Chapter 7 - Data Return

Contents

Introduction to Chapter 7

This chapter is a report on the NIMS data return for the C9 orbit. Due to the low downlink data rates available for Galileo Jupiter Operations and other unforeseen and unpredictable events during the C9 Encounter and Cruise, not all NIMS data recorded on the tape recorder or selected in real-time were returned. The previous 6 chapters nominally describe the planning and intention of the NIMS observations for this orbit, except the obstab section in chapter 4 which was updated to give the latest parameters for the data that were actually returned.

Ten NIMS software reloads were inserted into the C9 Encounter sequence to protect against processor halts. During C9 only 1 NIMS observations was lost due to processor halts. The approach that we are taking to avoid data loss due to processor halts has proven to be very successful.

Detectors 3 and 8 are still not functioning and are expected to be lost for the rest of the mission. Another autobias off test was performed in an attempt to understand their malfunction.

The plots on the pages 3 and 4 show the geometry of the NIMS C9 observations using a north trajectory pole projection. The 'returned' observations are in Bold characters and the 'non-returned' in gray.

The spreadsheets on pages 5 through 10 summarize the 'final' playback model for the 'returned' data.

The text on pages 11 and 12 gives a 'recap' of the C9 playback events which affected which observations were returned.

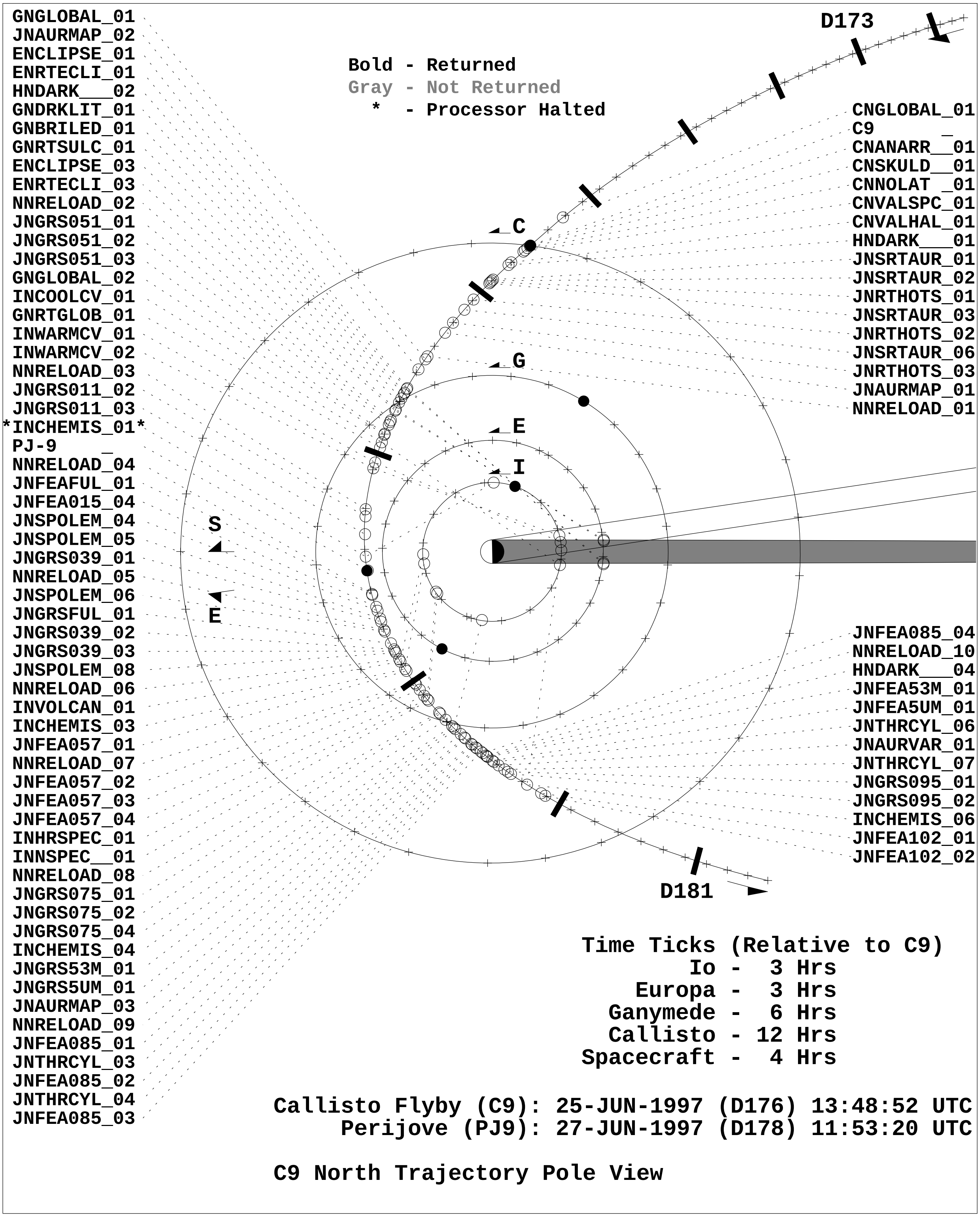
A Timeline of C9 playback events is on pages 13 through 16.

The text on pages 17 and 18 describes the C9 NIMS Anomalies.

The text on page 19 gives a brief discussion of the NIMS data files. Additional information about NIMS data formats, data types, data labels and data access is given on pages 20 and 21.

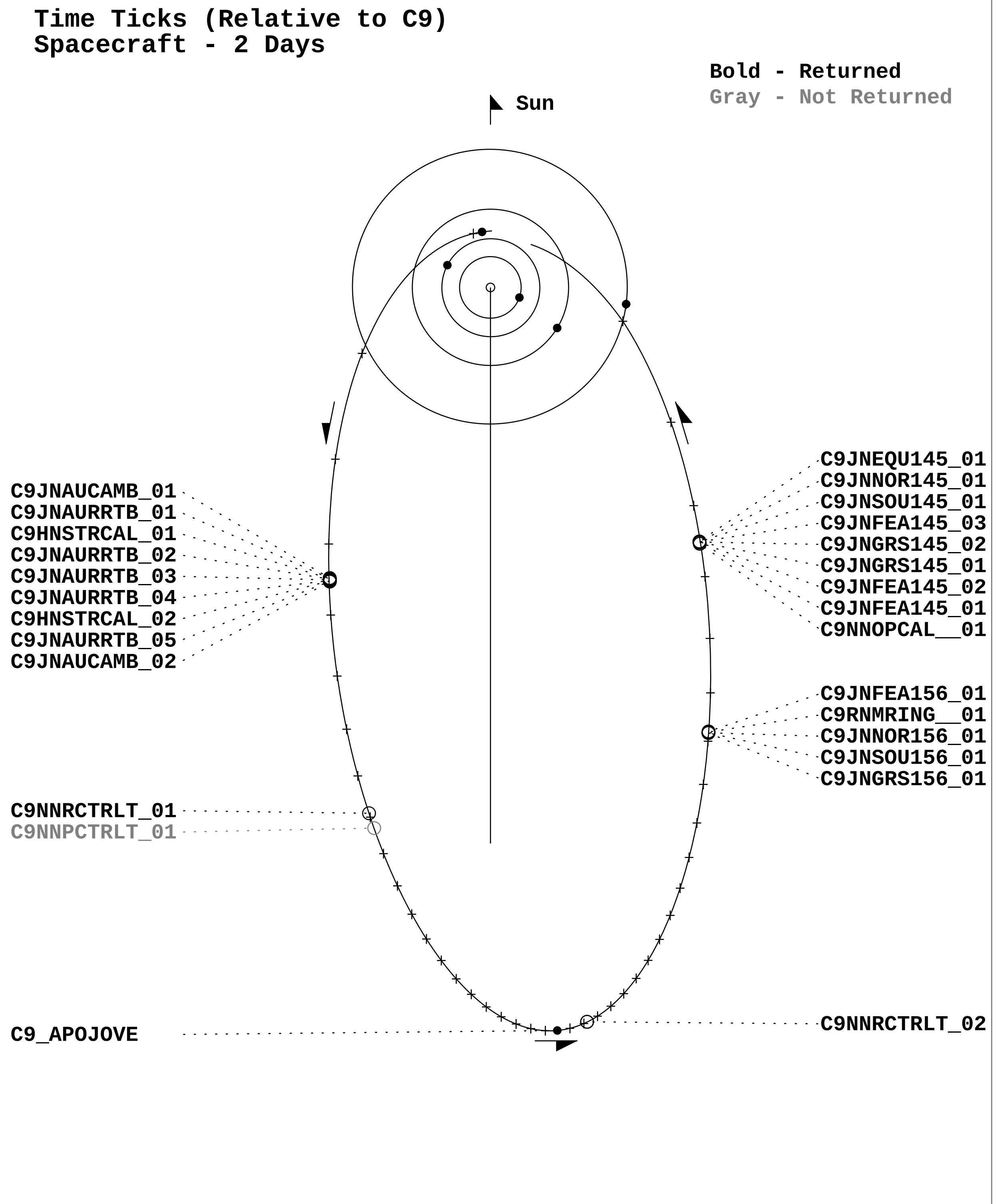
The text on page 22 is a guide to understanding the NIMS MASK.

NIMS C9 OBSERVATIONS



NIMS C9 CRUISE OBSERVATIONS

Callisto Flyby (C9): 25-JUN-1997 (D176) 13:48:52 UTC
Perijove (PJ9): 27-JUN-1997 (D178) 11:53:20 UTC



C9 North Trajectory Pole View, Perijove to Perijove

NIMS C9 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Mode	PSID
C9ENCLIPSE03-	Europa Eclipse part 3	C9EFM126B	C9EFM126B	FM	4	0	4	LPU	DO
C9ENRTECLI03-	NIMS Europa Real-Time Eclipse Obs	C9EFM204/MB	R/T	FM	4	0	4	R/T	EY
C9JNGRS05101-	Jupiter Great Red Spot 51 degrees prt 1	C9JFT68C	C9JFT25A	SM	2	1	4	LPU	DP
C9JNGRS05102-	Jupiter Great Red Spot 51 degrees prt 2	C9JFT68C	C9JFT25A	SM	2	1	4	LPU	DQ
C9JNGRS05103-	Jupiter Great Red Spot 51 degrees prt 3	C9JFT68C	C9JFT25A	SM	2	1	4	LPU	DR
C9GNGLOBAL02-	Global Surface Map	C9GLM243K	C9GLM228K	LM	4	0	4	LPU	DS
C9INCOOLCV01-	NIMS Io Eclipse Observation (ingress)	C9B_ISM68A	C9B_ISM68A	SM	2	1	4	LPU	DT
C9GNRTGLOB01+	SSI Ride-along	C9GLM442/MB	R/T	LM	4	0	4	R/T	
C9INWARMCV01-	NIMS Io Eclipse Observation (egress)	C9B_ISM68A	C9B_ISM68A	SM	2	1	4	LPU	DU
C9INWARMCV02-	NIMS Io Eclipse Obs. (post-egress)	C9B_ISM68A	C9B_ISM68A	SM	2	1	4	LPU	DV
C9JNGRS01102-	Jupiter Great Red Spot 11 degrees prt 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	DX
C9JNGRS01103-	Jupiter Great Red Spot 11 degrees prt 3	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	DY
C9INCHEMIS01-	MONITORING OF IO'S DAYSIDE	C9ILM243C	C9ILM228C	LM	2	0	4	LPU	EA
C9JNFEAFUL01-	Jupiter Ftr Trk Full Spectra	C9JFE253A	C9JFE253A	LM	2	0	4	LPU	EG
C9JNFEA01504-	Jupiter Ftr Trk 15 degrees Phase part 4	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EK
C9JNSPOLEM04-	Jupiter South Pole Map part 4	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EL
C9JNSPOLEM05-	Jupiter South Pole Map part 5	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EM
C9JNGRS03901-	Jupiter Great Red Spot 39 degrees prt 1	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EN
C9JNSPOLEM06-	Jupiter South Pole Map part 6	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EO
C9JNGRSFUL01-	Jupiter Great Red Spot Full-Spectra	C9JFE442A	C9JFE360A	LM	2	0	4	MPW	ET
C9JNGRS03902-	Jupiter Great Red Spot 39 degrees prt 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EU
C9JNGRS03903-	Jupiter Great Red Spot 39 degrees prt 3	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EV
C9JNSPOLEM08-	Jupiter South Pole Map part 8	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	EX
C9INVOLCAN01-	MONITORING OF SELECTED VOLCANIC REGIONS	C9ILMDK243D	C9ILMDK228D	LM	4	0	4	LPU	EZ
C9INCHEMIS03-	MONITORING OF IO'S DAYSIDE	C9ILM243C	C9ILM228C	LM	2	0	4	LPU	
C9JNFEA05701-	Jupiter Ftr Trk 57 degrees Phase part 1	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	FC
C9JNFEA05702-	Jupiter Ftr Trk 57 degrees Phase part 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	FF
C9JNFEA05703-	Jupiter Ftr Trk 57 degrees Phase part 3	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	FG
C9JNFEA05704-	Jupiter Ftr Trk 57 degrees Phase part 4	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	FH
C9INHRSPEC01-	HIGH SPATIAL & SPECTRAL OBS. OF IO	C9ILM442	C9ILM360	LM	2	0	4	MPW	FI
C9INNSPEC 01-	NIGHTSIDE SPECTRA AT HIGH RESOLUTION	C9ILM442	C9ILM360	LM	4	0	4	MPW	FJ
C9JNGRS07501-	Jupiter Great Red Spot 75 degrees prt 1	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FK
C9JNGRS07502-	Jupiter Great Red Spot 75 degrees prt 2	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FL
C9JNGRS07504-	Jupiter Great Red Spot 75 degrees prt 4	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FN
C9INCHEMIS04-	Monitoring of Io's Dayside and Nightside	C9ILM243C	C9ILM228C	LM	2	0	4	LPU	FO
C9JNGRS53M01-	Jupiter Great Red Spot 5 and 3 Microns	C9J35157	C9J35157	LM	4	0	4	LPU	FP
C9JNGRS5UM01-	Jupiter Great Red Spot 5 Micron Map	C9J35157	C9J35157	LM	4	0	4	LPU	FR
C9JNAURMAP03+	Jupiter UVS Ride RT	C9JLM442/MB	R/T	LM	4	0	4	R/T	
C9JNFEA08501-	Jupiter Ftr Trk 85 degrees Phase part 1	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FS
C9JNTHRCYL03-	Jupiter Thermal Cylindrical Map part 3	C9J5M253B	C9B_J5M127B	LM	4	0	4	LPU	FT
C9JNFEA08502-	Jupiter Ftr Trk 85 degrees Phase part 2	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FV
C9JNTHRCYL04-	Jupiter Thermal Cylindrical Map part 4	C9J5M253B	C9B_J5M127B	LM	4	0	4	LPU	FW

NIMS C9 DATA RETURN

Activity ID	Mode	Record Format	Wave-lengths ret	Record Time (sec)	PB Time (sec)	Sel Bits of Tape sBOT (Mbit)	Total Bits of Tape BOT (Mbit)	Mode Cycle Time	Thold	Comp	Total BTG (Mbtg) (4% ohead)	Data Reduct Factor (sBOT/BTG)	Pass
C9ENCLIPSE03-	FM	LPU	126	312	308	1.90	1.92	4.333	0	1.5	1.2420	1.53	1
C9ENRTECLI03-	FM	R/T	204										
C9JNGRS05101-	SM	LPU	25	202	198	1.22	1.25	2.33	0	1.79	0.2469	4.95	1
C9JNGRS05102-	SM	LPU	25	202	198	1.22	1.25	2.33	0	1.69	0.2615	4.67	1
C9JNGRS05103-	SM	LPU	25	203	199	1.23	1.25	2.33	0	1.56	0.2847	4.31	1
C9GNGLOBAL02-	LM	LPU	228	1210	1206	7.44	7.46	8.667	0	1.31	5.0374	1.48	1
C9INCOOLCV01-	SM	LPU	68	527	523	3.23	3.25	2.33	0	1.55	2.0483	1.57	1
C9GNRTGLOB01+	LM	R/T	408						0				
C9INWARMCV01-	SM	LPU	68	476	472	2.91	2.94	2.33	0	1.44	1.9897	1.46	1
C9INWARMCV02-	SM	LPU	68	302	298	1.84	1.86	2.33	0	1.29	1.4023	1.31	1
C9JNGRS01102-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.5	0.8094	1.52	1
C9JNGRS01103-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.43	0.8490	1.45	1
C9INCHEMIS01-	LM	LPU	228	125	121	0.75	0.77	8.667	0	3.5	0.1892	3.95	1
C9JNFEAFUL01-	LM	LPU	253	262	258	1.59	1.62	8.667	0	1.39	1.1270	1.41	1
C9JNFEA01504-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.48	0.8203	1.50	1
C9JNSPOLEM04-	SM	LPU	68	393	389	2.40	2.42	2.33	0	1.53	1.5434	1.55	1
C9JNSPOLEM05-	SM	LPU	68	393	389	2.40	2.42	2.33	0	1.52	1.5535	1.54	1
C9JNGRS03901-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.5	0.8094	1.52	1
C9JNSPOLEM06-	SM	LPU	68	393	389	2.40	2.42	2.33	0	1.57	1.5041	1.60	1
C9JNGRSFUL01-	LM	MPW	360	262	258	2.97	3.02	8.667	0	1.45	1.5373	1.93	1
C9JNGRS03902-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.52	0.7987	1.54	1
C9JNGRS03903-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.53	0.7935	1.55	1
C9JNSPOLEM08-	SM	LPU	68	393	389	2.40	2.42	2.33	0	1.51	1.5638	1.53	1
C9INVOLCAN01-	LM	LPU	228	97	93	0.57	0.60	8.667	0	1.31	0.3885	1.48	1
C9INCHEMIS03-	LM	LPU	228	204	200	1.23	1.26	8.667	0	1.4	0.7817	1.58	1
C9JNFEA05701-	SM	LPU	68	694	690	4.26	4.28	2.33	0	1.64	2.5540	1.67	1
C9JNFEA05702-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.62	0.7494	1.65	1
C9JNFEA05703-	SM	LPU	68	204	200	1.23	1.26	2.33	0	1.64	0.7403	1.67	1
C9JNFEA05704-	SM	LPU	68	209	205	1.26	1.29	2.33	0	1.8	0.6913	1.83	1
C9INHRSPEC01-	LM	MPW	360	155	151	1.74	1.79	8.667	2	1.57	0.8309	2.09	1
C9INNSPEC 01-	LM	MPW	360	125	121	1.39	1.44	8.667	2	2.14	0.4885	2.85	1
C9JNGRS07501-	SM	LPU	40	204	200	1.23	1.26	2.33	0	1.97	0.3625	3.40	1
C9JNGRS07502-	SM	LPU	40	204	200	1.23	1.26	2.33	0	2.29	0.3119	3.96	1
C9JNGRS07504-	SM	LPU	40	304	200	1.23	1.88	2.33	0	2.47	0.2891	4.27	1
C9INCHEMIS04-	LM	LPU	228	304	300	1.85	1.88	8.667	2	1.94	0.8462	2.19	1
C9JNGRS53M01-	LM	LPU	157	550	546	3.37	3.39	8.667	0	1.44	1.4286	2.36	1
C9JNGRS5UM01-	LM	LPU	157	550	546	3.37	3.39	8.667	0	1.56	1.3187	2.55	1
C9JNAURMAP03+	LM	R/T	408										
C9JNFEA08501-	SM	LPU	40	204	200	1.23	1.26	2.33	0	2.24	0.3188	3.87	1
C9JNTHRCYL03-	LM	LPU	127	1195	1191	7.35	7.37	8.667	0	1.61	2.2547	3.26	1
C9JNFEA08502-	SM	LPU	40	204	200	1.23	1.26	2.33	0	2.22	0.3217	3.83	1
C9JNTHRCYL04-	LM	LPU	127	1195	1191	7.35	7.37	8.667	0	1.6	2.2688	3.24	1

NIMS C9 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Mode	PSID
C9JNFEA08503-	Jupiter Ftr Trk 85 degrees Phase part 3	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FY
C9JNFEA08504-	Jupiter Ftr Trk 85 degrees Phase part 4	C9JFT68B	C9B_JFT40A	SM	2	1	4	LPU	FZ
C9NHNDARK_04-	NIMS Dark Observation	C9DRK252	C9DRK252	LM	3	0	4	LPU	LB
C9JNFEA53M01-	Jupiter Ftr Trk 5 and 3 Micron Map	C9J35157	C9J35157	LM	4	0	4	LPU	LC
C9JNFEA5UM01-	Jupiter Ftr Trk 5 Micron Map	C9J35157	C9J35157	LM	4	0	4	LPU	LD
C9JNTHRCYL06-	Jupiter Thermal Cylindrical Map part 6	C9J5M253B	C9B_J5M127B	LM	4	0	4	LPU	LE
C9JNAURVAR01+	Jupiter UVS Ride RT	C9JLM442/MB	R/T	LM	4	0	4	R/T	
C9JNTHRCYL07-	Jupiter Thermal Cylindrical Map part 7	C9J5M253B	C9B_J5M127B	LM	4	0	4	LPU	LF
C9JNGRS09501-	Jupiter Great Red Spot 95 degrees prt 1	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LG
C9JNGRS09502-	Jupiter Great Red Spot 95 degrees prt 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LI
C9INCHEMIS06-	Monitoring of Io's Dayside and Nightside	C9ILM243C	C9ILM228C	LM	2	0	4	LPU	LK
C9JNFEA10201-	Jupiter Ftr Trk 102 deg Phase part 1	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LQ
C9JNFEA10202-	Jupiter Ftr Trk 102 deg Phase part 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LR
C9CNGLOBAL01-	CALLISTO GLOBAL COVERAGE	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DC
C9CNANARR 01-	Anarr Crater Coverage	C9CLM442	C9CLM360	LM	4	0	4	MPW	DD
C9CNSKULD 01-	STUDY OF A BRIGHT CRATER	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DE
C9CNNOLAT 01-	North Latitude Coverage	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DF
C9CNVALSPC01-	Valhalla Spectral Scan	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DG
C9CNVALHAL01-	Valhalla Multi-Ring Structure Obs	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DH
C9NHNDARK_01-	NIMS Dark Observation	C9DRK252	C9DRK252	LM	4	0	4	LPU	DB
C9JNSRTAUR01-	NIMS Jupiter Real-Time Aurora Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	FE
C9JNSRTAUR02-	NIMS Jupiter Real-Time Aurora Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	FQ
C9JNRTHOTS01-	NIMS Real-Time Hotspot Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	MB
C9JNSRTAUR03-	NIMS Jupiter Real-Time Aurora Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	FU
C9JNRTHOTS02-	NIMS Real-Time Hotspot Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	MC
C9JNSRTAUR06-	NIMS Jupiter Real-Time Aurora Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	DM
C9JNRTHOTS03-	NIMS Real-Time Hotspot Obs	C9JLM442/MB	R/T	LM	4	0	4	R/T	MD
C9JNAURMAP01+	Jupiter UVS Ride RT	C9JLM442/MB	R/T	LM	4	0	4	R/T	
C9GNGLOBAL01-	Global Surface Map	C9GLM243K	C9GLM228K	LM	3	0	4	LPU	DI
C9JNAURMAP02+	Jupiter UVS Ride RT	C9JLM442/MB	R/T	LM	4	0	4	R/T	
C9ENCLIPSE01-	Europa Eclipse part 1	C9EFM126B	C9EFM126B	FM	4	0	4	LPU	DJ
C9ENRTECLI01-	NIMS Europa Real-Time Observation	C9EFM204/MB	R/T	FM	4	0	4	R/T	ME
C9NHNDARK_02-	NIMS Dark Observation	C9DRK252	C9DRK252	LM	2	0	4	LPU	DK
C9GNDRKLIT01-	Dark and Light transition	C9GLM243K	C9GLM228K	LM	3	0	4	LPU	DL
C9GNBRILED01-	Bright endmember lead hemisphere	C9GLM243K	C9GLM228K	LM	3	0	4	LPU	DN
C9GNRTSULC01+	SSI Ride-Along Real Time	C9GLM442/MB	R/T	LM	3	0	4	R/T	EQ
C9NNAUCAMB01-	Auroral Campaign B Map No. 1	C9B_JAU126A	C9B_JAU126A	FM	4	1	4	LPU	MR
C9NNAURRTB01	Auroral Campaign B Real-Time No. 1	C9JLM442/MB	R/T	LM	4	0	4	R/T	MS
C9HNSTRCAL01-	Star Calibration	SXM17	R/T	XM	4	0-11	4	R/T	
C9NNAURRTB02-	Auroral Campaign B Real-Time No. 2	C9JLM442/MB	R/T	LM	4	0	4	R/T	MU

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Activity ID	Mode	Record Format	Wave-lengths ret	Record Time (sec)	PB Time (sec)	Sel Bits of Tape sBOT (Mbit)	Total Bits of Tape BOT (Mbit)	Mode Cycle Time	Thold	Comp	Total BTG (Mbtg) (4% ohead)	Data Reduct Factor (sBOT/BTG)	Pass
C9JNFEA08503-	SM	LPU	40	204	200	1.23	1.26	2.33	0	2.48	0.2880	4.28	1
C9JNFEA08504-	SM	LPU	40	204	200	1.23	1.26	2.33	0	2.83	0.2524	4.89	1
C9HNDARK__04	LM	LPU	252	64	60	0.37	0.39	8.667	0	2.34	0.1551	2.39	1
C9JNFEA53M01-	LM	LPU	157	715	711	4.39	4.41	8.667	0	1.75	1.5308	2.86	1
C9JNFEA5UM01-	LM	LPU	157	550	546	3.37	3.39	8.667	0	1.77	1.1623	2.90	1
C9JNTHRCYL06-	LM	LPU	127	1339	1335	8.23	8.26	8.667	0	1.5	2.7126	3.04	1
C9JNAURVAR01+	LM	R/T	408										
C9JNTHRCYL07-	LM	LPU	127	1295	1291	7.96	7.99	8.667	0	1.54	2.5551	3.12	1
C9JNGRS09501-	SM	LPU	68	204	200	1.23	1.26	2.33	0	2.11	0.5754	2.14	1
C9JNGRS09502-	SM	LPU	68	391	387	2.39	2.41	2.33	0	2.35	0.9997	2.39	1
C9INCHEMIS06-	LM	LPU	228	224	155	0.96	1.38	8.667	2	4.37	0.1941	4.93	1
C9JNFEA10201-	SM	LPU	68	204	200	1.23	1.26	2.33	0	2.05	0.5922	2.08	1
C9JNFEA10202-	SM	LPU	68	204	200	1.23	1.26	2.33	0	2.3	0.5279	2.34	1
C9CNGLOBAL01-	LM	LPU	228	2004	2000	12.34	12.36	8.667	2	2.36	4.6371	2.66	2
C9CNANARR 01-	LM	MPW	360	604	300	3.46	6.96	8.667	0	1.94	1.3360	2.59	2,3
C9CNSKULD 01-	LM	LPU	228	604	300	1.85	3.73	8.667	0	1.95	0.8418	2.20	2,3
C9CNNOLAT 01-	LM	LPU	228	649	320	1.97	4.00	8.667	2	1.79	0.9782	2.02	2,3
C9CNVALSPC01-	LM	LPU	228	404	200	1.23	2.49	8.667	0	1.75	0.6253	1.97	2,3
C9CNVALHAL01-	LM	LPU	228	1720	858	5.29	10.61	8.667	2	1.85	2.5377	2.09	2,3
C9HNDARK__01	LM	LPU	252	64	60	0.37	0.39	8.667	0	2.16	0.1680	2.20	2
C9JNSRTAUR01-	LM	R/T	408						0				
C9JNSRTAUR02-	LM	R/T	408						0				
C9JNRTHOTS01-	LM	R/T	408						0				
C9JNSRTAUR03-	LM	R/T	408						0				
C9JNRTHOTS02-	LM	R/T	408						0				
C9JNSRTAUR06-	LM	R/T	408						0				
C9JNRTHOTS03-	LM	R/T	408						0				
C9JNAURMAP01+	LM	R/T	408						0				
C9GNGLOBAL01-	LM	LPU	228	2887	2883	17.78	17.81	8.667	2	1.84	8.5735	2.07	2
C9JNAURMAP02+	LM	R/T	408						0				
C9ENCLIPSE01-	FM	LPU	126	312	308	1.90	1.92	4.333	0	1.66	1.1222	1.69	2
C9ENRTECLI01-	FM	R/T	204						0				
C9HNDARK__02	LM	LPU	252	64	60	0.37	0.39	8.667	0	1.93	0.1880	1.97	2
C9GNDRKLIT01-	LM	LPU	228	1753	1749	10.79	10.81	8.667	0	1.53	6.2550	1.72	2
C9GNBRILED01-	LM	LPU	228	682	678	4.18	4.21	8.667	0	1.58	2.3480	1.78	2
C9GNRTSUCL01+	LM	R/T	408										
C9JNAUCAMB01	FM	LPU	126	312	308	1.90	1.92	4.333	0	2.15	0.8665	2.19	2
C9JNAURRTB01	LM	R/T	408										
C9HNSTRCAL01-	LM	R/T	17										
C9JNAURRTB02	LM	R/T	408										

NIMS C9 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Mode	PSID
C9NNAURRTB03-	Auroral Campaign B Real-Time No. 3	C9JLM442/MB	R/T	LM	4	0	4	R/T	MV
C9NNAURRTB04-	Auroral Campaign B Real-Time No. 4	C9JLM442/MB	R/T	LM	4	0	4	R/T	MW
C9HNSTRCAL02-	Star Calibration	SXM17	R/T	XM	4	12-23	4	R/T	
C9NNAURRTB05-	Auroral Campaign B Real-Time No. 5	C9JLM442/MB	R/T	LM	4	0	4	R/T	MX
C9NNAUCAMB02-	Auroral Campaign B Map No. 2	C9B_JAU126A	C9B_JAU126A	FM	4	1	4	LPU	MT
C9NNRCTRLT01-	NIMS RCT Calibration	C9RCT252	R/T	LM	1	0	4	R/T	LT
C9NNRCTRLT02-	NIMS RCT Calibration	C9RCT252	R/T	LM	1	0	4	R/T	LT
C9CNANARR 01-	Anarr Crater Coverage	C9CLM442	C9CLM360	LM	4	0	4	MPW	DD
C9CNSKULD 01-	STUDY OF A BRIGHT CRATER	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DE
C9CNNOLAT 01-	North Latitude Coverage	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DF
C9CNVALSPC01-	Valhalla Spectral Scan	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DG
C9CNVALHAL01-	Valhalla Multi-Ring Structure Obs	C9CLM243C	C9CLM228C	LM	4	0	4	LPU	DH
C9GNGLOBAL01-	Global Surface Map	C9GLM243K	C9GLM228K	LM	3	0	4	LPU	DI
C9GNDRKLIT01-	Dark and Light transition	C9GLM243K	C9GLM228K	LM	3	0	4	LPU	DL
C9JNGRS15601-	Jupiter Great Red Spot 156 Degrees	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LJ
C9JNSOU15601-	Jupiter Southern Hemisphere 156 Degrees	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LL
C9JNNOR15601-	Jupiter Northern Hemisphere 156 Degrees	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LM
C9RNMRING_01-	Sit and Stare Ring Observation	C9RFM126B	C9RFM126B	FM	4	0	4	LPU	DZ
C9JNFEA15601-	Jupiter Feature 156 Degrees Phase	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LO
C9NNOPCAL_01	NIMS OPCAL	C9OPCAL48	R/T	LM	4	0	4	R/T	
C9JNFEA14501-	Jupiter Feature 145 Degrees Phase prt 1	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LP
C9JNFEA14502-	Jupiter Feature 145 Degrees Phase prt 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LS
C9JNGRS14501-	Jupiter GRS 145 Degree Phase prt 1	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	FB
C9JNGRS14502-	Jupiter GRS 145 Degrees Phase prt 2	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LU
C9JNFEA14503-	Jupiter Feature 145 Degrees Phase prt 3	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	MG
C9JNSOU14501-	Jupiter South Hemisphere 145 Deg Phase	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	MH
C9JNNOR14501-	Jupiter North Hemisphere 145 Deg Phase	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	LZ
C9JNEQU14501-	Jupiter Equatorial 145 Degrees Phase	C9JFT68C	C9JFT68C	SM	2	1	4	LPU	MA

NIMS C9 DATA RETURN

Activity ID	Mode	Record Format	Wave-lengths ret	Record Time (sec)	PB Time (sec)	Sel Bits of Tape sBOT (Mbit)	Total Bits of Tape BOT (Mbit)	Mode Cycle Time	Thold	Comp	Total BTG (Mbtg) (4% ohead)	Data Reduct Factor (sBOT/BTG)	Pass
C9JNAURRTB03	LM	R/T	408										
C9JNAURRTB04	LM	R/T	408										
C9HNSTRCAL02-	LM	R/T	17										
C9JNAURRTB05	LM	R/T	408										
C9JNAUCAMB02	FM	LPU	126	312	308	1.90	1.92	4.333	0	2.39	0.7795	2.44	2
C9NNRCTRLT01	LM	R/T	252										
C9NNRCTRLT02	LM	R/T	252										
C9CNANARR 01-	LM	MPW	360	604	309	3.56	6.96	8.667	0	1.94	1.3761	2.59	2,3
C9CNSKULD 01-	LM	LPU	228	604	309	1.91	3.73	8.667	0	1.95	0.8671	2.20	2,3
C9CNNOLAT 01-	LM	LPU	228	649	329	2.03	4.00	8.667	2	1.79	1.0057	2.02	2,3
C9CNVALSPC01-	LM	LPU	228	404	209	1.29	2.49	8.667	0	1.75	0.6535	1.97	2,3
C9CNVALHAL01-	LM	LPU	228	1720	867	5.35	10.61	8.667	2	1.85	2.5643	2.09	2,3
C9GNGLOBAL01-	LM	LPU	228	2887	345	2.13	17.81	8.667	2	1.65	1.1441	1.86	2
C9GNDRKLIT01-	LM	LPU	228	1753	248	1.53	10.81	8.667	0	1.53	0.8869	1.72	2
C9JNGRS15601-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.16	0.1405	2.19	3
C9JNSOU15601-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.14	0.1418	2.17	3
C9JNNOR15601-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.06	0.1473	2.09	3
C9RNMRING_01-	FM	LPU	126	244	240	1.48	1.50	4.333	0	2.56	0.5670	2.61	3
C9JNFEA15601-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.27	0.1337	2.31	3
C9NNOPCAL_01-	LM	R/T	48						0				
C9JNFEA14501-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.04	0.1488	2.07	3
C9JNFEA14502-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.05	0.1481	2.08	3
C9JNGRS14501-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.01	0.1510	2.04	3
C9JNGRS14502-	SM	LPU	68	54	50	0.31	0.33	2.33	0	1.96	0.1549	1.99	3
C9JNFEA14503-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.06	0.1473	2.09	3
C9JNSOU14501-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.01	0.1510	2.04	3
C9JNNOR14501-	SM	LPU	68	54	50	0.31	0.33	2.33	0	1.96	0.1549	1.99	3
C9JNEQU14501-	SM	LPU	68	54	50	0.31	0.33	2.33	0	2.04	0.1488	2.07	3
										Total	95.7822		
										Alloc	98.3260		

RECAP OF C9 PLAYBACK EVENTS

The C9 orbit was unique for a number of reasons. It was the "largest" prime mission orbit in terms of duration and downlink bits. NIMS allocation for C9 was nearly 100 Megabits. In addition, during C9, playback was paused several times in order to record new observations on the tape. As a result the C9 playback process was significantly more complex than for any other Galileo orbit.

NIMS experienced one instrument software crash in C9 which resulted in the loss of one observation, C9INCHEMIS01. A portion of this data was returned to ground during playback because there were no opportunities to modify the playback table before the observation was sent down.

The Galileo main computer (CDS) experienced two significant problems in C9, one due to "overfilling" the multi-use buffer, and another involving continuous search mode for the tape recorder.

Compression of NIMS observations showed a clear relationship to distance from Jupiter, with observations inside 15 Rj compressing poorly and those outside 15 Rj compressing better than predicted. This caused playback to at times run ahead of schedule, and at times run behind.

There were 7 RDC ("record during cruise") events in C9. These permitted the recording of unique data on top of C9 encounter data that had already been played back. These events were somewhat costly, at something like 5 Mbits of downlink lost per event. During each one, the following steps were performed: Pause playback, slew to the tape location specified for recording, wait 15 minutes, record the observations, slew back to the point where playback was paused, and resume playback. Timing was critical, since a) if playback had not progressed as planned, we might write over encounter data that had not been played back, and b) if playback had progressed too far, then it might not be possible to reach the location for new recording before the time recording was to begin, causing loss of the new observation. All of the RDCs in C9 executed as planned.

RECAP OF C9 PLAYBACK EVENTS

To accomplish this, C9 departed from most orbits in abandoning the first recorded-first played back strategy. The following summary of the overall playback strategy was produced by playback coordinator Jeff Culwell in late April 1997:

The current strategy will have playback start on track 3. RDCs 1-4 will overwrite tracks 3 and 4. So there is only one pass across tracks 3 and 4. However, there is reasonable margin between the time when we playback data from tracks 3 and 4 and the time when we overwrite the data. The office and SPOT are aware that playback of encounter tracks 3 and 4 is a one pass plan, and adequate margin will be retained to prevent an overwrite before playback.

After completing the playback of tracks 3 and 4, playback will continue on tracks 1 and 2 for the first pass across this encounter data set. Playback will return RDCs 1-4 after finishing the first pass across tracks 1 and 2. RDCs 5-7 will overwrite RDCs 1 and 2 on track 3. There currently is plenty of margin between the time when we playback RDCs 1 and 2 and when we overwrite them. This margin is built into the playback plan.

After completing the playback of RDCs 1-4 on tracks 3 and 4, playback will continue with pass 2 of encounter tracks 1 and 2. All of track 2 will be available for 2 passes. After completing pass 2 on tracks 1 and 2, playback will return RDCs 5-7 on track 3.

This plan does not require any terminate/initiate commands during playback. There are no out of order recordings, and there are no special procedural issues with respect to SEQGEN or multiple files.

C9 Playback Events Timeline (04-30-97 to 09-13-97)

04-30-97: Playback table delivered with commands arranged to conform to NIMS C9 Playback strategy.

05-13-97: Internal trade of NIMS bits.
SWG gives 15.76 Mbits to AWG.

05-30-97: Playback table update. To ensure safe recording of RDCs, the playback coordinator requests we reduce playback of the Jupiter thermal cylindrical map observations (C9JNTHRCYL03, 04, 06, 07). Wavelength coverage for these is reduced to 127 bands, and the saved bits are moved to fill out other Jupiter observations, principally the high phase observations in RDCs 6 and 7.

06-11-97: Playback table updates with minor refinements.

06-18-97: Playback table updates with minor refinements.

06-24-97: Final pre-uplink update. NIMS playback plan is slightly under allocation and 0.5 Mbits is given to UVS in recognition of their generosity in the past. It is discovered that C9JNFEA05704 recording will begin too close to the end of the tape to permit playback of the full observation; about 1/3 of it cannot be brought down.

06-25-97: Callisto close approach occurs at 13:48 GMT.

06-27-97: NIMS software crash at about 10:00 GMT affects recording of C9INCHEMIS01. Reload #4 restores function 4 hours later. Perijove occurs at 11:53 GMT.

06-29-97: Playback begins.

07-04-97: Playback paused for RDC # 1 (Calibrations).
NIMS records a STRCAL and two observations of Jupiter aurora (C9JNAUCAMB01-02).

07-09-97: Playback table update. The following is from the memo produced for that date:
C9 playback has been eventful. Both SSI and NIMS under-compressed significantly during the first few days of playback, to the tune of some 10 Mbits, >60% SSI. Currently the best explanation is lots of noise. We had a close shave, barely completing playback of the observations that were scheduled to be overwritten by the first Record-During-Cruise (RDC). The next RDC is July 14, and there appears to be sufficient cushion to enable this to happen with less nail-biting. It proved to be impossible to delete the commands to play back the observation INCHEMIS01, which was to be taken at the time when the NIMS clock stopped (prior to software reload 04). The SSI undercompression left them in a painful position of having to delete commands to return some high priority images. Since AWG was retaining about 2 Mb in reserve, and since our AWG observations are fully selected from here on out (exception: we are returning 127 of 253

wavelengths for the JNTHRCYL observations), we decided to build some good will and transfer our share of the 2 Mb to SSI for this week's update. We returned our initial SWG observations without thresholding. This probably contributed to the problem with our compressions. Therefore in this update thresholding is commanded for 9 observations: INHRSPEC01, INNNSPEC01, INCHEMIS04, INCHEMIS06, CNGLOBAL01, CNNOLAT_01, CNVALHAL01, GNGLOBAL01, ENCLIPSE01. In no case are we returning part of an observation with thresholding, and part without.

07-14-97: Record during cruise #2 ("Dusk magnetotail #1).
NIMS returns RCTCAL.
First CDS anomaly results in stoppage of playback.

07-15-97: Playback table update window. The following is excerpted from a memo produced at that time:
As some of you know, Galileo stopped returning science data yesterday morning. This was a new variety of "anomaly." The multi-use buffer filled to capacity, and locked up. Fortunately CDS folks were able to diagnose the problem and uplink a patch in good time. We lost only 15 hours = 3.8 Mb of downlink capability. Tal Brady deserves a thank-you. The problem was traced to RRCC processes, which permit us to get continuous MWG data while the tape recorder is running up and down, recording image data. That process is permitted to place more than the standard maximum number of VCDU's in the MUB. There were apparently a few incomplete data packets in the MUB to start with. The system locked up (stopped processing) because there were more VCDU's than the software was equipped to cope with. This is another case that probably will not arise again. We were asked to identify what we would cut (using 2 scenarios) in order to permit the next RDC to occur as planned. The more optimistic case had us losing 4 Mbits, which we would have gotten by reducing wavelength coverage on the JNTHRCYL observations. Fortunately at the moment it appears that no such cuts will be required. The lost 3.8 Mb will come from the office margin. For this week's normal update cycle, two changes were required. In order for the two ENCLIPSE observations to be usefully comparable, they will both be returned without thresholding. One is down already, the other will be returned in pass 2. Secondly, we were about 0.9 Mb over our allocation due to pass 1 under-compression. To bring this into line the final Callisto observation was truncated in pass 2 playback (VALHAL01) by 307 seconds. It is expected taht this wll be added back in when office margin bits are released later on.

07-22-97: RDC #3 ("Dusk Magnetotail #2").

07-23-97: Playback table update - see following memo from that date:
After running significantly behind schedule for much of the early data return, improved compression performance has moved us ahead of schedule by more than a day. We

are currently performing the RDC 3; playback is paused in order to do this. Playback will resume with CNANARR_01, which was the second observation recorded by NIMS in C9. The first (CNGLOBAL01) has been returned in its entirety. The remarkably consistent degradation of NIMS compression on performance inside Ganymede's orbit in C9 is most probably due to radiation noise. In today's SSO meeting EPD/HIC reported that radiation around perijove was a factor of 2-3 times more intense than was observed earlier in C3. SSI reported that they were seeing noise levels 5-6 times higher than they expected. Together with the NIMS performance it seems almost certain that unusually high radiation was the cause for our low compression.
On Monday a 4-hour portion of our DSN-43 downlink was taken over by Mars Pathfinder, in their efforts to re-establish communication. While our playback was paused we lost about 2.5 Mb of capability. This was covered by SSO office margin, so no cuts by instrument teams will be needed. However, if MPF has its mission extended through August, and if they were to receive all the downlink that they want, it would cut more than 45 Mb from Galileo C9 playback capability. This worst-case scenario is unlikely but at the moment it is unclear whether Galileo will have to take further hits to subsidize MPF downlink. We lost 94 frames, mainly real-time data, due to Monday's event.

07-30-97: Playback table update-see following memo from that date: Due to significant overcompression by SSI and also (possibly) by NIMS, playback is about 2 days ahead of schedule. This has happened at an unfortunate time. Playback reached the end of segment 13 before segment 14 could be uplinked, and as a result playback paused at about 9:30 this morning. A one-way DSN63 pass is being converted to 2-way, and the new segment will go up later today. This will result in the loss of over 1 Mb of capability, which will be subtracted from our allocations. The impact should be minimal for us.
The observations CNVALHAL01 and HNDARK_01 should be on the ground now, followed later by GNGLOBAL01. It appears that we lost approximately 1.77 Mb (gaps) during the first pass of playback. We cannot go back to pick up lost bits now since the data has now been recorded over. However, we will have another shot to pick up missing data for our pass 2 Callisto and Ganymede observations.

08-07-97: RDC #4 ("Apojove A and B"). NIMS returns RCTCAL.

08-12-97: Playback table update window. See following memo from that date:
The C9 "process" shifted from snoozing to streaking during the past 48 hours. SSI was up against a tough choice. Due to data losses and errors in commanding they need about 7 Mb to bring down their key Callisto data. They were facing cuts in their calibration observations that would have only gotten them halfway there. As a result

they pressured the office to release office margin to help them out. Since we now have experience with the RDC process it was decided to release 10 Mb of margin, retaining 4 Mb for the coming weeks. The 10 was split between NIMS and SSI. SSI also got 2 Mb from other sources. In the meeting a trade was proposed. Since NIMS is in good shape, we offered to trade 2 Mb of our 5 for an equivalent amount in E11, where we are severely squeezed for downlink. The trade involved only office margin. After taking the offer to a telephone conference, they came back to dicker. We gave them 2.5 in exchange for the first 1.5 Mb of their share of E11 office margin. This is a good deal for us. After the trade and after projected gap filling requirements, and fully selecting all remaining NIMS data, we still have roughly 2.5 Mb more than we need in C9. We can consider replaying an entire Callisto observation without thresholding to sop up these bits. In E11, where we are squeezed, it is likely that we will receive about 3 Mb of office margin (ours and theirs), above our allocation.

08-14-97: A severe data loss occurs due to problems at DSN stations 14 and 43. We lose > 50% of C9JNAUCAMB02. This is not recoverable.

08-20-97: Playback table update. Seven sets of commands are entered to fill gaps in C9GNGLOBAL01 and C9GNDRKLIT01. Also, full spatial coverage is restored for C9CNVALHAL01.

08-23-97: RDC #5 ("Dawn Magnetotail").

09-03-97: RDC #6 ("AWG High Phase #1"). NIMS records Jupiter observations at phase 156 degrees.

09-08-97: Playback table update. See memo from that date (below): Although the playback process went into limited search mode, and was terminated, over the weekend, the impacts for NIMS will apparently be nil. A DSN station outage 10 hours long began during playback of the 156 degree phase Jupiter observations that were recorded during cruise last week. It will be possible to replay these observations however. An unrelated problem occurred to send the tape into limited search. The time of the next segment to be played back was later than anything existing on the tape (corresponding to RDC #7 playback; these observations will be recorded Wednesday). The tape would look for the nonexistent time forever if playback was not terminated. The fact that playback was terminated permits us to send up new commands to playback the remaining RDC 6 data, as well as the upcoming RDC 7 data. The impact of these events was the loss of a considerable amount of realtime data. None of this was NIMS data, however.

09-10-97: RDC #7 ("AWG High Phase #2"). NIMS records Jupiter observations at 145 degrees phase.

09-13-97: Playback is terminated. All commanded NIMS data from RDC #7 is received before termination.

NIMS Anomaly Report - C9 Sequence

Two types of anomalies occurred during the C9 Encounter: The NIMS processor halted once and NIMS realtime PCT data were lost from the MUB. The processor Halt was recoverable, but the PCT data were permanently lost.

Detectors 3 and 8 are still not functioning and are expected to be lost for the rest of the mission.

Processor Halts

Facts:

0. Between the start of the C9 Encounter and the single Halt NIMS returned 13 realtime observations and successfully reloaded NIMS from CDS 3 times. The NIMS SCLK engineering channels were continuously monitored for detecting a NIMS processor halt.

1. A NIMS processor halt was detected at SCLK 04017644 from the analysis of the NIMS SCLK engineering telemetry channels S-1931 and S-1932. This occurred about 2 hours before C9 perijove. A fourth NIMS reload occurred about 4 hours and 10 minutes later. No more Halts occurred during the rest of the encounter. A table of the NIMS engineering SCLK values near the time of the Halt follows (Note that the NIMS engineering SCLK value is normally 2 Rims behind the CDS SCLK Rim when it is reported):

NIMS SCLK	CDS SCLK	CDS SCET	GROUND ERT
04017478	04017480.40	1997-178T07:15:50.189	1997-178T08:19:50.149
04017644	04017665.05	1997-178T10:22:30.182	1997-178T10:58:59.739
04017644	04017882.58	1997-178T14:02:30.174	1997-178T14:58:24.454
04018045	04018047.43	1997-178T16:49:10.168	1997-178T17:38:49.493

2. Only one NIMS observation was lost due to this Halt: C9INCHEMIS01.

Timing:

SCLK	Comments
04017665.05	Anomalous 04017644 SCLK reported
04017679:00	Start of NIMS observation C9INCHEMIS01
04017683:79	END of NIMS observation C9INCHEMIS01
04017755:00	C9 Perijove
04017887:06	Start of NIMS CDS Reload04 (#4)

NIMS Anomaly Report - C9 Sequence

Summary:

1. One NIMS processor halt occurred during the C9 Encounter.

2. Continous monitoring of the NIMS SCLK channels led to a rapid identification that NIMS processor halts had occurred.

3. The 10 NIMS software reloads from CDS greatly lessened the potentially disastrous effects of the C9 Halt and protected the NIMS observations in the encounter.

4. Frequent NIMS realtime observations, both science observations and instrument health monitoring observations, verified that NIMS was functioning normally at various time points throughout the encounter.

5. The error avoidance measures applied to the C9 Encounter as determined in the analysis of the processor halts that occurred in earlier orbits were shown to be the proper response for dealing with the inevitable occurrence of radiation-induced NIMS processor halts.

Autobias Test

During C9 Cruise (B-load), we tested the effects of turning off the auotbias on all NIMS detectors. This is part of the on-going effort to understand what might be wrong with detectors 3 and 8 and how they might be made operational. The autobias off test was done in two C9B NIMS calibrations: the RCT Calibration and the PCT Calibration. In the C9B NIMS RCT calibration, autobias was turned off for the entire RCT Cal, looking at both dark sky and the RCT for detectors 7-17. In the C9B NIMS PCT calibration, autobias was turned off for the last 2 Rims of the PCT Cal, looking at the PCT for detectors 1-10. The RCT calibration data were returned successfully, but the PCT calibration data were lost in a CDS MUB overflow caused by SSI.

Autobias was turned off using the 37MPT command. The 37MPT command is similar to the one used in G8NNDET3AN01. For the RCT calibration, 37MPT,...,1,192,192 was commanded at 040411119:00; modify byte 1 of PTAB-A with 192, modify byte 1 of PTAB-B with 192. The 37IOP at RIM 04041146:84 put NIMS into SAFE Mode and loaded a new set of PTABs that have Autobias ON.

```
  192 = 11000000
  Byte 1 contains
    1) (M) Mirror Operation                 Bit 7
    2) (A) Autobias                         Bit 6
    3) (S) Grating Start Position           Bits 0-5
    M = INT(192/128)            = 1 ==>  (Mirror Scan ON)
    A = INT(192 - M*128)/64     = 1 ==>  (Autobias OFF)
    S = INT(192 - M*128 - A*64) = 0 ==>  (Grating Start Position)
```

Turning off the autobias did not make detectors 3 and 8 function in any nominal fashion at all.

NIMS Archived EDRs and CUBEs

The NIMS data are stored in EDRs (Experimental Data Records) produced by JPL-MIPS (Multi-mission Image Processing System). The NIMS Phase2 EDR is described in the NIMS EDR SIS (Software Interface Specification) Number 232-08. The same information is available in both human and machine-readable form in the PDS (Planetary Data System) structure files EDRHDR.FMT and EDRDATA.FMT in the LABEL directory of the NIMS EDR CD-ROM. Each observation has at least one EDR. The EDR file name is derived from the 12 character observation name plus a single character which allows an observation to be broken up into multiple EDRs. The EDRs have a Vicar label, followed by a PDS/ISIS label, binary header records and the data records. For archiving on CD-ROM, the Vicar labels are detached from the EDR (but kept separately on CD) and the file is renamed so as to conform to the 8.3 DOS file-naming convention. The 8.3 EDR name consists of a 2 character orbit identifier, a single character target identifier, a 3 digit counter and the suffix EDR. For example, the MIPS EDR G1GNGLOBAL01A.1 becomes G1G001.EDR. More information about NIMS EDRs can be found in the VOLINFO.TXT file on the EDR CD-ROM.

NIMS EDR data typically require considerable processing before they are readily amenable to science analysis. Normally, the EDRs are processed into spectral image cubes by one of several sets of software. MIPS systematically processes the EDRs into CUBEs (band sequential image files) and MASKs (spatial/spectral summary images) which are distributed on the NIMS CUBE CD-ROMs. Information about the structure of the NIMS CUBEs can be found in the VOLINFO.TXT file on the CUBE CD-ROM. The name of the CUBE file is derived from the input EDR filename. For archiving on CD-ROM, the CUBE files are renamed so as to conform to the 8.3 DOS file-naming convention. The 8.3 CUBE name consists of a 2 character orbit identifier, a single character target identifier, a 3 digit counter, a single character cube-type identifier, a single character data unit-type (DN, radiance or IOF) and the suffix QUB. For example, the MIPS IOF radiance cube for the observation G1GNGLOBAL01A.1 (G1G001) becomes G1G001CR.EDR. The summary MASKs on the CD-ROM have the same 6 character name as the EDR name with the suffix JPG or GIF to denote its graphics format.

NIMS Data Format - Data types - Data Labels - Data Access

Data Format

All data files have PDS labels. The raw data (EDR) file contains time-sequential, 16 bit integers. Reduced data files (TUBES and CUBES) may be viewed as images or spectra. They contain VAX real numbers, are band sequential (BSQ - the images are stacked in band order) and have geometry information appended as backplanes after the last NIMS band.

Data Types

Mask files contain summary images (3 band BSQ) and spectra of up to six selected regions that provide a quick indication of data location, data quality and spectral content. A Guide to understanding the NIMS mask is available.

Cube files contain data that have been projected and resampled. The core data are BSQ - spatial in the first two dimensions, and spectral in the third. Cubes of the satellites are projected in point-of-view, and, with few exceptions have no photometric correction applied. Cubes of Jupiter are (generally) projected as simple cylindrical. Cubes of Europa, Ganymede, and Callisto have been despiked. The cubes are available both in radiance and I/F (intensity divided by flux) form.

Tube files contain data in (almost) time order and normally have a NIMS-related 20 pixel spatial dimension (20 x n or n x 20). Projection coordinates are contained in backplanes, but the data have not been resampled. The data are in units of radiance and no despiking has been applied. All data in cubes are also available in tube form. Some data (such as spatially undersampled data) appear in tube form only.

A spike file contains a list of pixels that have been identified as spikes, but not replaced, in the tube. Spike files can be used to remove spikes from both tube and EDR files.

EDR files contain the most primitive form of the data available. They should be used only for advanced data analysis. The format is complex and the files do not form images or spectra without prior processing.

Data Labels

A data label (PDS form) is attached to the front of each file (except masks, which have an attached VICAR label and a detached PDS label). The labels are in ASCII keyword=value format and contain pointers to various data objects in the file, descriptions of the data objects and descriptions of the observation associated with the file. A history object in similar format follows and describes the processing steps that produced the file. Much of this information is necessary for understanding and viewing the cube. In particular, the label contains the offset to the cube, the dimensions of the cube, axes labels, and explicit wavelength information.

Data Access

Software for processing this data is called ISIS and is available for DEC VAX VMS, SUN Solaris, DEC Alpha Digital Unix, Silicon Graphics Unix and PC LINUX systems. The Unix versions are available from the USGS Astrogeology team. Images from NIMS cubes and tubes can be viewed with any image display program which allows an offset from the beginning of the file to the selected image. Packages tested include ISIS, VICAR, ENVI, SAO IMAGE, and NASAVIEW. ISIS and ENVI (and soon NASAVIEW) additionally display spectra. The ISIS viewer is named CV (UNIX) or QL3 (VMS).

Labels may be displayed with some editors (eg DOS edit), and with most "type" and "search" functions. Some editors do not recognize the PDS line termination conventions. The label may be listed by the ISIS function LHLIST (VMS) or LABEL (UNIX).

Software for converting EDRs to cubes exist in both ISIS (DEC VAX VMS) and VICAR (DEC Alpha VMS) versions only. A primitive list of values in an EDR may be obtained with the program EDRDMP2.

Understanding the NIMS Mask

The NIMS mask is designed to provide a quick summary of the contents of a NIMS data cube (or tube). It displays a view of both the spatial and spectral content of the data.

The mask has four regions. Starting from the upper left and proceeding clockwise: a spatial display; six or fewer representative spectra; annotation; and a spectral histogram.

The spatial display of an observation which has been projected and resampled (a cube) has a maximum size of 600x600 pixels. This is overlaid with surface coordinates and is embedded in a 700x700 grid of pixel coordinates. It is accompanied by two 1-dimensional histograms describing the raw image and the image stretched for display. The data image can range from a simple combination of up to 3 NIMS bands displayed in the RGB planes, to complicated arithmetic functions of NIMS bands displayed in the RGB planes. (The formulas appear as annotation below the histograms.) The graphics directly below the image show the input and output data histograms for the three color planes. The "shortest" color for each bin displays in front. The image also contains from one to six numbered rectangles, which show the from which averaged spectra (displayed on the right) were taken.

The spatial display of an observation in time sequence (a tube) is a graphic showing a footprint of the observation over a grid of surface coordinates on the target body. Numerals 1-6 on the graphic mark the locations of the average spectra displayed on the right.

The spectra to the right of the image may display either BDRF or radiance (or both). If both are displayed, then a vertical "radiance fence" line will appear where the breakpoint occurs. This permits display of both atmospheric data, which have significant reflectance and thermal components, and I/F satellite surface data which have strong absorptions at longer wavelengths (such as water spectra.) The spectra are labelled with wavelength in microns and location in both pixel and latitude-longitude space.

The annotation provides information about the observation, including its name, a brief description, its geometry, instrument and projection parameters. TCA is the time from Galileo’s closest approach to the target body.

The 2-dimensional spectral histogram in the lower left corner shows the number of pixels at a given radiance for each wavelength. If a surface contains spatial mixtures with significantly different spatial fractions for several components, the spectra of the components will be evident in this display.