BONES AVIATION PAGE

SBS BaseStation



Article 4.2





Socket Data and BST files

Overview

Users can look at the raw data being sent by the SBS unit by using a Telnet application to listen to port 30003.

The datastream looks like this:

Decoding this stream isn't difficult.

Message types

There are six message types - MSG, SEL, ID, AIR, STA, CLK. Most data from aircraft is contained in the MSG lines whilst the other types are triggered by user input or system settings. The MSG data was inhibited with a five minute delay in BaseStation versions prior to 1.2.3.145 but from this version onwards is in real time.

ID	Туре	Description
SEL	SELECTION CHANGE MESSAGE	Generated when the user changes the selected aircraft in BaseStation.
ID	NEW ID MESSAGE	Generated when an aircraft being tracked sets or changes its callsign.
AIR	NEW AIRCRAFT MESSAGE	Generated when the SBS picks up a signal for an aircraft that it isn't currently tracking.
STA	STATUS CHANGE MESSAGE	Generated when an aircraft's status changes according to the time-out values in the Data Settings menu.
CLK	CLICK MESSAGE	Generated when the user double-clicks (or presses return) on an aircraft (i.e. to bring up the aircraft details window).
MSG	TRANSMISSION MESSAGE	Generated by the aircraft. There are eight different MSG types.

Transmission messages (MSG) from aircraft may be one of eight types:

ID	Туре		Description
MSG,1	ES Identification and Category	DF17 BDS 0,8	
MSG,2	ES Surface Position Message	DF17 BDS 0,6	Triggered by nose gear squat switch.
MSG,3	ES Airborne Position Message	DF17 BDS 0,5	
MSG,4	ES Airborne Velocity Message	DF17 BDS 0,9	
MSG,5	Surveillance Alt Message	DF4, DF20	Triggered by ground radar. Not CRC secured. MSG,5 will only be output if the aircraft has previously sent a MSG,1, 2, 3, 4 or 8 signal.
MSG,6	Surveillance ID Message	DF5, DF21	Triggered by ground radar. Not CRC secured. MSG,6 will only be output if the aircraft has previously sent a

MSG,1, 2, 3, 4 or 8 signal.

DF16 Triggered from TCAS.
MSG,7 is now included in the SBS socket output.

MSG,8 All Call Reply DF11 Broadcast but also triggered by ground radar

Field Data

MSG.7 Air To Air Message

Each of the above message types may contain up to 22 data fields separated by commas. These fields are:

Field 1: Message type (MSG, STA, ID, AIR, SEL or CLK)

Field 2: Transmission Type MSG sub types 1 to 8. Not used by other message types.

Field 3: Session ID Database Session record number
Field 4: AircraftID Database Aircraft record number
Field 5: HexIdent Aircraft Mode S hexadecimal code
Field 6: FlightID Database Flight record number

Field 7: Date message generated As it says
Field 8: Time message generated As it says
Field 9: Date message logged As it says
Field 10: Time message logged As it says

The above basic data fields are standard for all messages (Field 2 used only for MSG).

The fields below contain specific aircraft information.

Field 11: Callsign An eight digit flight ID - can be flight number or registration (or even nothing).

Field 12: Altitude Mode C altitude. Height relative to 1013.2mb (Flight Level). Not height AMSL...

Field 13: GroundSpeed Speed over ground (not indicated airspeed)

Field 14: Track Track of aircraft (not heading). Derived from the velocity E/W and velocity N/S

Field 15: Latitude North and East positive. South and West negative.

Field 16: Longitude North and East positive. South and West negative.

Field 17: VerticalRate 64ft resolution

Field 18: Squawk Assigned Mode A squawk code.

Field 19: Alert (Squawk change) Flag to indicate squawk has changed.

Field 20: Emergency Flag to indicate emergency code has been set

Field 21: SPI (Ident) Flag to indicate transponder Ident has been activated.

Field 22: IsOnGround Flag to indicate ground squat switch is active

Notes (Courtesy of Edgy):

The socket data outputs a -1 for true, and a 0 for false. Neither means it is not used.

Field 11 (Callsign) is an 8 character (6 bit ASCII subset) field. In BaseStation a NULL is shown as a '@' which is ASCII for NULL. In the cockpit it is just a space on the transponder window, but is sent as a NULL. Therefore, if a crew enter eight spaces in the cockpit this will show in BaseStation as @@@@@@@@@@.

Field 12 (Altitude) can be 25ft or 100 foot resolution. Mode-C is 100 ft, but many aircraft today send out 25 ft resolution to be able to fly in Europe IFR (RVSM) space. BaseStation only displays Barometer altitude but in the data are HAE (height above ellipsoid), which is sent as the difference between GPS altitude and barometric altitude.

Message Content

Each message type contains different field content. In the table below green represents the fields that are sent and grey shows fields for which null data is transmitted. MSG signals contain up to 22 fields and other message types contain up to 10 fields.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
MSG 1	MT	TT	SID	AID	Hex	FID	DMG	TMG	DML	TML	CS											
MSG 2												Alt	GS	Trk	Lat	Lng						Gnd
MSG 3												Alt			Lat	LNG			Alrt	Emer	SPI	Gnd
MSG 4													GS	Trk			VR					
MSG 5												Alt							Alrt		SPI	Gnd
MSG 6												Alt						Sq	Alrt	Emer	SPI	Gnd
MSG 7												Alt										Gnd



Notes:

- 1. STA message uses the callsign field to record status flags based on user time-out values. Values are **PL** (Position Lost), **SL** (Signal Lost), **RM** (Remove), **AD** (Delete) and **OK** (used to reset time-outs if aircraft returns into cover).
- 2. CLK message returns a value of -1 in Fields 4 and 6. Field 5 is null.
- 3. MSG,7 (Air to Air message) has only recently been included in the socket output.
- 4. Although aircraft now transmit Heading and True Airspeed these values are not available in the socket output.

From the above table you see that MSG,1 messages only send data for the first eleven fields and the remaining 11 fields are empty. The result is a lot of commas in this (and in other MSG formats).

Examples of each message:

SEL,,496,2286,4CA4E5,27215,2010/02/19,18:06:07.710,2010/02/19,18:06:07.710,RYR1427
ID,,496,7162,405637,27928,2010/02/19,18:06:07.115,2010/02/19,18:06:07.115,EZY691A
AIR,,496,5906,400F01,27931,2010/02/19,18:06:07.128,2010/02/19,18:06:07.128
STA,,5,179,400AE7,10103,2008/11/28,14:58:51.153,2008/11/28,14:58:51.153,RM
CLK,,496,-1,,-1,2010/02/19,18:18:19.036,2010/02/19,18:18:19.036
MSG,1,145,256,7404F2,11267,2008/11/28,23:48:18.611,2008/11/28,23:53:19.161,RJA1118,,,,,,,,,
MSG,2,496,603,400CB6,13168,2008/10/13,12:24:32.414,2008/10/13,12:28:52.074,,,0,76.4,258.3,54.05735,-4.38826,,,,,,0
MSG,3,496,211,4CA2D6,10057,2008/11/28,14:53:50.594,2008/11/28,14:58:51.153,,37000,,,51.45735,-1.02826,,,0,0,0,0
MSG,4,496,469,4ca767,27854,2010/02/19,17:58:13.039,2010/02/19,17:58:13.368,,,288.6,103.2,,,-832,,,,,
MSG,5,496,329,394A65,27868,2010/02/19,17:58:12.644,2010/02/19,17:58:13.368,,10000,,,,,,,0,0
MSG,6,496,237,4Ca215,27864,2010/02/19,17:58:12.846,2010/02/19,17:58:13.368,,33325,,,,,0271,0,0,0,0
MSG,7,496,742,51106E,27929,2011/03/06,07:57:36.523,2011/03/06,07:57:37.054,,3775,,,,,,,
MSG,8,496,194,405F4E,27884,2010/02/19,17:58:13.244,2010/02/19,17:58:13.368,,,,,,,,

Interpolation

It can be seen that no single MSG type provides all the data we use in BaseStation and that some data fields are unique to one message type. Callsign is only found in MSG,1, VertRate only in MSG,4 and Squawk in MSG,6.

To collect all 11 data fields for one aircraft would require the reception of at least four MSG types (MSG,1, MSG,3, MSG,4 and MSG,6) but note that MSG,6 is only triggered by ground radar interrogation. If the aircraft is outside any ground radar coverage no MSG,6 will be sent. As MSG,6 is the only message that sends out the squawk code it means this will only be displayed for SBS users who are detecting aircraft within Mode S ground radar coverage.

Likewise MSG,5 and MSG,8 are only sent on interrogation but the data in these types is available in other messages.

MSG,5 and MSG,6 are not CRC secured and will only be received should an aircraft have already sent a MSG,1, 2, 3, 4 or 8.

Ground targets

If Field 22 (IsOnGround) is being sent this will trigger a change of values in Field 12 (Altitude) and in Fields 15 and 16 (Latitude and Longitude). Field 12 (Altitude) will reset to zero and whilst the aircraft remains on the ground no altitude data will be sent.

Positional Accuracy

The Compact Position Report in ADS-B sends Lat/Long data in 17 bits and when airborne this gives accuracy to 5.1 metres. 17 bits equates to four decimal places for Lat/Long values - e.g N54.1234, W145.1234. For ground operations greater positional accuracy is required and so Lat/Long values are extended to five decimal places - e.g. N54.12345, W145.12345 - which gives an accuracy of 1.25 metres.

To accommodate this accuracy into a 17 bit string some data is dropped - the full Lat/Long position data is no longer sent. In BaseStation the missing data needs to be added by the user and this is why Lat/Long values are only interpreted correctly if a location is set in the BaseStation Location Manager. For most users adding a home location in the Location Manager is sufficient but mobile users need to add further locations for the airfields they may be visiting abroad. By abroad I mean intercontinental as BaseStation now plots ground traffic correctly to within approx 2500nm of the set location (it formerly was only 90nm).

The socket data always shows Lat/Long data to five decimal places and can provide full 1.25 metre accuracy where this is sent.

Credits

My thanks go to Andy (Three Miles), Dave Reid and Steve (Edgy) who have posted much information on the Kinetic forum about socket data format. Without their research this page wouldn't exist.

BST files

Basestation has the an option to record data. This is not raw socket data as described above but processed data for the Basestation display.

Unlike raw data, each string in the BST files shows 17 data field values. All are populated, using last known values for each string until a socket MSG updates any values.

The recorded datastream looks like this:

```
"2018/07/05", "02:44:34.126", "9004131", "896463", "ETD44A", "United Arab Emirates", "0", "39000", "52.05327", "-3.81704", "-64", "-64", "484.6", "12018/07/05", "02:44:34.142", "4736069", "484445", "KLM656", "Netherlands", "0", "41000", "41000", "55.11269", "-3.75159", "0", "0", "400.8", "122.2", "25347" "2018/07/05", "02:44:34.153", "10672439", "A2D937", "AAL716", "United States", "0", "40000", "40000", "51.65419", "-3.77526", "-64", "-64", "474.5", "95.9", "2018/07/05", "02:44:34.153", "10895798", "A641B6", "DAL132", "United States", "0", "41000", "41000", "53.92718", "-2.84215", "-64", "-64", "494.4", "107.3", "2018/07/05", "02:44:34.178", "9004131", "896463", "ETD44A", "United Arab Emirates", "0", "39000", "39000", "52.05309", "-3.81561", "0", "484.6", "102.6", "02.144:35.122", "4736069", "484445", "KLM656", "Netherlands", "0", "41000", "41000", "55.11223", "-3.75030", "0", "0", "480.8", "122.2", "25347", "2018/07/05", "02:44:35.151", "9004131", "896463", "ETD44A", "United States", "0", "40000", "40000", "55.11223", "-3.77647", "-64", "-64", "-64", "95.9", "2018/07/05", "02:44:35.151", "9004131", "896463", "ETD44A", "United States", "0", "40000", "40000", "55.11223", "-3.77647", "-64", "-64", "-64", "95.9", "2018/07/05", "02:44:35.151", "9004131", "896463", "ETD44A", "United States", "0", "40000", "40000", "55.05286", "-3.81393", "0", "0", "484.6", "102.6", "2018/07/05", "02:44:35.155", "10895798", "A641B6", "DAL132", "United States", "0", "39000", "53.92667", "-2.83924", "-64", "-64", "494.4", "107.3", "2018/07/05", "02:44:35.454", "4736069", "484445", "KLM656", "Netherlands", "0", "41000", "41000", "55.11147", "-3.74617", "0", "0", "480.8", "122.2", "25347", "2018/07/05", "02:44:35.454", "4736069", "484445", "KLM656", "Netherlands", "0", "41000", "41000", "55.11147", "-3.7462", "-64", "-64", "494.4", "107.3", "2018/07/05", "02:44:35.454", "4736069", "484445", "KLM656", "Netherlands", "0", "41000", "41000", "55.11147", "-3.7462", "-64", "-64", "474.5", "95.9", "2018/07/05", "02:44:35.454", "4736069", "4844
```

Field Data

The BST file contains 17 data fields separated by commas. These fields are:

Field 1:	Date message generated	Self evident
Field 2:	Time message generated	Self evident
Field 3:	Mode S Code (Decimal)	Aircraft Mode S decimal code
Field 4:	Mode S Code (Hex)	Aircraft Mode S hexadecimal code
Field 5:	Callsign	An eight digit flight ID - can be flight number or registration (or even nothing).
Field 6:	Country	Interpolated from Mode S code using the Countries.dat file.
Field 7:	IsOnGround	Flag to indicate ground squat switch is active
Field 8:	Altitude	Mode C altitude. Height relative to 1013.2mb (Flight Level). Not height AMSL
Field 9:	Altitude	A placeholder for future development. Same data as above.
Field 10:	Latitude	North and East positive. South and West negative.
Field 11:	Longitude	North and East positive. South and West negative.
Field 12:	VerticalRate	64ft resolution
Field 13:	VerticalRate	Adjusted data for Basestation screen presentation.
Field 14:	GroundSpeed	Speed over ground (not indicated airspeed)
Field 15:	Track	Track of aircraft (not heading). Derived from the velocity E/W and velocity N/S
Field 16:	Squawk (Decimal)	Assigned Mode A squawk code, decimal.
Field 17:	Squawk (Octal)	Assigned Mode A squawk code, octal. Cockpit setting.

