SP1 format description (extract from NOAA Technical Report NOS 133 NGS 46)

Standard Product #1 (Position/Velocity)

The NGS Standard Product #1 was primarily defined as an 80-byte ASCII format (which will be referred to as SP1). Implied, however, was the associated 52-byte binary format (which will be referred to as ECF1) for direct or random access. The ASCII format was intended to be a format of exchange whereas the binary format was a suggested applications format and one that NGS has occasionally used in its routine operations. The binary format was not explicitly documented at that time. Rather, it was embedded in software available from NGS. Both the ASCII and the binary formats will be documented here. Users may elect to use their own binary formats, but this provides the community with a standard for binary exchange and a possible format for adoption. It should be stated that this ECF1 binary file is not strongly encouraged by NGS inasmuch as other binary formats discussed in this report are more efficient. On the other hand, NGS encourages users to adopt, promote, and suggest improvements to the ASCII formats.

Since 1985 the following three minor enhancements have been made to SP1 (ASCII):

(1) In the first line, column 76, and just to the right of the "Number of Epochs" parameter, is a single character describing The "Orbit Type." At this time only "F" (fitted), "E" (extrapolated or predicted), and "B" (broadcast) are defined. Naturally, others are possible.

(2) In the second line, columns 75 and 76, the 35th satellite identifier will be used for the "Coordinate System." Only two digits are allowed. At this time the following coordinate systems are defined. Others are possible. Naturally these formats will also work for inertial coordinate systems.

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72  --  WGS-72
84  --  WGS-84
85  --  Earth-fixed 1985 (IERS)
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(3) In the second line, columns 77 and 78, the 36th satellite identifier will be used for "Hundreds of GPS weeks." In columns 79 and 80 the 37th satellite identifier will be used for "GPS Weeks Modulo 100." This is equivalent to stating that columns 77-80 will be used for the GPS week. The distinction is made for binary compatibility reasons.

These changes will also be reflected in the binary formats discussed below. Otherwise this information would be lost when the program which converts ASCII to

binary is executed. The NGS program which converts ASCII to binary will embed these data in previously unused spare locations of the binary format.

Each line of the SP1 file (fig. 1) has unique symbols in the leftmost three columns. For all but the last line, the leftmost symbol is a blank. These symbols provide easy program checks for integrity of the format structure. They also permit ease of inspection by those who maintain and distribute SP1 files. UNIX (tm) facilities such as "grep" thus can provide easy inspection of one aspect of a file (e.g., grep 'SV13' NGS475.SP1) or one aspect of many files (e.g., grep '_#_' NGS*.SP1, where '_' represents a blank character).

SP1 (ASCII) Format
(Refer to fig. 1.)

SP1 First Line

Columns 1-3	Symbols	_#_
Column 4	Unused	
Columns 5-8	4-digit year	1989
Column 9	Unused	
Columns 10-11	Month	5
Column 12	Unused	
Columns 13-14	Day of month	7
Column 15	Unused	
Columns 16-17	Hour	0
Column 18	Unused	
Columns 19-20	Minute	0
Column 21	Unused	
Columns 22-31	Second	0.0000000
Column 32	Unused	
Columns 33-46	Epoch interval (s)	900.0000000
Column 47	Unused	
Columns 48-52	Mod. Jul Day	47653
Column 53	Unused	
Columns 54-68	Fractional day	0.0000000000000
Column 69	Unused	
Column 70-75	Number of epochs	673
Column 76	Orbit type	F
Column 77	Unused	
Columns 78-80	Agency source	NGS

SP1 Second Line

Columns 1-3	Symbols	_+_
Columns 4-5	Number of PRNs	7
Column 6	Unused	
Columns 7-8	PRN #1 id.	3
Columns 9-10	PRN #2 id.	6

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```
#  1989  5  7  0  0   0.0000000     900.0000000 47653 0.0000000000000      673F NGS
+  7   3 6 8 9111213 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 085 487
*  1989  5  7  0  0   0.0000000
SV 3 -13196.62895    1068.95680 -23275.89940 -1.69132152 -2.34970379  0.81385518
SV 6  -5487.19468 -13640.68966  21936.63349  1.09902137 -2.59868935 -1.34268484
SV 8  -5550.72604 -21683.98568  14215.82196  0.83728880  1.59100258  2.79300935
SV 9 -13529.97454    3581.61431  22122.47061  1.24723636 -2.62465830  1.19613960
SV11 -14234.54385 -22703.85280   1926.42949 -0.07089034  0.30308173  3.40804946
SV12 -15048.70901  17144.82212  13450.94106  0.82152205 -1.47952676  2.87598178
SV13 -18086.23952 -13188.68516 -14254.71415 -1.14715906 -1.40750521  2.75055503
*  1989  5  7  0 15   0.0000000
SV 3 -14767.70669    -946.03185 -22350.27830 -1.79145866 -2.12119795  1.23998845
SV 6  -4615.90907 -15943.98710  20539.74181  0.83701287 -2.50836974 -1.75698476
SV 8  -4665.18330 -20169.56926  16599.44226  1.13220544  1.76411628  2.49639529
SV 9 -12476.45122    1129.69271  22997.07080  1.08705551 -2.81432689  0.74458878
            .              .              .          .          .          .
            .              .              .          .          .          .
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            .              .              .          .          .          .
SV 6  -4723.27050 -15665.03362  20728.03053  0.86631900 -2.52381980 -1.70849404
SV 8  -4701.62293 -20299.84609  16427.17245  1.10545153  1.75565243  2.52086181
SV 9 -12574.27571    1374.64485  22928.69455  1.10598393 -2.79773574  0.79005190
SV11 -14173.36456 -22357.37167   4700.81060  0.15864975  0.57971322  3.35237656
SV12 -14383.03941  15831.36131  15663.98227  0.82001036 -1.79011870  2.62506983
SV13 -18973.53941 -14197.37576 -11953.81040 -1.05627014 -1.10152183  2.97536435
*  1989  5 14  0  0   0.0000000
SV 3 -16224.28157   -2558.45052 -21210.06122 -1.83557225 -1.88679822  1.60177777
SV 6  -4060.39827 -17874.02287  19013.44297  0.60838316 -2.37399948 -2.09611827
SV 8  -3572.24525 -18662.85582  18547.76332  1.40407201  1.87149519  2.18490712
SV 9 -11663.40131   -1208.57915  23431.91846  0.91286406 -2.93199922  0.32668896
SV11 -13904.22284 -21714.20824   7670.62786  0.44448923  0.84169683  3.23811739
SV12 -13665.36180  14073.39596  17884.39087  0.76590609 -2.11087186  2.30226560
SV13 -19857.59475 -15035.21064  -9180.61508 -0.89876266 -0.76178903  3.17840736
EOF
```

Figure 1.--SP1 ASCII example.

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*
*
*
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Columns 71-72	PRN #33 id.	_0
Columns 73-74	PRN #34 id.	_0
Columns 75-76	Coordinate Sys.	85
Columns 77-78	Hundreds GPS weeks	_4
Columns 79-80	GPS weeks Mod 100	87

SP1 Third Line (Epoch Header Line)

Columns 1-3	Symbols	_*_
Column 4	Unused	_
Columns 5-8	4-digit year	1989
Column 9	Unused	_
Columns 10-11	Month	_5
Column 12	Unused	_
Columns 13-14	Day of month	_7
Column 15	Unused	_
Columns 16-17	Hour	_0
Column 18	Unused	_
Columns 19-20	Minute	_0
Column 21	Unused	_
Columns 22-31	Second	_0.0000000

SP1 Fourth Line (Position-Velocity Line)

Columns 1-3	Symbols	_SV
Columns 4-5	Satellite id.	_3
Columns 6-18	x-coordinate (km)	_-13196.62895
Columns 19-31	y-coordinate (km)	___1068.95680
Columns 32-44	z-coordinate (km)	_-23275.89940
Columns 45-56	x-dot (km/sec)	_-1.69132152
Columns 57-68	y-dot (km/sec)	_-2.34970379
Columns 69-80	z-dot (km/sec)	__0.81385518

The number of epochs (NUMEP) is given in the first line (___673) and the
number of satellites (NUMPRN) appears on the second line (_7). Each epoch has
an epoch header line (third line) and NUMPRN number of lines. After two header
lines and NUMEP*(NUMPRN+1) lines, there is an end of file line as follows:

SP1 Last Line

Columns 1-3	Symbol	EOF
Columns 4-80	77-character Comment	CCCC.....CCCC

The last 77 columns of the last line may be used as a free form comment. This
comment, however, is informal in that it will not be embedded in the binary ECF1
format discussed below.

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