$Id: SOE_sequence_of_events,v 1.9 2004/10/20 16:01:40 glk Exp glk $

SOE Sequence of Events File.

The Sequence Of Events (SOE) file records the change of the state
of a specific satellite sensor or a satellite event which may alter
the processing parameters used for the L1B processing.The SOE file
contains sensor and event time series, which describe the changes
in their state. These time series should be interpretted in the
following way: The sensor/event state remains unchanged until
a new valid record appears in the file with new state information.
Next you will find a detailed description and format information
on how the SOE file is organized and the state information for
each sensor and event that is recorded.

NOTE: when starting a SOE from scratch, make sure to use
    the proper initialization. For more details see
    "Notes on initialization below"

The SOE file is a white space delimited file. If the first field
is an "x" the line has been deleted from active use. The fields
int the active lines are defined as follows:.

Active lines:

Field 1: gps seconds past J2000, 0 = 1-JAN-2000 12:00:00.0000 GPS =
                    1-JAN-2000 11:59:47.0000 UTC

Field 2: Spacecraft, "GRACEA" "GRACEB" "GRACEX" -- "GRACEX" means the event

effects both spacecraft

Field 3: Sensor/Event identifier

Currently the following sensor/event identifiers are recognized:

ACC ACCR ACCT AOCS CMCAL GRACEA GRACEB ICUVP IPU IPUR

KAMI KBR KBRCAL K_MI KTOFF MANV MTE1 MTE2 OCC QKS QSA

QSB SCA USO VCM VGB VGN VGO VKB VSL

See below for numerical field meanings

Field 4: Number of numerical fields to follow, N, N maybe 0

Fields 5..4+N: Numerical values, for instance which USO is active, GPS
antenna POD (precision orbit determination) dual-freq.
antenna offset. For a description of the fields for each
sensor/Event identifier see list below:

fields 5+N.... After these field any comment may be place, in general time tag
information on when the active line was inserted in the SOE file

The following Sensor/Event keys are defined which include the state information for each key (Field 3 above):

CMNT #fields = 0, Just a comment card about some event that may be
of interest to those using the data

ACC #fields = 1, field value = 1: main ICU active
field value = 2: redundant ICU active
Note ACC key is currently not set in the the SOE file

ACCR #fields = 1, field value = 0 (always zero) Time tag indicates power cycle
of ACC Sensor Unit (SU) or ACC-ICU

ACCT #fields = 1, field value = 0 Temperature set point change on ACC-ICU
field value = 1 Temperature set point change on ACC-SU

AOCS #fields = 1, field value = 0 = AOCS NO_MODE
field value = 1 = AOCS CMCMP (course pointing mode)
field value = 2 = AOCS CIMCMP (course pointing mode)
field value = 3 = AOCS AHM (attitude hold mode)
field value = 4 = AOCS BAHM (back up attitude hold mode)
field value = 5 = AOCS SM (science mode)
field value = 6 = AOCS BSM (back up science mode)

CMCAL #fields =1, field value = 0 CMCAL maneuver off
field value = 1 CMCAL maneuver on

ICUVP #fields =1, field value = 0 = NOMINAL Vp value
field value = 1 = OFF NOMINAL Vp value

IPU #fields = 1, field value = 1 = main IPU active derived from IPU log message
field value = 2 = redundant IPU active derived from IPU log message

IPUR #fields = 4, column 1: field value = 1 Main IPU active
field value = 2 Redundant IPU active
field value = -1 IPU active not known from IPU
log message
column 2: field value = time of IPU nudge from IPU log message
(gps seconds)

column 3: field value = 1 IPU flash OK

field value = 2 IPU flash corrupted

field value = -1 IPU flash state not known from IPU

log message

column 4: field value = amount of time nudged by IPU (sec)

KAMI #fields = 1, field value = time tag offset to be applied to (KBR) Ka-phase measurement (sec)

KBR #fields = 1, 1 = main KBR

2 = redundant KBR

Note KBR key is currently not set in the SOE file

KBRCAL #fields =1, field value = 0 KBRCAL maneuver off

field value = 1 KBRCAL maneuver on

K_MI #fields = 1, field value = time tag offset to be applied to (KBR) K-phase measurement (sec)

KTOFF #fields = 1, field value = time tag offset to be applied to (KBR) K and Ka-phase measurement (sec)

MANV #fields = 2, column1: 0 OC thruster 13 off

1 OC thruster 13 on

column2: 0 OC thruster 14 off

1 OC thruster 14 on

MTE1 #fields = 3, column1: field value = X-axis distance travelled by Trim Mass Assembly 1 since lauch (mm)

column2: field value = Y-axis distance travelled by
Trim Mass Assembly 1 since lauch (mm)
column3: field value = Z-axis distance travelled by
Trim Mass Assembly 1 since lauch (mm)

MTE2 #fields = 3, column1: field value = X-axis distance travelled by
Trim Mass Assembly 2 since lauch (mm)
column2: field value = Y-axis distance travelled by
Trim Mass Assembly 2 since lauch (mm)
column3: field value = Z-axis distance travelled by
Trim Mass Assembly 2 since lauch (mm)

OCC #fields =1, field value = 0 GPS OCC antenna off
field value = 1 GPS OCC antenna on

QKS #fields = 8, column1: field value = q0 quaternion of SCA1 to K frame rotation
column2: field value = q1 quaternion of SCA1 to K frame rotation
.
column5: field value = q0 quaternion of SCA2 to K frame rotation
.
column8: field value = q3 quaternion of SCA2 to K frame rotation
where q0 is the scalar

QSA #fields = 8, column1: field value = q0 quaternion of SCA1 to SRF frame rotation
column2: field value = q1 quaternion of SCA1 to SRF frame rotation
.
column5: field value = q0 quaternion of SCA2 to SRF frame rotation
.
column8: field value = q3 quaternion of SCA2 to SRF frame rotation

QSB #fields = 4, column1: field value = q0 quaternion of S/C body to SRF frame rotation

column2: field value = q1 quaternion of S/C body to SRF frame rotation

.

column4: field value = q3 quaternion of S/C body to SRF frame rotation

Note: QSB is currently not set in SOE file

SCA #fields = 2, column1: field value = 1 = SCA1 is primary head

field value = 2 = SCA2 is primary head

column2: field value = 1 = SCA1 is primary head

field value = 2 = SCA2 is primary head

USO #fields = 1, field value = 1 main USO for GRACE A

field value = 3 redundant USO on GRACE A

field value = 2 main USO for GRACE B

field value = 4 redundant USO on GRACE B

VCM #fields = 3, column1: field value = X-coordinate of CM in SRF (m)

column2: field value = Y-coordinate of CM in SRF (m)

column3: field value = Z-coordinate of CM in SRF (m)

VGB #fields = 6, column1: field value = X-coordinate of L1 phase center

for the backup GPS antenna in SRF (m)

column2: field value = Y-coordinate of L1 phase center

for the backup GPS antenna in SRF (m)

column3: field value = Z-coordinate of L1 phase center

for the backup GPS antenna in SRF (m)

column4: field value = X-coordinate of L2 phase center

for the backup GPS antenna in SRF (m)

column5: field value = Y-coordinate of L2 phase center
for the backup GPS antenna in SRF (m)
column6: field value = Z-coordinate of L2 phase center
for the backup GPS antenna in SRF (m)

VGN #fields = 6, column1: field value = X-coordinate of L1 phase center
for the navigation GPS antenna in SRF (m)
column2: field value = Y-coordinate of L1 phase center
for the navigation GPS antenna in SRF (m)
column3: field value = Z-coordinate of L1 phase center
for the navigation GPS antenna in SRF (m)
column4: field value = X-coordinate of L2 phase center
for the navigation GPS antenna in SRF (m)
column5: field value = Y-coordinate of L2 phase center
for the navigation GPS antenna in SRF (m)
column6: field value = Z-coordinate of L2 phase center
for the navigation GPS antenna in SRF (m)

VGO #fields = 6, column1: field value = X-coordinate of L1 phase center
for the occultation GPS antenna in SRF (m)
column2: field value = Y-coordinate of L1 phase center
for the occultation GPS antenna in SRF (m)
column3: field value = Z-coordinate of L1 phase center
for the occultation GPS antenna in SRF (m)
column4: field value = X-coordinate of L2 phase center
for the occultation GPS antenna in SRF (m)
column5: field value = Y-coordinate of L2 phase center
for the occultation GPS antenna in SRF (m)
column6: field value = Z-coordinate of L2 phase center

for the occultation GPS antenna in SRF (m)

VKB #fields = 3, column1: field value = X-coordinate of KBR phase center
in SRF (m)
column2: field value = Y-coordinate of KBR phase center
in SRF (m)
column3: field value = Z-coordinate of KBR phase center
SRF (m)

VSL #fields = 3, column1: field value = X-coordinate of SLR phase center
in SRF (m)
column2: field value = Y-coordinate of SLR phase center
in SRF (m)
column3: field value = Z-coordinate of SLR phase center
SRF (m)

The remainder of the line is arbitrary but will include the UTC time
that the line was added to the file and possible other arbitrary comments.

Currently the file is sorted on the Time Field (Field 1 of non-deleted
lines).

Examples:

0.0 GRACEB ACC 1 1

0.0 GRACEB QKS 8 0.3800290947 0.9249498818 -0.0067473944 0.0002758285 0.3789188498 -0.9253766203 0.0028558974 0.0095110300

0.0 GRACEB QSB 4 0.0 0.0 0.0 0.0

0.0 GRACEB VGB 6 -1.56125 -0.300 -0.19 -1.56125 -0.300 -0.19

0.0 GRACEB VGN 6 0.000602 0.000754 -0.45173 0.000602 0.000754 -0.47596

0.0 GRACEB VGO 6 -1.56125 0.000 -0.19 -1.56125 0.000 -0.19

0.0 GRACEB VSL 3 -0.6000 -0.3275 0.3300

100302780.0 GRACEA MTE1 3 16.115e-3 -3.0225e-3 4.03e-3

101531422 GRACEA AOCS 1 5 SM KBR-Calibrations

105746450 GRACEA KTOFF 1 0.0

1.0 GRACEB VKB 3 1.472580 -0.000088 0.003319

121227065 GRACEA SCA 2 2 1

122997938 GRACEB ICUVP 1 0 NOMINAL

123715827 GRACEB AOCS 1 6 BSM Normal-Operations

123853640.0 GRACEA K_MI 1 0.00

127123270.0 GRACEA KAMI 1 0.00

127947910 GRACEB IPUR 3 -1 127947897 2

128032830 GRACEB IPU 1 1

73346640.0 GRACEA VCM 3 -0.2350e-3 0.12561e-3 -0.11442e-3

73945590.0 GRACEA MTE2 3 23.7825e-3 -12.71e-3 11.5775e-3

87316760.0 GRACEA QSA 8 0.3758022940 0.9266991916 0.0003448607 -0.0010607145 0.3835688821 -0.9235064871 -0.0007310729 -0.0031853829

95910570 GRACEB USO 1 4

Notes on itialization.

When you want to make a SOE file from scratch make sure the all entries are initialized with time tag 0

for example the list below could serve as an initialization. The most important thing is the the first entry has a time tag of zero.

0.0 GRACEA ACC 1 1

0.0 GRACEB ACC 1 1

0.0 GRACEA ICUVP 1 0 NOMINAL

0.0 GRACEB ICUVP 1 0 NOMINAL

0.0 GRACEA IPU 1 1

0.0 GRACEB IPU 1 1

0.0 GRACEA KAMI 1 0.0

0.0 GRACEB KAMI 1 0.0

0.0 GRACEA KBR 1 1

0.0 GRACEB KBR 1 1

0.0 GRACEA KTOFF 1 40e-3

0.0 GRACEB KTOFF 1 39.99918e-3

0.0 GRACEA K_MI 1 0.0

0.0 GRACEB K_MI 1 0.0

0.0 GRACEA MTE1 3 0.0000 0.0000 0.0000

0.0 GRACEB MTE1 3 0.0000 0.0000 0.0000

0.0 GRACEA MTE2 3 0.0000 0.0000 0.0000

0.0 GRACEB MTE2 3 0.0000 -0.0000 0.0000

0.0 GRACEA QKS 8 0.3758033480 0.9266986052 -0.0004874449 -0.0011406637 0.3835705615 -0.9235080485 -0.0001949121 -0.0025437816

0.0 GRACEB QKS 8 0.3800290947 0.9249498818 -0.0067473944 0.0002758285 0.3789188498 -0.9253766203 0.0028558974 0.0095110300

0 GRACEA QSA 8 0.3874289318 0.9218918263 -0.0037081954 0.0007298903 0.3850069686 -0.9229102309 0.0001421031 -0.0025138753 QSA_FURUN (aka 1)

0 GRACEB QSA 8 0.3761313229 0.9261031197 -0.0270628263 0.0112179809 0.3793057732 -0.9251680296 0.0090521493 0.0104549496 QSA_FURUN (aka 1)

0.0 GRACEA QSB 4 0.0 0.0 0.0 0.0

0.0 GRACEB QSB 4 0.0 0.0 0.0 0.0

0.0 GRACEA SCA 2 1 2

0.0 GRACEB SCA 2 2 1

0.0 GRACEA USO 1 1

0.0 GRACEB USO 1 4

0.0 GRACEA VCM 3 0.00000 0.00000 0.00000

0.0 GRACEB VCM 3 0.00000 0.00000 0.00000

0.0 GRACEA VGB 6 -1.56125 -0.300 -0.19 -1.56125 -0.300 -0.19

0.0 GRACEB VGB 6 -1.56125 -0.300 -0.19 -1.56125 -0.300 -0.19

0.0 GRACEA VGN 6 -0.000400 -0.000400 -0.45142 -0.000400 -0.000400 -0.47565

0.0 GRACEB VGN 6 0.000602 0.000754 -0.45173 0.000602 0.000754 -0.47596

0.0 GRACEA VGO 6 -1.56125 0.000 -0.19 -1.56125 0.000 -0.19

0.0 GRACEB VGO 6 -1.56125 0.000 -0.19 -1.56125 0.000 -0.19

0.0 GRACEA VKB 3 1.472584 0.0 0.0

0.0 GRACEB VKB 3 1.472584 0.0 0.0

0.0 GRACEA VSL 3 -0.6000 -0.3275 0.2178

0.0 GRACEB VSL 3 -0.6000 -0.3275 0.2178

1.0 GRACEA VKB 3 1.472581 0.002663 0.001548 first solution by LJR

1.0 GRACEB VKB 3 1.472580 -0.000088 0.003319 first solution by LJR