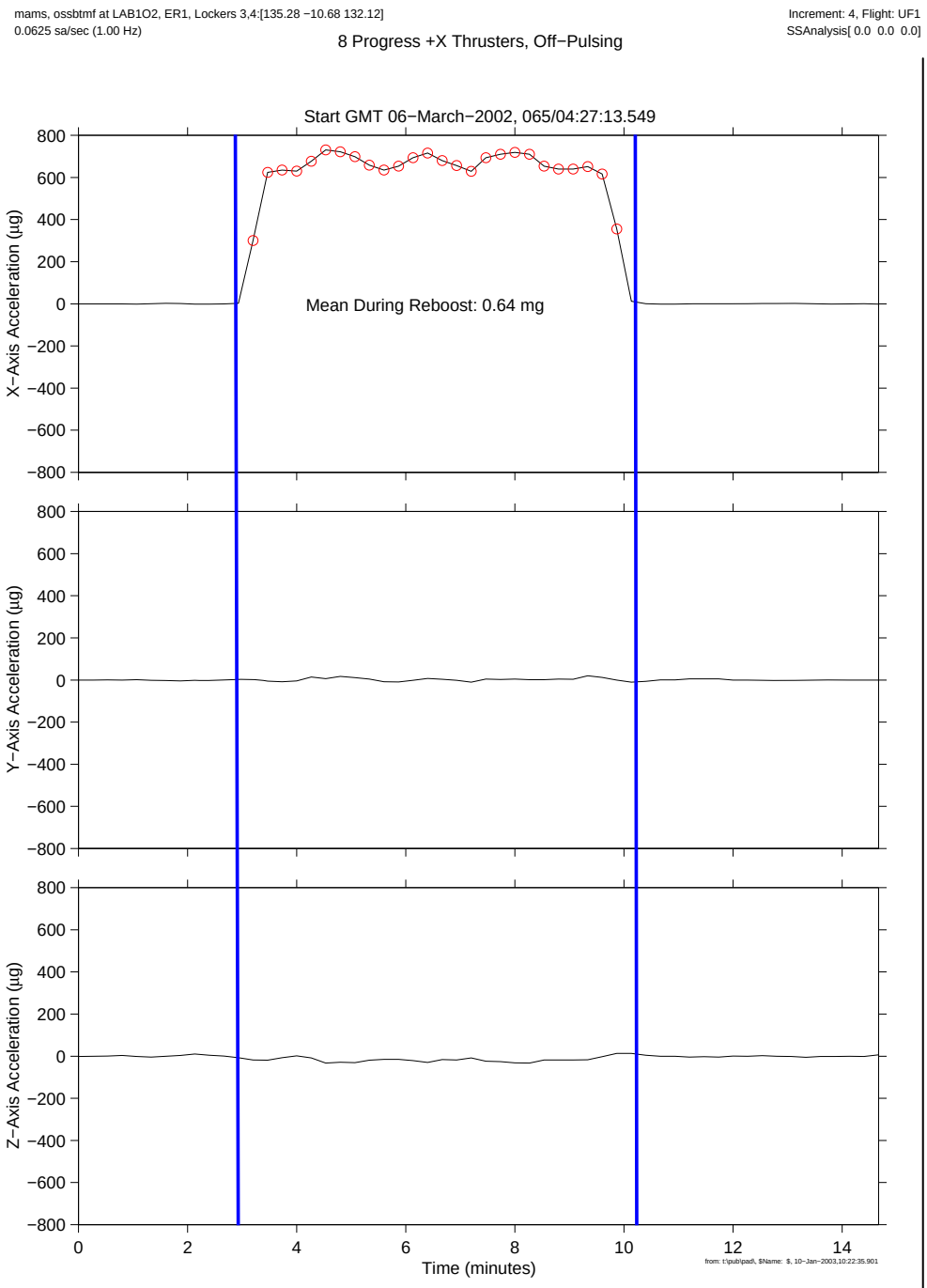
Progress Reboost



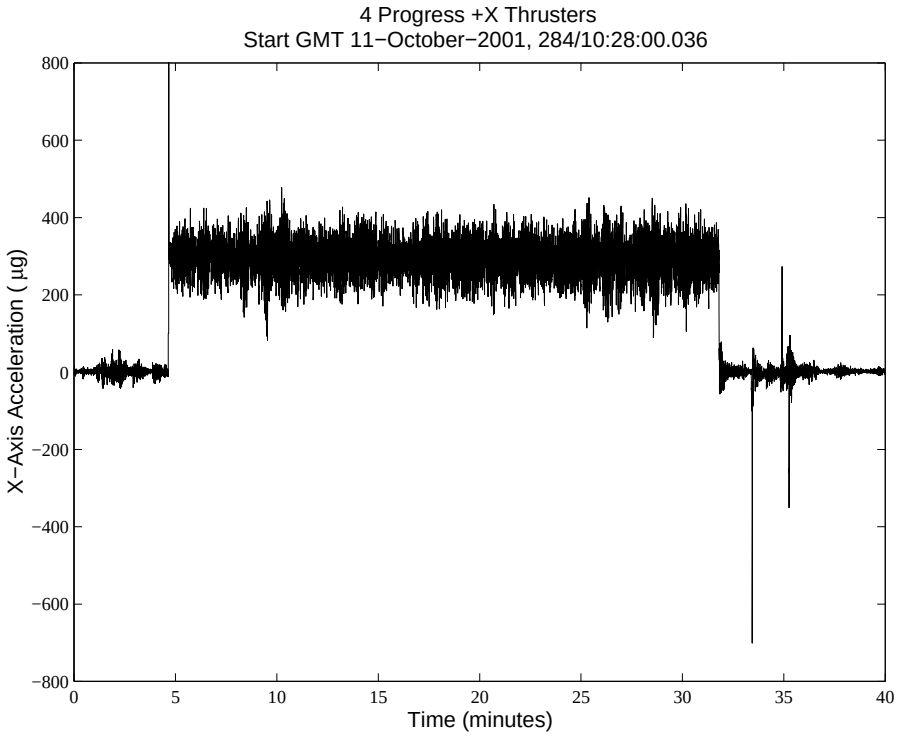
Description	
Sensor	MAMS,ossbtmf 0.0625 sa/sec (0.01 Hz)
Location	LAB1O2, ER1, Lockers 3,4
Orientation	Space Station Analysis (SSA)
Inc/Flight	Increment: 4, Flight: UF1
Plot Type	Time Series

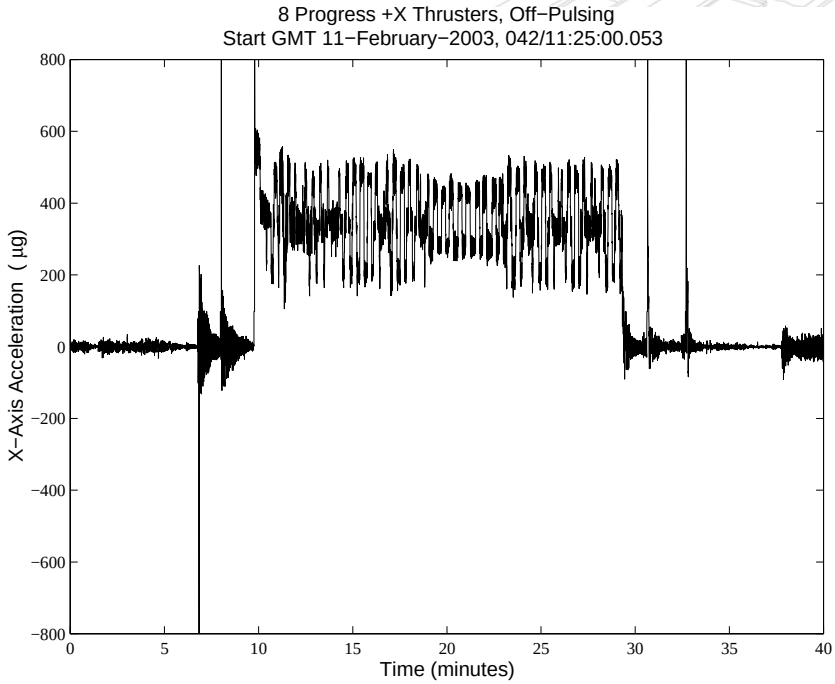
NOTES:

- Periodic reboosts of the ISS are necessary due to orbital decay.
- The primary method for conducting a reboost is using the aft facing attitude control thrusters of a docked cargo vehicle, typically a Progress.
- Station reboosts are open loop burns, where the firing is initiated at a prescribed time and place in orbit.
- Data shown was for Burn #2 and lasted 401 seconds using 143.8 kg of propellant.

Regime:	Quasi-steady
Category:	Vehicle
Source:	Reboost

Progress Reboost





Description	
Sensor	MAMS,ossraw 10 sa/sec (1 Hz)
Location	LAB1O2, ER1, Lockers 3,4
Orientation	Space Station Analysis (SSA)
Inc/Flight	Increment: 3-9 Flight: Various
Plot Type	Time Series

NOTES:

- In the "4 Progress +X Thrusters", four thrusters are pointed in the $-X_A$ direction and four other YZ thrusters are used for attitude control.
- "8 Progress +X Thrusters, Off-Pulsing", all thrusters are $-X_A$ direction; four on continuous, other four pulse on/off.
- Bias compensated OSSRAW data is shown to highlight the different modes. The trimmed mean filtered process masks this detail.

Regime:	Quasi-steady
Category:	Vehicle
Source:	Reboost

Progress Reboost

Reboost Information					Calculations from MAMS OSS Data		
Time of Ignition	Remarks	Vehicle	Duration (s)	ΔV	Duration (s)	ΔV	X-Axis Mean(µg)
11-Oct-2001, 284/10:31	4 Progress +X Thrusters	5P	1560	4.7	1629	4.63	290
11-Oct-2001, 284/15:54	4 Progress +X Thrusters	5P	1560	4.5	1624	4.46	280
10-Jan-2002, 010/01:35	4 Progress +X Thrusters	6P	1877	5.4	1864	5.3	290
10-Jan-2002, 010/03:43	4 Progress +X Thrusters	6P	1654	4.8	1643	4.67	290
21-Feb-2002, 052/08:27	8 Progress +X Thrusters, Off Pulsing	6P	239	1.35	237	1.21	520
21-Feb-2002, 052/09:59	8 Progress +X Thrusters, Off Pulsing	6P	243	1.35	239	1.24	530
06-Mar-2002, 65/03:37:12	8 Progress +X Thrusters, Off Pulsing	6P	158	1	158	0.93	600
06-Mar-2002, 65/04:29:07	8 Progress +X Thrusters, Off Pulsing	6P	395	2.5	399	2.5	640
13-Mar-2002, 72/00:04:10	8 Progress +X Thrusters, Off Pulsing	6P	319	2.2	300	1.8	610
13-Mar-2002, 72/00:52:49	8 Progress +X Thrusters, Off Pulsing	6P	636	4	610	3.94	660
19-Apr-2002, 109/07:59	8 Progress +X Thrusters, Off Pulsing	6P	118	0.73	143	0.6	430
01-Aug-2002, 213/17:24	8 Progress +X Thrusters, Off Pulsing	7P	760	4.3	761	4.18	560
11-February-2003, 42/11:34	8 Progress +X Thrusters, Off Pulsing	10P	1200	4.2	1168	4.01	350
12-March-2003, 71/22:58	Progress Manifold 1 4 Progress +X Thrusters	10P	597	1.38	634	1.3	210
04-April-2003, 94/12:59:18	8 Progress +X Thrusters, Off Pulsing	10P	N/A	1.8	835	1.83	230
10-Apr-2003, 100/10:55	8 Progress +X Thrusters, Off Pulsing	10P	661	1.48	672	1.43	220
30-May-2003, 150/16:50	8 Progress +X Thrusters, Off Pulsing	10P	447	1	448	0.93	210
01-Oct-2003, 274/13:11	8 Progress +X Thrusters, Off Pulsing	12P	450	1.7	469	1.72	360
08-Jan-2004, 8/19:59	8 Progress +X Thrusters, Off Pulsing	12P	329	1.4	367	1.41	390

Description	
Sensor	MAMS,ossbtmf 0.0625 sa/sec (1 Hz)
Location	LAB1O2, ER1, Lockers 3,4
Orientation	Space Station Analysis (SSA)
Inc/Flight	Increments: 3-28 Flights: Various
Plot Type	Time Series

View of the first reboost burn by Progress M-47/10P. (from ISS Digital Imagery Management System)

Regime:	Quasi-steady
Category:	Vehicle
Source:	Progress Thrusters

Progress Reboost

Reboost Information					Calculations from MAMS OSS Data		
Time of Ignition	Remarks	Vehicle	Duration (s)	ΔV	Duration (s)	ΔV	X-Axis Mean(μg)
02-Mar-2004, 62/22:40	8 Progress +X Thrusters, Off Pulsing	13P	531	2.2	528	2.08	400
18-May-2004,139/16:50	8 Progress +X Thrusters, Off Pulsing	14P	480	2.3	511	2.18	430
20-Aug-2004, 233/01:24	8 Progress +X Thrusters, Off Pulsing	15P	352	1.3	352	1.38	400
23-Sep-2004, 267/12:05	8 Progress +X Thrusters, Off Pulsing	15P	660	2.7	655	2.64	410
17-Nov-2004, 322/14:12	Off-pulsing, Underburn - human error	15P	510	2.5	546	1.6	300
15-Jan-2005, 15/15:10	pr-08 off-pulsing	16P	1200	5	1195.8	5.15	439
16-Feb-2005, 47/01:22	pr-08 off-pulsing	16P	416	1.9	456.6	1.92	428
25-Mar-2005, 84/10:00	pr-08 off-pulsing	17P	413	1.68	412.2	1.67	413
11-May-2005, 131/14:27	pr-08 off-pulsing	17P	175	0.75	166.2	0.71	438
29-Jun-2005, 180/20:03	pr-08 off-pulsing	18P	318	1.3	367.8	1.29	357
6-Jul-2005, 187/14:58	pr-08 off-pulsing	18P	465	1.9	471	1.88	408
18-Oct-2005, 291/00:00	ABORTED	19P	697	N/A	N/A	N/A	N/A
26-Oct-2005, 299/20:12	Reboost Test	19P	114	0.25	115.2	0.25	225
10-Nov-2005, 314/11:23	Part 1 of Dual Burn, pr-08 off-pulsing	19P	1008	2.2	1005	2.22	225
10-Nov-2005, 314/12:42	Part 2 of Dual Burn, pr-08 off-pulsing	19P	1008	2.2	1005	2.25	227
22-Feb-2006, 53/17:50	pr-08 off-pulsing	19P	859	0	804.6	1.6	203
4-May-2006, 124/11:29	pr-08 off-pulsing	21P	391	1.6	393.6	1.59	412
9-Jun-2006, 160/18:47	NO DATA	21P	171	0.7	N/A	N/A	N/A
26-Jul-2006, 207/04:58	NO DATA	21P	185	0.78	N/A	N/A	N/A

Description	
Sensor	MAMS,ossbtmf 0.0625 sa/sec (1 Hz)
Location	LAB1O2, ER1, Lockers 3,4
Orientation	Space Station Analysis (SSA)
Inc/Flight	Increments: 3-9 Flights: Various
Plot Type	Time Series

NOTES:

- Reboost Information column contains estimates. This information was obtained from Rex Delventhal, GNC Daily Reports and/or On-Orbit Summaries.
- Values marked with an asterisk may be off by as much as 14 ug due to lack of bias compensation for OSS A-range data.

Regime:	Quasi-steady
Category:	Vehicle
Source:	Progress Thrusters

Progress Reboost

Reboost Information					Calculations from MAMS OSS Data		
Time of Ignition	Remarks	Vehicle	Duration (s)	ΔV	Duration (s)	ΔV	X-Axis Mean(µg)
23-Aug-2006, 235/16:04	NO DATA	21P	544	2.26	N/A	N/A	N/A
29-Nov-2006, 333/23:05		23P	196	0.4	212	0.43	204
16-Mar-2007, 75/02:47	NO DATA	23P	750	2.85	N/A	N/A	N/A
23-Jul-2007, 204/22:06	NO DATA	25P	1279	4.3	N/A	N/A	N/A
4-Oct-2008, 278/10:06		30P	282	0.73	286	0.74	267
29-Oct-2008, 303/01:13		30P	204	0.55	213	0.56	267
17-Dec-2008, 352/03:58	MAMS Data transformed to attitude YPR (358 340 8.2)	31P	568	0.5	586	0.53	93
1-Aug-2009, 213/08:15		34P	459	1.25	480	1.25	265
20-Feb-2010, 51/21:15		36P	1534	3.6	1603	3.76	239
24-Mar-2010, 83/09:15		36P	425	1.0	436	0.99	232
23-Apr-2010, 113/20:30		36P	1245	3.0	1262	3.08	249
26-May-2010, 146/06:25	DEBOOST (PROG ON DC1)	37P	591	-0.8	598	-0.79	134
8-Jun-2010, 159/00:10	Part 1 of Dual Burn	37P	580	0.8	589	0.8	139
8-Jun-2010, 159/01:45	Part 2 of Dual Burn	37P	465	0.6	435	0.6	141
16-Jul-2010, 197/07:42		38P	1065	2.1	1091	2.14	200
18-Aug-2010, 230/20:30		38P	659	1.3	684	1.32	197
15-Sep-2010, 258/09:04		39P	526	1.2	542	1.26	237
20-Oct-2010, 293/19:41		39P	229	0.5	232	0.47	208
26-Oct-2010, 299/10:25	Debris Avoidance Maneuver (DAM)	39P	180	0.4	181	0.38	214

Description	
Sensor	MAMS,ossbtmf 0.0625 sa/sec (1 Hz)
Location	LAB1O2, ER1, Lockers 3,4
Orientation	Space Station Analysis (SSA)
Inc/Flight	Increments: 3-28 Flights: Various
Plot Type	Time Series

Nadir view of the docked Progress 36P spacecraft taken by an STS-130 crewmember. (from ISS Digital Imagery Management Sytem)

Regime:	Quasi-steady
Category:	Vehicle
Source:	Progress Thrusters

Progress Reboost

Reboost Information					Calculations from MAMS OSS Data		
Time of Ignition	Remarks	Vehicle	Duration (s)	ΔV	Duration (s)	ΔV	X-Axis Mean(µg)
25-Nov-2010, 329/05:03		39P	458	1	464	0.93	205
22-Dec-2010, 356/16:28		39P	1271	2.4	1292	2.37	187
13-Jan-2011, 13/09:00		39P	664	1.4	686	1.38	201
9-Feb-2011, 40/21:37		39P	252	0.5	260	0.48	189
29-Jun-2011, 180/12:15	R&D Thrusters	43P	1986	2.1	2008	2.21	112
01-Jul-2011, 182/12:11		43P	1772	1.95	1798.8	1.98	112

Description	
Sensor	MAMS,ossbtmf 0.0625 sa/sec (1 Hz)
Location	LAB1O2, ER1, Lockers 3,4
Orientation	Space Station Analysis (SSA)
Inc/Flight	Increments: 3-9 Flights: Various
Plot Type	Time Series

NOTES:

- Official reboost delta velocity values may include attitude maneuvers as well as the reboost itself.

Regime:	Quasi-steady
Category:	Vehicle
Source:	Progress Thrusters