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ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-32) LAUNCH

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16. Abstract

This report presents a summary of selected atmospheric conditions observed near space shuttle STS-32 launch time on January 9, 1990, at Kennedy Space Center, Florida. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of pre-launch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-32 vehicle ascent has been constructed. The STS-32 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment that was traversed by the STS-32 vehicle.

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ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-32) LAUNCH

I. INTRODUCTION

This report presents an evaluation of the atmospheric environmental data taken during the launch of the space shuttle/STS-32 vehicle. This space shuttle vehicle was launched from Pad 39A at Kennedy Space Center (KSC), Florida, on a reference bearing of 90-degrees east of north, at 1235 u.t. (0735 e.s.t.) on January 9, 1990.

This report presents a summary of the atmospheric environment at launch time (L+0) of the STS-32, together with the sequence of prelaunch Jimsphere-measured winds aloft profiles from L-4.15 h through liftoff. The general atmospheric situation for the launch and flight area is described, and surface and upper level wind/thermodynamic observations near launch time are given. Since a ship was unavailable for STS-32 duty, the solid rocket booster (SRB) descent/impact atmospheric data were not taken. However, one can use the STS-32 ascent data for SRB studies as the best substitute.

Previous MSFC-related launch vehicle atmospheric environmental conditions have been published as appendix A of individual MSFC Saturn Flight Evaluation Working Group reports [1]. Office memorandums have been issued for previous flights giving launch pad wind information. A report has also been published [2] which summarizes most launch atmospheric conditions observed for the past 155 MSFC/ABMA-related vehicle launches through SA-208 (Skylab 4). Reports summarizing ASTP, STS-1 through STS-33 launch conditions are presented in references 3 through 28, respectively. Table 1 gives the atmospheric L+0 launch conditions for all the space shuttle missions.

II. SOURCES OF DATA

Atmospheric observational data used in this report were taken from synoptic maps made by the National Weather Service, plus all available surface observations and measurements from around the launch area. Upper air observations were taken from balloon-released instruments sent aloft from Cape Canaveral Air Force Station (CCAFS). High-altitude winds and thermodynamic data were measured by the Super-Loki rocketsondes launched from the CCAFS. However, the data from the rocketsondes were bad and the Global Reference Atmosphere Model (GRAM) [29] parameters for January KSC conditions were used to replace the Super-Loki rocketsonde data. Table 2 presents a listing of systems used to obtain the upper level wind profiles used in compiling the final ascent atmospheric data tape. Data cutoff altitudes are also given in table 2.

III. GENERAL SYNOPTIC SITUATION AT LAUNCH TIME

A large area of high pressure prevailed over all of Florida during the liftoff of STS-32. Surface winds were mostly light and variable just prior to the launch time. Figure 1 shows the surface map 35 min before the launch of STS-32. Southwesterly winds dominated the flow aloft over the KSC region. Figure 2 presents the winds aloft condition at the 500-mb level 35 min before launch.

Scattered clouds were over the launch area prior to and during the launch of STS-32. Figure 3 depicts the GOES-7 infrared satellite picture at 1231 u.t. (4 min before liftoff) with 500-mb heights denoted in meters and wind barbs superimposed. Figure 4 gives an up-close visible shot of the Florida peninsula as recorded by GOES-7 also taken at 1231 u.t. with surface temperatures, wind barbs, and pressure superimposed.

IV. SURFACE OBSERVATIONS AT LAUNCH TIME

Surface observations at launch time for selected KSC locations are given in table 3. Included are pad 39A, shuttle runway, and CCAFS balloon release station observations. Neither precipitation nor lightning was observed at launch time.

Table 4 presents pad 39A wind data along with other standard hourly atmospheric measurements and sky observations for the 6-h period prior to launch of STS-32. Values for wind speed and direction are given for the 18-m (60-ft) pad light pole level.

V. UPPER AIR MEASUREMENTS DURING LAUNCH

The FPS-16 Jimsphere (1125 u.t.) and the MSS Rawinsonde (0705 u.t.) systems were used to measure the upper level wind and thermodynamic parameters for STS-32 launch. At altitudes above the measured data, the GRAM [29] parameters for January KSC conditions were used. A tabulation of the STS-32 final atmospheric data for ascent is presented in table 5 which lists the wind and thermodynamic parameters versus altitude. A brief summary of parameters is given in the following paragraphs.

A. Wind Speed

At launch time, wind speeds were 6.8 ft/s (4.0 kn) at the 60-ft level and increased to a maximum of 160 ft/s (94.7 kn) at 43,800 ft (13,350 m). The winds decrease above this level and began increasing at the 67,000-ft (20,421.6-m) level. The maximum wind speed above this level was 67.6 ft/s (40.0 kn) at the 88,000-ft (26,822-m) level which was 2,000 ft below the last measurable wind speed level.

B. Wind Direction

At launch time, the 60-ft wind direction was from the west southwest and was variable until the 1,900-ft (579-m) level where winds became southwesterly. Winds maintained a southwesterly component until near the 67,000-ft (20,422-m) level where they became westerly. The winds continued from this direction throughout the 90,000-ft (27,432-m) level which was the last measurable wind direction level.

C. Prelaunch/Launch Wind Profiles

Prelaunch/launch wind profiles given in figures 6 through 9 were measured by the Jimsphere FPS-16 system. Data are shown for four measurement periods beginning at L–4.15 h and extending through L + 15 min.

The wind speed and direction profiles for the 4.15-h period prior to and including L + 15 min are shown in figures 6 and 7. The in-plane (head-tail wind) and out-of-plane (left-right crosswind) profiles are given in figures 8 and 9. The wind speeds and in-plane component speeds were generally equal to the January mean wind values at mostly all altitude levels. The out-of-plane component speeds were less than the January mean wind values at mostly all altitudes.

D. Thermodynamic Data

The thermodynamic data, taken at STS-32 launch time, consisted of atmospheric temperature, dew-point temperature, pressure, and density. These data have been compiled as the STS-32 ascent atmospheric data and are presented in table 5. The vertical structure of temperature and dew-point temperature for STS-32 ascent are shown graphically versus altitude in figure 10.

E. SRB Upper Air and Surface Measurements

As has been mentioned in the introduction, since there was no ship available, an SRB descent atmospheric data tape has not been constructed. The tabular values for the ascent atmospheric tape, as presented in table 5, should be used for SRB descent/impact studies since it is the closest measured data source.

Table 1. Selected atmospheric observations for the flights of the space shuttle vehicles.

Vehicle Data[h]				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			Count Down and Launch Comments of Meterological Significance
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	
1	STS-1 Columbia	4/12/81	0700	10.234[d]	21	82	11.8 15.2	125 120	44,300	98	250	
2	STS-2 Columbia	11/12/81	1010	10.166	23	61	27.0 27.0	345 355	36,300	158	286	
3	STS-3 Columbia	3/22/82	1100	10.160	24	71	7.0[e] 8.0[e]	50[e] 145[e]	45,000	119	250	Wind directional change observed at Pad just prior to L+0. Onset of sea breeze.
4	STS-4 Columbia	6/27/82	1100[f]	10.200	29	70	5.8[g] 4.9[g]	133[g] 141[g]	47,900	37	329	
5	STS-5 Columbia	11/11/82	0719	10.227	22	68	22.0 35.0	90 90	40,600	146	336	
6	STS-6 Challenger	4/4/83	1330	10.183	23	55	12.7 16.4	63 55	46,100	155	277	
7	STS-7 Challenger	6/18/83	0733[f]	10.146	25	80	5.9[e] 10.3[e]	10[e] 350[e]	45,900	76	278	
8	STS-8 Challenger	8/30/83	0232[f]	10.111	24	97	8.8 14.0	269 268	45,100	30	349	17-min countdown delay due to adverse weather conditions.
9	STS-9 (SL-1) Columbia	11/28/83	1100	10.153	24	83	19.1 32.0	183 190	47,100	117	252	
10	STS-11 (41-B) Challenger	2/3/84	0800	10.173	17	75	0.0 NA	0 NA	38,200	143	288	
11	STS-13 (41-C) Challenger	4/6/84	0858	10.149	16	56	21.5 18.6	320 275	37,700	176	289	
12	STS-41D Discovery	8/30/84	0842[f]	10.172	26	81	3.0 3.6	106 39	40,300	44	270	
13	STS-41G Challenger	10/5/84	0703[f]	10.210	23	60	16.5 14.8	73 58	40,600	78	303	
14	STS-51A Discovery	11/8/84	0715	10.227	20	59	23.0 31.1	24 10	33,100	131	272	1-day delay due to excessive wind loads, calculated at high altitudes.
15	STS-51C Discovery	1/24/85	1450	10.173	18	46	17.1 15.5	228 253	42,900	199	265	1-day delay due to extreme cold surface temperatures.

Table 1. Selected atmospheric observations for the flights of the space shuttle vehicles (continued).

Vehicle Data[h]				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	Count Down and Launch Comments of Meteorological Significance
16	STS-51D Discovery	4/12/85	1359	10.257	21	55	19.9 22.3	82 82	42,600	134	265	55-min delay due to a ship in the SRB impact area, and concerns over potential weather related impacts (cloud cover).
17	STS-51B Challenger	4/29/85	1202[f]	10.128	27	65	11.5 18.4	005 337	32,900 40,700	68 68	320 297	
18	STS-51G Discovery	6/17/85	0733[f]	10.201	23	91	2.9 11.8	201 206	40,100 46,700	55 55	298 302	
19	STS-51F Challenger	7/29/85	1700[f]	10.174	28	72	14.9 13.4	101 113	48,000	53	035	(20) 8/24 launch scrub due to unexceptable weather in launch area. Rain during countdown.
20	STS-51I Discovery	8/27/85	0658[f]	10.225	24	86	14.2 16.6	073 070	41,000	43	123	
21	STS-51J Atlantis	10/3/85	1115[f]	10.185	28	79	17.0 13.7	213 171	48,000	48	283	(24) 1/7 launch scrub due to unexceptable weather at TAW sites. 1/10 launch scrub due to heavy rain in launch area.
22	STS-61A Challenger	10/30/85	1200	10.059	28	72	12.7 14.1	217 174	43,000	81	218	
23	STS-61B Atlantis	11/26/85	1929	10.202	23	81	10.1 10.4	165 112	49,300	75	270	(25) 1/26 launch scrub due in part to potential bad weather associated with frontal passage. 1/27 launch scrub due in part to strong cross winds at X68. 1/28 2-hr delay due in part to cold early morning temps.
24	STS-61C Columbia	1/12/86	0655	10.206	12	84	15.4 18.6	323 342	40,000	221	263	
25[j]	STS-51L[i] Challenger	1/28/86	1138	10.253	3	27	20.1 15.3	331 262	42,000	174	264	
26[j]	STS-26 Discovery	9/29/88	1137[f]	10.182	29	56	13.7 13.5	058 047	53,100	44	304	(26) 1-hr and 37-min delay due to light winds.
27[j]	STS-27 Atlantis	12/2/88	930	10.270	14	50	25.5 22.0	314 352	40,200	187	245	(27) 1-day delay due to excessive wind loads, calculated at high altitudes.
28[j]	STS-29 Discovery	3/13/89	957	10.190	18	78	16.9	242	45,200	105	283	(28) 2-hr delay due to fog and strong winds aloft.
29[j]	STS-30 Atlantis	5/4/89	1437[f]	10.200	26	57	21.6	106	44,200	157	255	(29) 59-min delay due to cloud cover over the launch area.

Table 1. Selected atmospheric observations for the flights of the space shuttle vehicles (continued).

Vehicle Data[h]				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	Count Down and Launch Comments of Meteorological Significance
30[j]	STS-28 Columbia	8/8/89	0837[f]	10.120	27	80	12.5	252	24,100	35	286	
31[j]	STS-34 Atlantis	10/18/89	1254[f]	10.152	30	52	13.5	193	45,800 47,100	61 61	287 294	(31) 1 day delay due to rain showers in launch area.
32[j]	STS-33 Discovery	11/22/89	1924	10.132	19	80	16.9	208	41,900	110	237	
33	STS-32 Columbia	1/9/90	0735	10.194	12	100	6.8	246	42,800	160	242	(33) 1-day delay due to cloud cover over the launch area.

a. Pad 39A thermodynamic measurements taken at approximately 1.2 m (4 ft) above natural grade at camera site No. 3.
b. 1-min average prior to L+0 of 60-ft PLP (listed first) and 275-ft FSS winds measured above natural grade. 275-ft FSS winds were not available after sequence No. 27.
c. Pressure measurement applicable to 21 ft above MSL unless otherwise indicated.
d. Pressure measurement applicable to 14 ft above MSL.
e. 10-sec average prior to L+0.
f. Eastern daylight time.
g. 30-sec average prior to L+0.
h. All vehicles launched from LC 39A except where noted.
i. Shuttle exploded in flight.
j. Vehicle launched from 39B.

Table 2. Systems used to measure upper air wind data for STS-32 ascent.

Type of Data	Date: January 9, 1990		Portion of Data Used			
	Release Time		Start		End	
	Time (u.t.) (h:min)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)
FPS-16 Jimsphere	11:25	-70	6 (21)	-70	14,935 (49,000)	-21
MSS Rawinsonde	07:05	-330	15,240 (50,000)	-280	27,432 (90,000)	-240

Table 3. Surface observations at STS-32 launch time.

Location[a]	Time After L+0 (min)	Pressure (MSL) N/cm^2 (psia)	Temperature K (°F)	Dew Point K (°F)	Relative Humidity (%)	Visibility km (miles)	Sky Cover			Wind	
							Cloud Amount*	Cloud Type	Height of Base Meters (ft)	Speed ft/s (kt)	Direction (deg)
NASA Space Shuttle Runway X68[d] Winds Measured at 10.4 m (34 ft)	0	10.207 (14.804)	285.4 (54.0)	284.8 (53.0)	95	8 (10)	4	Altocumulus	2,743 (9,000)	3.4 (2.0)	230
							1	Cirrostratus	9,144 (30,000)		
CCAFS XMR[c] Surface Measurements	0	10.203 (14.798)	285.4 (54.0)	284.8 (53.0)	95	8 (10)	8	Altocumulus	2,743 (9,000)	6.8 (4.0)	280
							1	Cirrus	8,230 (27,000)		
Pad 39A Lightpole SE 18.3 m (60.0 ft)[b]	0	10.194 (14.785)	285.4 (54.0)	285.4 (54.0)	100	-	-	-	-	6.8 (4.0)	246

*5/10 total sky cover at X68 and 9/10 total sky cover at XMR.

a. Altitudes of measurements are above natural grade, except where noted.

b. Approximately 1-min average prior to L+0.

c. Balloon release site.

d. Official STS-32 sky observational site.

Table 4. STS-32 pre-launch through launch KSC pad 39A atmospheric measurements.

Hourly Atmospheric Measurements[a]						Sky Condition[b]			
January 9, 1990 Time u.t.	Temperature (°F)	Dew Point (°F)	Relative Humidity (%)	60' Level (SE) WS Kt	60' Level (SE) WD°	Clouds	Total Sky Cover	Vis. (mi.)	Other Remarks
0700	53	52	96	8	270	Scattered at 11,000 ft	1/10	10	
0800	52	51	99	6	276	Scattered at 11,000 ft	1/10	10	
0900	52	52	100	7	275	Scattered at 10,000 ft	1/10	10	
1000	52	52	100	6	289	Scattered at 30,000 ft	4/10	10	
1100	52	51	97	7	286	Scattered at 500, 9,000, and 30,000 ft	4/10	10	
1200	52	51	99	6	291	Broken at 9,500 and 30,000 ft	8/10	10	
L+0[c] 1235	54	54	100	4	246	Scattered at 9,000 and 30,000 ft	5/10	10	

a. Hourly pad observations (obtained via MSFC/HOSC) averaged over 5 min, centered on the hour.

b. Sky observations taken at the shuttle runway site X68.

c. L+0 pad wind and thermodynamic parameters obtained from HOSC strip charts. The SE anemometer was used at the 60-ft level for L+0 wind conditions (approximately 1-min average prior to L+0). Pad 39A L+0 atmospheric pressure at sea level was 10.194 N/cm^2.

Table 5. STS-32 ascent atmospheric data tape.

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
21.	4.92	320.00	13.61	0.1019E+04	0.1231E+04	12.51
100.	7.55	323.00	13.71	0.1016E+04	0.1227E+04	11.99
200.	9.84	324.00	13.85	0.1012E+04	0.1223E+04	11.34
300.	12.14	325.00	13.98	0.1009E+04	0.1218E+04	10.69
400.	14.44	325.00	14.11	0.1005E+04	0.1213E+04	10.03
500.	15.42	328.00	14.25	0.1002E+04	0.1209E+04	9.38
600.	18.70	338.00	14.38	0.9979E+03	0.1204E+04	8.72
700.	18.37	349.00	14.51	0.9943E+03	0.1199E+04	8.07
800.	18.70	0.00	14.64	0.9907E+03	0.1195E+04	7.42
900.	21.00	1.00	14.78	0.9872E+03	0.1190E+04	6.76
1000.	18.04	21.00	14.91	0.9836E+03	0.1185E+04	6.11
1100.	14.11	350.00	15.07	0.9801E+03	0.1181E+04	5.18
1200.	13.78	355.00	15.23	0.9766E+03	0.1176E+04	4.25
1300.	10.50	358.00	15.39	0.9731E+03	0.1171E+04	3.32
1400.	9.84	4.00	15.55	0.9696E+03	0.1167E+04	2.39
1500.	6.89	16.00	15.71	0.9661E+03	0.1162E+04	1.46
1600.	5.58	17.00	15.87	0.9626E+03	0.1157E+04	0.53
1700.	5.58	27.00	16.03	0.9592E+03	0.1153E+04	-0.40
1800.	2.30	35.00	16.19	0.9557E+03	0.1148E+04	-1.33
1900.	1.64	228.00	16.35	0.9523E+03	0.1144E+04	-2.26
2000.	2.95	346.00	16.51	0.9489E+03	0.1139E+04	-3.19
2100.	3.94	244.00	16.51	0.9455E+03	0.1135E+04	-3.28
2200.	4.92	232.00	16.51	0.9421E+03	0.1131E+04	-3.37
2300.	4.27	235.00	16.51	0.9388E+03	0.1127E+04	-3.46
2400.	5.58	233.00	16.51	0.9354E+03	0.1123E+04	-3.55
2500.	7.87	258.00	16.51	0.9321E+03	0.1119E+04	-3.64
2600.	12.80	241.00	16.51	0.9288E+03	0.1115E+04	-3.73
2700.	15.75	233.00	16.51	0.9255E+03	0.1111E+04	-3.82
2800.	13.78	235.00	16.51	0.9222E+03	0.1107E+04	-3.91
2900.	18.04	232.00	16.51	0.9189E+03	0.1103E+04	-4.00
3000.	25.92	222.00	16.51	0.9156E+03	0.1099E+04	-4.09
3100.	25.59	223.00	16.44	0.9123E+03	0.1095E+04	-3.34
3200.	22.31	221.00	16.37	0.9091E+03	0.1092E+04	-2.59
3300.	25.26	222.00	16.30	0.9058E+03	0.1088E+04	-1.84
3400.	24.61	229.00	16.23	0.9026E+03	0.1084E+04	-1.09
3500.	23.62	237.00	16.16	0.8994E+03	0.1080E+04	-0.34
3600.	28.22	237.00	16.09	0.8961E+03	0.1076E+04	0.41
3700.	29.86	239.00	16.02	0.8929E+03	0.1073E+04	1.16
3800.	31.82	247.00	15.95	0.8897E+03	0.1069E+04	1.91
3900.	32.81	244.00	15.88	0.8866E+03	0.1065E+04	2.66
4000.	39.04	246.00	15.81	0.8834E+03	0.1061E+04	3.41
4100.	40.35	244.00	15.70	0.8802E+03	0.1058E+04	3.63
4200.	41.99	242.00	15.59	0.8771E+03	0.1055E+04	3.85
4300.	44.62	242.00	15.48	0.8739E+03	0.1051E+04	4.07
4400.	44.29	239.00	15.37	0.8708E+03	0.1048E+04	4.29
4500.	44.95	236.00	15.26	0.8677E+03	0.1044E+04	4.51
4600.	48.23	237.00	15.15	0.8645E+03	0.1041E+04	4.73
4700.	47.57	236.00	15.04	0.8614E+03	0.1037E+04	4.95
4800.	47.57	232.00	14.93	0.8583E+03	0.1034E+04	5.17
4900.	53.15	228.00	14.82	0.8553E+03	0.1031E+04	5.39

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
5000.	50.85	227.00	14.71	0.8522E+03	0.1027E+04	5.61
5100.	50.85	223.00	14.51	0.8491E+03	0.1024E+04	5.17
5200.	52.17	224.00	14.31	0.8461E+03	0.1021E+04	4.73
5300.	51.51	225.00	14.11	0.8430E+03	0.1019E+04	4.29
5400.	50.52	226.00	13.91	0.8400E+03	0.1016E+04	3.85
5500.	50.85	228.00	13.71	0.8370E+03	0.1013E+04	3.41
5600.	51.51	230.00	13.51	0.8339E+03	0.1010E+04	2.97
5700.	51.84	232.00	13.31	0.8309E+03	0.1007E+04	2.53
5800.	52.17	234.00	13.11	0.8280E+03	0.1004E+04	2.09
5900.	52.82	235.00	12.91	0.8250E+03	0.1001E+04	1.65
6000.	53.48	237.00	12.71	0.8220E+03	0.9987E+03	1.21
6100.	53.81	239.00	12.59	0.8190E+03	0.9954E+03	1.64
6200.	54.13	240.00	12.47	0.8161E+03	0.9921E+03	2.07
6300.	54.79	242.00	12.35	0.8131E+03	0.9888E+03	2.50
6400.	55.12	244.00	12.23	0.8102E+03	0.9855E+03	2.93
6500.	55.77	245.00	12.11	0.8072E+03	0.9822E+03	3.36
6600.	56.10	247.00	11.99	0.8043E+03	0.9789E+03	3.79
6700.	56.43	248.00	11.87	0.8014E+03	0.9757E+03	4.22
6800.	53.48	245.00	11.75	0.7985E+03	0.9724E+03	4.65
6900.	55.12	245.00	11.63	0.7956E+03	0.9692E+03	5.08
7000.	52.17	249.00	11.51	0.7927E+03	0.9659E+03	5.51
7100.	57.74	250.00	11.34	0.7898E+03	0.9630E+03	5.44
7200.	58.40	251.00	11.17	0.7870E+03	0.9601E+03	5.37
7300.	57.74	251.00	11.00	0.7841E+03	0.9572E+03	5.30
7400.	60.04	252.00	10.83	0.7813E+03	0.9543E+03	5.23
7500.	63.32	253.00	10.66	0.7784E+03	0.9514E+03	5.16
7600.	65.29	251.00	10.49	0.7756E+03	0.9485E+03	5.09
7700.	63.98	251.00	10.32	0.7728E+03	0.9456E+03	5.02
7800.	62.99	249.00	10.15	0.7700E+03	0.9428E+03	4.95
7900.	61.02	247.00	9.98	0.7672E+03	0.9399E+03	4.88
8000.	57.41	246.00	9.81	0.7644E+03	0.9371E+03	4.81
8100.	62.01	245.00	9.58	0.7616E+03	0.9344E+03	4.65
8200.	60.70	245.00	9.35	0.7588E+03	0.9318E+03	4.49
8300.	60.70	245.00	9.12	0.7560E+03	0.9292E+03	4.33
8400.	60.04	246.00	8.89	0.7532E+03	0.9265E+03	4.17
8500.	60.70	243.00	8.66	0.7505E+03	0.9239E+03	4.01
8600.	61.02	243.00	8.43	0.7477E+03	0.9213E+03	3.85
8700.	58.07	244.00	8.20	0.7450E+03	0.9187E+03	3.69
8800.	61.02	244.00	7.97	0.7422E+03	0.9161E+03	3.53
8900.	59.71	244.00	7.74	0.7395E+03	0.9135E+03	3.37
9000.	64.96	242.00	7.51	0.7368E+03	0.9109E+03	3.21
9100.	65.29	245.00	7.25	0.7341E+03	0.9084E+03	3.28
9200.	62.66	244.00	6.99	0.7314E+03	0.9058E+03	3.35
9300.	64.30	245.00	6.73	0.7287E+03	0.9033E+03	3.42
9400.	60.37	245.00	6.47	0.7260E+03	0.9008E+03	3.49
9500.	63.32	245.00	6.21	0.7233E+03	0.8983E+03	3.56
9600.	59.38	249.00	5.95	0.7207E+03	0.8958E+03	3.63
9700.	56.10	246.00	5.69	0.7180E+03	0.8933E+03	3.70
9800.	54.46	243.00	5.43	0.7154E+03	0.8908E+03	3.77
9900.	58.07	242.00	5.17	0.7127E+03	0.8883E+03	3.84

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
10000.	57.74	237.00	4.91	0.7101E+03	0.8858E+03	3.91
10100.	60.37	237.00	4.90	0.7075E+03	0.8827E+03	3.14
10200.	60.04	240.00	4.89	0.7048E+03	0.8797E+03	2.37
10300.	60.04	237.00	4.88	0.7022E+03	0.8766E+03	1.60
10400.	59.71	240.00	4.87	0.6996E+03	0.8735E+03	0.83
10500.	62.34	240.00	4.86	0.6970E+03	0.8705E+03	0.06
10600.	63.98	241.00	4.85	0.6944E+03	0.8674E+03	-0.71
10700.	67.59	239.00	4.84	0.6918E+03	0.8643E+03	-1.48
10800.	68.57	239.00	4.83	0.6892E+03	0.8613E+03	-2.25
10900.	65.94	240.00	4.82	0.6867E+03	0.8582E+03	-3.02
11000.	66.27	236.00	4.81	0.6841E+03	0.8552E+03	-3.79
11100.	68.57	236.00	4.66	0.6815E+03	0.8525E+03	-4.32
11200.	65.94	236.00	4.51	0.6790E+03	0.8499E+03	-4.85
11300.	66.93	234.00	4.36	0.6765E+03	0.8473E+03	-5.38
11400.	69.55	237.00	4.21	0.6739E+03	0.8446E+03	-5.91
11500.	67.59	237.00	4.06	0.6714E+03	0.8420E+03	-6.44
11600.	71.19	237.00	3.91	0.6689E+03	0.8394E+03	-6.97
11700.	68.24	239.00	3.76	0.6664E+03	0.8368E+03	-7.50
11800.	70.21	236.00	3.61	0.6639E+03	0.8341E+03	-8.03
11900.	69.88	237.00	3.46	0.6615E+03	0.8315E+03	-8.56
12000.	67.26	238.00	3.31	0.6590E+03	0.8289E+03	-9.09
12100.	66.27	237.00	3.21	0.6565E+03	0.8262E+03	-9.66
12200.	69.23	237.00	3.11	0.6541E+03	0.8234E+03	-10.23
12300.	73.49	238.00	3.01	0.6516E+03	0.8207E+03	-10.80
12400.	71.19	236.00	2.91	0.6492E+03	0.8180E+03	-11.37
12500.	74.48	235.00	2.81	0.6467E+03	0.8153E+03	-11.94
12600.	72.51	235.00	2.71	0.6443E+03	0.8125E+03	-12.51
12700.	73.82	235.00	2.61	0.6419E+03	0.8098E+03	-13.08
12800.	71.52	235.00	2.51	0.6395E+03	0.8071E+03	-13.65
12900.	72.83	232.00	2.41	0.6371E+03	0.8044E+03	-14.22
13000.	73.49	234.00	2.31	0.6347E+03	0.8018E+03	-14.79
13100.	69.23	235.00	2.09	0.6323E+03	0.7994E+03	-14.84
13200.	70.87	237.00	1.87	0.6299E+03	0.7970E+03	-14.89
13300.	70.87	239.00	1.65	0.6276E+03	0.7946E+03	-14.94
13400.	71.52	238.00	1.43	0.6252E+03	0.7923E+03	-14.99
13500.	70.87	238.00	1.21	0.6228E+03	0.7899E+03	-15.04
13600.	70.21	237.00	0.99	0.6205E+03	0.7876E+03	-15.09
13700.	67.59	238.00	0.77	0.6182E+03	0.7853E+03	-15.14
13800.	67.91	236.00	0.55	0.6158E+03	0.7829E+03	-15.19
13900.	69.23	233.00	0.33	0.6135E+03	0.7806E+03	-15.24
14000.	72.18	232.00	0.11	0.6112E+03	0.7783E+03	-15.29
14100.	67.26	236.00	-0.09	0.6089E+03	0.7759E+03	-15.28
14200.	67.26	233.00	-0.29	0.6066E+03	0.7735E+03	-15.27
14300.	65.94	234.00	-0.49	0.6043E+03	0.7711E+03	-15.26
14400.	67.59	236.00	-0.69	0.6020E+03	0.7688E+03	-15.25
14500.	65.94	236.00	-0.89	0.5997E+03	0.7664E+03	-15.24
14600.	67.26	239.00	-1.09	0.5974E+03	0.7641E+03	-15.23
14700.	67.59	239.00	-1.29	0.5951E+03	0.7617E+03	-15.22
14800.	68.90	240.00	-1.49	0.5929E+03	0.7594E+03	-15.21
14900.	68.90	243.00	-1.69	0.5906E+03	0.7571E+03	-15.20

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
15000.	71.85	244.00	-1.89	0.5884E+03	0.7547E+03	-15.19
15100.	71.19	243.00	-2.00	0.5862E+03	0.7522E+03	-15.87
15200.	74.48	244.00	-2.11	0.5839E+03	0.7497E+03	-16.55
15300.	75.46	243.00	-2.22	0.5817E+03	0.7472E+03	-17.23
15400.	77.10	242.00	-2.33	0.5795E+03	0.7447E+03	-17.91
15500.	79.40	242.00	-2.44	0.5772E+03	0.7422E+03	-18.59
15600.	80.05	238.00	-2.55	0.5750E+03	0.7397E+03	-19.27
15700.	81.04	237.00	-2.66	0.5728E+03	0.7372E+03	-19.95
15800.	82.35	235.00	-2.77	0.5707E+03	0.7347E+03	-20.63
15900.	84.65	234.00	-2.88	0.5685E+03	0.7322E+03	-21.31
16000.	83.99	238.00	-2.99	0.5663E+03	0.7297E+03	-21.99
16100.	80.05	236.00	-3.20	0.5641E+03	0.7275E+03	-22.04
16200.	82.02	235.00	-3.41	0.5620E+03	0.7253E+03	-22.09
16300.	81.69	236.00	-3.62	0.5598E+03	0.7230E+03	-22.14
16400.	81.04	236.00	-3.83	0.5576E+03	0.7208E+03	-22.19
16500.	84.97	234.00	-4.04	0.5555E+03	0.7186E+03	-22.24
16600.	84.65	235.00	-4.25	0.5534E+03	0.7164E+03	-22.29
16700.	83.01	236.00	-4.46	0.5512E+03	0.7142E+03	-22.34
16800.	84.97	234.00	-4.67	0.5491E+03	0.7120E+03	-22.39
16900.	87.60	235.00	-4.88	0.5470E+03	0.7098E+03	-22.44
17000.	81.69	236.00	-5.09	0.5449E+03	0.7077E+03	-22.49
17100.	81.36	235.00	-5.32	0.5428E+03	0.7055E+03	-22.53
17200.	78.41	235.00	-5.55	0.5407E+03	0.7034E+03	-22.57
17300.	84.32	233.00	-5.78	0.5386E+03	0.7012E+03	-22.61
17400.	84.65	234.00	-6.01	0.5365E+03	0.6991E+03	-22.65
17500.	80.05	234.00	-6.24	0.5344E+03	0.6970E+03	-22.69
17600.	84.97	233.00	-6.47	0.5323E+03	0.6949E+03	-22.73
17700.	86.94	234.00	-6.70	0.5303E+03	0.6928E+03	-22.77
17800.	85.96	234.00	-6.93	0.5282E+03	0.6907E+03	-22.81
17900.	91.54	235.00	-7.16	0.5261E+03	0.6886E+03	-22.85
18000.	90.55	236.00	-7.39	0.5241E+03	0.6865E+03	-22.89
18100.	89.57	235.00	-7.62	0.5221E+03	0.6845E+03	-23.31
18200.	90.88	237.00	-7.85	0.5200E+03	0.6824E+03	-23.73
18300.	89.24	236.00	-8.08	0.5180E+03	0.6803E+03	-24.15
18400.	90.22	236.00	-8.31	0.5160E+03	0.6783E+03	-24.57
18500.	88.58	238.00	-8.54	0.5140E+03	0.6762E+03	-24.99
18600.	90.55	238.00	-8.77	0.5119E+03	0.6742E+03	-25.41
18700.	90.88	238.00	-9.00	0.5099E+03	0.6722E+03	-25.83
18800.	92.52	238.00	-9.23	0.5080E+03	0.6701E+03	-26.25
18900.	92.85	239.00	-9.46	0.5060E+03	0.6681E+03	-26.67
19000.	95.80	239.00	-9.69	0.5040E+03	0.6661E+03	-27.09
19100.	94.49	239.00	-9.93	0.5020E+03	0.6641E+03	-27.28
19200.	94.49	239.00	-10.17	0.5000E+03	0.6621E+03	-27.47
19300.	97.44	240.00	-10.41	0.4980E+03	0.6600E+03	-27.66
19400.	97.44	242.00	-10.65	0.4961E+03	0.6580E+03	-27.85
19500.	95.14	241.00	-10.89	0.4941E+03	0.6560E+03	-28.04
19600.	99.74	239.00	-11.13	0.4921E+03	0.6540E+03	-28.23
19700.	99.41	240.00	-11.37	0.4902E+03	0.6520E+03	-28.42
19800.	94.82	239.00	-11.61	0.4883E+03	0.6501E+03	-28.61
19900.	97.44	238.00	-11.85	0.4863E+03	0.6481E+03	-28.80

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
20000.	97.44	239.00	-12.09	0.4844E+03	0.6461E+03	-28.99
20100.	95.14	238.00	-12.31	0.4825E+03	0.6441E+03	-29.18
20200.	97.77	238.00	-12.53	0.4806E+03	0.6421E+03	-29.37
20300.	99.41	239.00	-12.75	0.4787E+03	0.6401E+03	-29.56
20400.	98.10	238.00	-12.97	0.4767E+03	0.6381E+03	-29.75
20500.	98.75	239.00	-13.19	0.4749E+03	0.6361E+03	-29.94
20600.	99.41	240.00	-13.41	0.4730E+03	0.6341E+03	-30.13
20700.	102.36	238.00	-13.63	0.4711E+03	0.6321E+03	-30.32
20800.	99.74	238.00	-13.85	0.4692E+03	0.6302E+03	-30.51
20900.	98.43	238.00	-14.07	0.4674E+03	0.6282E+03	-30.70
21000.	103.02	237.00	-14.29	0.4655E+03	0.6262E+03	-30.89
21100.	102.69	238.00	-14.52	0.4636E+03	0.6243E+03	-31.06
21200.	100.07	237.00	-14.75	0.4618E+03	0.6223E+03	-31.23
21300.	101.38	236.00	-14.98	0.4599E+03	0.6204E+03	-31.40
21400.	96.46	235.00	-15.21	0.4581E+03	0.6184E+03	-31.57
21500.	101.38	235.00	-15.44	0.4562E+03	0.6165E+03	-31.74
21600.	97.11	237.00	-15.67	0.4544E+03	0.6145E+03	-31.91
21700.	98.75	235.00	-15.90	0.4525E+03	0.6126E+03	-32.08
21800.	100.07	235.00	-16.13	0.4507E+03	0.6107E+03	-32.25
21900.	97.11	236.00	-16.36	0.4489E+03	0.6088E+03	-32.42
22000.	100.39	234.00	-16.59	0.4471E+03	0.6069E+03	-32.59
22100.	102.03	234.00	-16.74	0.4453E+03	0.6048E+03	-32.74
22200.	105.97	234.00	-16.89	0.4435E+03	0.6027E+03	-32.89
22300.	107.61	234.00	-17.04	0.4417E+03	0.6006E+03	-33.04
22400.	107.28	234.00	-17.19	0.4399E+03	0.5986E+03	-33.19
22500.	109.58	235.00	-17.34	0.4382E+03	0.5965E+03	-33.34
22600.	104.99	236.00	-17.49	0.4364E+03	0.5945E+03	-33.49
22700.	106.96	234.00	-17.64	0.4346E+03	0.5924E+03	-33.64
22800.	107.94	233.00	-17.79	0.4329E+03	0.5904E+03	-33.79
22900.	105.31	231.00	-17.94	0.4311E+03	0.5883E+03	-33.94
23000.	109.91	231.00	-18.09	0.4294E+03	0.5863E+03	-34.09
23100.	106.63	232.00	-18.28	0.4276E+03	0.5844E+03	-34.22
23200.	106.63	232.00	-18.47	0.4259E+03	0.5824E+03	-34.35
23300.	104.99	232.00	-18.66	0.4242E+03	0.5805E+03	-34.48
23400.	108.92	232.00	-18.85	0.4224E+03	0.5785E+03	-34.61
23500.	109.58	232.00	-19.04	0.4207E+03	0.5766E+03	-34.74
23600.	109.91	231.00	-19.23	0.4190E+03	0.5747E+03	-34.87
23700.	106.63	230.00	-19.42	0.4173E+03	0.5728E+03	-35.00
23800.	104.33	230.00	-19.61	0.4156E+03	0.5709E+03	-35.13
23900.	104.00	229.00	-19.80	0.4139E+03	0.5690E+03	-35.26
24000.	105.97	230.00	-19.99	0.4122E+03	0.5671E+03	-35.39
24100.	104.00	233.00	-20.29	0.4105E+03	0.5654E+03	-35.56
24200.	104.66	233.00	-20.59	0.4088E+03	0.5638E+03	-35.73
24300.	101.05	233.00	-20.89	0.4071E+03	0.5621E+03	-35.90
24400.	103.35	235.00	-21.19	0.4055E+03	0.5605E+03	-36.07
24500.	102.36	235.00	-21.49	0.4038E+03	0.5588E+03	-36.24
24600.	101.71	236.00	-21.79	0.4022E+03	0.5572E+03	-36.41
24700.	102.69	237.00	-22.09	0.4005E+03	0.5556E+03	-36.58
24800.	102.36	237.00	-22.39	0.3989E+03	0.5540E+03	-36.75
24900.	102.69	238.00	-22.69	0.3972E+03	0.5524E+03	-36.92

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
25000.	103.02	239.00	-22.99	0.3956E+03	0.5508E+03	-37.09
25100.	104.33	240.00	-23.18	0.3940E+03	0.5489E+03	-37.15
25200.	104.00	240.00	-23.37	0.3923E+03	0.5470E+03	-37.21
25300.	106.63	240.00	-23.56	0.3907E+03	0.5452E+03	-37.27
25400.	108.92	240.00	-23.75	0.3891E+03	0.5433E+03	-37.33
25500.	107.61	240.00	-23.94	0.3875E+03	0.5415E+03	-37.39
25600.	106.96	240.00	-24.13	0.3859E+03	0.5397E+03	-37.45
25700.	104.66	242.00	-24.32	0.3843E+03	0.5378E+03	-37.51
25800.	107.28	241.00	-24.51	0.3827E+03	0.5360E+03	-37.57
25900.	107.28	241.00	-24.70	0.3811E+03	0.5342E+03	-37.63
26000.	105.97	240.00	-24.89	0.3795E+03	0.5324E+03	-37.69
26100.	108.27	239.00	-25.05	0.3779E+03	0.5305E+03	-37.87
26200.	110.56	238.00	-25.21	0.3763E+03	0.5286E+03	-38.05
26300.	107.94	239.00	-25.37	0.3748E+03	0.5268E+03	-38.23
26400.	106.63	239.00	-25.53	0.3732E+03	0.5249E+03	-38.41
26500.	109.91	239.00	-25.69	0.3716E+03	0.5230E+03	-38.59
26600.	110.56	239.00	-25.85	0.3701E+03	0.5212E+03	-38.77
26700.	104.99	242.00	-26.01	0.3685E+03	0.5193E+03	-38.95
26800.	109.91	240.00	-26.17	0.3670E+03	0.5175E+03	-39.13
26900.	105.64	242.00	-26.33	0.3654E+03	0.5157E+03	-39.31
27000.	106.63	243.00	-26.49	0.3639E+03	0.5138E+03	-39.49
27100.	106.63	243.00	-26.64	0.3624E+03	0.5120E+03	-39.61
27200.	107.61	245.00	-26.79	0.3608E+03	0.5102E+03	-39.73
27300.	110.56	245.00	-26.94	0.3593E+03	0.5083E+03	-39.85
27400.	107.61	246.00	-27.09	0.3578E+03	0.5065E+03	-39.97
27500.	109.91	246.00	-27.24	0.3563E+03	0.5047E+03	-40.09
27600.	109.58	250.00	-27.39	0.3548E+03	0.5029E+03	-40.21
27700.	113.19	249.00	-27.54	0.3533E+03	0.5011E+03	-40.33
27800.	115.81	252.00	-27.69	0.3518E+03	0.4993E+03	-40.45
27900.	120.73	255.00	-27.84	0.3504E+03	0.4975E+03	-40.57
28000.	118.44	253.00	-27.99	0.3489E+03	0.4957E+03	-40.69
28100.	121.72	253.00	-28.18	0.3474E+03	0.4940E+03	-40.86
28200.	121.06	251.00	-28.37	0.3460E+03	0.4923E+03	-41.03
28300.	121.06	252.00	-28.56	0.3445E+03	0.4906E+03	-41.20
28400.	119.42	253.00	-28.75	0.3430E+03	0.4889E+03	-41.37
28500.	118.77	252.00	-28.94	0.3416E+03	0.4872E+03	-41.54
28600.	119.42	252.00	-29.13	0.3401E+03	0.4855E+03	-41.71
28700.	117.45	252.00	-29.32	0.3387E+03	0.4838E+03	-41.88
28800.	117.78	251.00	-29.51	0.3373E+03	0.4821E+03	-42.05
28900.	117.45	249.00	-29.70	0.3358E+03	0.4805E+03	-42.22
29000.	116.14	248.00	-29.89	0.3344E+03	0.4788E+03	-42.39
29100.	111.88	249.00	-30.14	0.3330E+03	0.4773E+03	-42.55
29200.	115.81	247.00	-30.39	0.3316E+03	0.4757E+03	-42.71
29300.	119.09	248.00	-30.64	0.3301E+03	0.4742E+03	-42.87
29400.	110.89	250.00	-30.89	0.3287E+03	0.4726E+03	-43.03
29500.	117.45	245.00	-31.14	0.3273E+03	0.4711E+03	-43.19
29600.	116.80	244.00	-31.39	0.3259E+03	0.4696E+03	-43.35
29700.	118.44	245.00	-31.64	0.3245E+03	0.4681E+03	-43.51
29800.	114.83	246.00	-31.89	0.3232E+03	0.4665E+03	-43.67
29900.	114.83	244.00	-32.14	0.3218E+03	0.4650E+03	-43.83

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
30000.	118.11	243.00	-32.39	0.3204E+03	0.4635E+03	-43.99
30100.	119.75	243.00	-32.68	0.3190E+03	0.4621E+03	-44.21
30200.	120.73	243.00	-32.97	0.3176E+03	0.4606E+03	-44.43
30300.	122.70	242.00	-33.26	0.3163E+03	0.4592E+03	-44.65
30400.	121.06	240.00	-33.55	0.3149E+03	0.4578E+03	-44.87
30500.	121.72	241.00	-33.84	0.3135E+03	0.4563E+03	-45.09
30600.	122.70	240.00	-34.13	0.3122E+03	0.4549E+03	-45.31
30700.	121.39	240.00	-34.42	0.3108E+03	0.4535E+03	-45.53
30800.	122.38	241.00	-34.71	0.3095E+03	0.4521E+03	-45.75
30900.	122.70	241.00	-35.00	0.3081E+03	0.4507E+03	-45.97
31000.	121.72	240.00	-35.29	0.3068E+03	0.4493E+03	-46.19
31100.	120.73	241.00	-35.58	0.3055E+03	0.4479E+03	-46.50
31200.	122.70	240.00	-35.87	0.3041E+03	0.4465E+03	-46.81
31300.	121.39	240.00	-36.16	0.3028E+03	0.4451E+03	-47.12
31400.	120.73	240.00	-36.45	0.3015E+03	0.4437E+03	-47.43
31500.	122.38	240.00	-36.74	0.3002E+03	0.4423E+03	-47.74
31600.	120.41	240.00	-37.03	0.2989E+03	0.4409E+03	-48.05
31700.	122.05	239.00	-37.32	0.2976E+03	0.4395E+03	-48.36
31800.	120.73	240.00	-37.61	0.2963E+03	0.4382E+03	-48.67
31900.	121.06	239.00	-37.90	0.2950E+03	0.4368E+03	-48.98
32000.	120.41	241.00	-38.19	0.2937E+03	0.4354E+03	-49.29
32100.	122.38	240.00	-38.45	0.2924E+03	0.4340E+03	-49.51
32200.	124.34	240.00	-38.71	0.2911E+03	0.4325E+03	-49.73
32300.	122.05	241.00	-38.97	0.2898E+03	0.4311E+03	-49.95
32400.	125.00	240.00	-39.23	0.2885E+03	0.4296E+03	-50.17
32500.	122.70	240.00	-39.49	0.2872E+03	0.4282E+03	-50.39
32600.	124.02	240.00	-39.75	0.2860E+03	0.4268E+03	-50.61
32700.	124.02	241.00	-40.01	0.2847E+03	0.4254E+03	-50.83
32800.	124.02	240.00	-40.27	0.2834E+03	0.4239E+03	-51.05
32900.	123.03	240.00	-40.53	0.2822E+03	0.4225E+03	-51.27
33000.	120.08	242.00	-40.79	0.2809E+03	0.4211E+03	-51.49
33100.	121.06	242.00	-41.09	0.2796E+03	0.4198E+03	-51.74
33200.	125.33	243.00	-41.39	0.2784E+03	0.4184E+03	-51.99
33300.	122.70	242.00	-41.69	0.2772E+03	0.4171E+03	-52.24
33400.	123.36	243.00	-41.99	0.2759E+03	0.4158E+03	-52.49
33500.	123.03	243.00	-42.29	0.2747E+03	0.4145E+03	-52.74
33600.	124.34	244.00	-42.59	0.2735E+03	0.4132E+03	-52.99
33700.	122.70	244.00	-42.89	0.2722E+03	0.4118E+03	-53.24
33800.	124.67	245.00	-43.19	0.2710E+03	0.4105E+03	-53.49
33900.	123.03	246.00	-43.49	0.2698E+03	0.4092E+03	-53.74
34000.	123.36	246.00	-43.79	0.2686E+03	0.4079E+03	-53.99
34100.	124.67	247.00	-44.07	0.2674E+03	0.4066E+03	-54.21
34200.	128.94	246.00	-44.35	0.2662E+03	0.4053E+03	-54.43
34300.	126.97	248.00	-44.63	0.2650E+03	0.4039E+03	-54.65
34400.	125.00	248.00	-44.91	0.2638E+03	0.4026E+03	-54.87
34500.	126.64	248.00	-45.19	0.2626E+03	0.4013E+03	-55.09
34600.	126.97	249.00	-45.47	0.2614E+03	0.3999E+03	-55.31
34700.	126.64	249.00	-45.75	0.2602E+03	0.3986E+03	-55.53
34800.	128.28	249.00	-46.03	0.2590E+03	0.3973E+03	-55.75
34900.	129.27	250.00	-46.31	0.2579E+03	0.3960E+03	-55.97

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
35000.	127.30	252.00	-46.59	0.2567E+03	0.3947E+03	-56.19
35100.	129.27	253.00	-46.81	0.2555E+03	0.3933E+03	-56.37
35200.	129.92	254.00	-47.03	0.2543E+03	0.3918E+03	-56.55
35300.	130.91	255.00	-47.25	0.2532E+03	0.3904E+03	-56.73
35400.	128.61	254.00	-47.47	0.2520E+03	0.3890E+03	-56.91
35500.	130.58	255.00	-47.69	0.2508E+03	0.3876E+03	-57.09
35600.	127.95	253.00	-47.91	0.2497E+03	0.3861E+03	-57.27
35700.	129.27	252.00	-48.13	0.2485E+03	0.3847E+03	-57.45
35800.	131.23	251.00	-48.35	0.2474E+03	0.3833E+03	-57.63
35900.	130.91	251.00	-48.57	0.2462E+03	0.3819E+03	-57.81
36000.	129.92	252.00	-48.79	0.2451E+03	0.3806E+03	-57.99
36100.	130.25	251.00	-48.97	0.2440E+03	0.3791E+03	-58.16
36200.	129.92	250.00	-49.15	0.2428E+03	0.3777E+03	-58.33
36300.	130.58	250.00	-49.33	0.2417E+03	0.3762E+03	-58.50
36400.	129.92	247.00	-49.51	0.2406E+03	0.3748E+03	-58.67
36500.	128.61	247.00	-49.69	0.2395E+03	0.3733E+03	-58.84
36600.	128.28	247.00	-49.87	0.2384E+03	0.3719E+03	-59.01
36700.	129.59	246.00	-50.05	0.2373E+03	0.3705E+03	-59.18
36800.	130.91	245.00	-50.23	0.2362E+03	0.3691E+03	-59.35
36900.	128.61	246.00	-50.41	0.2351E+03	0.3677E+03	-59.52
37000.	128.61	246.00	-50.59	0.2340E+03	0.3663E+03	-59.69
37100.	127.62	244.00	-50.91	0.2329E+03	0.3651E+03	-59.97
37200.	126.64	243.00	-51.23	0.2318E+03	0.3639E+03	-60.25
37300.	125.66	244.00	-51.55	0.2307E+03	0.3627E+03	-60.53
37400.	127.62	245.00	-51.87	0.2297E+03	0.3616E+03	-60.81
37500.	127.62	246.00	-52.19	0.2286E+03	0.3604E+03	-61.09
37600.	125.33	244.00	-52.51	0.2275E+03	0.3592E+03	-61.37
37700.	127.30	245.00	-52.83	0.2265E+03	0.3581E+03	-61.65
37800.	130.25	245.00	-53.15	0.2254E+03	0.3569E+03	-61.93
37900.	125.00	247.00	-53.47	0.2243E+03	0.3558E+03	-62.21
38000.	125.33	245.00	-53.79	0.2233E+03	0.3546E+03	-62.49
38100.	127.62	243.00	-53.94	0.2222E+03	0.3532E+03	-62.62
38200.	127.30	248.00	-54.09	0.2212E+03	0.3518E+03	-62.75
38300.	126.64	251.00	-54.24	0.2202E+03	0.3503E+03	-62.88
38400.	131.89	248.00	-54.39	0.2191E+03	0.3489E+03	-63.01
38500.	136.48	253.00	-54.54	0.2181E+03	0.3475E+03	-63.14
38600.	135.50	250.00	-54.69	0.2171E+03	0.3461E+03	-63.27
38700.	139.11	250.00	-54.84	0.2160E+03	0.3447E+03	-63.40
38800.	138.78	251.00	-54.99	0.2150E+03	0.3433E+03	-63.53
38900.	141.08	253.00	-55.14	0.2140E+03	0.3420E+03	-63.66
39000.	144.03	252.00	-55.29	0.2130E+03	0.3406E+03	-63.79
39100.	144.03	253.00	-55.09	0.2120E+03	0.3387E+03	-63.63
39200.	140.09	254.00	-54.89	0.2110E+03	0.3368E+03	-63.47
39300.	143.04	256.00	-54.69	0.2100E+03	0.3349E+03	-63.31
39400.	143.04	254.00	-54.49	0.2090E+03	0.3330E+03	-63.15
39500.	145.34	256.00	-54.29	0.2080E+03	0.3311E+03	-62.99
39600.	143.37	259.00	-54.09	0.2071E+03	0.3293E+03	-62.83
39700.	142.06	258.00	-53.89	0.2061E+03	0.3274E+03	-62.67
39800.	141.40	258.00	-53.69	0.2051E+03	0.3256E+03	-62.51
39900.	142.06	258.00	-53.49	0.2042E+03	0.3238E+03	-62.35

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
40000.	140.42	259.00	-53.29	0.2032E+03	0.3220E+03	-62.19
40100.	139.44	259.00	-53.39	0.2022E+03	0.3206E+03	-62.29
40200.	137.47	259.00	-53.49	0.2013E+03	0.3192E+03	-62.39
40300.	139.11	262.00	-53.59	0.2003E+03	0.3179E+03	-62.49
40400.	137.80	262.00	-53.69	0.1994E+03	0.3165E+03	-62.59
40500.	134.84	260.00	-53.79	0.1984E+03	0.3151E+03	-62.69
40600.	136.48	257.00	-53.89	0.1975E+03	0.3138E+03	-62.79
40700.	140.42	258.00	-53.99	0.1966E+03	0.3125E+03	-62.89
40800.	142.72	257.00	-54.09	0.1956E+03	0.3111E+03	-62.99
40900.	143.70	257.00	-54.19	0.1947E+03	0.3098E+03	-63.09
41000.	141.73	254.00	-54.29	0.1938E+03	0.3085E+03	-63.19
41100.	146.33	255.00	-54.36	0.1929E+03	0.3071E+03	-63.26
41200.	143.37	254.00	-54.43	0.1920E+03	0.3057E+03	-63.33
41300.	141.08	253.00	-54.50	0.1911E+03	0.3044E+03	-63.40
41400.	139.44	251.00	-54.57	0.1901E+03	0.3030E+03	-63.47
41500.	143.37	252.00	-54.64	0.1892E+03	0.3017E+03	-63.54
41600.	139.44	250.00	-54.71	0.1883E+03	0.3004E+03	-63.61
41700.	142.39	252.00	-54.78	0.1875E+03	0.2990E+03	-63.68
41800.	143.37	250.00	-54.85	0.1866E+03	0.2977E+03	-63.75
41900.	142.39	251.00	-54.92	0.1857E+03	0.2964E+03	-63.82
42000.	141.73	250.00	-54.99	0.1848E+03	0.2951E+03	-63.89
42100.	143.70	248.00	-55.15	0.1839E+03	0.2939E+03	-64.04
42200.	147.97	247.00	-55.31	0.1830E+03	0.2927E+03	-64.19
42300.	149.28	245.00	-55.47	0.1822E+03	0.2915E+03	-64.34
42400.	152.89	246.00	-55.63	0.1813E+03	0.2904E+03	-64.49
42500.	152.89	245.00	-55.79	0.1804E+03	0.2892E+03	-64.64
42600.	154.53	243.00	-55.95	0.1796E+03	0.2880E+03	-64.79
42700.	157.48	243.00	-56.11	0.1787E+03	0.2869E+03	-64.94
42800.	156.82	242.00	-56.27	0.1779E+03	0.2857E+03	-65.09
42900.	157.15	243.00	-56.43	0.1770E+03	0.2846E+03	-65.24
43000.	155.84	243.00	-56.59	0.1762E+03	0.2834E+03	-65.39
43100.	158.46	246.00	-56.76	0.1754E+03	0.2823E+03	-9999.00
43200.	158.79	243.00	-56.93	0.1745E+03	0.2812E+03	-9999.00
43300.	160.10	242.00	-57.10	0.1737E+03	0.2801E+03	-9999.00
43400.	160.10	241.00	-57.27	0.1729E+03	0.2790E+03	-9999.00
43500.	159.78	241.00	-57.44	0.1721E+03	0.2779E+03	-9999.00
43600.	159.45	243.00	-57.61	0.1712E+03	0.2768E+03	-9999.00
43700.	157.48	241.00	-57.78	0.1704E+03	0.2757E+03	-9999.00
43800.	160.43	242.00	-57.95	0.1696E+03	0.2746E+03	-9999.00
43900.	157.81	241.00	-58.12	0.1688E+03	0.2735E+03	-9999.00
44000.	157.15	241.00	-58.29	0.1680E+03	0.2724E+03	-9999.00
44100.	158.46	241.00	-58.56	0.1672E+03	0.2714E+03	-9999.00
44200.	155.18	240.00	-58.83	0.1664E+03	0.2704E+03	-9999.00
44300.	157.15	243.00	-59.10	0.1656E+03	0.2694E+03	-9999.00
44400.	153.54	239.00	-59.37	0.1648E+03	0.2685E+03	-9999.00
44500.	150.59	239.00	-59.64	0.1640E+03	0.2675E+03	-9999.00
44600.	151.57	239.00	-59.91	0.1632E+03	0.2665E+03	-9999.00
44700.	155.18	239.00	-60.18	0.1624E+03	0.2656E+03	-9999.00
44800.	152.89	238.00	-60.45	0.1616E+03	0.2646E+03	-9999.00
44900.	149.93	236.00	-60.72	0.1608E+03	0.2637E+03	-9999.00

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
45000.	143.04	236.00	-60.99	0.1600E+03	0.2627E+03	-9999.00
45100.	147.31	235.00	-61.30	0.1592E+03	0.2618E+03	-9999.00
45200.	148.29	234.00	-61.61	0.1584E+03	0.2609E+03	-9999.00
45300.	147.31	234.00	-61.92	0.1576E+03	0.2600E+03	-9999.00
45400.	146.65	233.00	-62.23	0.1569E+03	0.2591E+03	-9999.00
45500.	145.34	233.00	-62.54	0.1561E+03	0.2582E+03	-9999.00
45600.	143.37	234.00	-62.85	0.1553E+03	0.2573E+03	-9999.00
45700.	145.01	236.00	-63.16	0.1546E+03	0.2564E+03	-9999.00
45800.	143.70	235.00	-63.47	0.1538E+03	0.2555E+03	-9999.00
45900.	145.34	237.00	-63.78	0.1531E+03	0.2547E+03	-9999.00
46000.	143.37	236.00	-64.09	0.1523E+03	0.2538E+03	-9999.00
46100.	145.01	238.00	-64.36	0.1515E+03	0.2529E+03	-9999.00
46200.	146.00	237.00	-64.63	0.1508E+03	0.2519E+03	-9999.00
46300.	146.98	237.00	-64.90	0.1500E+03	0.2510E+03	-9999.00
46400.	145.01	239.00	-65.17	0.1493E+03	0.2501E+03	-9999.00
46500.	148.95	240.00	-65.44	0.1486E+03	0.2492E+03	-9999.00
46600.	147.31	240.00	-65.71	0.1478E+03	0.2482E+03	-9999.00
46700.	147.31	240.00	-65.98	0.1471E+03	0.2473E+03	-9999.00
46800.	147.64	240.00	-66.25	0.1464E+03	0.2464E+03	-9999.00
46900.	146.33	239.00	-66.52	0.1456E+03	0.2455E+03	-9999.00
47000.	146.33	243.00	-66.79	0.1449E+03	0.2446E+03	-9999.00
47100.	140.09	240.00	-66.94	0.1442E+03	0.2436E+03	-9999.00
47200.	143.04	244.00	-67.09	0.1435E+03	0.2425E+03	-9999.00
47300.	139.11	238.00	-67.24	0.1427E+03	0.2415E+03	-9999.00
47400.	142.72	240.00	-67.39	0.1420E+03	0.2404E+03	-9999.00
47500.	138.45	239.00	-67.54	0.1413E+03	0.2394E+03	-9999.00
47600.	137.80	241.00	-67.69	0.1406E+03	0.2384E+03	-9999.00
47700.	137.47	239.00	-67.84	0.1399E+03	0.2374E+03	-9999.00
47800.	135.83	240.00	-67.99	0.1392E+03	0.2364E+03	-9999.00
47900.	135.50	240.00	-68.14	0.1385E+03	0.2353E+03	-9999.00
48000.	135.50	238.00	-68.29	0.1378E+03	0.2343E+03	-9999.00
48100.	137.14	239.00	-68.51	0.1371E+03	0.2334E+03	-9999.00
48200.	135.83	237.00	-68.73	0.1364E+03	0.2325E+03	-9999.00
48300.	138.45	237.00	-68.95	0.1357E+03	0.2315E+03	-9999.00
48400.	137.14	237.00	-69.17	0.1350E+03	0.2306E+03	-9999.00
48500.	135.50	240.00	-69.39	0.1344E+03	0.2297E+03	-9999.00
48600.	133.20	241.00	-69.61	0.1337E+03	0.2288E+03	-9999.00
48700.	137.14	242.00	-69.83	0.1330E+03	0.2279E+03	-9999.00
48800.	129.92	245.00	-70.05	0.1323E+03	0.2270E+03	-9999.00
48900.	132.22	248.00	-70.27	0.1317E+03	0.2261E+03	-9999.00
49000.	130.25	248.00	-70.49	0.1310E+03	0.2252E+03	-9999.00
50000.	124.34	247.00	-70.59	0.1245E+03	0.2141E+03	-9999.00
51000.	118.11	252.00	-70.59	0.1183E+03	0.2035E+03	-9999.00
52000.	111.55	256.00	-70.89	0.1124E+03	0.1936E+03	-9999.00
53000.	100.72	255.00	-72.79	0.1068E+03	0.1857E+03	-9999.00
54000.	88.91	249.00	-72.69	0.1014E+03	0.1762E+03	-9999.00
55000.	80.71	245.00	-72.29	0.9630E+02	0.1670E+03	-9999.00
56000.	72.83	244.00	-72.79	0.9146E+02	0.1590E+03	-9999.00
57000.	62.99	244.00	-72.79	0.8686E+02	0.1510E+03	-9999.00
58000.	49.54	243.00	-72.09	0.8250E+02	0.1429E+03	-9999.00

Table 5. STS-32 ascent atmospheric data tape (continued).

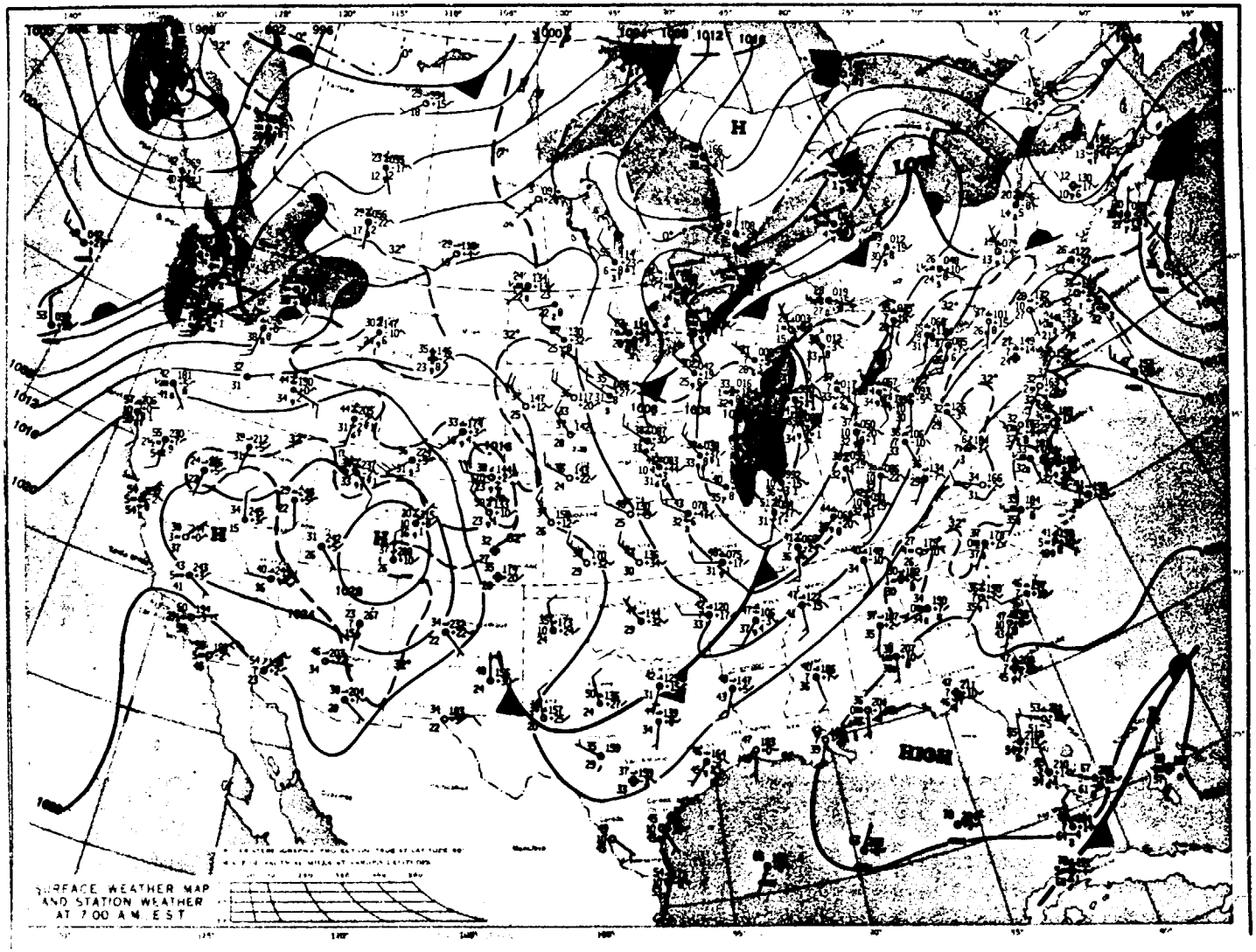
ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
59000.	43.31	240.00	-70.59	0.7838E+02	0.1348E+03	-9999.00
60000.	38.71	242.00	-71.29	0.7448E+02	0.1285E+03	-9999.00
61000.	31.82	250.00	-71.69	0.7076E+02	0.1224E+03	-9999.00
62000.	27.23	259.00	-70.89	0.6723E+02	0.1158E+03	-9999.00
63000.	24.28	269.00	-69.89	0.6389E+02	0.1095E+03	-9999.00
64000.	17.39	269.00	-70.69	0.6072E+02	0.1045E+03	-9999.00
65000.	9.19	256.00	-67.09	0.5772E+02	0.9758E+02	-9999.00
66000.	1.97	261.00	-65.99	0.5491E+02	0.9234E+02	-9999.00
67000.	5.58	170.00	-66.39	0.5224E+02	0.8802E+02	-9999.00
68000.	17.39	192.00	-66.09	0.4970E+02	0.8362E+02	-9999.00
69000.	25.26	214.00	-64.39	0.4729E+02	0.7892E+02	-9999.00
70000.	25.92	239.00	-63.89	0.4501E+02	0.7493E+02	-9999.00
71000.	24.61	269.00	-63.19	0.4285E+02	0.7110E+02	-9999.00
72000.	21.65	289.00	-63.69	0.4080E+02	0.6786E+02	-9999.00
73000.	18.37	300.00	-61.39	0.3885E+02	0.6391E+02	-9999.00
74000.	16.73	298.00	-60.89	0.3700E+02	0.6073E+02	-9999.00
75000.	15.09	272.00	-62.19	0.3524E+02	0.5819E+02	-9999.00
76000.	18.37	249.00	-60.59	0.3356E+02	0.5500E+02	-9999.00
77000.	23.62	255.00	-59.39	0.3198E+02	0.5212E+02	-9999.00
78000.	28.54	260.00	-59.29	0.3047E+02	0.4963E+02	-9999.00
79000.	32.15	260.00	-58.29	0.2904E+02	0.4708E+02	-9999.00
80000.	34.45	262.00	-58.59	0.2768E+02	0.4494E+02	-9999.00
81000.	38.06	266.00	-57.79	0.2638E+02	0.4267E+02	-9999.00
82000.	42.32	268.00	-59.59	0.2514E+02	0.4101E+02	-9999.00
83000.	45.93	266.00	-60.69	0.2396E+02	0.3929E+02	-9999.00
84000.	52.49	266.00	-59.09	0.2282E+02	0.3714E+02	-9999.00
85000.	57.74	267.00	-57.89	0.2175E+02	0.3520E+02	-9999.00
86000.	60.37	272.00	-54.79	0.2074E+02	0.3309E+02	-9999.00
87000.	63.65	280.00	-52.89	0.1979E+02	0.3130E+02	-9999.00
88000.	67.59	286.00	-51.49	0.1889E+02	0.2969E+02	-9999.00
89000.	65.29	282.00	-50.79	0.1803E+02	0.2825E+02	-9999.00
90000.	58.07	271.00	-50.69	0.1721E+02	0.2695E+02	-9999.00
91000.	55.09	271.92	-49.71	0.1613E+02	0.2516E+02	-9999.00
94000.	46.27	275.36	-46.77	0.1330E+02	0.2046E+02	-9999.00
97000.	37.70	280.41	-43.82	0.1096E+02	0.1664E+02	-9999.00
100000.	29.58	288.31	-40.88	0.9029E+01	0.1354E+02	-9999.00
103000.	22.43	301.67	-37.94	0.7440E+01	0.1102E+02	-9999.00
106000.	24.00	298.95	-35.89	0.6550E+01	0.9617E+01	-9999.00
109000.	25.57	296.60	-33.83	0.5770E+01	0.8399E+01	-9999.00
112000.	25.43	294.55	-30.97	0.5100E+01	0.7336E+01	-9999.00
115000.	23.82	292.43	-27.46	0.4520E+01	0.6409E+01	-9999.00
118000.	22.27	289.98	-23.94	0.4010E+01	0.5606E+01	-9999.00
121000.	20.74	287.20	-20.41	0.3550E+01	0.4893E+01	-9999.00
124000.	19.30	283.97	-16.88	0.3150E+01	0.4282E+01	-9999.00
127000.	17.91	280.34	-13.33	0.2790E+01	0.3741E+01	-9999.00
130000.	18.40	273.37	-11.30	0.2490E+01	0.3313E+01	-9999.00
133000.	19.16	266.86	-9.28	0.2230E+01	0.2944E+01	-9999.00
136000.	20.10	260.89	-7.25	0.2000E+01	0.2620E+01	-9999.00
139000.	21.28	255.54	-5.23	0.1790E+01	0.2327E+01	-9999.00
142000.	22.62	250.78	-3.21	0.1600E+01	0.2065E+01	-9999.00

Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
145000.	24.31	247.21	-1.81	0.1430E+01	0.1836E+01	-9999.00
148000.	26.26	244.94	-1.20	0.1280E+01	0.1640E+01	-9999.00
151000.	28.26	242.93	-0.58	0.1150E+01	0.1470E+01	-9999.00
154000.	30.32	241.22	0.04	0.1030E+01	0.1313E+01	-9999.00
157000.	32.38	239.69	0.65	0.9200E+00	0.1171E+01	-9999.00
160000.	34.45	238.35	1.26	0.8240E+00	0.1046E+01	-9999.00
163000.	39.94	242.82	-0.03	0.7390E+00	0.9426E+00	-9999.00
166000.	46.04	246.70	-1.57	0.6630E+00	0.8505E+00	-9999.00
169000.	52.34	249.68	-3.16	0.5940E+00	0.7664E+00	-9999.00
172000.	58.74	252.01	-4.77	0.5320E+00	0.6906E+00	-9999.00
175000.	65.23	253.88	-6.39	0.4770E+00	0.6229E+00	-9999.00
178000.	72.10	255.32	-8.35	0.4260E+00	0.5604E+00	-9999.00
181000.	79.67	256.38	-11.00	0.3780E+00	0.5023E+00	-9999.00
184000.	87.26	257.25	-13.65	0.3360E+00	0.4511E+00	-9999.00
187000.	94.87	257.96	-16.29	0.2990E+00	0.4055E+00	-9999.00
190000.	102.48	258.59	-18.93	0.2660E+00	0.3645E+00	-9999.00
193000.	110.12	259.11	-21.56	0.2360E+00	0.3268E+00	-9999.00
196000.	121.80	262.07	-24.57	0.2090E+00	0.2929E+00	-9999.00
199000.	135.00	265.12	-27.70	0.1850E+00	0.2626E+00	-9999.00
202000.	148.52	267.61	-30.82	0.1640E+00	0.2358E+00	-9999.00
205000.	162.24	269.69	-33.94	0.1450E+00	0.2112E+00	-9999.00
208000.	176.17	271.43	-37.06	0.1280E+00	0.1889E+00	-9999.00
211000.	185.27	272.87	-40.23	0.1130E+00	0.1690E+00	-9999.00
214000.	177.10	274.11	-43.59	0.9870E-01	0.1498E+00	-9999.00
217000.	168.98	275.46	-46.94	0.8620E-01	0.1327E+00	-9999.00
220000.	160.96	276.95	-50.30	0.7530E-01	0.1177E+00	-9999.00
223000.	153.06	278.59	-53.28	0.6580E-01	0.1043E+00	-9999.00
226000.	145.31	280.42	-56.23	0.5750E-01	0.9234E-01	-9999.00
229000.	139.98	279.91	-58.36	0.5000E-01	0.8110E-01	-9999.00
232000.	135.93	278.08	-60.08	0.4340E-01	0.7096E-01	-9999.00
235000.	132.02	276.13	-61.81	0.3770E-01	0.6214E-01	-9999.00
238000.	128.24	274.08	-63.55	0.3270E-01	0.5435E-01	-9999.00
241000.	124.68	271.92	-65.29	0.2840E-01	0.4760E-01	-9999.00
244000.	120.64	269.64	-66.93	0.2460E-01	0.4156E-01	-9999.00
247000.	111.50	267.39	-67.62	0.2120E-01	0.3593E-01	-9999.00
250000.	102.56	264.75	-68.82	0.1820E-01	0.3103E-01	-9999.00
253000.	93.92	261.60	-70.02	0.1570E-01	0.2693E-01	-9999.00
256000.	85.58	257.85	-71.22	0.1350E-01	0.2329E-01	-9999.00
259000.	77.69	253.29	-72.41	0.1170E-01	0.2030E-01	-9999.00
262000.	73.27	249.89	-73.42	0.1000E-01	0.1744E-01	-9999.00
265000.	71.37	247.86	-74.28	0.8640E-02	0.1514E-01	-9999.00
268000.	69.53	245.73	-75.13	0.7440E-02	0.1309E-01	-9999.00
271000.	67.83	243.48	-75.99	0.6400E-02	0.1131E-01	-9999.00
274000.	66.24	241.12	-76.86	0.5510E-02	0.9779E-02	-9999.00
277000.	64.75	238.68	-77.84	0.4740E-02	0.8455E-02	-9999.00
280000.	54.50	236.49	-79.04	0.4050E-02	0.7269E-02	-9999.00
283000.	44.36	233.30	-80.23	0.3470E-02	0.6266E-02	-9999.00
286000.	34.44	228.24	-81.42	0.2970E-02	0.5396E-02	-9999.00
289000.	25.02	219.31	-82.60	0.2540E-02	0.4644E-02	-9999.00
292000.	16.87	200.73	-83.78	0.2170E-02	0.3992E-02	-9999.00

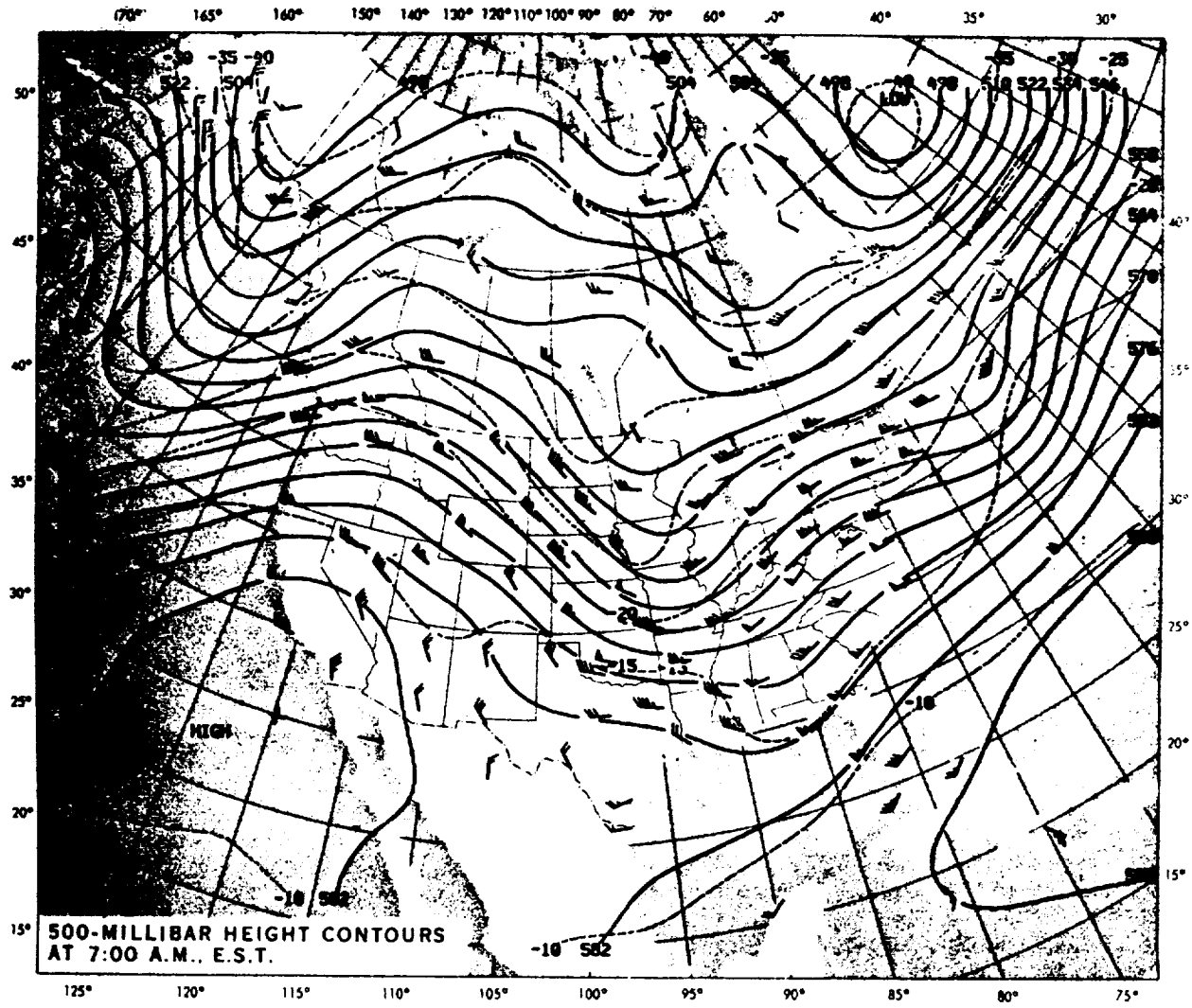
Table 5. STS-32 ascent atmospheric data tape (continued).

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
295000.	18.29	192.22	-84.01	0.1860E-02	0.3426E-02	-9999.00
298000.	29.59	200.10	-83.05	0.1590E-02	0.2914E-02	-9999.00
301000.	40.33	199.04	-82.09	0.1360E-02	0.2480E-02	-9999.00
304000.	49.08	192.39	-81.13	0.1160E-02	0.2105E-02	-9999.00
307000.	55.88	178.99	-80.16	0.9900E-03	0.1787E-02	-9999.00
310000.	65.26	156.79	-79.20	0.8460E-03	0.1520E-02	-9999.00
313000.	70.15	152.06	-77.65	0.7260E-03	0.1294E-02	-9999.00
316000.	73.12	149.59	-76.03	0.6240E-03	0.1103E-02	-9999.00
319000.	75.12	146.40	-74.41	0.5360E-03	0.9395E-03	-9999.00
322000.	75.84	142.13	-72.79	0.4600E-03	0.7998E-03	-9999.00
325000.	75.18	136.20	-71.17	0.3950E-03	0.6813E-03	-9999.00
328000.	75.19	130.29	-68.90	0.3400E-03	0.5799E-03	-9999.00
331000.	78.89	128.87	-65.32	0.2950E-03	0.4945E-03	-9999.00
334000.	81.56	127.05	-61.73	0.2550E-03	0.4202E-03	-9999.00
337000.	82.90	124.63	-58.15	0.2210E-03	0.3581E-03	-9999.00
340000.	82.36	121.35	-54.57	0.1910E-03	0.3044E-03	-9999.00
343000.	79.49	116.58	-50.99	0.1660E-03	0.2603E-03	-9999.00
346000.	79.77	113.72	-45.39	0.1450E-03	0.2218E-03	-9999.00
349000.	81.42	113.49	-39.22	0.1280E-03	0.1906E-03	-9999.00
352000.	81.38	113.20	-33.05	0.1130E-03	0.1640E-03	-9999.00
355000.	79.02	112.76	-26.88	0.9940E-04	0.1406E-03	-9999.00
358000.	73.58	112.10	-20.71	0.8740E-04	0.1206E-03	-9999.00
361000.	64.88	105.46	-14.08	0.7730E-04	0.1039E-03	-9999.00
364000.	67.08	106.83	-5.79	0.6980E-04	0.9095E-04	-9999.00
367000.	68.62	108.54	2.49	0.6290E-04	0.7950E-04	-9999.00
370000.	69.23	110.70	10.77	0.5670E-04	0.6957E-04	-9999.00
373000.	68.75	113.54	19.05	0.5100E-04	0.6080E-04	-9999.00
376000.	66.90	117.42	27.33	0.4590E-04	0.5322E-04	-9999.00
379000.	58.41	106.38	36.54	0.4170E-04	0.4691E-04	-9999.00
382000.	56.75	108.85	46.53	0.3820E-04	0.4163E-04	-9999.00
385000.	55.30	111.51	56.84	0.3510E-04	0.3705E-04	-9999.00
388000.	54.05	114.42	67.47	0.3240E-04	0.3314E-04	-9999.00
391000.	53.02	117.53	78.37	0.2990E-04	0.2963E-04	-9999.00
394000.	52.19	120.90	89.52	0.2770E-04	0.2661E-04	-9999.00
397000.	51.61	124.46	100.89	0.2580E-04	0.2403E-04	-9999.00
400000.	51.26	128.19	112.45	0.2400E-04	0.2168E-04	-9999.00



Surface synoptic map at 1200 u.t. January 9, 1990—isobaric, frontal, and precipitation patterns are shown in standard symbolic form.

Figure 1. Surface synoptic chart 35 min before launch of STS-32.



500-mb height
Contours at 1200 u.t.
January 9, 1990
Continuous lines indicate height contours at feet above sea level.
Dashed lines are isotherms in degrees centigrade. Arrows show wind direction and speed at the 500-mb level.

Figure 2. 500-mb map 35 min before launch of STS-32.

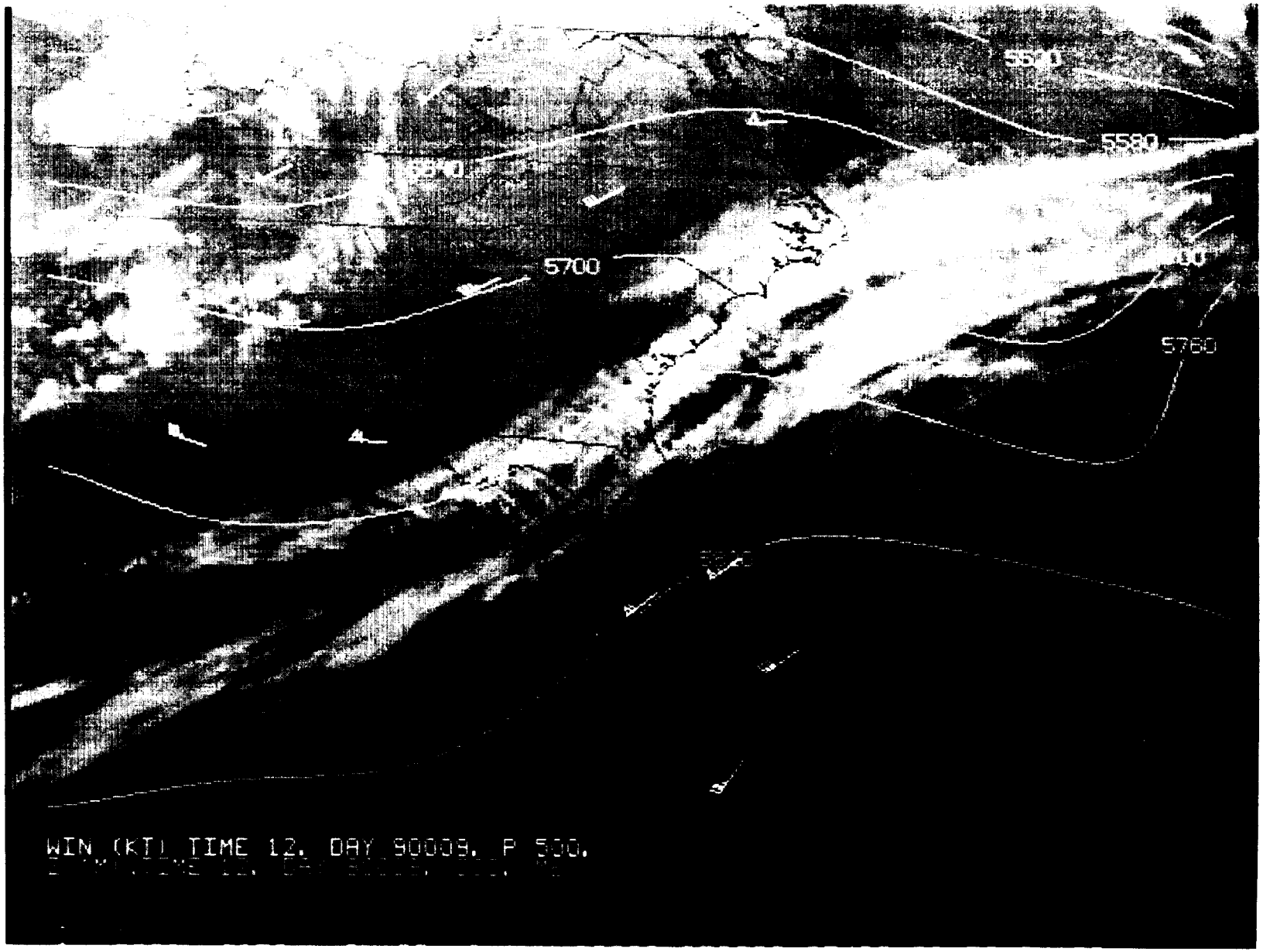


Figure 3. GOES-7 infrared imagery of cloud cover 4 min before the launch of STS-32 (1235 u.t., January 9, 1990). 500-mb heights (meters) and wind barbs are also included for 1200 u.t.

Figure 4. Enlarged view of GOES-7 visible imagery of cloud cover taken 4 min before the launch of STS-32 (1235 u.t., January 9, 1990). Surface temperatures, isobaric parameters, and wind barbs for 1200 u.t. are also included.

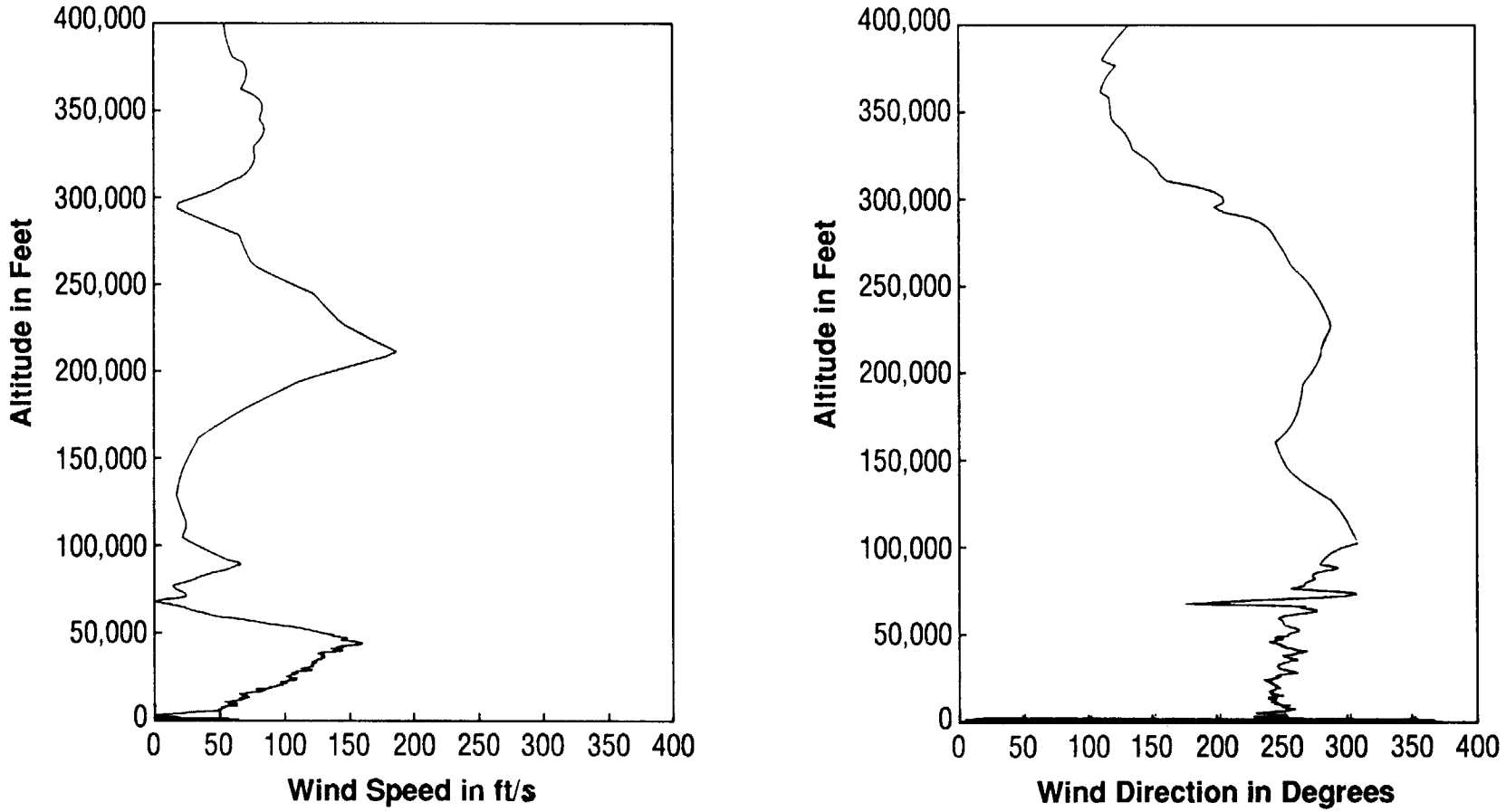


Figure 5. Scalar wind speed and direction at launch time of STS-32.

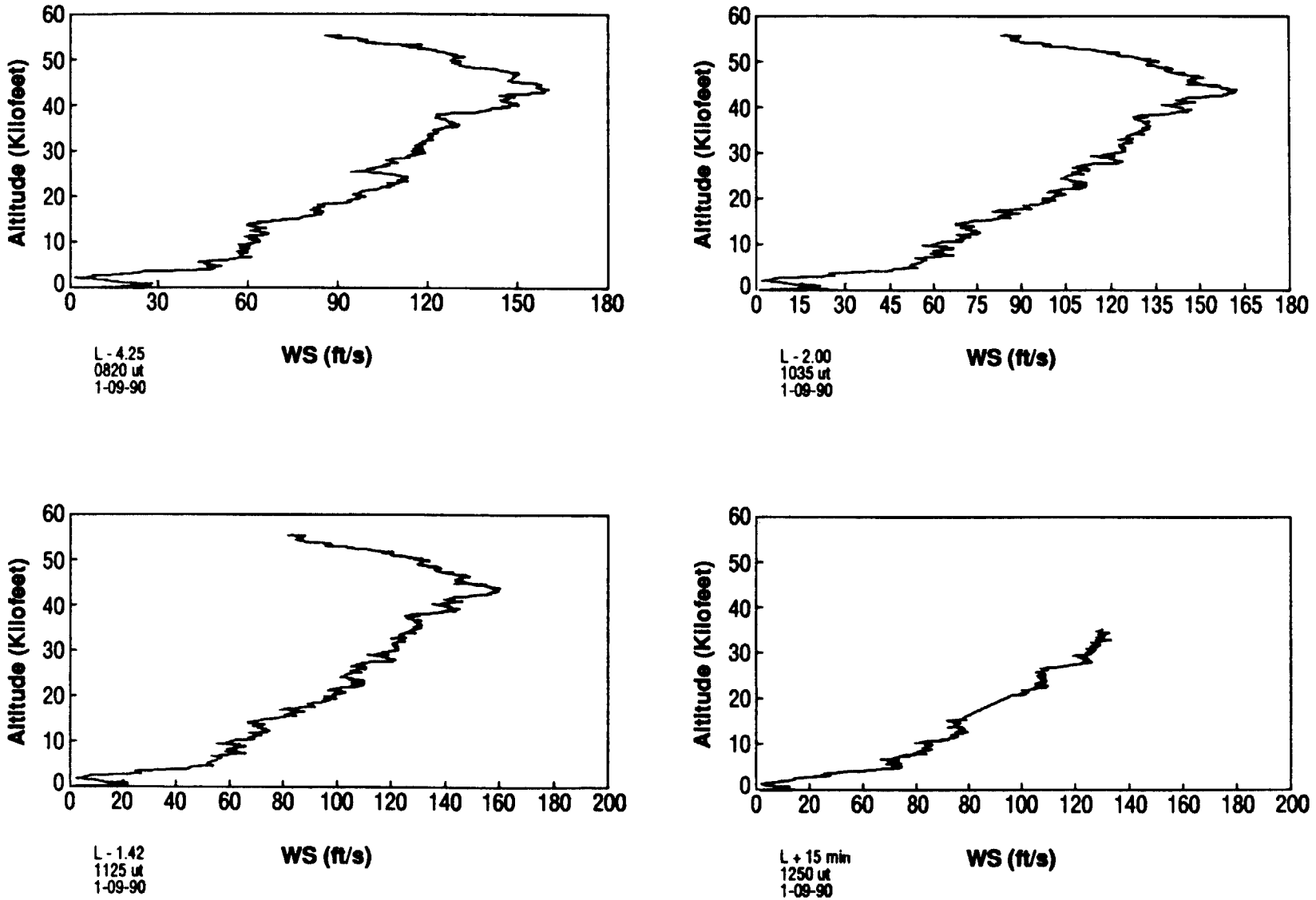


Figure 6. STS-32 prelaunch/launch Jimsphere-measured wind speeds (FPS).

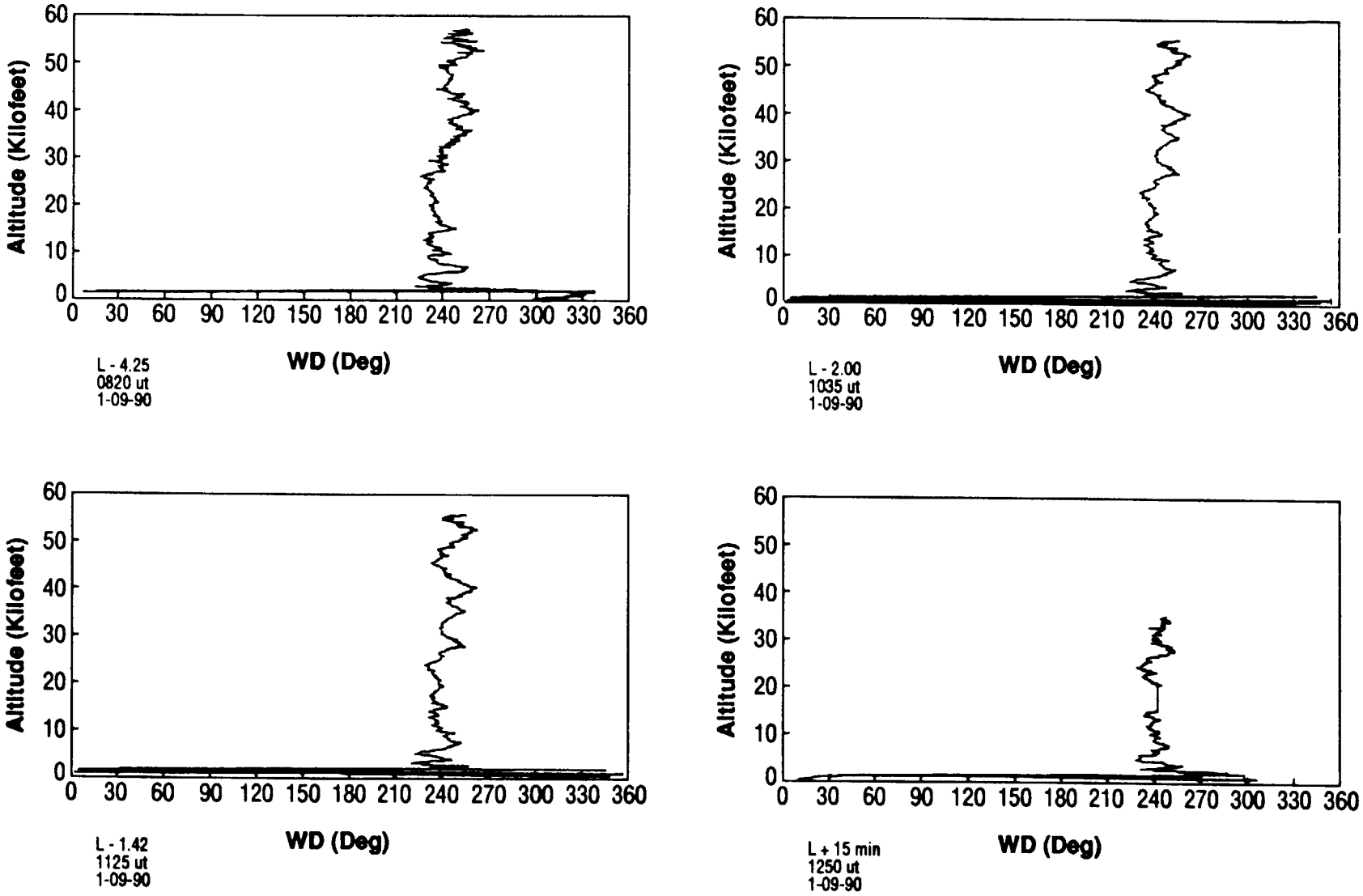


Figure 7. STS-32 prelaunch/launch Jimsphere-measured wind directions (degrees).

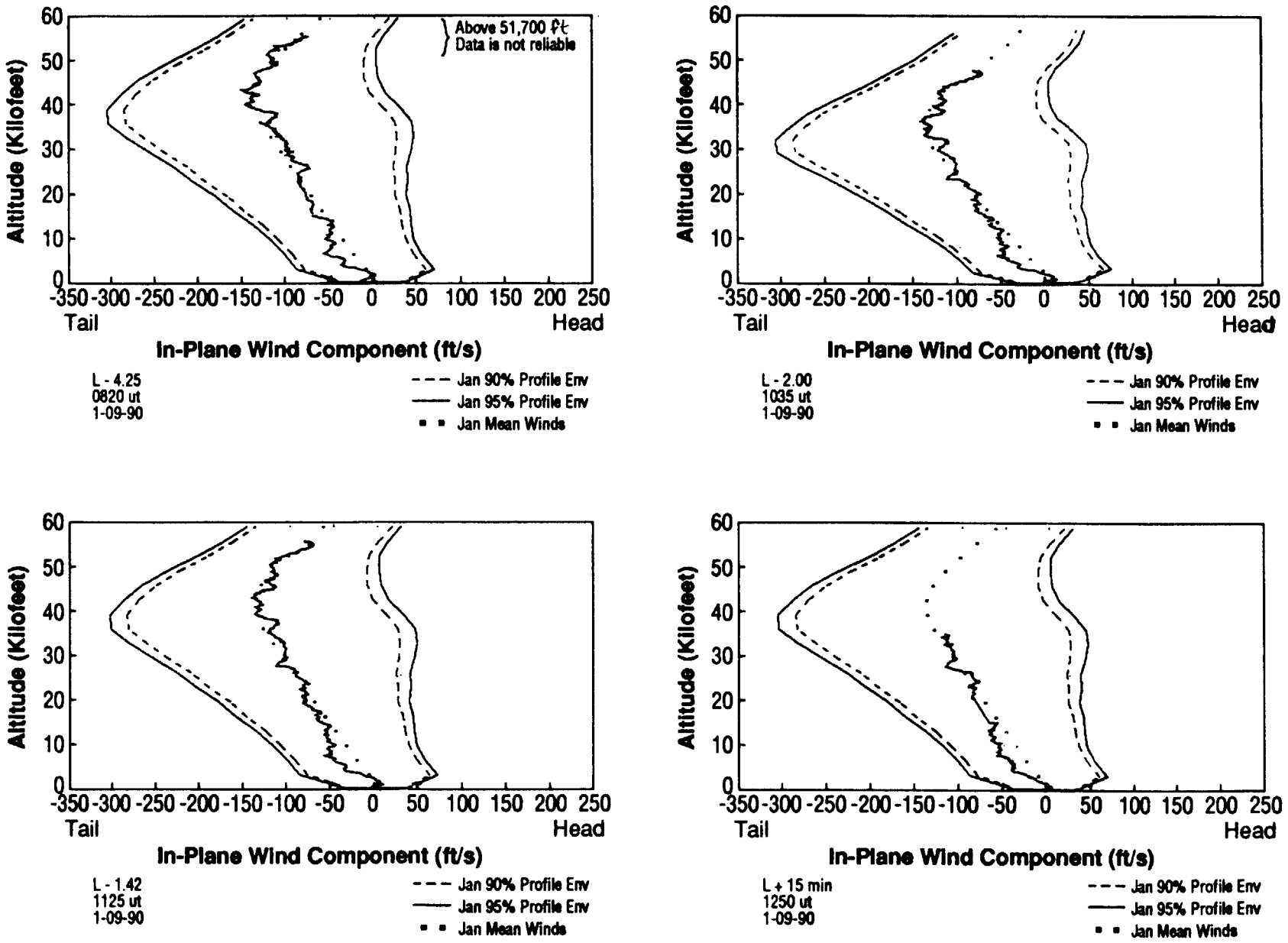


Figure 8. STS-32 prelaunch/launch Jimsphere-measured in-plane component winds (FPS). Flight azimuth = 90 degrees.

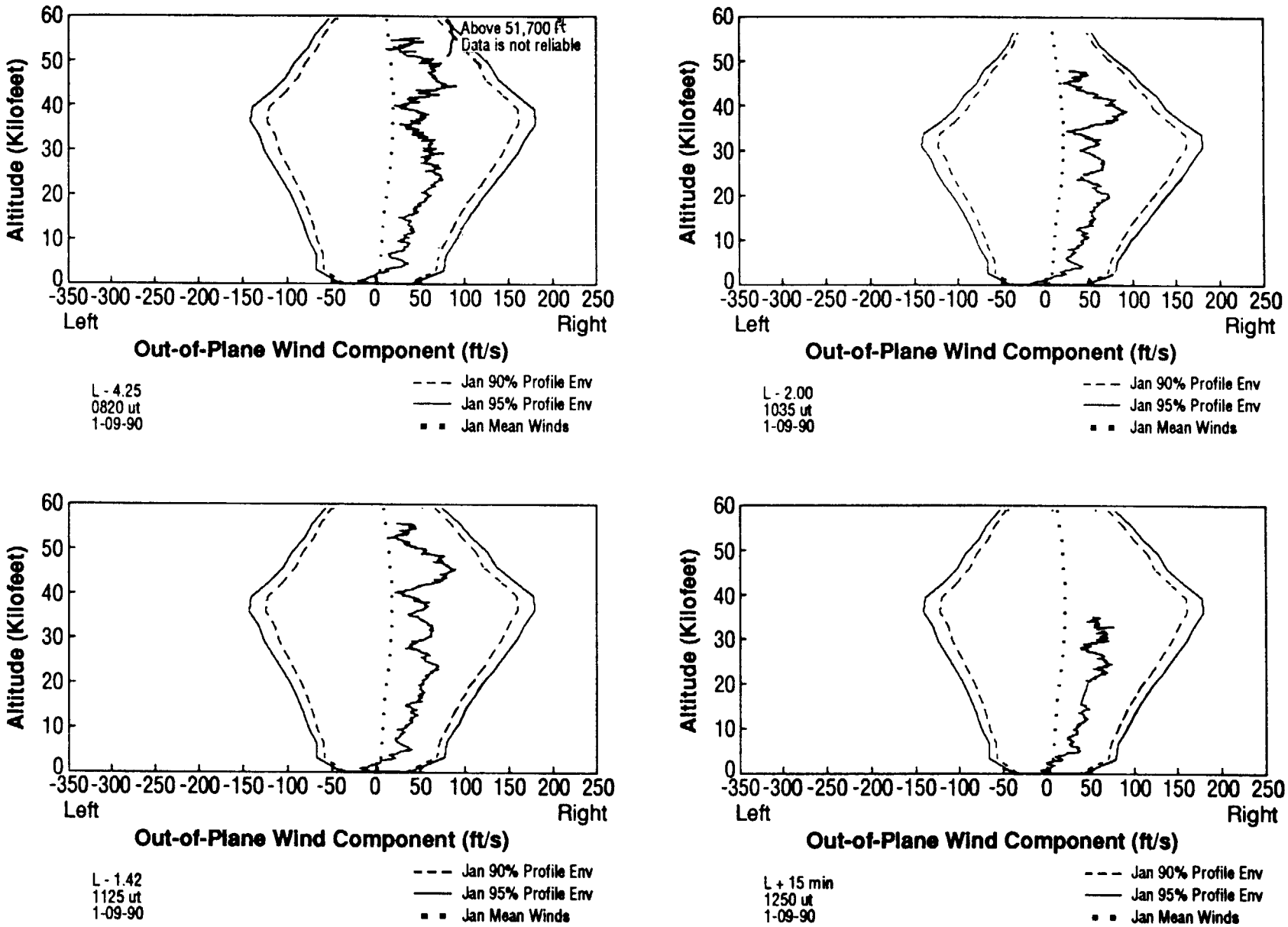


Figure 9. STS-32 prelaunch/launch Jimsphere-measured out-of-plane component winds (FPS). Flight azimuth = 90 degrees.

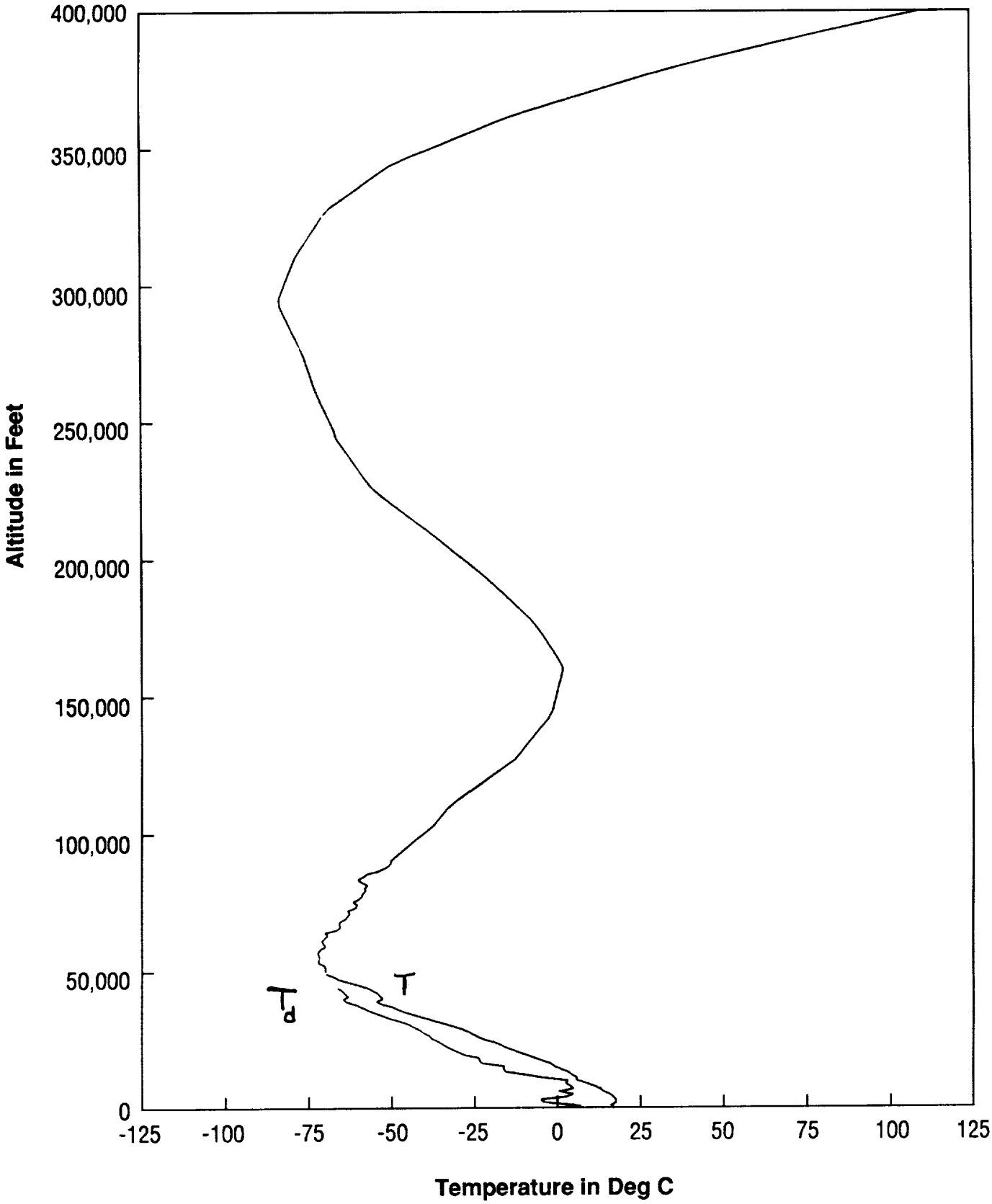


Figure 10. STS-32 temperature profiles versus altitude for launch (ascent).

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APPROVAL

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-32) LAUNCH

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The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

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