1. Flight Data Console Export

Possible Structures contained in the Exported Savefile.

FSDATA_T#	FLIGHT SCIENCE DATA
FSDATA_ATT_T#	ATTITUDE DATA INTERPOLATED TO FLIGHT SCIENCE TIMES
FSDATA_EPH_T#	EPHEMERIS DATA INTERPOLATED TO FLIGHT SCIENCE TIMES
HSKDATA_T#	HOUSEKEEPING DATA
HSKDATA_ATT_T#	ATTITUDE DATA INTERPOLATED TO HOUSEKEEPING TIMES
HSKDATA_EPH_T#	EPHEMERIS DATA INTERPOLATED TO HOUSEKEEPING TIMES
ADATA_T#	ATTITUDE DATA
EDATA_T#	EPHEMERIS DATA
KPDATA	KP/AP DATA
DSTDATA	KYOTO DST DATA
AMDATA	ACE MAG DATA
ASDATA	ACE SWEPAM DATA

Every structure will have a TIME array associated with it. The TIME array is in units of Modified Julian Date. If no data was available for the start and stop time requested, the TIME array will be filled with 0 and none of the selected variables will appear in the saveset.
In the case of Direct Events, since more than 1 Direct Event can occur per timestamp, the array returned will be sized [N_TIMESTAMP, MAX_DE_PER_TIMESTAMP]. A fill value of -999 is used for times when the number of direct events does not match the maximum direct events possible.

2. Image Plot Console Export

TWINS#_DATA = {		
TWINS_IMAGE	DOUBLE	Array[22, 90]
UNFLIPPED_TWINS_IMAGE	DOUBLE	Array[44, 45]
IMAGE_MAKING_RECORD	STRUCT	-> <Anonymous> Array[20]
PIXELSIZE	INT	4
TITLE	STRING	‘’
ENERGY	LONG	0
ALL_ENERGIES	INT	1
SW_VERSION	STRING	'1.0 beta'
CREATION_TIME	STRING	'Tue Sep 30 16:44:04 2008'
}		

TWINS_IMAGE is an array of values that is the final product of the image_making code. It is sized by [FLOOR(90/PIXELSIZE), 90]. The first index is for polar angle and the second is for actuation angle. If one is looking at the geophysical image, the polar angle

runs from ~0º to 90º, where 90º is the center of the image. (If a user chooses 4 degree pixelsize, the elevation angles run from 2-90 degrees in 4 degree steps. If the user chooses 1 degree pixelsize, then the angles will run from 0-90 in 1 degree steps. Basically the max(polar_angle) is always 90 and the minimum is 90-pixelsize*floor(90/pixelsize).) The actuation angle runs from -90 º (at the right of the image), then goes clockwise to 0º, 90º, and then completes a full circle returning to -90º.
UNFLIPPED_TWINS_IMAGE is an array of values that is essentially the step prior to TWINS_IMAGE. It contains data from -90º to 90º in polar angle and from -90º to 90º in actuation angle. In order to create the geophysical image, the array needed to be modified to have a 90º range for polar angle and 360º range for actuation angle.
IMAGE_MAKING_RECORD contains the raw data needed to calculate the fluxes. This structure is complicated, so it is described in Appendix A; essentially it contains a certain number of sweeps. Each sweep is comprised of a full 180º of actuation.
PIXELSIZE is a quantity that the user can select when requesting an image. The pixelsize is defaulted to 4 degrees and represents the bin size in polar angle. The actuation bin size is currently set to 4 degrees and cannot be modified by the user.
TITLE is a string that contains the start and stop times of the image, along with the selected number of sweeps.
ENERGY is set to 0 if the user selects an All Energies image. It is set to # keV if the user selects Differential Energy Flux image at # keV.
ALL_ENERGIES is set to 0 if the user selects a Differential Energy Flux image. It is set to 1 if the user selects an All Energies image.
SW_VERSION is a string to differentiate the different software versions.
CREATION_TIME is a string denoting the time when the image was created.

3. Calibration Data Console Export

CALSDATA_T#	CALIBRATION SCIENCE DATA
CALHSKDATA_T#	CALIBRATION HOUSEKEEPING DATA
CHAMBERDATA_T#	CALIBRATION CHAMBER DATA

Every structure will have a TIME array associated with it. The TIME array is in units of Modified Julian Date. If no data was available for the start and stop time requested, the TIME array will be filled with 0 and none of the selected variables will appear in the saveset.
In the case of Direct Events, since more than 1 Direct Event can occur per timestamp, the array returned will be sized [N_TIMESTAMP, MAX_DE_PER_TIMESTAMP]. A fill value of -999 is used for times when the number of direct events does not match the maximum direct events possible.

Appendix A

Image record structure:

Field name	Type	Units	Description
sat_id	8 bit uint	None	Satellite identifier, 0 (TWIN-1) or 1 (TWIN-2)
telem_mode [1]	8 bit uint	None	Telemetry mode. Modes used are static test, dynamic test, static imaging, dynamic imaging.
scan_state [2]	8 bit uint	None	Scan (sweep) direction state. Indicates forward or reverse scan.
Twa_speedselect	8 bit uint	None	Scan Speed Selection as commanded
scand [45]	scan data structure	None	Array of scan data structures

Scan data structure:

Field name	Type	Units	Description
mjd	double	days	Modified Julian Day at start of sector sweep. Epoch (mjd = 0) is 00:00 Nov 17,1858.
sector [2]	8 bit uint	None	The sweep sector number, 0 <= sector < 45.
sector_timelapse [2]	double	msec	Sector time lapse, the time the actuator took to move across the sector
azimuth[5] [2]	double	degrees	position encoder readings at i * 333 ms intervals. Azimuth[0] is the sector start position. This is a combination of fields from the instrument status data, fields "sector start position" and Position at sector start. Azimuth[5] is the sector end position. *NOTE: The azimuth vector numbers are negative versions of the sector_position fields in the instrument status data.
velocity [2]	double	deg/sec	Velocity at sector start.
total_starts [2] [3]	float	None	Total start events for each head in this sector
total_stops [2] [3]	float	None	Total stop events for each head in this sector
total_valids [2] [3]	float	None	Total valid events for each head in this sector
satatt_GCI [3] [5]	double	Unit Vector	Spacecraft attitude (0 deg elevation vector), GCI coordinate system.
Prime_Meridian [3] [5]	double	Unit vector	Spacecraft attitude (0 deg azimuth vector), GCI coordinate system.
satpos_GCI [3] [4]	double	km	Spacecraft position, GCI coordinate system.
sunpos_GCI [3] [4]	double	km	Sun position, GCI coordinate system
earth_field_axis_GCI[4]	double	nT	Magnetic Field Vector with respect to GCI coordinate system.
de [varies]	direct events structure	None	An array of direct events structures

Direct events structure :

Field name	Type	Units	Description
head_id [6]	8 bit uint	None	Head detecting the event, 0 <= head <= 1
slice [6]	8 bit uint	None	slice number within sector, 0 <= slice < 4, indicating which 1 degree segment within the sector where the event occurred.
mid_angle [3]	Float	Deg	(Azimuth[slice+1]+Azimuth[slice]/2)
start_pos [6]	8 bit uint	None	Event start position number, 0 <= start_pos < 64
start_height [6]	8 bit uint	None	Start height number, 0 <= start_height < 256
stop_pos [6]	8 bit uint	None	Event stop position number, 0 <= stop_pos < 256
stop_height [6]	8 bit uint	None	Stop height number, 0 <= stop_height < 128
tof [6]	8 bit uint	None	Time-of-flight number, 0 <= tof < 256

[1] From telemetry secondary header
[2] From telemetry instrument status
[3] From telemetry singles data
[4] From derived ephemeris
[5] From spacecraft attitude
[6] From telemetry direct events

For every sweep, there is a single IMAGE_MAKING_RECORD structure. Within a multi-sweep saveset, there will be an array of IMAGE_MAKING_RECORD structures. For example if there are 5 sweeps in the saveset, then the total number of Prime_Meridian vectors will be 5*45. The Prime Meridian vector itself has 3 elements (X, Y, and Z.)