Aqua/Aura
QuickDAM (QDAM) 2.0 Ops Concept

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QDAM Goals

- **Reduce work load and dependency on staff and systems.**
  - – Enhance capabilities so that repetitive processes are not necessary for every option.
  - – Streamline process so that unnecessary preparation steps, systems, personnel are not needed.

- **Reduce turn-around time and provide emergency last minute capabilities.**
  - – With Drag Make Up (DMU) and Risk Mitigation Maneuver (RMM) flow, all steps must be completed, in order to execute a burn.
  - – Create a streamlined and safe process to be able to prepare for RMMs with minimal time so that the Flight Operations Team (FOT) does not have to ‘gear up’ for every plausible RMM scenario.
  - – This would also save the FOT from having to ’waive off’ RMMs where the threat self-mitigates.

- **Increase burn parameter flexibility.**
  - – Execution time of burn and burn duration are fixed in stored command sequence (SCS).
  - – In RMM scenarios, sometimes last minute tracking updates cause a desired change in burn parameters.

Summary of Previous RMM Capability Enhancements

- **Manual Instrument Commanding for Aqua**
  - SCSs were developed that would allow the FOT to configure two instruments (CERES and AIRS) without having to place the commands in the daily stored command load built two days before the maneuver date.
  - This allowed more flexibility in changing the time of maneuver.
  - This also gave the capability to execute a maneuver with less warning and preparation time.

- **No Slew DMUs and RMMs**
  - In 2012 the FOT developed a method of conducting DMUs and RMMs without performing the wheel based yaw slew maneuver necessary to align the thrusts with the orbital velocity vector before hand.
  - By eliminating the slew out and slew back, the DMU and RMM sequence was greatly simplified, making it easier to plan multiple options, requiring less contacts and load building.

Summary of Previous RMM Capability Enhancements (cont'd)

- **QDAM 2.0 is actually the 5th generation operational RMM enhancement implemented.**
  - Variable Burn Duration (VBD) Slewed version
  - QDAM 1.0 Slewed version
  - Variable Burn Duration (VBD) No-Slew version
  - QDAM 1.0 No-Slew version
  - **QDAM 2.0 (No-Slew)**

- **QDAM 2.0 Key Enhancements over QDAM 1.0**
  - There were 3 critical drawbacks with the QDAM 1.0 No-Slew version presently onboard.
    1 - A communications contact was needed to execute the burn, limiting options, and making obtaining communications contacts a critical step.
    2 - The burn would execute at an imprecise time whenever command was sent real-time.
    3 - Only pre-canned burn durations were available, limiting burn size fidelity.
  - **These key drawbacks made QDAM 1.0 an emergency only option and was never utilized.**

- **QDAM 2.0 Key Enhancements over VBD**
  - More flexibility to change the burn duration at time of execution.
  - Reduced the number of SCSs required if many different durations were being at any same start time.
  - Pre-canned options were no longer limited.

SCS Background

STEP	ABS TIME	DELAY (MC)	COMMAND		DESCRIPTION	Expected Raw Command Hex			
0	11:59:03.000		SCS_ABD_DELAY TIMEVALUE=	1735732778	ABSOLUTE TIME DELAY	2000	6775	2e2a	0000
1	11:59:03.000		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
2	11:59:03.000		GNC_DISABLE_MTA1HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA1	0000	0810	3501	0000
3	11:59:03.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
4	11:59:03.125		GNC_DISABLE_MTA2HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA2	0000	0810	3502	0000
5	11:59:03.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
6	11:59:03.250		GNC_DISABLE_MTA3HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA3	0000	0810	3503	0000
7	11:59:03.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
8	11:59:03.375		GNC_DISABLE_RFFMLNT		Flag to Disable Response for FM Loss of Nadir Trigger	0000	0810	3541	0000
9	11:59:03.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
10	11:59:03.500		GNC_DISABLE_RFFMKFT		Flag to Disable Response for FM Kalman Filter Trigger	0000	0810	3543	0000
11	11:59:03.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
12	11:59:03.625		GNC_DISABLE_RFFMODET		Flag to Disable Response for FM ODE/CSS Trigger	0000	0810	3546	0000
13	11:59:03.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
14	11:59:03.750		GNC_DISABLE_VDEHWCM		Flag that Disables Sending H/W Cmds from vde_cp to VDE	0000	0810	355d	0000
15	11:59:03.750	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
16	11:59:03.875		GNC_TURN_ON_VDE1		VDE 1 RELAY ON COMMAND	0000	4800	1086	0000
17	11:59:03.875		GNC_TURN_ON_VDE1		VDE 1 RELAY ON COMMAND	0000	4800	1086	0000
18	11:59:03.875	9	SCS_REL_DELAY DELAYVALUE=9		RELATIVE TIME DELAY	1000	0000	0009	0000
19	11:59:05.000		GNC_ENABLE_HDAGRP15 MASK=NO_10 VALUE=N		GNC ENABLE HDA GROUPING IDs 08-15	0000	2810	4404	2020
20	11:59:05.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
21	11:59:05.125		GNC_INSTRUCT_FSWPVDE		Flag Instructing FSW to Interface with the Primary VDE	0000	0810	3504	0000
22	11:59:05.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
23	11:59:05.250		GNC_ENABLE_VDERPWCM		Flag that Enables Sending Roll PW Cmds from thrust_cl to vde_cp	0000	0810	3559	0001
24	11:59:05.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
25	11:59:05.375		GNC_ENABLE_VDEPPWCM		Flg that Enables Sending Pitch PW Cmds from thrust_cl to vde_cp	0000	0810	355a	0001
26	11:59:05.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
27	11:59:05.500		GNC_ENABLE_VDEYPWCM		Flag that Enables Sending Yaw PW Cmds from thrust_cl to vde_cp	0000	0810	355b	0001
28	11:59:05.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
29	11:59:05.625		GNC_ENABLE_VDEHWCM		Flag that Enables Sending H/W Cmds from vde_cp to VDE	0000	0810	355d	0001
30	11:59:05.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
31	11:59:05.750		GNC_SELECT_QCMDLVLH		Flag to Interpret Offset Quatn w/ respect to LVLH Frame in AHM	0000	0810	3535	0000
32	11:59:05.750	2	SCS_REL_DELAY DELAYVALUE=2		RELATIVE TIME DELAY	1000	0000	0002	0000
33	11:59:06.000		GNC_CHANGE_MODEAHM		Mode Change Cmd to Attitude Hold Mode	0000	0810	353e	0001
34	11:59:06.000	16	SCS_REL_DELAY DELAYVALUE=16		RELATIVE TIME DELAY	1000	0000	0010	0000
35	11:59:08.000		GNC_SET_DLVBRND VALUE=	0	Commanded Delta V Burn Duration	0000	0810	3808	0000
36	11:59:08.000					0000	0810	3809	0000
37	11:59:08.000		GNC_LOAD_NWHLBIAS1 VALUE=-6.79999828339		Buffered Value of New Wheel 1 Bias Momentum Command	0000	0810	3529	9333
38	11:59:08.000					0000	0810	352a	3503
39	11:59:08.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
40	11:59:08.125		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
41	11:59:08.125		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
42	11:59:08.125		GNC_LOAD_NWHLBIAS2 VALUE=6.79999828339		Buffered Value of New Wheel 2 Bias Momentum Command	0000	0810	352c	6ccc
43	11:59:08.125					0000	0810	352d	cb03
44	11:59:08.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
45	11:59:08.250		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
46	11:59:08.250		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
47	11:59:08.250		GNC_LOAD_NWHLBIAS3 VALUE=6.79999828339		Buffered Value of New Wheel 3 Bias Momentum Command	0000	0810	352f	6ccc
48	11:59:08.250					0000	0810	3530	cb03
49	11:59:08.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
50	11:59:08.375		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
51	11:59:08.375		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
52	11:59:08.375		GNC_LOAD_NWHLBIAS4 VALUE=-6.79999828339		Buffered Value of New Wheel 4 Bias Momentum Command	0000	0810	3532	9333
53	11:59:08.375					0000	0810	3533	3503
54	11:59:08.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
55	11:59:08.500		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
56	11:59:08.500		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
57	11:59:08.500		GNC_USE_NWHLBIAS1		Flg to Swtch Buffrd new_whl_bias_cmd(1) to processd whl_bias(1)	0000	0810	352b	0001
58	11:59:08.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
59	11:59:08.625		GNC_USE_NWHLBIAS2		Flg to Swtch Buffrd new_whl_bias_cmd(2) to processd whl_bias(2)	0000	0810	352e	0001
60	11:59:08.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
61	11:59:08.750		GNC_USE_NWHLBIAS3		Flg to Swtch Buffrd new_whl_bias_cmd(3) to processd whl_bias(3)	0000	0810	3531	0001
62	11:59:08.750	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
63	11:59:08.875		GNC_USE_NWHLBIAS4		Flg to Swtch Buffrd new_whl_bias_cmd(4) to processd whl_bias(4)	0000	0810	3534	0001
64	11:59:08.875	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
65	11:59:09.000		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000

- **From DMU to DMU, there are only two things in the custom built SCS that vary.**
- **Absolute time delay, 32-bit unsigned integer in GIRD epoch seconds.**
- **The burn duration (BD), 32-bit floating point.**

QDAM 1.0 Concept

STEP	ABS TIME	DELAY (MC)	COMMAND		DESCRIPTION	Expected Raw Command Hex			
0	11:59:03.000		SCS_ABD_DELAY TIMEVALUE=	1735732778	ABSOLUTE TIME DELAY	2000	6775	2e2a	0000
1	11:59:03.000		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
2	11:59:03.000		GNC_DISABLE_MTA1HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA1	0000	0810	3501	0000
3	11:59:03.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
4	11:59:03.125		GNC_DISABLE_MTA2HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA2	0000	0810	3502	0000
5	11:59:03.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
6	11:59:03.250		GNC_DISABLE_MTA3HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA3	0000	0810	3503	0000
7	11:59:03.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
8	11:59:03.375		GNC_DISABLE_RFFMLNT		Flag to Disable Response for FM Loss of Nadir Trigger	0000	0810	3541	0000
9	11:59:03.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
10	11:59:03.500		GNC_DISABLE_RFFMKFT		Flag to Disable Response for FM Kalman Filter Trigger	0000	0810	3543	0000
11	11:59:03.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
12	11:59:03.625		GNC_DISABLE_RFFMODET		Flag to Disable Response for FM ODE/CSS Trigger	0000	0810	3546	0000
13	11:59:03.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
14	11:59:03.750		GNC_DISABLE_VDEHWCM		Flag that Disables Sending H/W Cmds from vde_cp to VDE	0000	0810	355d	0000
15	11:59:03.750	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
16	11:59:03.875		GNC_TURN_ON_VDE1		VDE 1 RELAY ON COMMAND	0000	4800	1086	0000
17	11:59:03.875		GNC_TURN_ON_VDE1		VDE 1 RELAY ON COMMAND	0000	4800	1086	0000
18	11:59:03.875	9	SCS_REL_DELAY DELAYVALUE=9		RELATIVE TIME DELAY	1000	0000	0009	0000
19	11:59:05.000		GNC_ENABLE_HDAGRP15 MASK=NO_10 VALUE=N		GNC ENABLE HDA GROUPING IDs 08-15	0000	2810	4404	2020
20	11:59:05.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
21	11:59:05.125		GNC_INSTRUCT_FSWPVDE		Flag Instructing FSW to Interface with the Primary VDE	0000	0810	3504	0000
22	11:59:05.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
23	11:59:05.250		GNC_ENABLE_VDERPWCM		Flag that Enables Sending Roll PW Cmds from thrust_cl to vde_cp	0000	0810	3559	0001
24	11:59:05.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
25	11:59:05.375		GNC_ENABLE_VDEPPWCM		Flg that Enables Sending Pitch PW Cmds from thrust_cl to vde_cp	0000	0810	355a	0001
26	11:59:05.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
27	11:59:05.500		GNC_ENABLE_VDEYPWCM		Flag that Enables Sending Yaw PW Cmds from thrust_cl to vde_cp	0000	0810	355b	0001
28	11:59:05.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
29	11:59:05.625		GNC_ENABLE_VDEHWCM		Flag that Enables Sending H/W Cmds from vde_cp to VDE	0000	0810	355d	0001
30	11:59:05.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
31	11:59:05.750		GNC_SELECT_QCMDLVLH		Flag to Interpret Offset Quatn w/ respect to LVLH Frame in AHM	0000	0810	3535	0000
32	11:59:05.750	2	SCS_REL_DELAY DELAYVALUE=2		RELATIVE TIME DELAY	1000	0000	0002	0000
33	11:59:06.000		GNC_CHANGE_MODEAHM		Mode Change Cmd to Attitude Hold Mode	0000	0810	353e	0001
34	11:59:06.000	16	SCS_REL_DELAY DELAYVALUE=16		RELATIVE TIME DELAY	1000	0000	0010	0000
35	11:59:08.000		GNC_SET_DLVBRND VALUE=	0	Commanded Delta V Burn Duration	0000	0810	3808	0000
36	11:59:08.000					0000	0810	3809	0000
37	11:59:08.000		GNC_LOAD_NWHLBIAS1 VALUE=-6.79999828339		Buffered Value of New Wheel 1 Bias Momentum Command	0000	0810	3529	9333
38	11:59:08.000					0000	0810	352a	3503
39	11:59:08.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
40	11:59:08.125		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
41	11:59:08.125		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
42	11:59:08.125		GNC_LOAD_NWHLBIAS2 VALUE=6.79999828339		Buffered Value of New Wheel 2 Bias Momentum Command	0000	0810	352c	6ccc
43	11:59:08.125					0000	0810	352d	cb03
44	11:59:08.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
45	11:59:08.250		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
46	11:59:08.250		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
47	11:59:08.250		GNC_LOAD_NWHLBIAS3 VALUE=6.79999828339		Buffered Value of New Wheel 3 Bias Momentum Command	0000	0810	352f	6ccc
48	11:59:08.250					0000	0810	3530	cb03
49	11:59:08.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
50	11:59:08.375		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
51	11:59:08.375		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
52	11:59:08.375		GNC_LOAD_NWHLBIAS4 VALUE=-6.79999828339		Buffered Value of New Wheel 4 Bias Momentum Command	0000	0810	3532	9333
53	11:59:08.375					0000	0810	3533	3503
54	11:59:08.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
55	11:59:08.500		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
56	11:59:08.500		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
57	11:59:08.500		GNC_USE_NWHLBIAS1		Flg to Swtch Buffrd new_whl_bias_cmd(1) to processd whl_bias(1)	0000	0810	352b	0001
58	11:59:08.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
59	11:59:08.625		GNC_USE_NWHLBIAS2		Flg to Swtch Buffrd new_whl_bias_cmd(2) to processd whl_bias(2)	0000	0810	352e	0001
60	11:59:08.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
61	11:59:08.750		GNC_USE_NWHLBIAS3		Flg to Swtch Buffrd new_whl_bias_cmd(3) to processd whl_bias(3)	0000	0810	3531	0001
62	11:59:08.750	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
63	11:59:08.875		GNC_USE_NWHLBIAS4		Flg to Swtch Buffrd new_whl_bias_cmd(4) to processd whl_bias(4)	0000	0810	3534	0001
64	11:59:08.875	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
65	11:59:09.000		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000

- **Replaced the first absolute time delay with a no-op. So SCS runs as soon as its activated.**

- **Replaced burn duration command with a call to another ‘sub’-SCS. There are multiple of versions of this sub-SCS with different burn durations that user can uplink.**

QDAM 2.0 Concept

‘start time sub-load’

‘BD sub-load’

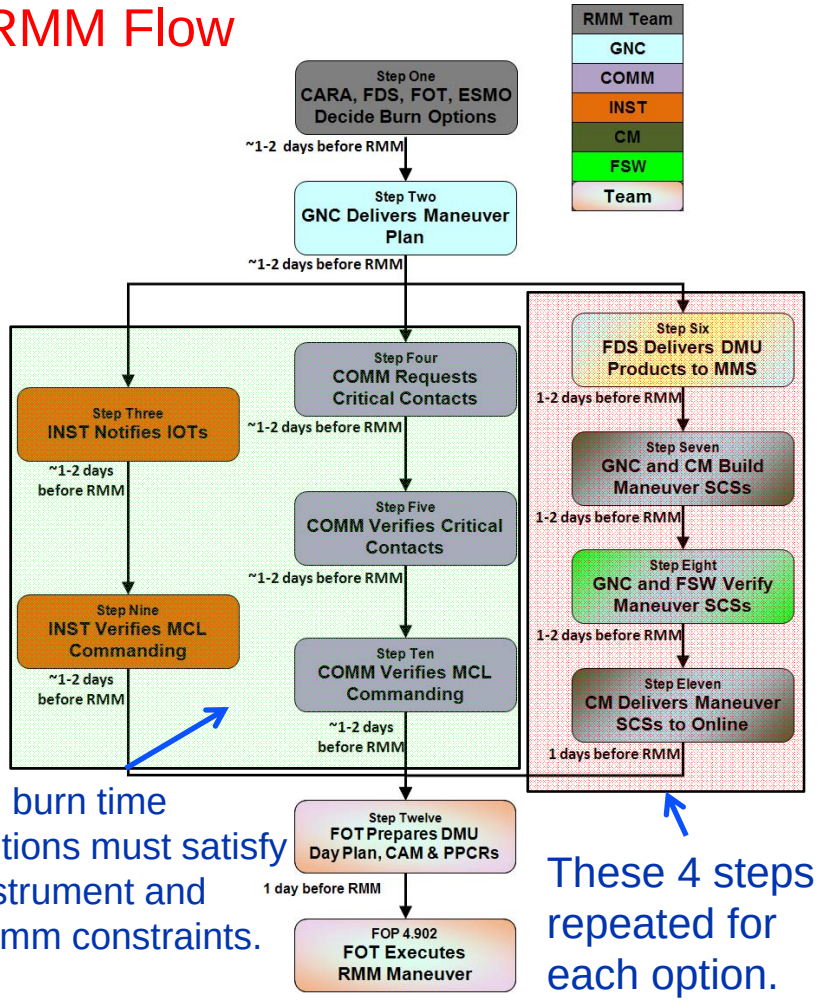
STEP	ABS TIME	DELAY (MC)	COMMAND		DESCRIPTION	Expected Raw Command Hex			
0	11:59:03.000		SCS_ABD_DELAY TIMEVALUE=	1735732778	ABSOLUTE TIME DELAY	2000	6775	2e2a	0000
1	11:59:03.000		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
2	11:59:03.000		GNC_DISABLE_MTA1HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA1	0000	0810	3501	0000
3	11:59:03.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
4	11:59:03.125		GNC_DISABLE_MTA2HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA2	0000	0810	3502	0000
5	11:59:03.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
6	11:59:03.250		GNC_DISABLE_MTA3HWCM		Flag that Disables Sending H/W Cmds from tde_cp to TDE/MTA3	0000	0810	3503	0000
7	11:59:03.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
8	11:59:03.375		GNC_DISABLE_RFFMLNT		Flag to Disable Response for FM Loss of Nadir Trigger	0000	0810	3541	0000
9	11:59:03.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
10	11:59:03.500		GNC_DISABLE_RFFMKFT		Flag to Disable Response for FM Kalman Filter Trigger	0000	0810	3543	0000
11	11:59:03.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
12	11:59:03.625		GNC_DISABLE_RFFMODET		Flag to Disable Response for FM ODE/CSS Trigger	0000	0810	3546	0000
13	11:59:03.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
14	11:59:03.750		GNC_DISABLE_VDEHWCM		Flag that Disables Sending H/W Cmds from vde_cp to VDE	0000	0810	355d	0000
15	11:59:03.750	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
16	11:59:03.875		GNC_TURN_ON_VDE1		VDE 1 RELAY ON COMMAND	0000	4800	7086	0000
17	11:59:03.875		GNC_TURN_ON_VDE1		VDE 1 RELAY ON COMMAND	0000	4800	7086	0000
18	11:59:03.875	9	SCS_REL_DELAY DELAYVALUE=9		RELATIVE TIME DELAY	1000	0000	0009	0000
19	11:59:05.000		GNC_ENABLE_HDAGRP15 MASK=NO_10 VALUE=N		GNC ENABLE HDA GROUPING IDs 08-15	0000	2810	4404	2020
20	11:59:05.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
21	11:59:05.125		GNC_INSTRUCT_FSWPVDE		Flag Instructing FSW to Interface with the Primary VDE	0000	0810	3500	0000
22	11:59:05.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
23	11:59:05.250		GNC_ENABLE_VDERPWCM		Flag that Enables Sending Roll PW Cmds from thrust_cl to vde_cp	0000	0810	3559	0001
24	11:59:05.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
25	11:59:05.375		GNC_ENABLE_VDEPPWCM		Flg that Enables Sending Pitch PW Cmds from thrust_cl to vde_cp	0000	0810	355a	0001
26	11:59:05.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
27	11:59:05.500		GNC_ENABLE_VDEYPWCM		Flag that Enables Sending Yaw PW Cmds from thrust_cl to vde_cp	0000	0810	355b	0001
28	11:59:05.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
29	11:59:05.625		GNC_ENABLE_VDEHWCM		Flag that Enables Sending H/W Cmds from vde_cp to VDE	0000	0810	355d	0001
30	11:59:05.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
31	11:59:05.750		GNC_SELECT_QCMDLVLH		Flag to Interpret Offset Quatn w/ respect to LVLH Frame in AHM	0000	0810	3536	0000
32	11:59:05.750	2	SCS_REL_DELAY DELAYVALUE=2		RELATIVE TIME DELAY	1000	0000	0002	0000
33	11:59:06.000		GNC_CHANGE_MODEAHM		Mode Change Cmd to Attitude Hold Mode	0000	0810	353e	0000
34	11:59:06.000	16	SCS_REL_DELAY DELAYVALUE=16		RELATIVE TIME DELAY	1000	0000	0010	0000
35	11:59:08.000		GNC_SET_DLVBRND VALUE=	0	Commanded Delta V Burn Duration	0000	0810	3808	0000
36	11:59:08.000					0000	0810	3809	0000
37	11:59:08.000		GNC_LOAD_NWHLBIAS1 VALUE=-6.79999828339		Buffered Value of New Wheel 1 Bias Momentum Command	0000	0810	3529	9333
38	11:59:08.000					0000	0810	352a	3503
39	11:59:08.000	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
40	11:59:08.125		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
41	11:59:08.125		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
42	11:59:08.125		GNC_LOAD_NWHLBIAS2 VALUE=6.79999828339		Buffered Value of New Wheel 2 Bias Momentum Command	0000	0810	352c	6ccc
43	11:59:08.125					0000	0810	352d	cb03
44	11:59:08.125	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
45	11:59:08.250		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
46	11:59:08.250		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
47	11:59:08.250		GNC_LOAD_NWHLBIAS3 VALUE=6.79999828339		Buffered Value of New Wheel 3 Bias Momentum Command	0000	0810	352f	6ccc
48	11:59:08.250					0000	0810	3530	cb03
49	11:59:08.250	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
50	11:59:08.375		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
51	11:59:08.375		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
52	11:59:08.375		GNC_LOAD_NWHLBIAS4 VALUE=-6.79999828339		Buffered Value of New Wheel 4 Bias Momentum Command	0000	0810	3532	9333
53	11:59:08.375					0000	0810	3533	3503
54	11:59:08.375	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
55	11:59:08.500		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
56	11:59:08.500		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000
57	11:59:08.500		GNC_USE_NWHLBIAS1		Flg to Swtch Buffrd new_whl_bias_cmd(1) to processd whl_bias(1)	0000	0810	352b	0001
58	11:59:08.500	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
59	11:59:08.625		GNC_USE_NWHLBIAS2		Flg to Swtch Buffrd new_whl_bias_cmd(2) to processd whl_bias(2)	0000	0810	352e	0001
60	11:59:08.625	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
61	11:59:08.750		GNC_USE_NWHLBIAS3		Flg to Swtch Buffrd new_whl_bias_cmd(3) to processd whl_bias(3)	0000	0810	3531	0001
62	11:59:08.750	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
63	11:59:08.875		GNC_USE_NWHLBIAS4		Flg to Swtch Buffrd new_whl_bias_cmd(4) to processd whl_bias(4)	0000	0810	3534	0001
64	11:59:08.875	1	SCS_REL_DELAY DELAYVALUE=1		RELATIVE TIME DELAY	1000	0000	0001	0000
65	11:59:09.000		SCS_NOP		SCS NOP COMMAND	e000	0000	0000	0000

- **Since QDAM 1.0 had the critical flaws that made it an emergency only option, it was desired to make a new concept that can be used for all DAMs.**
- **It was proposed that a memory write command could be used to overwrite the absolute time and burn duration memory with whatever the user wants.**
- **However memory write commands cannot overwrite “protected memory” areas; such as SCSs, algorithms.**
- **In response, the ground system maintenance contractor (Raytheon) created a new ground system command that mimicked a memory load.**
- **The FOT has completed testing on these commands.**

New vs Old DAM Flows

Past Nominal RMM vs Quick DAM 2.0 Planning Flows

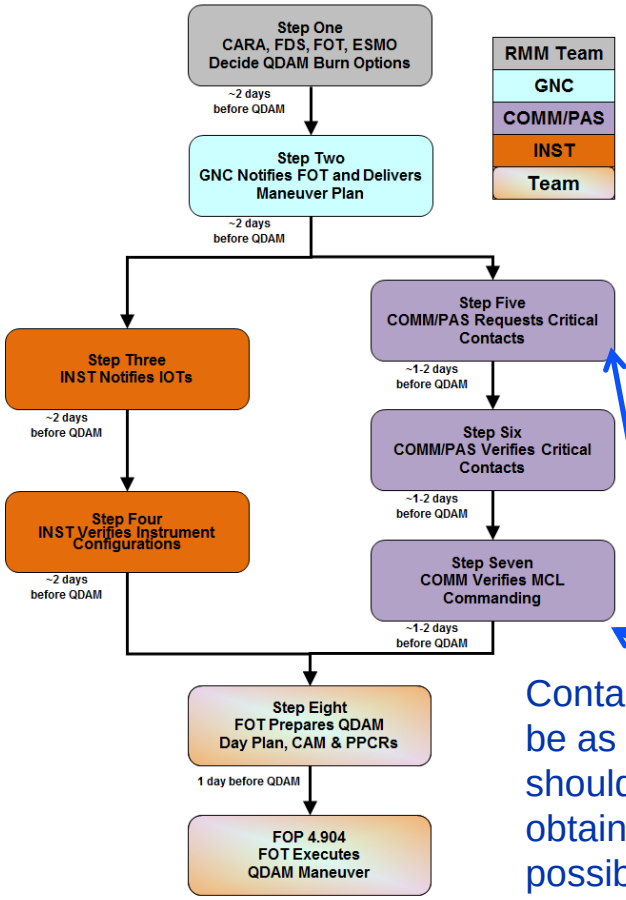
Past Nominal RMM Flow



All burn time options must satisfy instrument and comm constraints.

These 4 steps repeated for each option.

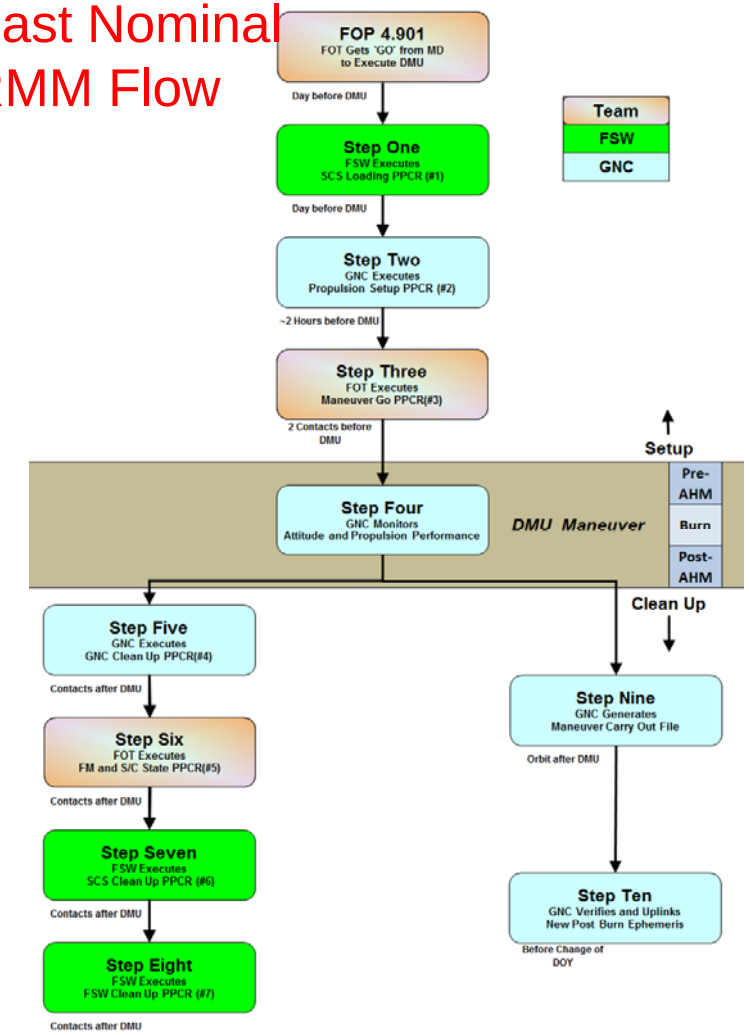
Quick DAM 2.0 Flow



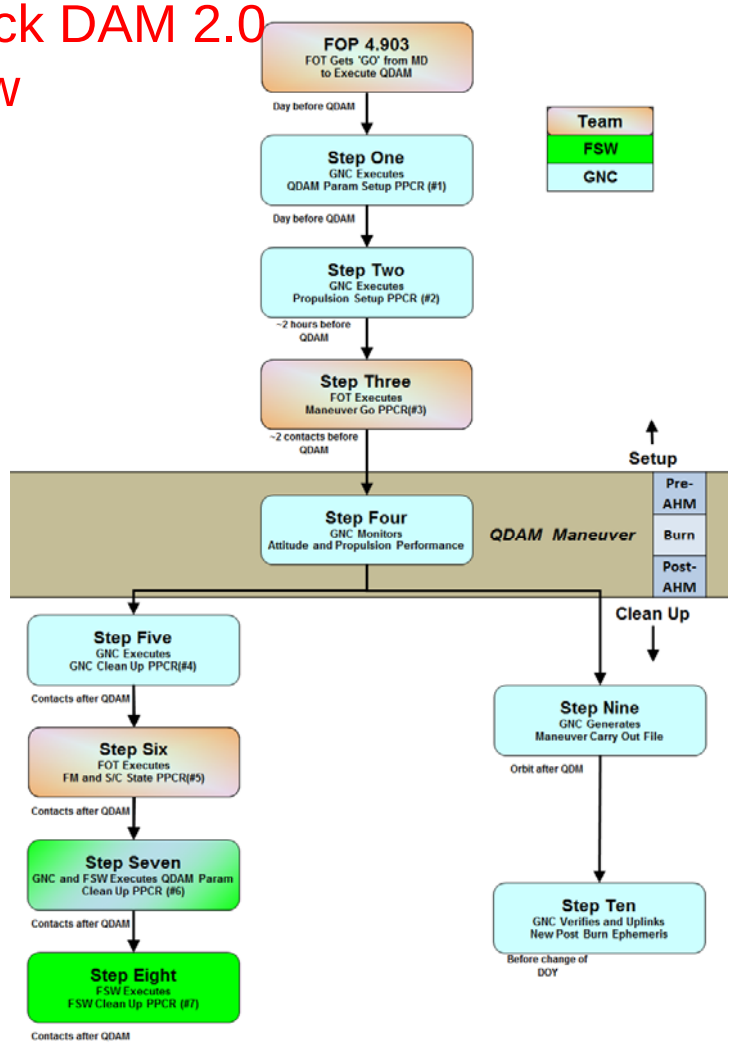
Contacts will not be as critical but should be obtained when possible.

Past Nominal RMM vs Quick DAM 2.0 Execution Flows

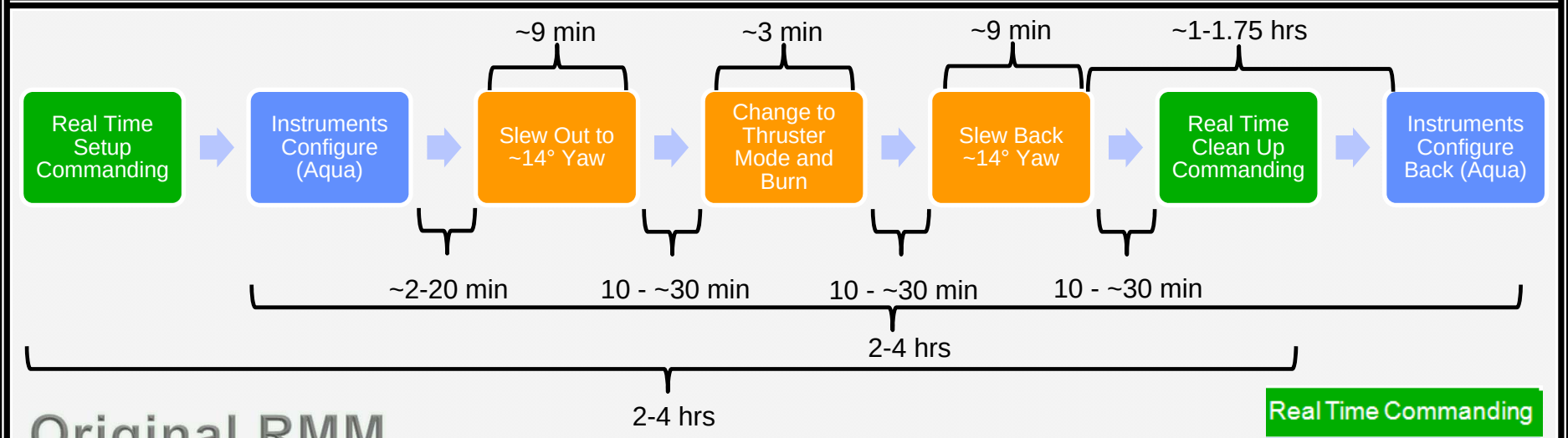
Past Nominal RMM Flow



Quick DAM 2.0 Flow



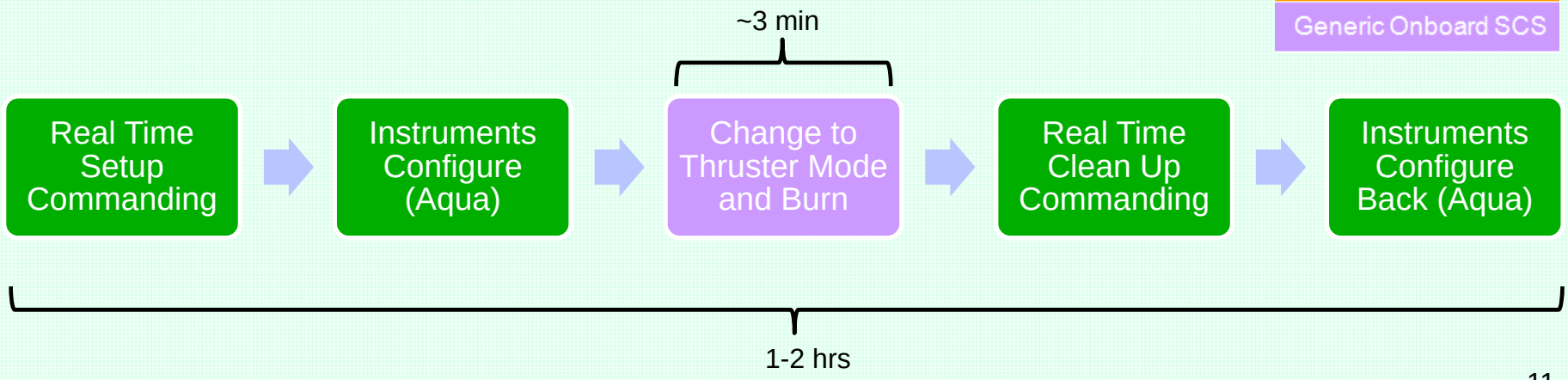
Original RMM vs Quick DAM 2.0 Execution Timeline



Original RMM

Real Time Commanding
Daily Command Load (MCL)
Maneuver SCS
Generic Onboard SCS

QuickDAM 2.0



RMM Capability History

	Past RMM Concepts			
	Pre 2012 (Original RMM)	**2012-2014 (Nominal RMM)**	**2012-2014 (Emergency RMM)**	**Current (Quick DAM 2.0)**
Shortest Turn Around	24-48 Hours	~6-12 hours	~2-6 hours	~2-6 hours
Burn Parameter Flexibility	~12 hours out, complete fidelity	Last minute, reduced fidelity	Last minute, imprecise start time, reduced fidelity	Last minute, complete fidelity
Precise Burn Time	Yes	Yes	**No**	Yes
Personnel	FDS, CM, GNC, INST, FSW	FDS, CM, GNC, INST, FSW	GNC, INST, FSW	GNC, INST, FSW
Systems Required	FDS, MMS, EMOS	FDS, MMS, EMOS	EMOS	EMOS
SCSs to Build	3 per burn time/duration option	1 per burn time option	0	0
Burn Contact Required	No	No	**Yes**	No
Total Planning SOP Steps	12 (4 repeated for every option)	12 (4 repeated for every burn time option)	8	8

**All turn around times, systems and personnel listed are in reference to FOT operational constraints/requirements.*