REPORT UAG - 27

WORLD DATA CENTER A
for
Solar-Terrestrial Physics

HIGH SPEED STREAMS IN THE SOLAR WIND

JUNE 1973

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National Academy of Sciences

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High Speed Streams in the Solar Wind

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Description of Lists of High Speed Streams

The following is a list of the high speed solar wind proton streams observed in the interplanetary medium by the Ames Research Center solar wind spectrometer on the Pioneer 6, 7, 8 and 9 spacecraft. This is followed by a similar list based on the observations from the Vela 3, 4, 5A and 5B satellites. The Pioneer list specifies all high speed streams that occurred between December 16, 1965 and June 30, 1971 for which there are data. There were many time intervals during which there was no ground tracking of the spacecraft.

The first four columns on the left are, respectively, the year, month, day, and hour (if known) in UT of the beginning of the high speed stream. The fifth column from the left indicates the number of the Pioneer spacecraft. The sixth column, T(days) gives the co-rotation delay time in days for the beginning of the high speed stream to reach the earth. This is not the co-rotation delay that would correspond to the peak speed associated with the stream. The co-rotation delay was calculated in the same manner as those published with the Pioneer observations in Solar-Geophysical Data:

$$\text{co-rotation delay (secs)} = \text{Tau} = \frac{\phi}{W} - \frac{1}{U_{H^+}} (r_p - r_e)$$

where

W = 27-day solar rotation period angular velocity (in radians sec^{-1})
= 2.6934×10^{-6} radians sec^{-1}

ϕ = Ecliptic projection of Earth-Sun-Pioneer angle (in radians)

r_p = Ecliptic projection of Sun-Pioneer distance (in km)

r_e = Sun-Earth distance (in km)

U_{H^+} = Solar wind speed (in km sec^{-1})

the degree of out-of-the-ecliptic of each spacecraft is insignificant and hence is ignored in the above calculation. A positive (+) co-rotation delay indicates that the observation of the high speed stream at the Pioneer spacecraft was before the observation of the stream at Earth; a negative (-) co-rotation delay indicates that the high speed stream should have been previously observed at the Earth.

The seventh column from the left indicates the approximate duration of the high speed stream in days. The eighth column indicates the increase in the solar wind speed during the high speed stream in increments of 50 km sec^{-1} each. For example, if before the beginning of the stream the solar wind speed was 300 km sec^{-1} and if later the peak speed in the stream was 700 km sec^{-1} then there was a base to peak increase in solar wind speed of 400 km sec^{-1}, i.e., there are "8" 50 km sec^{-1} increases. The three columns on the right are, respectively, the approximate peak speed of the stream, and the approximate day and hour in UT of the peak.

The list of the high speed streams for the Vela data is similar to the list for the Pioneer data. The Vela list specifies all high speed streams that were observed from July 1965 through November 1967 and then from January 1969 through May 1971. The Vela list is also subject to data gaps when the satellites were not tracked. In addition, the Vela satellites spend a large part of each orbit in the magnetosphere and, therefore, do not monitor the solar wind during this time.

The first four columns on the left are, respectively, the year, month, day, and approximate hour (in UT) of the start of the high speed stream. The fifth column lists the number of the Vela spacecraft at which the stream was observed. There is no co-rotation delay listed for the Vela observations since these satellites are relatively close to Earth. The sixth column lists the approximate duration of the high speed streams in days. The seventh column indicates the increase in the solar wind speed associated with the stream in increments of 50 km sec^{-1} (see example in Pioneer description above). The three columns on the right list the approximate peak speed of the stream and the day and hour in UT of the observation.

HIGH SPEED STREAMS IN THE SOLAR WIND

PIONEER SPACECRAFT

Date		Time UT	S/C	T(days)	Duration (Days)	Number of 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
65 Dec.	25	20	6	.05	5.2	4	600	26	12
66 Jan.	4	12	6	.11	1.3	2	497	5	0
	7	12	6	.13	4	3	506	8	6
	20	14	6	.22	7.7	4	626	24	9
Feb.	3	8	6	.30	3.9	3	586	4	9
	19	8	6	.38	2.5	6	701	20	6
	22	16	6	.29	2.6	4	660	23	15
Mar.	18		6	.29	13	4	629	23	
Apr.	21		6	-.1	6	3	520	24	
May	2		6	-.49	5	2	530	4	
	26		6	-1.22	10	4	600	Jun 1	
Jun.	28		6	-2.33	2	3	575	30	
Jul.	9	18	6	-2.68	2	5	675	11	
Aug.	23	1	7	-.03	6.3	4	611	23	18
	30	11	7	-.07	4.1	5	654	31	18
Sept.	5	8	7	-.09	7.4	5	650	8	22
	14	12	7	-.15	3.6	7	670	17	7
	19	3	7	-.14	2.8	3	550	19	13
	23	6	7	-.14	1.8	5	530	23	18
	27	17	7	-.19	4.3	6	645	29	9
Oct.	5	0	7	-.15	4.1	3	607	6	6
	27	15	7	-.01	.2	5	632	27	19
Nov.	2	12	6	-3.99	2.5	5	650	3	15
Dec.	5		7	.31	2	4	655	5	
	12		7	.15	4	2	500	13	
	27		7	.55	3	4	605	27	
67 Feb.	9		7	1.13	1	2	490	9	
	15	11	7	1.01	5	2	423	17	11
	20	12	7	1.07	9	2	447	25	17
Mar.	7		7	1.62	1	4	591	7	
May	21	12	7	2.56	1.5	2	550	23	
June	4	13	6	-6.85	9	4	535	6	12
Aug.	3	12	7	2.83	8	4	527	9	12
	6	12	6	-7.89	3.2	4	559	7	14
	13	20	7	2.82	7.6	5	659	15	12
	25		7	2.78	2	3	525	25	
	30		7	2.77	2	2	530	31	
Sept.	1	12	6	-7.90	4	3	508	4	13
	11	12	7	2.74	5.9	3	579	12	11
Oct.	7		7	2.63	10.5	5	631	8	12
	23		6	-7.92	1	2	608	24	19

Date		Time UT	S/C	T(days)	Duration (Days)	Number 50km/sec Increases	Peak Speed	Day and Time (UT)of Peak	
Oct.	30	12	7	2.57	5	3	496	31	12
	30	15	6	-7.78	8.9	7	738	Nov.1	15
Nov.	11		7	2.63	2	4	630	11	
	13		7	2.69	3	4	600	14	
	15	12	6	-7.77	9.1	7	700	20	12
	29		6	-8.06	1	4	575	29	
	30	11	7	2.61	11.6	6	647	Dec.6	12
Dec.	19	14	6	-8.41	2	6	787	19	14
	28		6	-8.27	4	3	567	29	16
68 Jan.	1	13	6	-8.3	4.2	4	586	3	13
	12	13	6	-8.4	7.1	4	600	14	19
	19		7	3.21	7.8	3	567	19	12
	27	14	6	-8.9	4	5	623	31	15
Feb.	9	18	6	-9.5	5.9	3	536	12	17
	9	21	7	3.25	11.9	7	735	12	19
	21	19	7	3.36	9	4	491	24	19
	27	16	6	-9.8	5	5	638	Mar.1	18
Mar.	6	19	6	-9.92	7.8	7	660	10	19
	10		7	3.81	8	5	605	15	1
	17	19	7	3.88	12	4	562	26	19
	19	17	6	-10.41	6.1	3	553	21	18
	25	20	6	-10.36	8.9	3	461	29	23
	30	20	7	4.12	5	3	500	Apr.2	
Apr.	3	18	6	-10.82	6	3	571	6	18
	5		7	4.16	10	5	624	10	19
	9	18	6	-10.93	9	4	620	17	17
	26	22	7	4.50	3.8	3	538	27	22
May	4	20	7	4.56	7.8	5	586	7	17
	13	15	6	-11.45	3	4	551	14	16
	14	17	7	4.82	1	3	624	15	17
	17	1	7	4.85	4.6	4	614	19	17
	18	15	6	-11.58	11.1	4	553	24	16
	23	0	7	4.89	7	4	617	28	17
	29	17	6	-11.6	8	4	573	Jun.1	16
June	3	0	7	5.09	2.7	3	597	4	17
	7	0	7	5.08	11.7	6	708	10	17
	10	15	6	-11.69	3.1	3	536	11	16
	15		6	-11.78	5.5	4	612	15	16
	24	0	7	5.25	2.7	2	510	25	18
	25	17	6	-11.74	11.1	2	476	27	17
July	2	18	7	5.33	9.2	6	784	9	17
	13	19	6	-11.77	7	4	599	18	14
	21	16	6	-11.74	3.2	5	590	22	17

Date		Time UT	S/C	T(days)	Duration (Days)	Number 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
July	27	17	6	-11.76	9	3	578	29	17
Aug.	2	18	7	5.52	4	4	625	5	18
	14		6	-11.83	10.5	7	770	18	17
	26		7	5.54	8	5	664	31	18
	26	13	6	-11.78	10.2	5	694	29	17
Sept.	3	18	7	5.54	8	3	589	5	0
	8	15	6	-11.69	4.1	6	644	10	17
	14	18	6	-11.78	6.8	2	513	17	18
	19	18	7	5.55	23	9	770	26	18
	21	15	6	-11.73	10.1	5	578	27	15
Oct.	6		8	1.46	10	8	680	11	
	16		6	-12.31	5.5	5	751	16	17
	16		8	1.52	6	5	542	17	
	17	0	7	5.48	16	5	573	25	22
	24		8	1.53	7	13	980	29	
	25	17	6	-12.13	1.2	3	550	26	21
Nov.	1		8	1.60	9	9	783	2	
	5	14	6	-12.41	2.1	3	586	6	16
	10		8	1.60	6	5	542	12	
	17		9	.05	1	1	410	18	12
	20		8	1.62	9	6	630	24	
	20	6	9	.07	1.5	4	575	21	
	22		9	.08	2.5	3	590	23	12
	24	12	9	.11	1.2	1	510	25	
	28		9	.13	2	2	490	28	12
	30		8	1.64	8	4	585	Dec.5	
Dec.	2		9	.16	3.7	4	570	4	12
	6	12	9	.20	.2	1	475	6	14
	8		8	1.65	2	2	542	9	
	10	18	9	.24	3.5	2	480	12	12
	14	18	9	.29	1.5	2	445	15	6
	14	23	6	13.66	5.8	3	511	18	20
	16		8	1.65	14	5	680	21	
	17	18	9	.30	2.2	2	470	19	18
	20		9	.32	4	3	550	21	
	24	12	9	.31	1.2	3	565	24	12
	31	12	9	.39	1	1	475	31	15
69 Jan.	6	8	9	.55	1.9	5	550	7	6
	10		8	1.64	2	3	504	11	
	11		9	.52	1.5	3	480	11	15
	14		9	.54	8.3	5	585	19	
	15		8	1.65	5	2	630	17	
	20		8	1.64	8	5	731	24	

Date		Time UT	S/C	T(days)	Duration (Days)	Number 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
Jan.	23	12	9	.56	6.5	5	720	25	16
Feb.	1	16	9	.52	3.3	5	620	2	
	6		8	1.63	2	2	542	7	
	10	12	9	.30	1.2	2	510	10	12
	11		8	1.63	4	4	630	12	
	13	12	9	.45	.8	1	430	13	5
	15		9	.38	2.3	1	485	15	12
	18		9	.52	.7	2	430	18	6
	19	12	9	.37	2.2	3	525	20	12
	22		9	.41	2.5	3	500	23	12
	25		8	1.63	5	2	542	26	
	25		9	.25	1.3	2	505	25	3
Mar.	1		9	-.01	1.3	1	590	1	12
	3		8	1.63	11	3	542	10	
	7		9	-.02	2	3	580	8	
	10	12	9	-.07	.3	2	490	10	12
	17		9	-.15	3.7	3	520	19	3
	22	1	7	6.39	3	3	612	23	1
	22	16	9	-.68	1.3	2	620	23	
	22	23	6	11.51	1	2	555	23	22
	25		8	1.65	13	5	630	28	
	25	8	9	-.83	.2	1	630	25	10
	28		9	-.66	5	4	585	31	16
Apr.	3		9	-1.06	6	2	585	4	8
	6		6	11.43	1	4	630	6	
	9		6	11.41	1	4	715	9	
	10		8	1.65	8	6	630	13	
	16		6	11.60	1	2	525	17	
	17		9	-1.40	4	4	585	18	8
	19		8	1.73	2	4	585	20	
	21		8	1.77	4	2	585	23	
	21		9	-1.82	3	4	630	23	7
	21	2	7	6.69	2.8	3	618	22	1
	25		8	1.76	11	2	585	30	
	26		9	-2.06	2	4	630	27	15
	28		9	-2.15	5	3	585	30	16
	30	20	6	11.71	1	6	625	May 1	21
May	3		7	6.89	5	4	524	7	17
	5	16	6	11.71	7	6	631	6	20
	14		6	11.69	1	2	500	15	
	14		7	7.08	2	2	595	15	19
	27	18	6	11.71	4	2	535	28	18

Date		Time UT	S/C	T(days)	Duration (Days)	Number of 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
June	2		7	7.29	7	2	616	5	19
	4	18	6	11.66	3	6	748	7	17
July	1		6	11.49	1.9	2	588	3	20
Sept.	5	20	6	11.67	2	4	512	7	16
	8	1	7	8.42	10	4	494	12	23
	11	18	6	10.92	3	2	476	14	19
	19	19	6	10.85	10	4	553	20	20
	25		7	8.48	3	1	559	25	0
Oct.	4		6	10.37	3	2	480	5	
	10	19	6	10.25	2	2	511	11	20
	16	20	6	10.17	7	2	468	19	18
	23	19	6	10.17	10	7	641	27	20
	24	23	7	8.65	8	7	678	28	18
Nov.	6	20	6	9.67	7	3	470	9	20
	6	21	7	8.65	7	3	468	11	22
	10	5	9	-4.72	1.5	2	560	10	12
	17	9	9	-4.60	.5	4	570	17	18
	21	9	9	-4.58	.3	4	580	21	11
	23	21	9	-4.75	1	3	610	24	9
	25	18	7	8.45	4	3	575	27	20
	26	21	6	8.57	3	4	590	27	21
	29	20	6	8.39	4	6	747	30	21
	29	13	9	-4.69	1	3	520	30	3
	30	19	7	8.41	4	3	615	Dec.1	19
Dec.	1	21	9	-4.55	7.6	6	600	6	7
	5	18	7	8.38	5	2	492	6	17
	5		6	8.30	3	2	460	7	
	12		7	8.35	8	2	500	14	
	12	5	9	-4.77	3.5	3	520	14	0
	13		6	8.06	6	2	500	15	
	26	2	9	-5.32	1.5	5	600	26	5
70 Jan.	1		7	8.34	3	2	520	2	
	1		6	7.61	6	3	480	3	
	13		7	8.28	5.5	4	542	14	19
	13	21	6	7.51	5	3	488	16	21
Feb.	10		6	7.38	1	4	585	10	1
Mar.	20	1	6	7.73	9	6	554	26	22
Apr.	2		6	7.69	9	3	540	4	
	25		6	7.66	6	4	604	28	2
May	4	0	6	7.8	3	3	496	5	3
	23		6	7.4	6	6	647	25	23
	25		7	9.6	3	5	739	25	3

Date		Time UT	S/C	T(days)	Duration (Days)	Number of 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
May	29	1	6	7.5	9.8	5	647	Jun.2	18
July	2	0	7	9.8	1	4	500	3	
	13		6	7.1	9	3	560	20	
	16		7	10.0	4	3	570	17	
Aug.	2	1	6	6.5	2.9	5	647	2	21
	10	19	6	6.4	12	8	852	16	0
	11	18	7	10.4	8	7	739	12	17
	25	16	6	6.0	11	6	606	28	20
Sept.	5	18	7	10.6	11	5	654	7	17
	7	0	6	5.5	15	6	647	9	11
	28	20	6	4.6	7.1	7	756	29	20
Oct.	5	23	6	4.5	11.6	3	506	10	0
	17	15	6	4.2	5.2	4	506	19	20
	22	19	6	4.1	10.5	4	566	27	12
Nov.	3	12	6	3.8	8.6	7	647	7	0
	22	3	6	3.3	3.9	6	647	23	1
Dec.	4	1	6	3.3	4.1	6	506	6	4
	14	1	6	3.2	2	3	506	15	1
	22		6	3.1	1	2	506	22	0
	26	8	6	3.1	4	3	506	27	7
	31	8	6	3.1	5	3	506	2	20
71 Jan.	13	8	6	3.1	8	7	756	16	15
	24	16	6	3.2	7.6	5	647	28	18
Feb.	11	8	6	3.3	8	3	566	13	23
	20	6	6	3.4	7	7	647	24	0
Mar.	9	8	6	3.4	6.6	4	647	11	0
Apr.	5	1	6	3.6	5	5	647	8	0
May	15	4	6	3.5	10.3	5	566	17	4
	26	2	6	3.5	9.6	6	647	Jun.1	12
June	23	12	6	2.5	7.1	4	556	24	12

HIGH SPEED STREAMS IN THE SOLAR WIND

VELA SPACECRAFT

Date		Time UT	S/C	Duration (Days)	Number of 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
65 July	27	6	3	4.5	5	578	29	15
Aug.	18		3	4.6	4	541	19	21
	23	2	3	6	3	536	26	3
Sept.	5	0	3	3.2	1	611	5	9
	11	6	3	1.6	2	419	12	12
	15	12	3	2.1	4	513	16	21
	19	0	3	3.6	3	447	19	15
	23	12	3	3.2	1	462	24	6
	28	15	3	3.1	2	482	29	0
Oct.	4	21	3	3.4	4	511	7	0
	8	9	3	1.9	3	457	9	12
	22	9	3	2.7	3	496	24	6
	27	3	3	2.6	3	543	28	0
Nov.	1	9	3	1.7	2	480	2	3
	18	21	3	3.3	2	471	21	0
	30	12	3	1.2	2	438	30	15
Dec.	4	0	3	2.4	1	412	4	18
	10	3	3	5.6	3	509	11	0
	16	21	3	3.9	3	380	18	12
	22	0	3	1.1	1	418	22	21
	24	12	3	7.5	5	586	27	18
66 Jan.	8	0	3	3	2	496	8	0
	19	15	3	7.4	5	606	26	12
Feb.	3	6	3	2.5	5	554	5	0
	19	0	3	3.3	7	681	20	12
	23	3	3	6.1	3	625	24	0
Mar.	2	6	3	4.2	3	424	4	6
	17	3	3	4.5	6	581	19	12
	23	6	3	8.5	3	616	27	3
Apr.	5	0	3	4.9	2	450	7	9
	21	15	3	5.1	4	518	24	0
July	10	9	3	1.1	1	573	10	15
Aug.	12	3	3	1.2	1	502	13	3
	22	3	3	5.6	4	566	23	12
	31	12	3	4.7	5	653	31	12
Sept.	5	6	3	7.9	5	618	9	3
	14	9	3	8.6	5	531	19	9
	27	9	3	5.1	4	599	29	6
Oct.	4	6	3	4.6	5	596	6	0
	24	12	3	5.9	5	637	27	6
	30	9	3	8.1	4	619	Nov.3	18

Date		Time UT	S/C	Duration (Days)	Number of 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
Nov.	7	12	3	8	3	462	13	6
	27	15	3	2.1	3	535	28	18
	29	18	3	3.9	2	477	Dec.1	9
Dec.	4	0	3	4.9	4	571	6	12
	13	3	3	4.4	2	537	14	21
	25	9	3	2.2	5	656	27	3
67 Feb.	6	21	3	6.1	5	578	9	0
	15	21	3	2.4	7	640	16	12
	22	21	3	7.5	3	464	27	0
Mar.	17	12	3	5.6	5	508	19	18
	27	3	3	4.9	2	471	28	6
Apr.	1	3	3	12.4	5	553	5	3
	19	3	3	1.4	2	481	19	18
	23	0	3	6.5	7	682	24	21
May	1	12	3	2.1	3	502	2	0
	23	21	3	6.4	7	650	25	21
	30	6	3	1.6	3	582	31	3
June	5	3	3	5.7	3	526	8	21
Aug.	20	3	3	1.1	1	569	20	12
Sept.	22	18	3	.2	1	563	22	18
Oct.	10	15	3	1.1	3	652	10	15
Nov.	12	18	3	.5	2	617	13	3
69 Jan.	15		3	11	10	770	26	0
Feb.	2		3	1	3	646	2	21
	27		3	1	3	646	27	12
Mar.	23		3	5	2	541	27	2
Apr.	12		3	8	2	432	14	3
	12		4	7	3	508	17	14
	22		3	7	5	541	24	12
May	8	10	3	2	3	455	10	3
	13	1	3	2	3	769	14	20
	14		4	1	4	651	15	10
	18		3	6	2	480	23	
June	9		3	17	3	541	19	15
Nov.	7	2	5	9.6	6	637	10	12
70 Feb.	1	18	3	5	3	541	3	0
Mar.	1	5	3	15	3	525	2	5
	30		3	13	5	618	31	9
May	1	18	5B	7	4	547	7	18
June	23	7	5B	4	6	637	27	7

Date		Time UT	S/C	Duration (Days)	Number of 50km/sec Increases	Peak Speed	Day and Time (UT) of Peak	
July	3	22	5B	5	5	637	4	5
	8	4	5B	9.5	3	470	11	1
	24	12	5B	2.6	5	707	25	18
Aug.	7		5B	6	3	519	8	20
	16	2	5B	4	4	516	17	7
Sept.	1	5	5B	7	3	520	2	11
	12	23	5B	5	5	576	14	2
	19	1	5B	2.3	2	520	20	2
	29	8	5B	10	6	745	Oct.4	8
Oct.	11	6	5B	7	3	446	11	22
	27	4	5B	4	4	520	29	1
	28		5A	3	2	600	30	
Nov.	6	5	5B	3	5	606	7	13
Dec.	6	17	5B	2	3	495	8	8
	13	14	5B	1	4	637	14	4
71 Jan.	1	2	5B	5.8	4	576	3	21
	17		5B	7	8	745	20	19
	24	15	5B	4.8	2	525	27	7
	29	10	5B	5	4	575	Feb.1	
Feb.	6	10	5B	7.6	3	470	7	21
	15		5A	2	2	637	16	19
Mar.	7	15	5B	10.5	5	637	13	17
	24		5A	2	2	520	25	
	25		5B	2	4	475	26	
Apr.	9	1	5B	2	2	520	10	21
May	6		5A	1	4	625	7	
	7		5B	2	4	620	7	

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