.0	0.6840	<b>0.2501</b>	15.52	438	1275	162	-151	-436	4443	0.028	0.024	540.0
93	55	<b>30</b>	0.002234	776.6	0.6836	<b>0.2490</b>	14.65	462	617	127	-217	-15	2550	0.057	0.002	534.4
93	56	<b>30</b>	0.002234	776.6	0.6837	<b>0.2498</b>	15.58	435	1321	148	-169	-200	4566	0.060	0.003	541.2
93	57	<b>30</b>	0.002234	777.3	0.6843	<b>0.2505</b>	16.32	408	1889	142	-75	-227	6247	0.023	0.052	545.3
93	58	<b>30</b>	0.002233	776.8	0.6838	<b>0.2513</b>	17.21	383	2550	141	-41	-43	8273	0.047	-0.030	548.0
93	59	<b>30</b>	0.002234	777.1	0.6841	<b>0.2494</b>	18.01	348	3292	116	-7	25	10531	0.066	0.022	546.8
93	60	<b>30</b>	0.002233	776.7	0.6837	<b>0.2503</b>	18.82	339	3874	115	34	98	12433	0.021	-0.041	545.0
93	61	<b>30</b>	0.002233	776.7	0.6836	<b>0.2506</b>	19.75	332	4632	112	3	99	14924	-0.014	-0.011	539.5
93	62	<b>30</b>	0.002232	776.7	0.6836	<b>0.2512</b>	20.54	302	5189	124	-70	14	16889	0.025	-0.034	537.2
93	63	<b>30</b>	0.002233	778.3	0.6850	<b>0.2498</b>	16.42	412	2009	142	-103	-219	6586	-0.012	0.026	548.0
93	64	<b>30</b>	0.002226	777.4	0.6846	<b>0.2753</b>	18.09	501	1976	169	-141	-201	6922	0.034	0.018	583.0
93	65	<b>30</b>	0.002227	777.3	0.6845	<b>0.2753</b>	16.50	576	694	172	-310	-299	2851	-0.009	-0.006	578.6
93	66	<b>30</b>	0.002225	777.4	0.6844	<b>0.2753</b>	17.33	539	1360	176	-254	-316	4959	0.010	-0.006	581.4
93	67	<b>30</b>	0.002226	776.6	0.6838	<b>0.2748</b>	18.10	509	1967	154	-223	-164	6935	0.010	0.036	581.2
93	68	<b>30</b>	0.002226	776.4	0.6837	<b>0.2750</b>	18.89	479	2643	147	-207	-18	9142	0.015	0.003	580.5
93	69	<b>30</b>	0.002225	776.7	0.6838	<b>0.2756</b>	19.63	460	3192	125	-143	52	11054	0.010	0.068	580.6
93	70	<b>30</b>	0.002224	776.7	0.6837	<b>0.2754</b>	20.39	428	3811	131	-190	96	13216	0.034	0.045	576.5
93	71	<b>30</b>	0.002225	775.8	0.6831	<b>0.2762</b>	21.29	424	4535	124	-216	70	15804	-0.037	0.017	567.0
93	72	<b>30</b>	0.002225	776.0	0.6832	<b>0.2753</b>	21.58	413	4812	96	-224	-2	16769	-0.025	0.129	563.8
93	73	<b>30</b>	0.002226	777.5	0.6846	<b>0.2747</b>	17.90	532	1808	161	-416	-293	6366	0.050	0.048	583.3

**Table 7m. TTR/699 performance data for run 94**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
94	11	<b>30</b>	0.002275	768.8	0.6842	<b>0.3005</b>	19.69	602	1927	8	37	2044	7214	-0.022	0.002	594.5
94	19	<b>30</b>	0.002264	769.1	0.6828	<b>0.3000</b>	19.59	601	1919	17	40	2051	7076	0.002	-0.027	591.0
94	20	<b>30</b>	0.002261	771.3	0.6844	<b>0.3002</b>	17.99	678	590	110	-17	595	2450	0.012	0.030	591.7
94	21	<b>30</b>	0.002260	771.0	0.6840	<b>0.3005</b>	18.93	642	1349	81	-61	1080	5057	0.005	0.015	592.9
94	22	<b>30</b>	0.002260	771.2	0.6840	<b>0.3002</b>	19.68	626	1943	103	-265	871	7212	-0.011	-0.012	592.5
94	23	<b>30</b>	0.002259	771.7	0.6844	<b>0.3000</b>	20.49	575	2622	155	-230	253	9674	0.067	-0.005	591.6
94	24	<b>30</b>	0.002257	771.2	0.6838	<b>0.3006</b>	21.19	554	3195	149	-179	301	11787	0.013	0.006	586.4
94	25	<b>30</b>	0.002257	771.6	0.6841	<b>0.3016</b>	22.10	520	3852	151	-280	300	14383	0.051	-0.010	582.3
94	26	<b>30</b>	0.002255	771.2	0.6834	<b>0.3002</b>	22.57	487	4302	165	-319	241	16069	0.073	-0.036	569.8
94	27	<b>30</b>	0.002256	772.1	0.6843	<b>0.3007</b>	19.76	623	2018	159	-205	157	7480	-0.006	0.005	590.8
94	28	<b>30</b>	0.002247	772.6	0.6851	<b>0.3249</b>	21.19	737	1890	190	-205	76	7392	0.009	-0.007	621.4
94	29	<b>30</b>	0.002246	771.5	0.6839	<b>0.3245</b>	19.50	801	516	142	-88	376	2245	0.030	0.003	623.0
94	30	<b>30</b>	0.002246	771.5	0.6838	<b>0.3249</b>	20.49	768	1315	136	-172	642	5229	0.039	0.000	622.0
94	31	<b>30</b>	0.002245	771.4	0.6837	<b>0.3254</b>	21.33	723	1951	178	-242	236	7703	0.031	-0.034	622.1
94	32	<b>30</b>	0.002244	772.0	0.6841	<b>0.3256</b>	22.02	702	2590	188	-109	201	10119	0.006	-0.046	618.0
94	33	<b>30</b>	0.002244	771.6	0.6836	<b>0.3261</b>	22.62	664	3008	172	-60	253	11880	0.009	-0.022	610.0
94	34	<b>30</b>	0.002244	771.7	0.6838	<b>0.3251</b>	21.30	729	2015	191	-139	-19	7843	-0.014	0.016	618.5
94	35	<b>30</b>	0.002235	771.8	0.6841	<b>0.3503</b>	21.24	959	603	169	-228	248	2613	0.028	0.010	652.6
94	36	<b>30</b>	0.002233	771.6	0.6837	<b>0.3505</b>	22.14	908	1326	175	-296	305	5538	0.054	-0.008	651.2
94	37	<b>30</b>	0.002234	771.8	0.6839	<b>0.3508</b>	22.51	886	1647	218	-281	-10	6852	0.018	0.008	649.8
94	38	<b>30</b>	0.002234	771.7	0.6839	<b>0.3504</b>	22.09	911	1299	217	-317	-166	5433	-0.027	0.007	650.7
94	48	<b>80</b>	0.002295	774.6	0.6843	<b>0.1251</b>	1.82	214	3156	65	-87	-540	3069	0.010	-0.023	155.3
94	49	<b>80</b>	0.002295	774.1	0.6839	<b>0.1248</b>	-2.15	202	672	135	-144	-520	2766	0.034	-0.010	92.1
94	50	<b>80</b>	0.002295	774.1	0.6840	<b>0.1251</b>	-1.24	203	1240	117	-135	-540	2637	0.070	0.000	110.3
94	51	<b>80</b>	0.002294	774.1	0.6839	<b>0.1254</b>	-0.32	214	1840	104	-93	-560	2631	-0.012	-0.005	128.2

94	52	<b>80</b>	0.002295	774.3	0.6841	<b>0.1253</b>	0.76	215	2498	85	-105	-570	2790	0.009	0.008	145.7
94	53	<b>80</b>	0.002294	774.5	0.6842	<b>0.1252</b>	1.87	210	3206	64	-84	-569	3100	0.025	-0.017	161.0
94	54	<b>80</b>	0.002294	774.8	0.6844	<b>0.1253</b>	2.87	212	3833	38	-52	-579	3474	-0.005	0.007	171.8
94	55	<b>80</b>	0.002294	774.6	0.6842	<b>0.1250</b>	4.05	203	4580	5	-46	-548	4016	0.036	-0.001	181.6
94	56	<b>80</b>	0.002294	775.0	0.6846	<b>0.1250</b>	5.08	216	5254	-26	13	-501	4574	-0.047	-0.016	191.2
94	57	<b>80</b>	0.002294	774.8	0.6844	<b>0.1249</b>	5.54	199	5514	-32	21	-486	4865	0.028	-0.013	195.3
94	58	<b>80</b>	0.002294	774.9	0.6845	<b>0.1255</b>	1.89	213	3196	75	-76	-605	3094	0.017	-0.060	159.0

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**Table 7n. TTR/699 performance data for run 95**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
95	11	90	0.002291	774.8	0.6842	0.1256	-0.28	200	3211	-68	376	630	2285	0.006	-0.003	98.5
95	12	90	0.002289	774.7	0.6838	0.1254	-2.78	191	1533	11	384	704	2517	0.029	-0.032	62.0
95	13	90	0.002288	774.7	0.6838	0.1248	-2.22	194	1905	-7	359	678	2399	0.041	-0.037	70.1
95	14	90	0.002288	774.7	0.6838	0.1249	-1.24	196	2574	-37	366	635	2277	0.023	-0.016	85.6
95	15	90	0.002288	774.7	0.6837	0.1252	-0.21	201	3226	-66	367	659	2305	0.010	-0.025	103.0
95	16	90	0.002287	774.7	0.6836	0.1251	0.71	200	3828	-95	372	672	2414	0.007	-0.007	118.0
95	17	90	0.002287	775.1	0.6840	0.1251	1.73	197	4548	-127	379	736	2631	0.016	-0.020	130.5
95	18	90	0.002288	775.1	0.6841	0.1249	2.77	185	5248	-163	402	799	2942	0.036	-0.032	142.7
95	19	90	0.002287	775.1	0.6840	0.1250	3.26	186	5546	-173	415	835	3121	-0.001	-0.066	148.0
95	20	90	0.002287	775.1	0.6840	0.1250	-0.22	197	3232	-64	335	633	2295	0.041	-0.021	102.8

**Table 7o. TTR/699 performance data for run 104**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
104	19	0.0	0.002309	653.8	0.5832	0.3104	21.9	-37	507	-81	159	850	3199	0.04	0.04	542.5
104	20	0.0	0.002306	653.3	0.5823	0.3108	21.9	-58	506	-100	-91	793	3200	0.61	0.22	538.7
104	21	0.0	0.002304	653.3	0.5821	0.3107	21.8	-32	469	-67	141	830	3081	0.06	0.00	538.6
104	22	0.0	0.002302	653.4	0.5820	0.3110	21.9	-7	465	-44	367	879	3057	-0.47	-0.20	539.7
104	23	0.0	0.002301	653.6	0.5819	0.3105	21.8	-25	463	-59	139	805	3011	0.01	0.01	538.6
104	24	0.0	0.002299	655.0	0.5830	0.3099	21.8	-44	512	-39	92	1070	3180	0.16	-0.54	541.1
104	25	0.0	0.002298	655.9	0.5836	0.3095	21.8	-23	497	-69	116	833	3114	0.00	0.01	539.4
104	26	0.0	0.002296	655.9	0.5834	0.3095	21.8	4	492	-93	120	597	3105	-0.16	0.57	540.6
104	27	0.0	0.002295	656.0	0.5834	0.3096	21.7	-11	467	-63	90	818	2988	-0.01	0.02	540.0
104	28	0.0	0.002294	655.2	0.5825	0.3107	22.6	-37	964	-109	82	1395	5052	0.09	0.02	537.9
104	29	0.0	0.002293	655.5	0.5826	0.3114	23.3	-32	1426	-149	74	1751	6999	0.05	0.05	536.4
104	30	0.0	0.002291	656.0	0.5829	0.3117	24.2	-38	1945	-170	-22	2163	9231	0.06	0.01	531.7
104	31	0.0	0.002290	655.6	0.5825	0.3121	24.9	-22	2391	-188	-157	2388	11237	0.04	0.01	527.0
104	32	0.0	0.002289	656.8	0.5834	0.3114	25.7	22	2908	-178	-720	2294	13464	0.05	0.02	523.8
104	33	0.0	0.002289	656.5	0.5830	0.3119	26.4	69	3332	-136	-1402	1933	15425	0.05	-0.03	516.7
104	34	0.0	0.002288	656.2	0.5827	0.3130	27.1	153	3718	-47	-2411	577	17282	0.05	0.03	509.6
104	35	0.0	0.002287	656.7	0.5830	0.3118	26.4	-41	3317	-1	-14	161	15377	0.07	0.00	514.7
104	36	0.0	0.002286	657.5	0.5835	0.3110	25.6	-41	2872	-13	-65	129	13317	0.07	0.04	520.5
104	37	0.0	0.002286	657.0	0.5830	0.3115	24.8	-28	2396	-5	-84	97	11165	0.05	0.02	524.5
104	38	0.0	0.002285	657.4	0.5833	0.3122	24.1	-23	1911	-7	-85	107	9081	0.01	0.01	529.0
104	39	0.0	0.002285	657.9	0.5837	0.3108	23.2	-13	1392	-2	-235	-132	6794	0.04	0.07	534.7
104	40	0.0	0.002285	657.0	0.5829	0.3115	22.6	-9	924	19	-244	-274	4881	0.06	0.03	534.5
104	41	0.0	0.002284	656.9	0.5826	0.3100	21.8	10	511	33	-312	-469	3140	0.03	0.01	534.4

Table 7p. TTR/699 performance data for run 105

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
105	13	0	0.002300	774.3	0.6839	<b>0.1336</b>	8.14	-22	661	-41	137	449	2480	0.066	0.005	370.3
105	14	0	0.002298	774.2	0.6836	<b>0.1332</b>	9.00	-30	1320	-58	174	673	3608	0.043	0.004	378.5
105	15	0	0.002298	774.2	0.6835	<b>0.1342</b>	9.98	-36	1995	-75	206	917	4896	0.041	0.002	388.3
105	16	0	0.002297	774.7	0.6838	<b>0.1332</b>	10.81	-36	2674	-81	144	1002	6222	0.049	0.007	392.9
105	17	0	0.002295	774.7	0.6836	<b>0.1336</b>	11.75	-28	3347	-16	-21	136	7688	0.047	0.018	403.0
105	18	0	0.002295	774.9	0.6837	<b>0.1334</b>	12.59	-51	4017	12	164	-303	9105	0.054	0.050	403.1
105	19	0	0.002294	775.1	0.6838	<b>0.1338</b>	13.52	-62	4670	14	259	-262	10625	0.054	0.039	405.4
105	20	0	0.002293	775.3	0.6837	<b>0.1336</b>	14.41	-71	5359	11	358	-247	12250	0.040	0.053	406.0
105	21	0	0.002292	775.3	0.6836	<b>0.1340</b>	15.30	-67	5978	21	352	-259	13827	0.040	-0.004	413.0
105	22	0	0.002291	775.7	0.6837	<b>0.1332</b>	16.22	-68	6738	28	255	-365	15691	0.050	0.011	415.9
105	23	0	0.002290	776.1	0.6840	<b>0.1342</b>	17.06	-68	7309	33	250	-480	17317	0.056	0.027	414.6
105	24	0	0.002289	776.1	0.6840	<b>0.1338</b>	17.27	-70	7505	36	242	-514	17789	0.055	0.031	422.5
105	25	0	0.002289	776.3	0.6841	<b>0.1338</b>	8.18	-30	684	-16	203	166	2498	0.040	0.043	365.4
105	26	0	0.002287	776.0	0.6841	<b>0.1567</b>	9.98	-27	658	-20	138	186	2558	0.041	0.022	416.8
105	27	0	0.002287	775.6	0.6838	<b>0.1560</b>	10.79	-37	1320	-39	157	402	3894	0.060	0.043	426.0
105	28	0	0.002287	775.9	0.6840	<b>0.1571</b>	11.76	-37	2019	-51	161	598	5453	0.032	0.026	434.2
105	29	0	0.002287	775.8	0.6840	<b>0.1556</b>	12.46	-39	2651	-35	89	375	6838	0.031	0.041	436.6
105	30	0	0.002286	775.7	0.6838	<b>0.1563</b>	13.40	-52	3314	6	107	-89	8470	0.069	0.043	440.7
105	31	0	0.002286	775.8	0.6839	<b>0.1569</b>	14.33	-63	4009	14	225	-94	10203	0.056	0.000	448.1
105	32	0	0.002286	775.9	0.6839	<b>0.1561</b>	15.15	-69	4682	1	348	-63	11890	0.045	0.047	439.7
105	33	0	0.002286	775.9	0.6839	<b>0.1568</b>	16.02	-69	5321	2	390	-26	13611	0.016	0.021	448.9
105	34	0	0.002285	776.1	0.6840	<b>0.1570</b>	16.90	-63	5984	-4	403	-19	15430	-0.008	0.024	468.2
105	35	0	0.002285	775.9	0.6838	<b>0.1560</b>	17.76	-90	6707	1	313	-110	17396	0.087	0.048	454.7
105	36	0	0.002285	776.0	0.6839	<b>0.1567</b>	9.98	-13	657	-13	17	136	2562	0.023	0.020	419.2
105	37	0	0.002270	775.7	0.6844	<b>0.2325</b>	16.03	-11	683	-10	-94	76	3281	0.010	0.033	574.4
105	38	0	0.002269	775.0	0.6839	<b>0.2335</b>	16.89	-25	1329	-21	-72	202	5298	0.072	0.035	581.2

105	39	0	0.002268	775.4	0.6840	<b>0.2334</b>	17.69	-37	2004	-2	14	-39	7470	0.062	0.043	583.2
105	40	0	0.002268	775.1	0.6837	<b>0.2339</b>	18.45	-47	2601	-5	111	-21	9439	0.039	0.031	583.7
105	41	0	0.002267	775.3	0.6838	<b>0.2326</b>	19.19	-51	3363	-9	240	2	11884	0.023	0.060	574.0
105	42	0	0.002267	775.4	0.6838	<b>0.2328</b>	19.91	-63	3907	-9	247	17	13783	0.043	0.073	576.1
105	43	0	0.002267	775.3	0.6838	<b>0.2338</b>	20.82	-73	4620	-5	178	-11	16359	0.059	0.045	573.8
105	44	0	0.002266	775.8	0.6841	<b>0.2338</b>	21.36	-62	5083	26	124	-53	18029	0.072	-0.026	569.7
105	45	0	0.002266	776.3	0.6845	<b>0.2330</b>	16.01	-4	628	22	-201	-291	3116	0.017	0.026	573.2
105	46	0	0.002239	774.7	0.6834	<b>0.3109</b>	21.82	-3	719	25	-115	-422	4405	-0.014	0.052	714.6
105	47	0	0.002237	774.5	0.6831	<b>0.3124</b>	22.61	-24	1325	12	-19	-230	6887	0.030	0.026	715.6
105	48	0	0.002236	775.2	0.6835	<b>0.3108</b>	23.30	-47	2027	2	150	-71	9815	0.004	0.016	707.8
105	49	0	0.002235	775.0	0.6832	<b>0.3121</b>	24.01	-53	2615	1	230	12	12388	0.026	0.022	705.1
105	50	0	0.002233	776.6	0.6843	<b>0.3123</b>	24.80	-53	3312	-1	282	-31	15452	-0.020	0.030	701.2
105	51	0	0.002231	776.7	0.6843	<b>0.3128</b>	25.24	-64	3700	0	235	-111	17147	0.053	0.029	696.4
105	52	0	0.002232	777.1	0.6845	<b>0.3109</b>	21.85	-8	724	23	-128	-490	4406	0.006	0.041	718.6

**Table 7q. TTR/699 performance data for run 108**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
108	12	0	0.002323	758.8	0.6841	<b>0.3906</b>	27.08	-18	696	-13	-94	-46	5542	0.022	0.034	826.3
108	13	0	0.002320	758.3	0.6832	<b>0.3915</b>	27.42	-20	986	-7	-42	63	7019	0.028	0.000	821.1
108	14	0	0.002315	759.7	0.6838	<b>0.3911</b>	27.73	-25	1323	-26	-8	152	8712	0.041	0.037	823.5
108	15	0	0.002313	759.7	0.6832	<b>0.3902</b>	28.03	-19	1638	-41	59	249	10373	0.012	0.045	816.2
108	16	0	0.002310	760.5	0.6836	<b>0.3907</b>	28.52	-42	2091	-40	29	424	12796	0.059	0.008	810.0
108	17	0	0.002308	761.4	0.6841	<b>0.3899</b>	28.73	-33	2341	-42	13	419	14060	0.053	0.019	807.0
108	18	0	0.002307	761.1	0.6836	<b>0.3909</b>	29.18	-26	2744	-48	-56	373	16197	0.045	0.071	796.6
108	19	0	0.002305	760.9	0.6832	<b>0.3910</b>	29.30	-4	2896	-44	-158	352	16973	0.050	0.074	790.7
108	20	0	0.002304	761.7	0.6838	<b>0.3909</b>	27.11	-2	757	-15	-250	143	5801	0.020	0.059	828.8
108	21	0	0.002255	763.3	0.6848	<b>0.4677</b>	31.80	4	780	-40	-320	333	7341	0.026	-0.025	952.1
108	22	0	0.002252	761.5	0.6828	<b>0.4691</b>	32.10	-6	1032	-58	-325	431	8898	0.064	0.038	945.3
108	23	0	0.002249	761.9	0.6827	<b>0.4694</b>	32.61	3	1511	-69	-309	504	11889	-0.001	0.064	935.1
108	24	0	0.002247	762.6	0.6830	<b>0.4697</b>	32.89	2	1807	-63	-370	496	13728	0.008	0.049	928.0
108	25	0	0.002245	763.7	0.6838	<b>0.4697</b>	33.19	13	2100	-57	-467	384	15593	-0.009	0.052	921.2
108	26	0	0.002244	763.6	0.6836	<b>0.4695</b>	33.24	37	2173	-59	-619	242	16075	-0.017	0.079	917.6
108	27	0	0.002243	762.8	0.6826	<b>0.4705</b>	33.56	32	2438	-39	-737	66	17753	0.046	0.059	908.4
108	28	0	0.002242	765.5	0.6848	<b>0.4678</b>	31.83	15	798	-47	-471	220	7577	-0.018	0.056	951.6

**Table 7r. TTR/699 performance data for run 109**

Run	Point	Yaw	$\rho$	$V_{tip}$	$M_{tip}$	$\mu$	Coll	AF	NF	SF	PM	RM	YM	Lat. gimbal	Long. gimbal	PLL, mean
		deg	slug/ft <sup>3</sup>	ft/sec			deg	lb	lb	lb	ft-lb	ft-lb	ft-lb	deg	deg	lb
109	12	<b>80</b>	0.002358	767.9	0.6834	0.1254	-1.08	179	1336	14	265	746	2628	0.005	-0.017	111.3
109	13	<b>80</b>	0.002357	768.6	0.6840	0.1257	-0.02	183	2017	-4	280	697	2655	0.001	0.032	130.4
109	14	<b>80</b>	0.002357	768.7	0.6840	0.1259	0.93	184	2579	-18	263	738	2813	0.021	0.005	146.0
109	15	<b>80</b>	0.002357	768.7	0.6840	0.1259	2.04	178	3311	-49	241	798	3124	0.075	0.023	160.9
109	16	<b>80</b>	0.002356	768.6	0.6838	0.1252	2.58	182	3641	-64	254	844	3320	0.020	0.020	168.8
109	17	<b>80</b>	0.002356	768.3	0.6836	0.1255	3.09	185	3916	-73	282	892	3519	-0.009	-0.008	174.3
109	18	<b>80</b>	0.002355	768.6	0.6837	0.1257	3.61	189	4294	-95	312	979	3754	-0.064	-0.007	178.7
109	19	<b>80</b>	0.002355	768.9	0.6840	0.1256	4.11	176	4610	-120	246	1022	4009	0.046	0.045	183.7
109	20	<b>80</b>	0.002355	768.6	0.6837	0.1258	4.63	182	4938	-137	263	1101	4283	0.005	0.029	188.7
109	21	<b>80</b>	0.002355	769.0	0.6840	0.1261	5.21	177	5351	-147	260	1186	4613	0.030	-0.019	193.9
109	22	<b>80</b>	0.002354	769.0	0.6840	0.1261	5.68	172	5615	-179	236	1422	4904	0.033	0.000	197.6
109	23	<b>80</b>	0.002354	768.7	0.6837	0.1257	-1.16	183	1257	8	178	973	2639	0.031	-0.040	115.2
109	24	<b>85</b>	0.002353	769.4	0.6842	0.1258	-2.16	179	1241	-25	194	961	2648	0.077	0.003	86.9
109	25	<b>85</b>	0.002353	769.5	0.6843	0.1260	-1.11	192	1937	-49	253	899	2515	-0.037	-0.005	104.2
109	26	<b>85</b>	0.002353	769.2	0.6840	0.1255	0.01	197	2700	-68	251	915	2541	-0.013	-0.069	119.4
109	27	<b>85</b>	0.002353	769.1	0.6839	0.1257	0.96	195	3308	-89	262	939	2698	-0.026	-0.036	130.9
109	28	<b>85</b>	0.002353	769.0	0.6838	0.1258	1.44	193	3645	-98	284	941	2808	-0.036	-0.030	137.1
109	29	<b>85</b>	0.002353	769.0	0.6837	0.1261	1.98	191	3994	-118	295	953	2976	-0.045	0.018	144.0
109	30	<b>85</b>	0.002353	769.2	0.6839	0.1261	2.53	179	4342	-123	280	1001	3160	0.035	-0.017	152.1
109	31	<b>85</b>	0.002352	769.1	0.6838	0.1253	3.01	188	4654	-147	309	1052	3341	-0.025	0.003	158.1
109	32	<b>85</b>	0.002352	769.2	0.6838	0.1254	3.51	183	4932	-167	305	1095	3549	-0.018	0.044	165.6
109	33	<b>85</b>	0.002352	769.7	0.6843	0.1253	4.10	187	5372	-174	315	1189	3811	-0.035	-0.059	171.2
109	34	<b>85</b>	0.002352	769.9	0.6844	0.1254	4.59	174	5640	-193	316	1250	4073	0.011	-0.027	177.4
109	35	<b>85</b>	0.002351	769.2	0.6837	0.1257	-2.17	181	1284	-22	236	960	2647	0.000	-0.006	85.1
109	36	<b>95</b>	0.002351	769.6	0.6840	0.1254	-4.18	198	1317	20	226	1119	2677	0.035	-0.037	25.1
109	37	<b>95</b>	0.002351	769.8	0.6842	0.1253	-3.21	205	2008	5	198	994	2298	0.070	-0.010	43.9

109	38	<b>95</b>	0.002351	769.5	0.6839	0.1253	-2.29	221	2625	-9	233	944	2070	-0.032	-0.106	56.9
109	39	<b>95</b>	0.002351	769.1	0.6835	0.1253	-1.33	214	3259	-46	186	860	1948	0.035	-0.009	72.7
109	40	<b>95</b>	0.002350	769.8	0.6841	0.1252	-4.21	200	1323	24	241	1139	2677	0.011	-0.094	27.0
109	41	<b>100</b>	0.002350	769.5	0.6839	0.1256	-5.17	174	1301	5	228	1080	2720	0.048	-0.030	-6.3
109	42	<b>100</b>	0.002350	769.8	0.6842	0.1254	-4.26	179	1909	-5	207	928	2260	0.036	-0.004	12.2
109	43	<b>100</b>	0.002351	769.4	0.6838	0.1253	-3.23	183	2649	-20	217	791	1844	-0.009	0.002	30.1
109	44	<b>100</b>	0.002351	770.0	0.6843	0.1252	-2.33	180	3311	-38	203	734	1591	0.011	-0.072	44.7
109	45	<b>100</b>	0.002351	769.3	0.6837	0.1253	-1.84	173	3641	-71	183	635	1515	0.036	0.072	52.4
109	46	<b>100</b>	0.002351	769.4	0.6839	0.1252	-1.36	175	3988	-72	199	652	1456	0.024	-0.045	61.4
109	47	<b>100</b>	0.002351	769.5	0.6839	0.1254	-0.90	176	4307	-90	213	652	1426	0.000	-0.038	68.9
109	48	<b>100</b>	0.002351	769.4	0.6839	0.1253	-0.43	165	4683	-108	189	621	1401	0.047	-0.016	77.2
109	49	<b>100</b>	0.002351	769.2	0.6838	0.1252	-0.01	165	4958	-120	201	609	1416	0.027	-0.012	82.9
109	50	<b>100</b>	0.002350	769.7	0.6841	0.1252	0.49	162	5348	-141	196	620	1450	0.047	-0.001	89.7
109	51	<b>100</b>	0.002350	769.5	0.6839	0.1251	0.93	157	5629	-153	198	657	1493	0.042	-0.020	95.1
109	52	<b>95</b>	0.002350	769.1	0.6837	0.1260	0.70	221	4686	-130	159	950	2034	-0.008	-0.035	99.1
109	53	<b>95</b>	0.002350	769.2	0.6837	0.1260	1.06	204	4993	-145	140	973	2070	0.045	-0.055	101.1
109	54	<b>95</b>	0.002350	769.2	0.6837	0.1260	1.49	211	5253	-163	162	960	2159	-0.025	-0.035	106.6
109	55	<b>95</b>	0.002350	769.4	0.6839	0.1261	2.13	201	5673	-190	149	979	2318	0.008	-0.023	114.0

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