



42 Sim Project Objectives

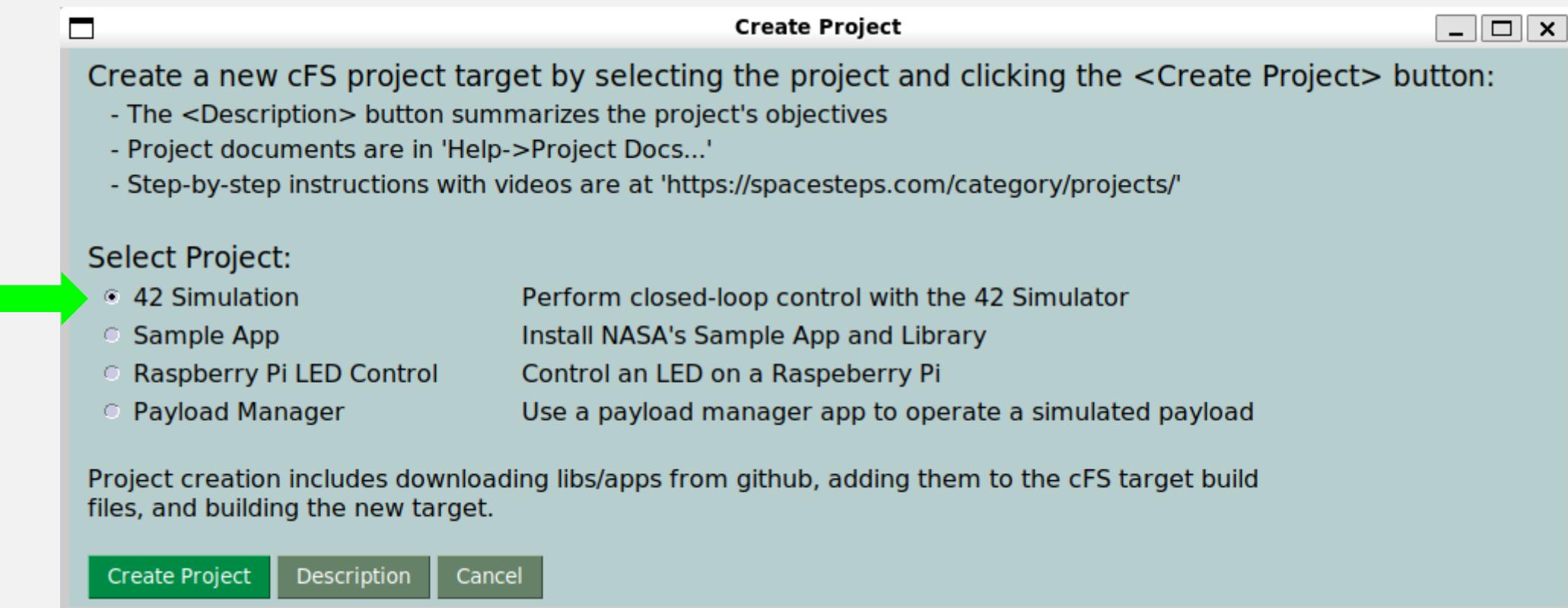
This project enables you to run a spacecraft attitude controller in a cFS app in a closed-loop simulation using the 42 simulator. Closed-loop simulation is a method of running a system by connecting a controller to a simulator that models the time-varying behavior of the spacecraft and its environment.

Detailed project instructions with videos can be found at

<https://spacesteps.com/TODO/>

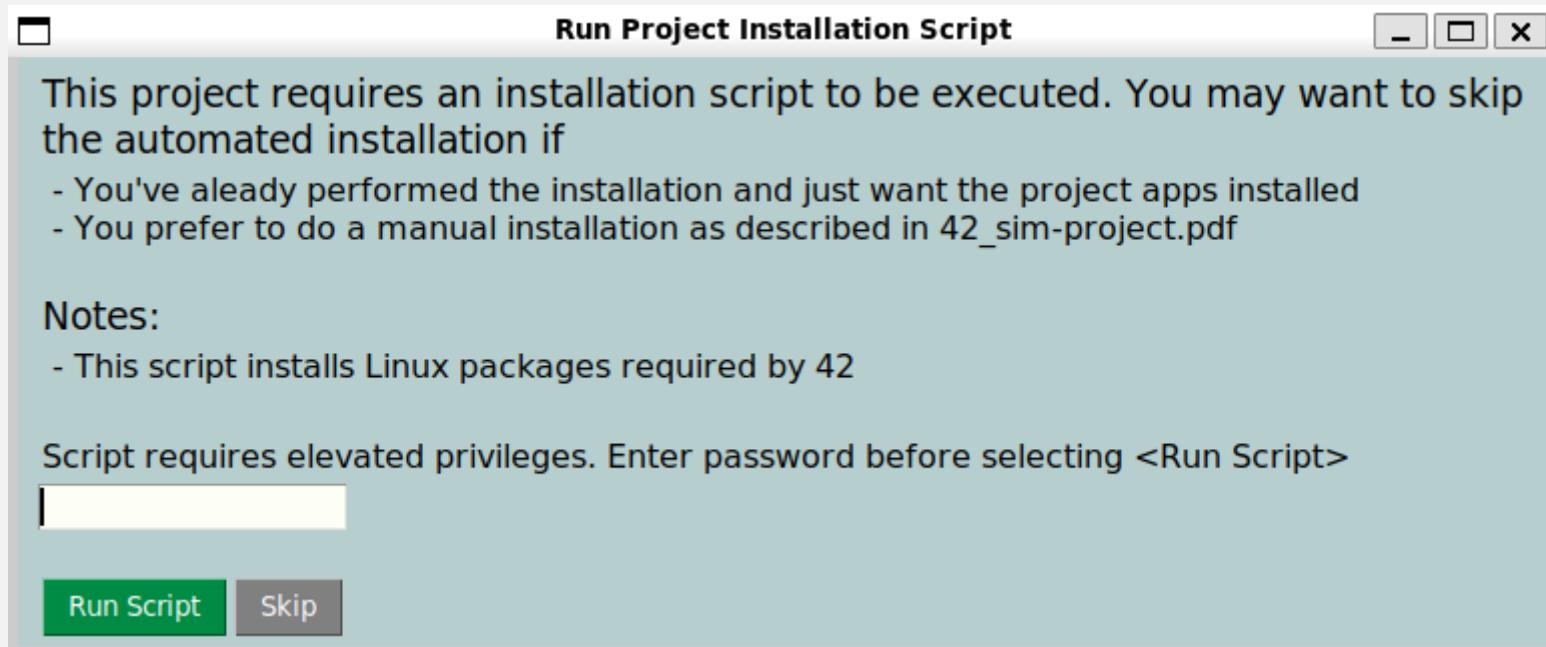
Software Installation (1 of 3)

This project requires a library and two apps to be installed into the cFS target. It also requires the 42 Simulator to be downloaded from github, configured and built in its “Standalone” mode.



Software Installation (2 of 3)

This window allows the gnd-sys/projects/42-sim/42_sim_project.sh script to be run from the GUI.

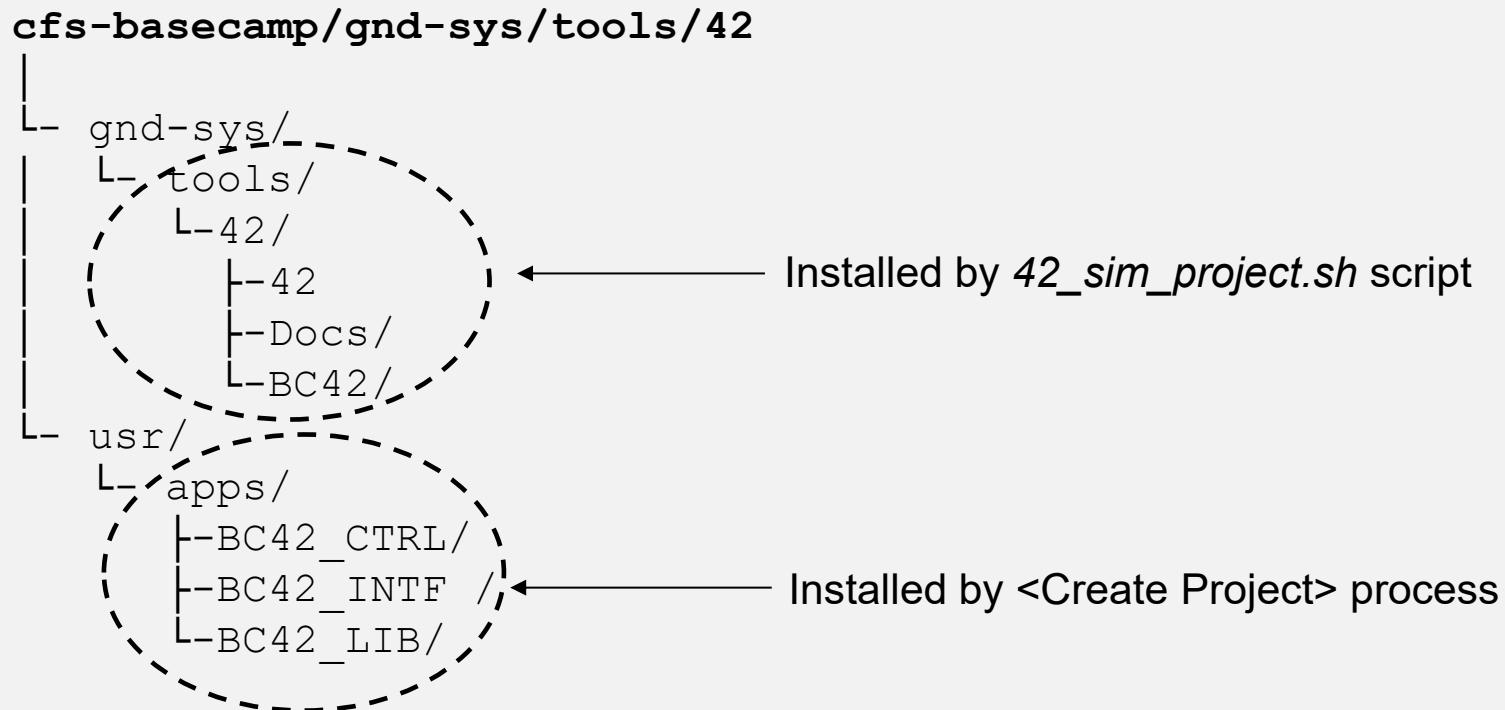


Notes:

1. The *42_sim_project.sh* script serves as the 42-installation documentation

Software Installation (3 of 3)

42 is installed Basecamp's ground system tools directory.



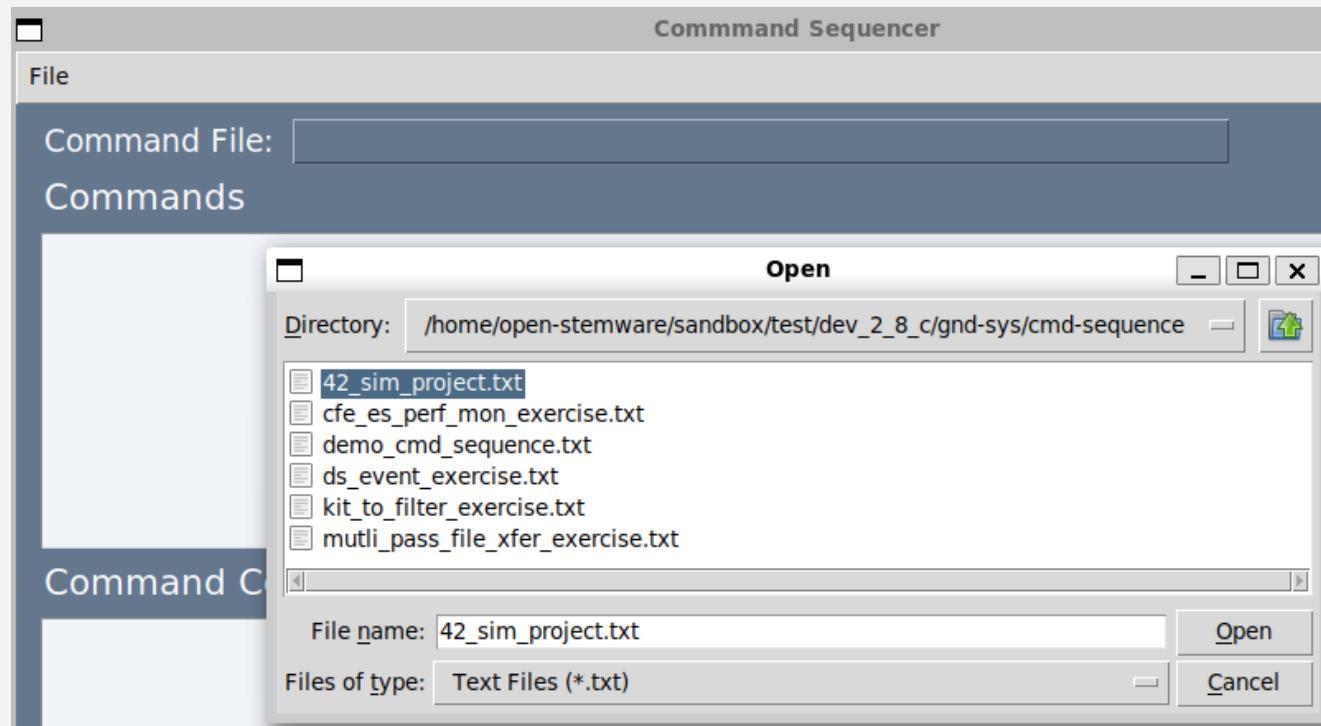
Running a Simulation (1 of 4)

1. Start 42
 - A. Open a new terminal window
 - B. Change directory to /gnd-sys/tools/42
 - C. Start 42 './42 BC42'
 - D. Multiple blank windows should appear and you should see the follow output in the terminal window

```
open-stemware@Open-STEMware:~/sandbox/42$ ./42 BC42
0.0 SC[0] qrl = [0.0  0.0  0.0  1.0]
Reached CmdScript EOF at Time = 0.000000
Initializing GLUT
Initializing Cam Window
Loading Cam Shaders
Loading Cam Textures
Loading 3D Noise
Loading Cam Lists
Cam Window Width = 800
Cam Window Height = 800
Cam Screen Width = 1600
Cam Screen Height = 900
Done Initializing Cam Window
Server is listening on port 10001
```

Running a Simulation (2 of 4)

2. Start Basecamp and then start the cFS
3. Launch the *Command Sequencer* from the Tools menu and open the 42_sim_project.txt file



Running a Simulation (3 of 4)

4. Send the BC42_INTF StartSim command

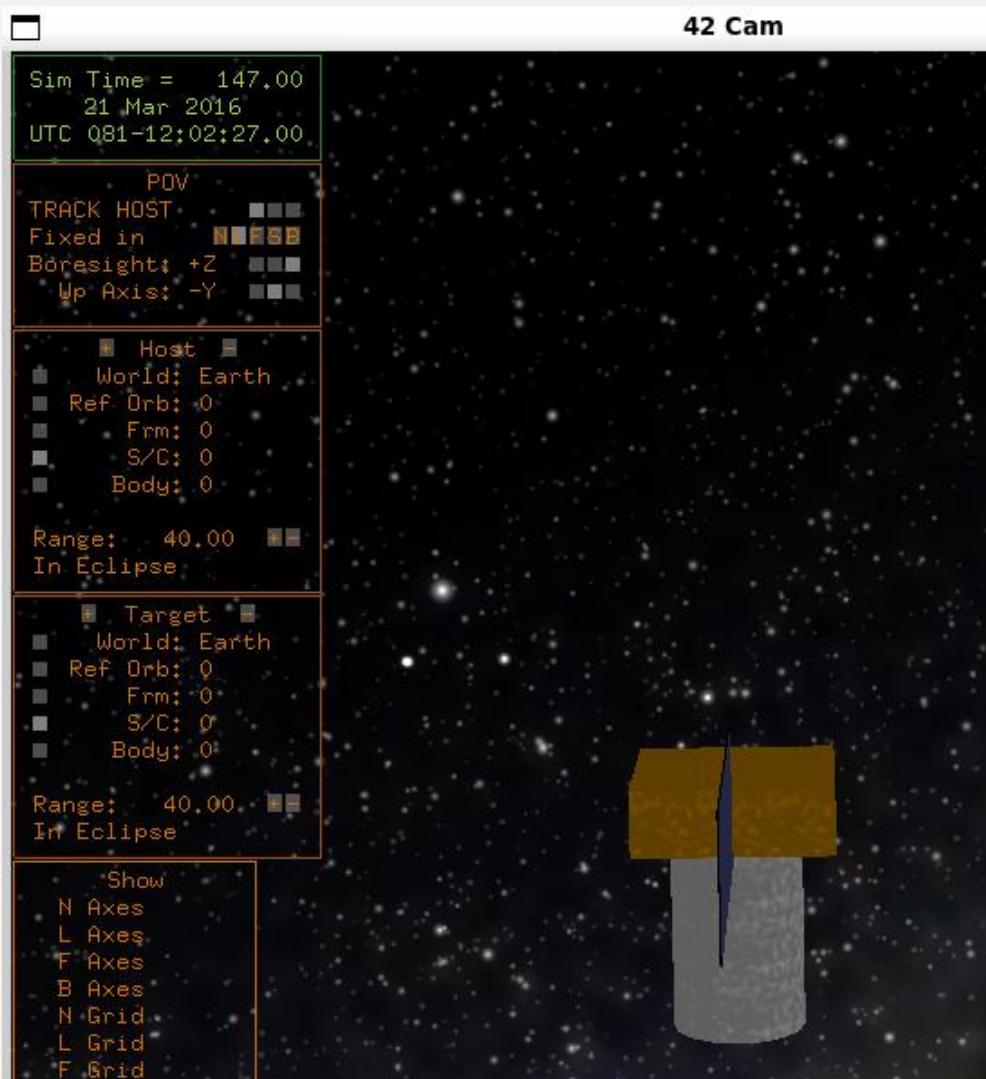
- A. Highlight the StartSim command line
- B. Right click and select Send

```
Commands

># See prologue for 42 installation requirements
># In a separate terminal window start 42: 42 BC42
'BC42_INTF', 'StartSim', {}           Send
'BC42_INTF', 'StopSim', {}
># ID 0 = Controller, Type 1 = Update
'BC42_CTRL', 'LoadTbl', {'Id': 0, 'Type': 1, 'Filename': '/cf/bc42_ctrl_k.json'}
'BC42_CTRL', 'LoadTbl', {'Id': 0, 'Type': 1, 'Filename': '/cf/bc42_ctrl_prm.json'}
'BC42_CTRL', 'SendCtrlGainsTlm', {}
'BC42_CTRL', 'RestoreDefaultCtrlGains', {}
```

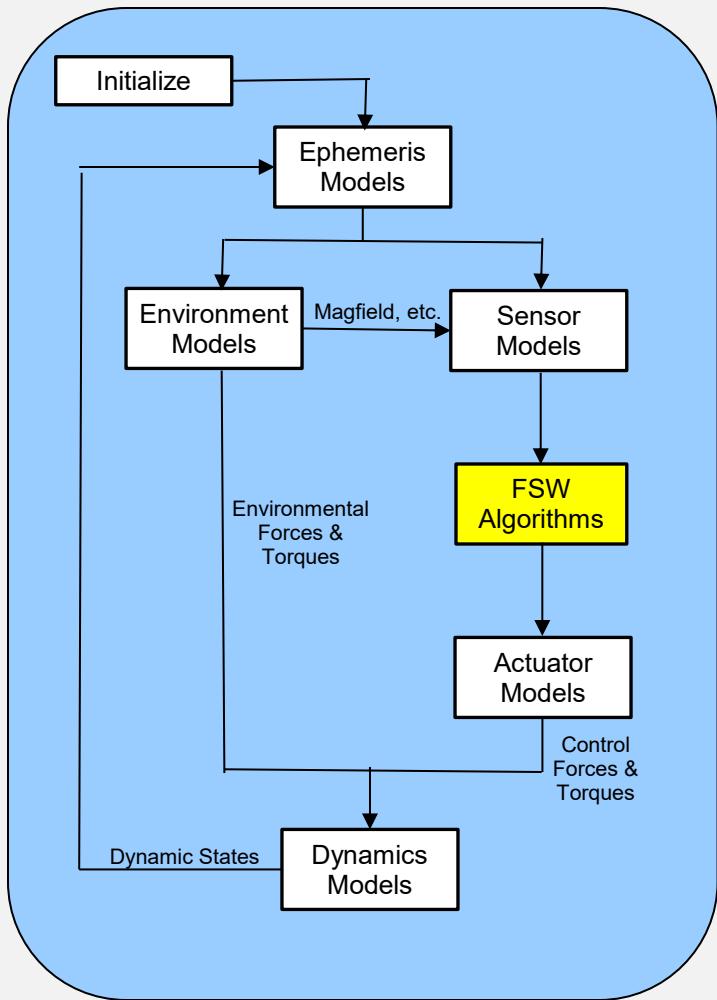
Running a Simulation (4 of 4)

The blank 42 screen should be populated





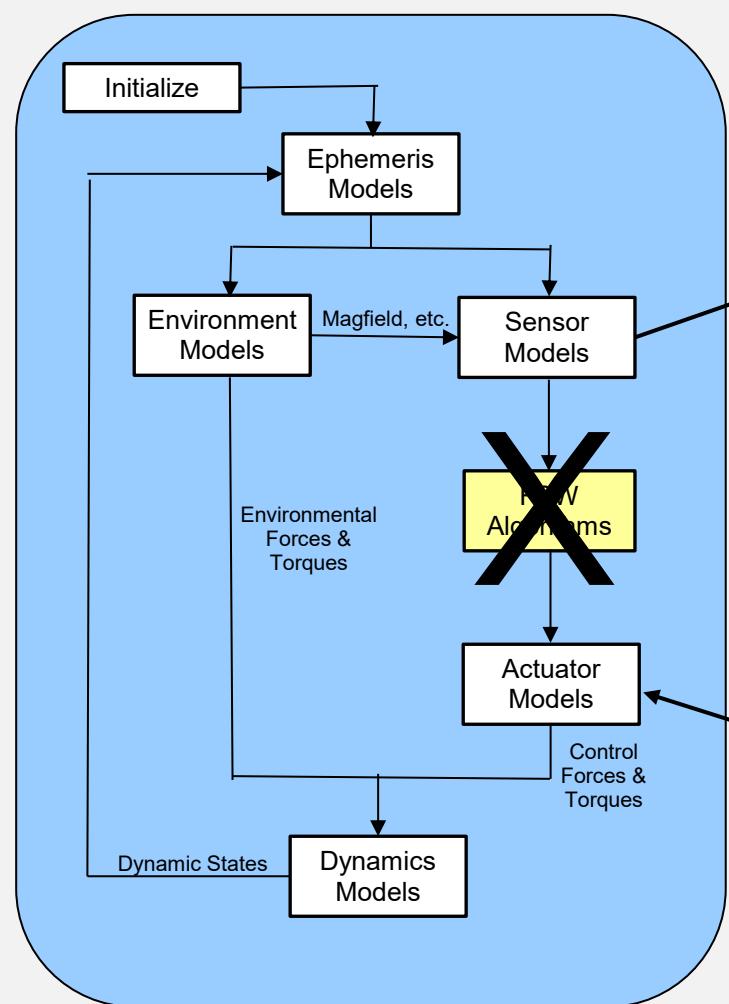
42 Sim Data Flow



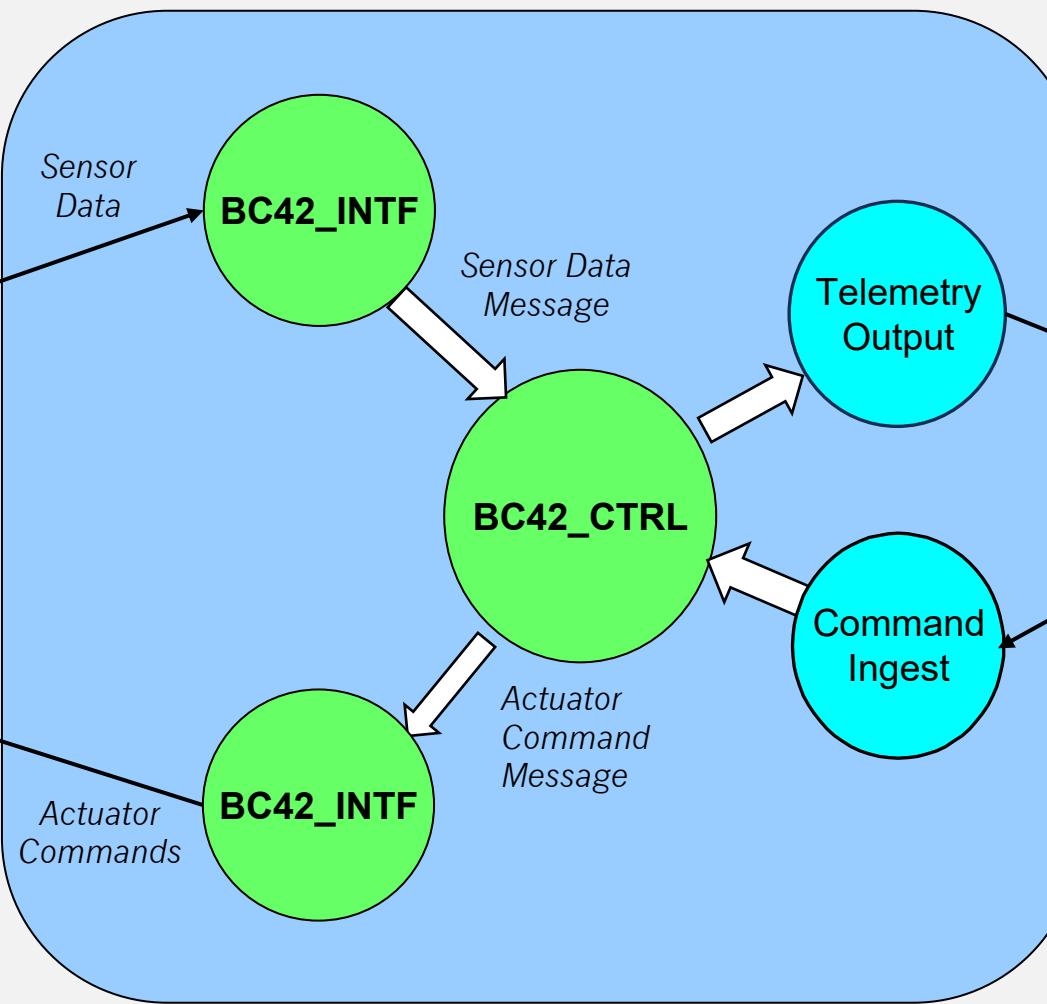


Closed-loop Control Data Flow

42 Simulator



cFS Target



Basecamp GUI

The screenshot shows the cFS Basecamp - v2.7 application window. At the top, there's a menu bar with File, Tools, Remote Ops, Tutorials, Help, and a toolbar with Build, Start, Stop buttons. The main area has tabs for Mission, basecamp, Target: cpul, Image, and Home. Below the tabs is a toolbar with Erase Tim, Browse Files, Quick Cmd, Send Cmd, View Tim, and Telemetry Topic buttons. A large arrow points to the 'Send Cmd' button.

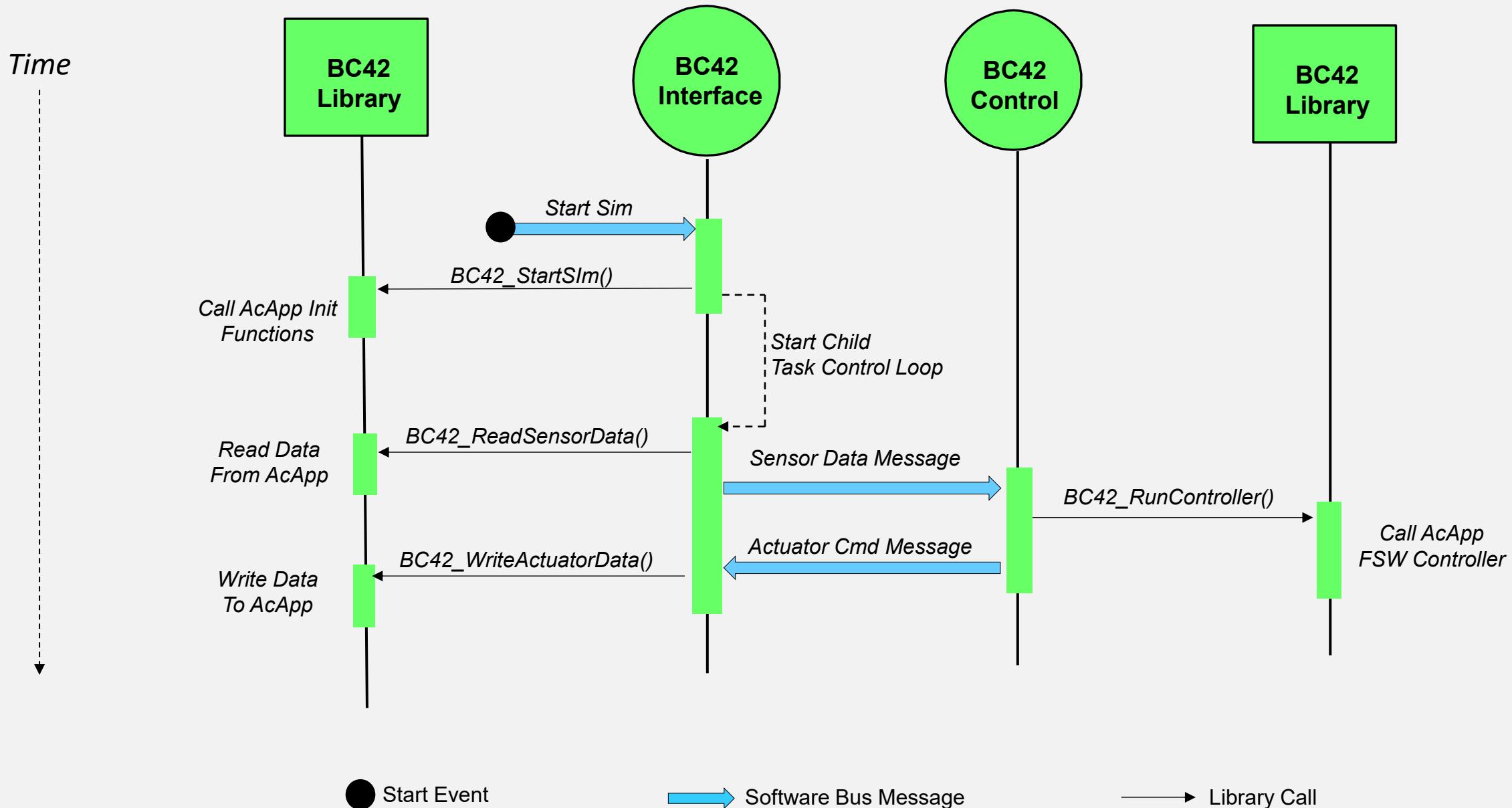
cFS Target Process Window

Port	Message	Time
Evs Port 0	66/1/FILE MGR 100 : FILE MGR App Initialized. Version 4.0.0	2023-07-31T06:48:26
Evs Port 0	66/1/KIT SCH 235 : Successfully replaced table 0 using file /cfkit.sch.msgtbl.json	2023-07-31T06:48:26
Evs Port 0	66/1/KIT SCH 208 : Scheduler Table loaded updated 27 entries	2023-07-31T06:48:26
Evs Port 0	66/1/KIT SCH 199 : Successfully replaced table 1 using file /cfkit.sch.shtbl.json	2023-07-31T06:48:26
Evs Port 0	66/1/KIT SCH 181 : KIT SCH Initialized. Version 3.0.0	2023-07-31T06:48:26
Evs Port 0	66/1/KIT SCH 178 : KIT SCH initialized successfully	2023-07-31T06:48:26
Evs Port 0	66/1/FILER MGR 53 : Child task initialization complete	2023-07-31T06:48:26
Evs Port 0	66/1/KIT TO 387 : Removed 0 table packet entries	2023-07-31T06:48:26
Evs Port 0	66/1/KIT TO 386 : Successfully loaded new table with 34 packets	2023-07-31T06:48:26
Evs Port 0	66/1/KIT TO 25 : Successfully replaced table 0 using file /cfkit.to.kpt.tbl.json	2023-07-31T06:48:26
Evs Port 0	66/1/KIT TO 389 : KIT TO Initialized. Version 3.2.0	2023-07-31T06:48:26
Evs Port 0	66/1/PPS 14 : PPS 14.35 : CFE_EVS_Main : PPS INT state	2023-07-31T06:48:26
Evs Port 0	66/1/PPS 14 : 14.35 : CFE_EVS_Main : Entering OPERATIONAL state	2023-07-31T06:48:26
Evs Port 0	66/1/PPS 14 : 14.35 : CFE_EVS_Main : PPS 22 : Telemetry output enabled for IP 127.0.0.1	2023-07-31T06:48:26
Evs Port 0	66/1/SOC 404 : Major Frame Sync too noisy (Stat 1). Disabling synchronization.	2023-07-31T06:48:26

Ground Events

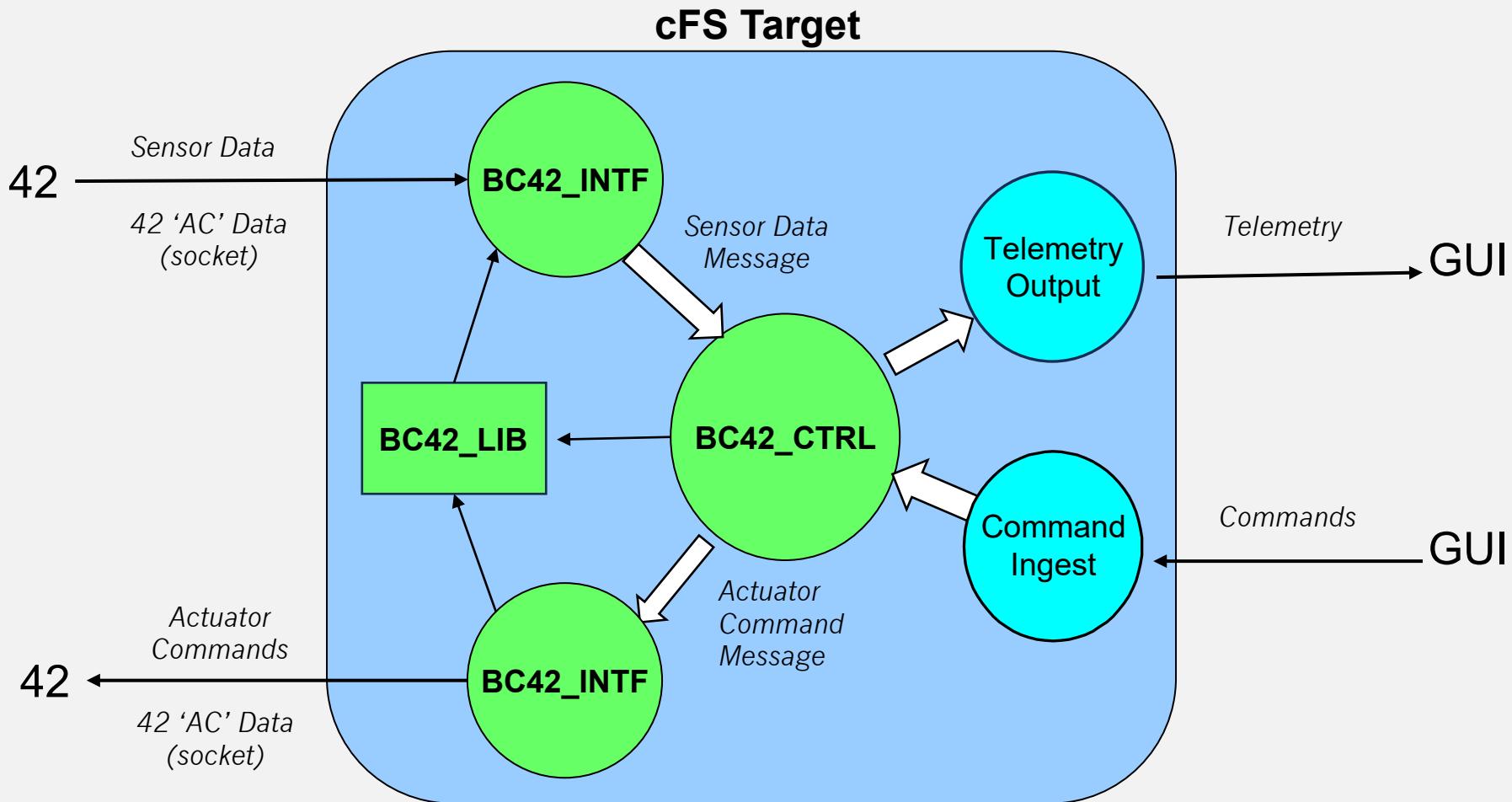
Event ID	Event Name	Time
00-48-26	Bascamp version 2.7 initialized with mission 'basecamp', target 'cpul'	07/31/2025 at 06:48:26
00-48-26	Bascamp Target host 127.0.0.1, command port 1234, telemetry port 1235	07/31/2025 at 06:48:26
00-48-31	CFE_EVS/AdvAddDriverFilterCmd command	07/31/2025 at 06:48:31
00-48-31	Send CFE_EVS/AdvAddDriverFilterCmd command	07/31/2025 at 06:48:31
00-48-32	Fw Event at 1085357 : KIT TO_2 : Telemetry output enabled for IP 127.0.0.1	07/31/2025 at 06:48:32
00-49-12	Fw Event at 1085577 : KIT_SCH_3 : Major Frame Sync too noisy (Stat 1). Disabling synchronization.	07/31/2025 at 06:49:12

Start & Run Simulation





Detailed Library Flow

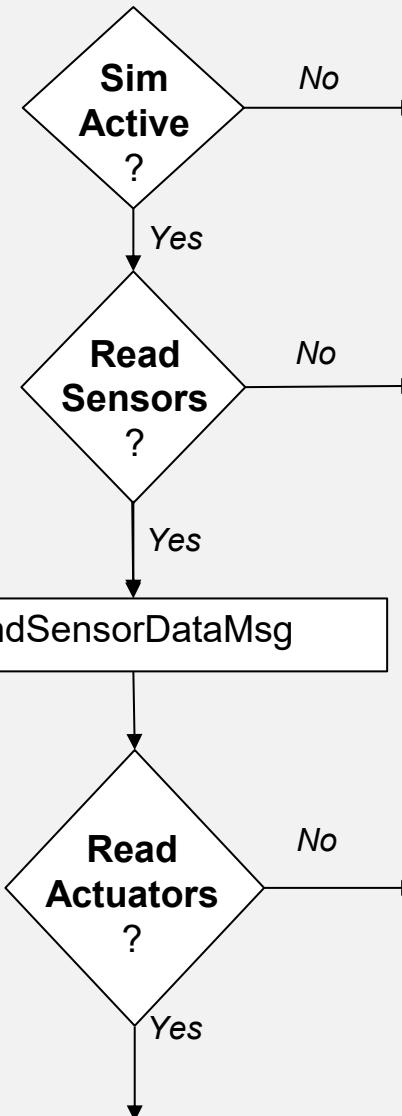
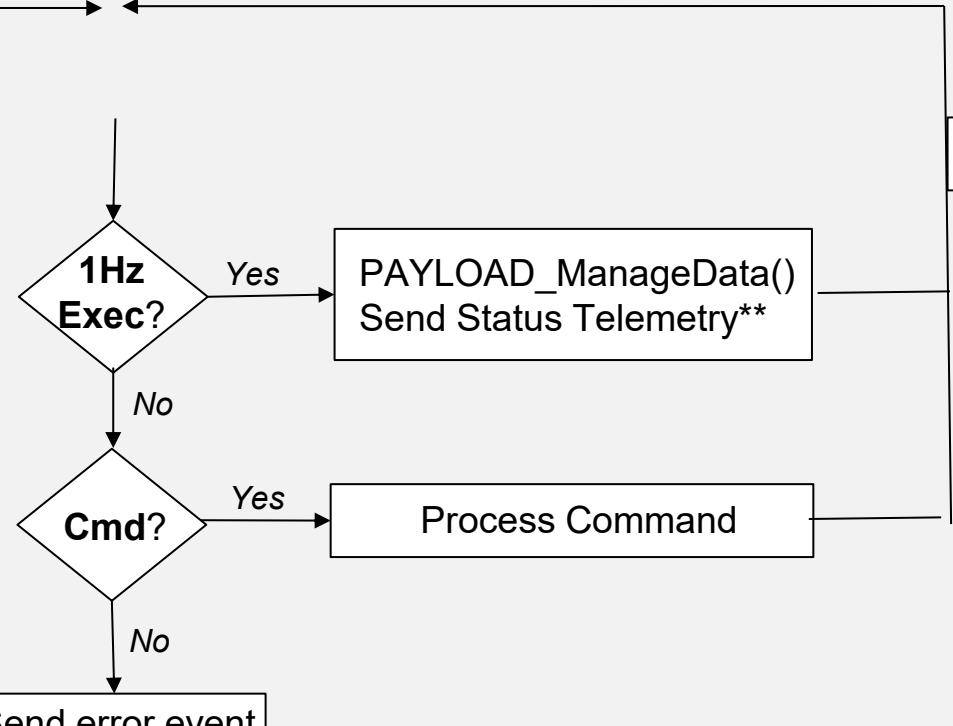




BC42_INTF::ControlLoopTask

Initialize App

Subscribe to 1Hz Exec,
Command messages





Detailed 42 Interface Flow

