

Lesson 2 – Demo App

2/2

Objective

- Introduce *Basecamp* features by interacting with the *APP_C_DEMO* app

Agenda

1. Describe the *APP_C_DEMO* app
2. Send commands to *APP_C_DEMO* and observe responses in *APP_C_DEMO*'s telemetry

APP_C_DEMO

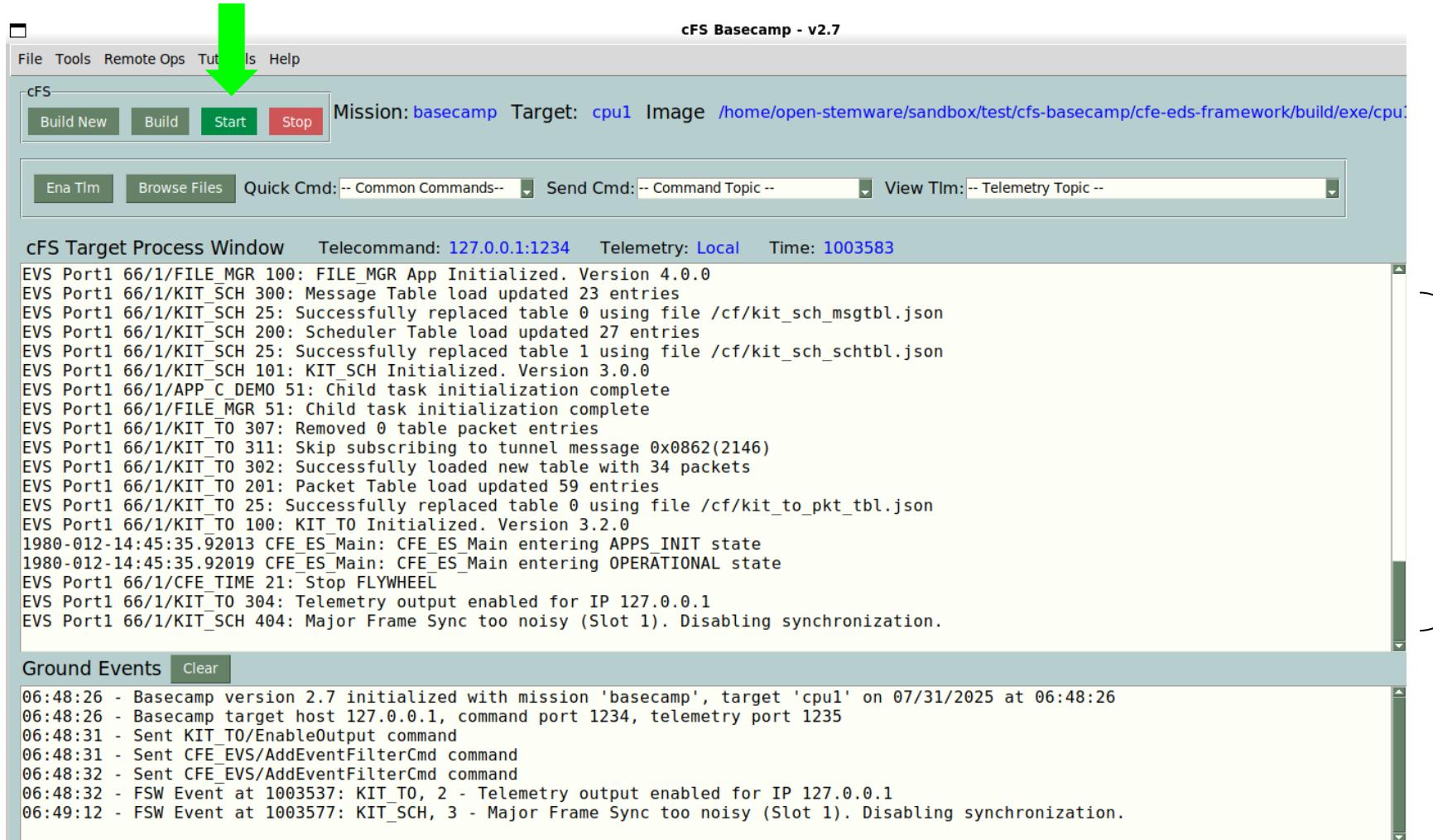
- The *APP_C_DEMO*'s name is based on the fact that the app uses the Application C-based Framework (*APP_C_FW*)
- The *APP_C_DEMO* app features and design have been specified to provide a non-trivial app that
 - Is easy for users to quickly understand and operate
 - Has enough complexity so it can be used to illustrate most Basecamp operational features and use a large percentage of the *APP_C_FW* app framework
 - *APP_C_DEMO* functions are designed to help teach app development concepts and may not be practical for a space mission
- This tutorial introduces *APP_C_DEMO*, refer to the Basecamp Application Developer's Guide for a complete description

APP_C_DEMO Functionality

- *APP_C_DEMO* computes a histogram for a randomly generated integer
- The range of the random number, the number of histogram bins, and the bin limits can be changed
- The following *APP_C_DEMO* commands are used
 - **Noop**: No operation sends an informational event message with the app's version number. All apps provide a Noop command.
 - **Load Table**: Load the histogram bin definition table. The default table is automatically loaded when the app initializes
 - **Start Histogram**: Enables the histogram computations and the running results are contained in the status telemetry message
 - **Start Histogram Log**: The command specifies a bin number and each time a new random data value is received for that bin a time-stamped entry is written to the log file. The number of log entries is specified in the command and the log file is automatically closed when that number is reached. Logging can be disabled using the *Stop Histogram Log* command.
 - **Playback Histogram Log**: The contents of the log file are sent in a telemetry message. One log file entry is sent in the telemetry message and the playback continuously cycles through log file until it is commanded to stop.
- All commands increment a command valid/invalid counter. These counters are contained in the app's status telemetry

Install Basecamp and Start the cFS

1. Install Basecamp following the instructions at <https://github.com/cfs-tools/cfs-basecamp>
2. After Basecamp's GUI is launched, click <Start cFS> to start the cFS target



The cFS initialization messages
should appear in the cFS Process
Window

Display APP_C_DEMO Status Telemetry

cFS Basecamp - v2.7

target: cpu1 Image /home/open-stemware/sandbox/test/cfs-basecamp/cfe-eds-framework/build/

Send Cmd: -- Command Topic -- View Tlm: -- Telemetry Topic --

-- Telemetry Topic --
APP_C_DEMO/Application/BIN_PLAYBK_TLM
APP_C_DEMO/Application/STATUS_TLM
CFE_ES/Application/APP_TLM

1234 Telemetry: Local Time: 1003875

zed Version 4 A A

1. Select APP_C_DEMO/Application/STATUS_TLM from the View Tlm dropdown list

APP_C_DEMO/Application/STATUS_TLM - Port 9003

App ID: 98 Length: 167 Seq Cnt: 56

Payload

StatusTlm.Payload.ValidCmdCnt	:	0
StatusTlm.Payload.InvalidCmdCnt	:	0
StatusTlm.Payload.ChildValidCmdCnt	:	0
StatusTlm.Payload.ChildInvalidCmdCnt	:	0
StatusTlm.Payload.LastTblAction	:	LOAD
StatusTlm.Payload.LastTblActionStatus	:	VALID
StatusTlm.Payload.DeviceData	:	74
StatusTlm.Payload.DeviceDataModulo	:	100
StatusTlm.Payload.HistEna	:	FALSE
StatusTlm.Payload.HistMaxValue	:	99
StatusTlm.Payload.HistSampleCnt	:	0
StatusTlm.Payload.HistBinCntStr	:	Undefined
StatusTlm.Payload.HistLogEna	:	FALSE
StatusTlm.Payload.HistLogBinNum	:	0
StatusTlm.Payload.HistLogCnt	:	0
StatusTlm.Payload.HistLogMaxEntries	:	0
StatusTlm.Payload.HistLogPlaybkEna	:	FALSE
StatusTlm.Payload.HistLogPlaybkCnt	:	0
StatusTlm.Payload.HistLogFilename	:	Undefined

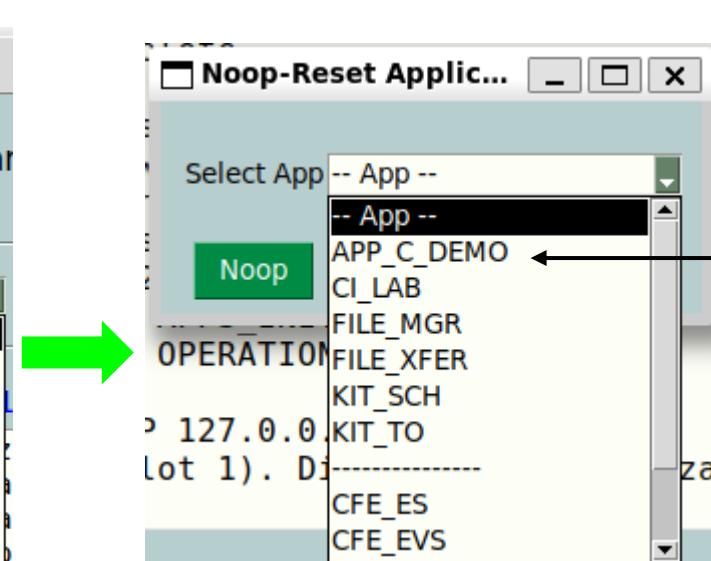
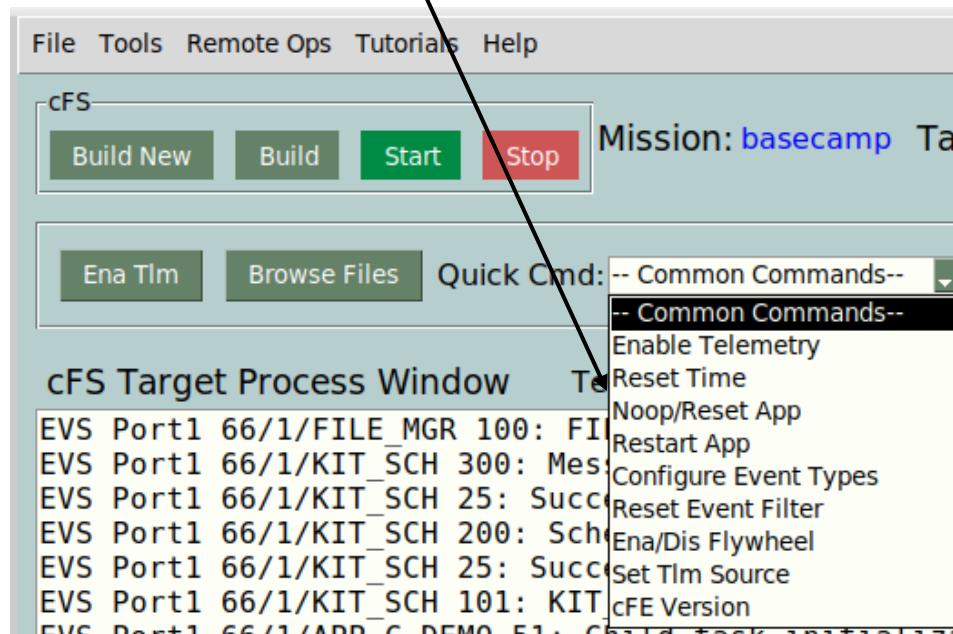
2. Note the following default states

- Command counters are zero
- Randomly generated *DeviceData* is updating
- Histogram is disabled

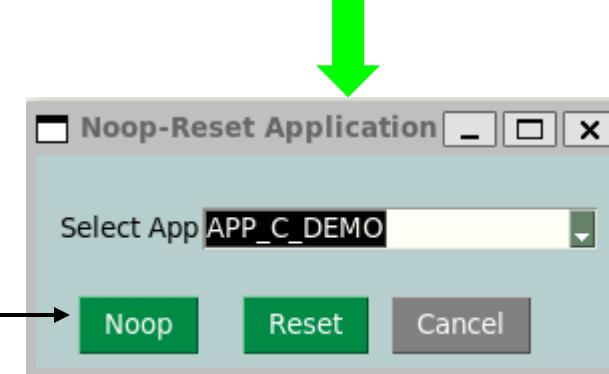
Send Noop Command

The *Quick Cmd* dropdown allows users to send commonly used command without going through the Send Command menus

1. From the Quick Cmd dropdown select the *Noop/Reset App* option



2. Select APP_C_DEMO from the popup window's app list



3. Select the <Noop> button to send the Noop command

Command response
on next slide

Noop Command Response

- Valid command counter incremented
- Event message sent

The screenshot shows the CFE TLM application window titled "APP_C_DEMO/Application/STATUS_TLM - Port 9003". The window has three main sections: a toolbar at the top, a log window below it, and a payload table on the right.

Toolbar: Ena Tlm, Files..., Quick Cmd: Noop/Reset App, Send Cn

Log Window: cFS Process Window Time: 1001339

```
EVS Port1 66/1/FILE_MGR 51: Child task initialization complete
EVS Port1 66/1/KIT_T0 306: Removed 0 table packet entries
EVS Port1 66/1/KIT_T0 310: Skip subscribing to message 0
EVS Port1 66/1/KIT_T0 301: Successfully loaded new table
EVS Port1 66/1/KIT_T0 201: Packet Table load updated 69
EVS Port1 66/1/KIT_T0 25: Successfully replaced table 0
EVS Port1 66/1/KIT_T0 100: KIT_T0 Initialized. Version 3
1980-012-14:03:20.70920 CFE_ES_Main: CFE_ES_Main entering APPS_INIT state
1980-012-14:03:20.70922 CFE_ES_Main: CFE_ES_Main entering OPERATIONAL state
EVS Port1 66/1/CFE_TIME 21: Stop FLYWHEEL
EVS Port1 66/1/KIT_T0 303: Telemetry output enabled for IP 127.0.0.1
EVS Port1 66/1/KIT_SCH 406: Multiple slots processed: slot = 1, count = 2
EVS Port1 66/1/KIT_SCH 404: Major Frame Sync too noisy (Slot 1). Disabling synchronization.
EVS Port1 66/1/APP_C_DEMO 101: No operation command received for APP_C_DEMO App version 4.0.0
```

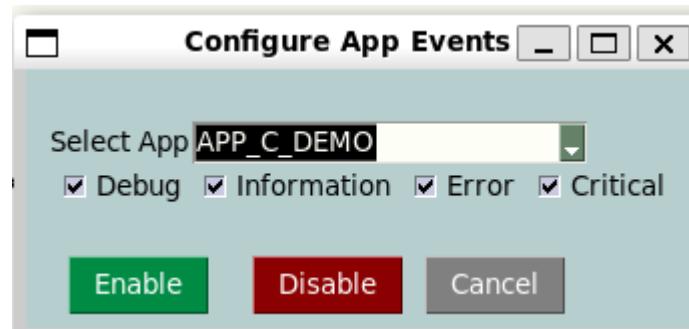
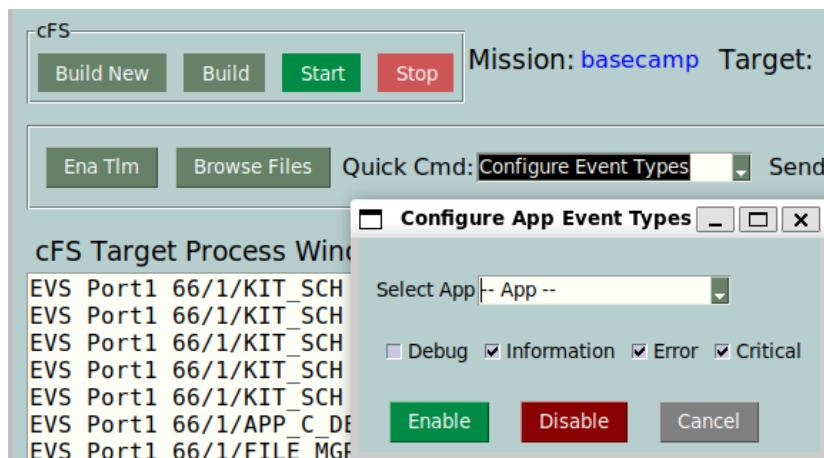
Payload Table:

Payload	
StatusTlm.Payload.ValidCmdCnt	: 1
StatusTlm.Payload.InvalidCmdCnt	: 0
StatusTlm.Payload.ChildValidCmdCnt	: 0
StatusTlm.Payload.ChildInvalidCmdCnt	: 0
StatusTlm.Payload.LastTblAction	: LOAD
StatusTlm.Payload.LastTblActionStatus	: VALID
StatusTlm.Payload.DeviceData	: 86
StatusTlm.Payload.DeviceDataModulo	: 100
StatusTlm.Payload.HistEna	: FALSE
StatusTlm.Payload.HistMaxValue	: 99
StatusTlm.Payload.HistSampleCnt	: 0
StatusTlm.Payload.HistBinCntStr	: Undefined
StatusTlm.Payload.HistLogEna	: FALSE
StatusTlm.Payload.HistLogBinNum	: 0
StatusTlm.Payload.HistLogCnt	: 0
StatusTlm.Payload.HistLogMaxEntries	: 0
StatusTlm.Payload.HistLogPlaybkEna	: FALSE
StatusTlm.Payload.HistLogPlaybkCnt	: 0
StatusTlm.Payload.HistLogFilename	: Undefined

Enable APP_C_DEMO Debug Events

- There are four types of event messages: *Debug*, *Information*, *Error*, and *Critical*.
- Events can be enabled/disabled from being sent on the software bus at the system or app level.
- Debug messages are disabled by default.

1. From the Quick Cmd dropdown select the *Configure Events* option.



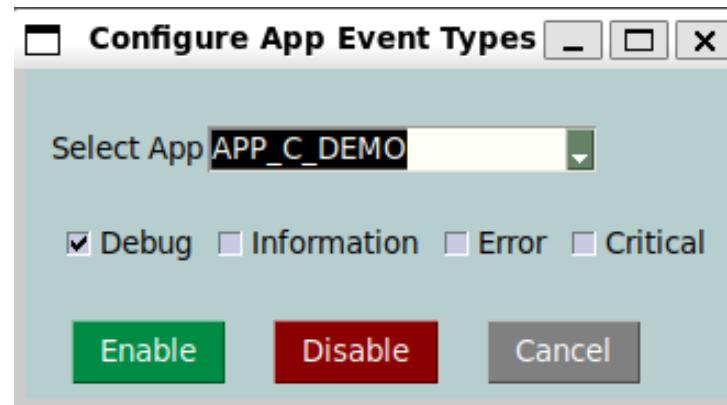
2. Select APP_C_DEMO, check the Debug box, and click <Enable>

APP_C_DEMO has debug event that is sent each time a new random number is generated for the Device Data

```
cFS Target Process Window    Telecommand: 127.0.0.1:1234    Telemetry: Local    Time: 1001447
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.405, new value 95
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.406, new value 60
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.407, new value 29
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.408, new value 29
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.409, new value 13
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.410, new value 24
EVS Port1 66/1/APP_C_DEMO 120: Device data modulo 100, count.411, new value 28
```

Disable APP_C_DEMO Debug Events

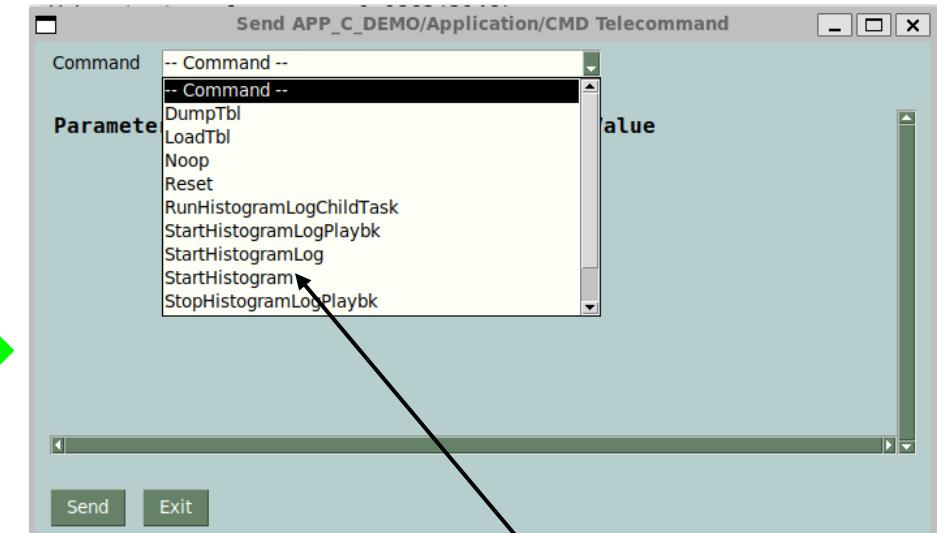
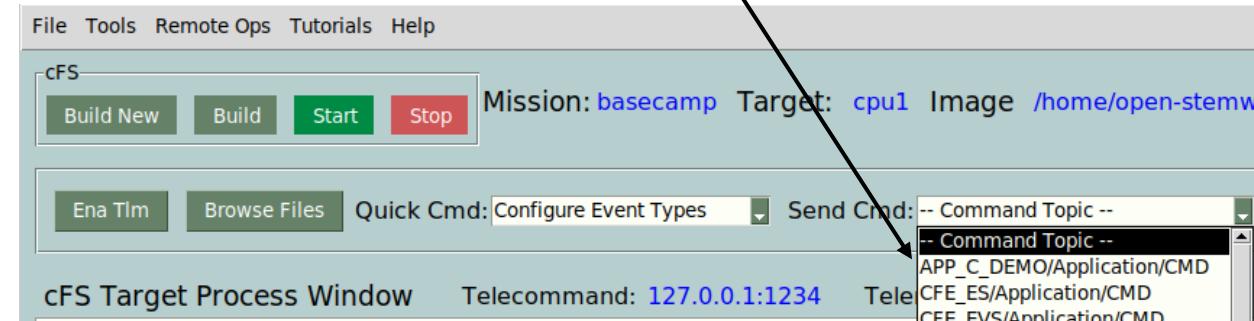
1. From the Quick Cmd dropdown select the *Configure Events* option
2. In the popup select APP_C_DEMO, check the Debug box, unselect the other event types, and click <Disable>



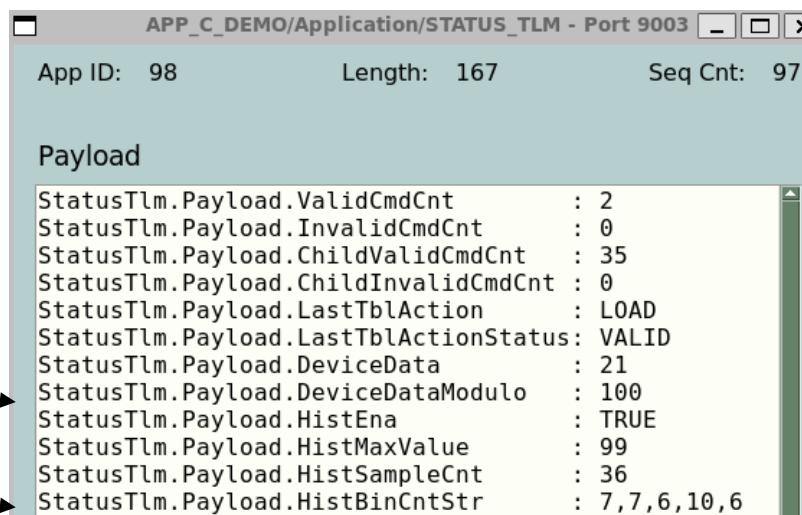
Start Histogram

- The Send Cmd dropdown provides access to all flight app commands
- The command menu system accommodates commands with and without parameters
- When a commands with parameters selected the final input menu will only display the required parameters

1. From the Send Cmd dropdown select APP_C_DEMO



2. Select **StartHistogram**
3. Click <Send>



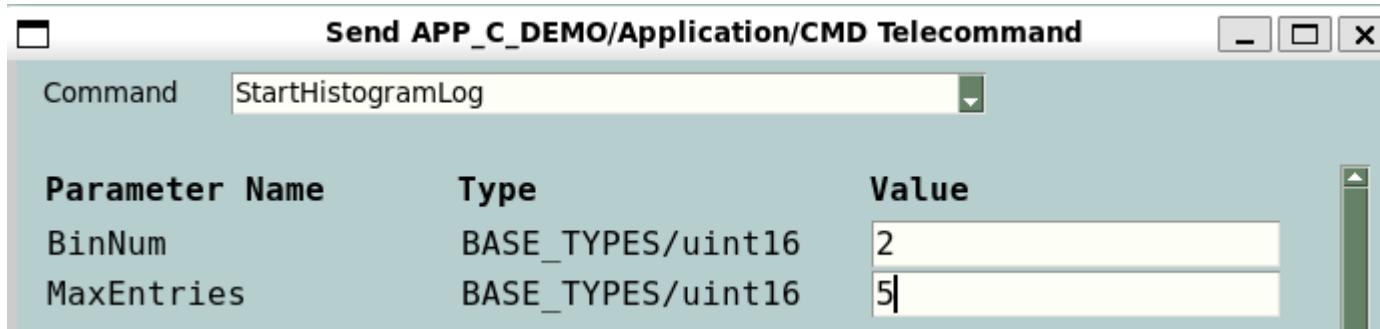
Telemetry reports

- Histogram enabled
- Running bin counts

Start Histogram Log

1. Using the Send Cmd dropdown Navigate to the *StartHistogramLog* command

- This example creates a log file for bin number 2



Information events are sent when the log file is created and closed

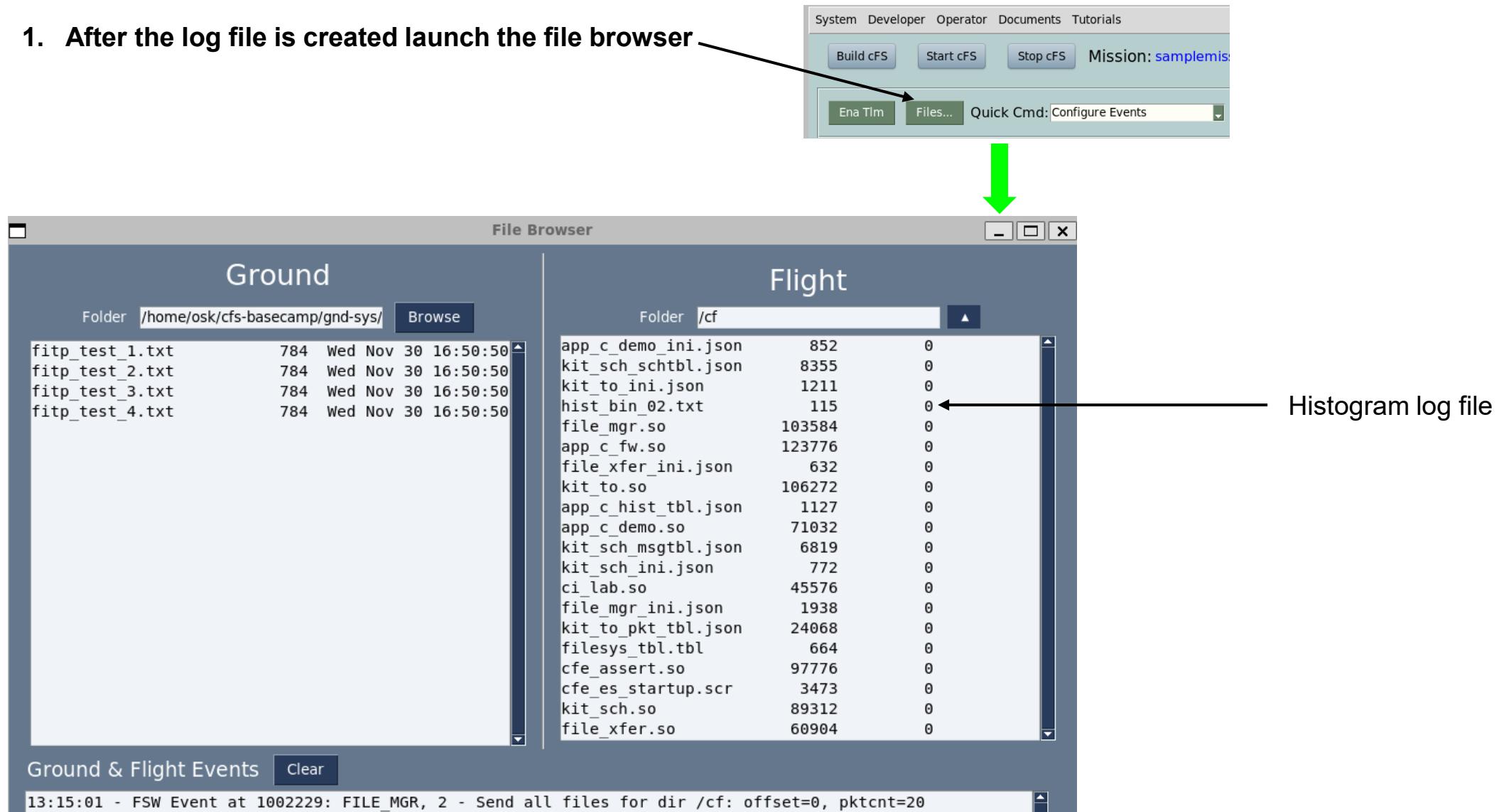
Status telemetry reports the log is enabled for bin 2 with a maximum of 5 entries and the filename is /cf/hist_bin_02.txt

StatusTlm.Payload.HistLogEna	:	TRUE
StatusTlm.Payload.HistLogBinNum	:	2
StatusTlm.Payload.HistLogCnt	:	0
StatusTlm.Payload.HistLogMaxEntries	:	5
StatusTlm.Payload.HistLogPlaybkEna	:	FALSE
StatusTlm.Payload.HistLogPlaybkCnt	:	0
StatusTlm.Payload.HistLogFilename	:	/cf/hist_bin_02.txt

```
EVS Port1 66/1/APP_C_DEMO 140: Started histogram with 5 bins
EVS Port1 66/1/APP_C_DEMO 161: Created new log file /cf/hist_bin_02.txt with a maximum of 5 entries
EVS Port1 66/1/APP_C_DEMO 163: Closed log file /cf/hist_bin_02.txt with 5 entries
```

List the Histogram Log File

1. After the log file is created launch the file browser



Transfer the Histogram Log File

Flight			
File	Size	Last Modified	Actions
app_c_demo_ini.json	852	0	
kit_sch_schtbl.json	8355	0	
kit_to_ini.json	1169	0	
hist_bin_02.txt	92	0	
Refresh			
file_mgr	3576	0	
app_c_fw	3992	0	
List Dir			
file_xfe	632	0	
Send Text to Ground			
kit_to.s	6984	0	
app_c_hi	1127	0	
app_c_de	1136	0	
Cancel Send			
kit_sch_	6819	0	
kit_sch_	772	0	
Create Dir			
ci_lab.s	5544	0	
Delete Dir			
file_mgr	1938	0	
kit_to_p	5822	0	
Rename File			
filesys_	664	0	
Delete File			
cfe asse	7920	0	

1. Select the histogram log filename using the left mouse button
2. Right click to bring up a menu
3. Choose **Send Text to Ground**
 - When StatusTlm.Payload.HistLogEna is FALSE the log file is complete and can be transferred



Ground listing
shows log file

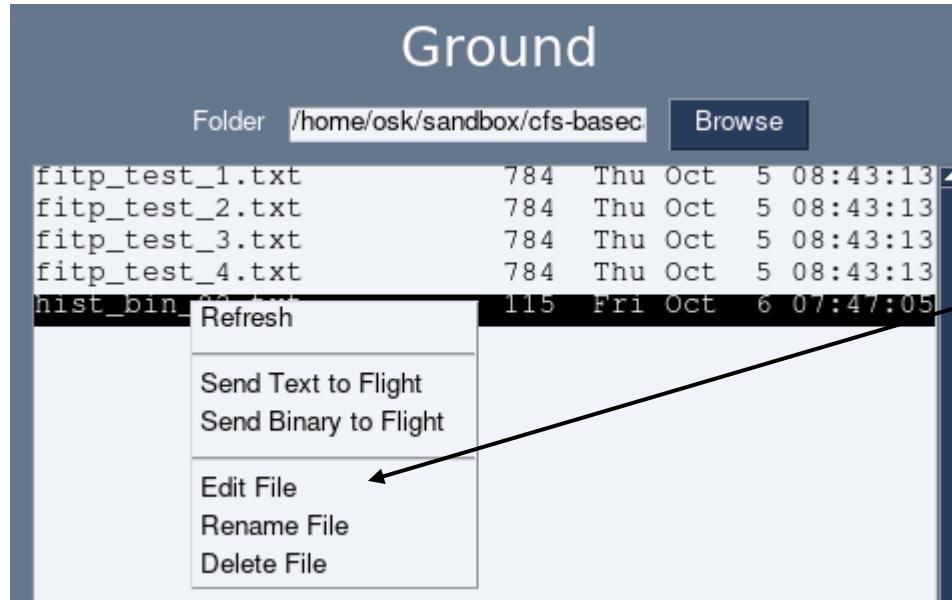
Ground						
File	Size	Date	Month	Year	Time	Action
fitp_test_1.txt	784	Wed	Nov	30	16:50:50	
fitp_test_2.txt	784	Wed	Nov	30	16:50:50	
fitp_test_3.txt	784	Wed	Nov	30	16:50:50	
fitp_test_4.txt	784	Wed	Nov	30	16:50:50	
hist_bin_02.txt	115	Mon	Jan	16	13:18:44	



Events show file transfer
succeeded

Ground & Flight Events	
Clear	
13:15:01 - FSW Event at 1002229: FILE_MGR, 2 - Send all files for dir /cf: offset=0, ptkcnt=20	
13:18:43 - FSW Event at 1002451: FILE_XFER, 2 - Start file transfer command accepted for /cf/hist_bin_02.txt, Segment length 512 and offset 0	
13:18:44 - FSW Event at 1002453: FILE_XFER, 2 - Completed 115 byte file transfer of /cf/hist_bin_02.txt	

View the Histogram Log File



1. Select the histogram log filename using the left mouse button
2. Right click to bring up a menu
3. Choose Edit File

Log file contains time-stamped bin entries



Text File Editor

File Edit Execute

Help /home/grandpa-dave/cfs-basecamp/gnd-sys/flt-file-server//hist_bin_02.txt

```
1980-012-21:27:06: 46
1980-012-21:27:08: 47
1980-012-21:27:09: 48
1980-012-21:27:17: 58
1980-012-21:27:28: 50
```

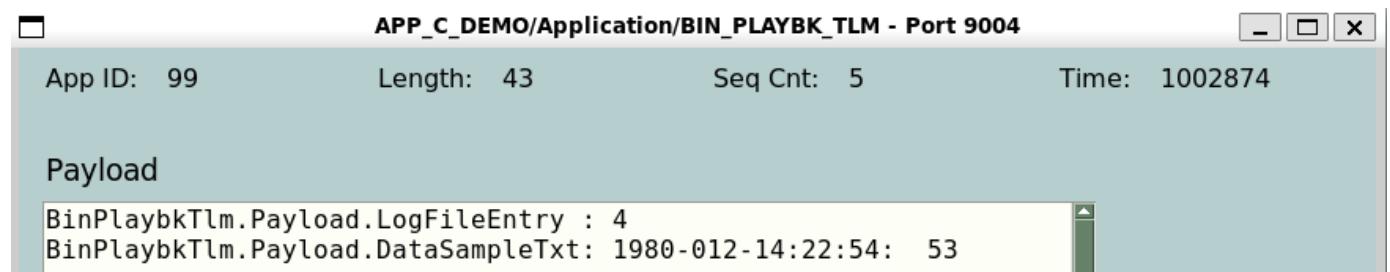
3. Close the text editor and file browser

Playback Logfile in Telemetry

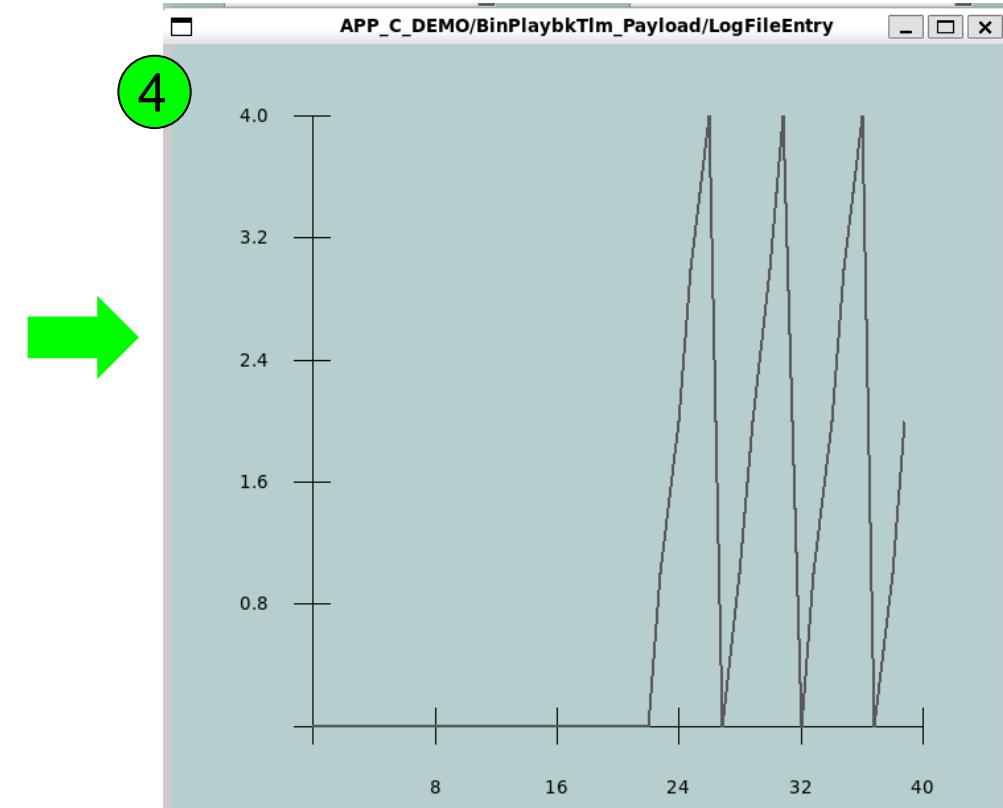
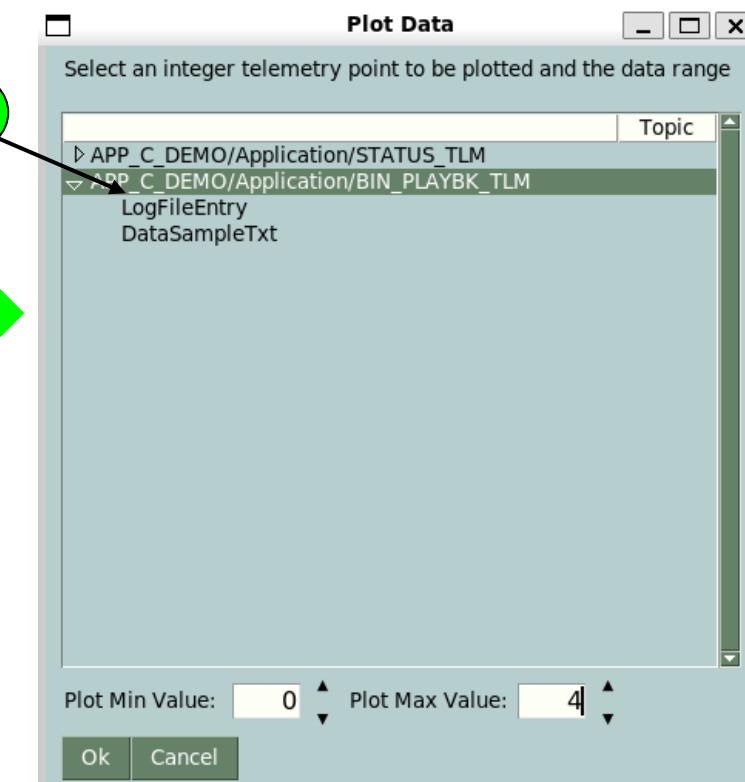
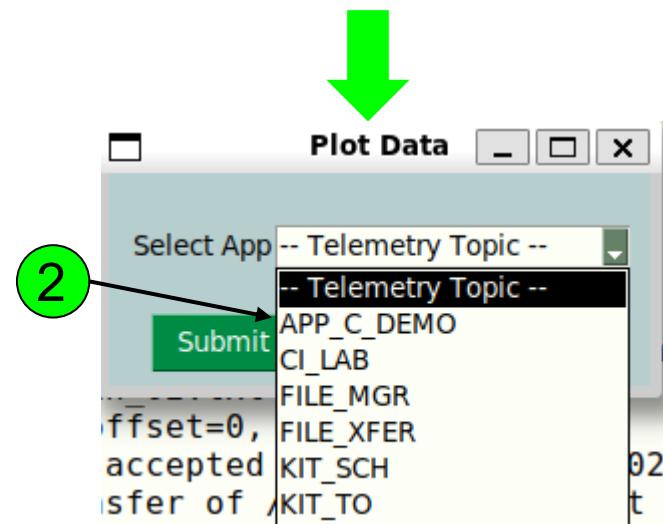
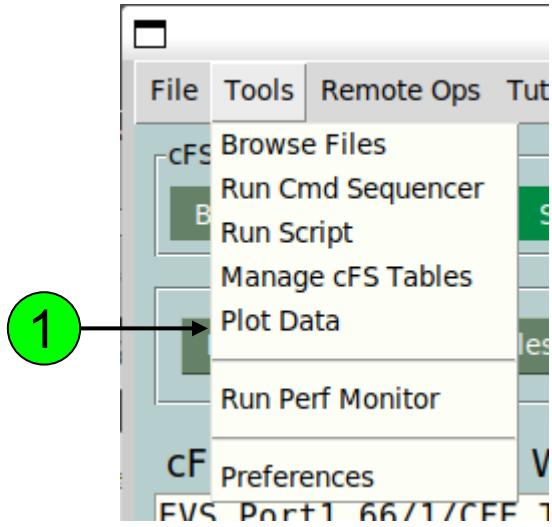
1. Use the View Tlm dropdown menu to launch APP_C_DEMO's *BIN_PLAYBK_TLM* message
 - The initial window will be empty because no messages are being sent



2. Use the Send Cmd dropdown to navigate to and send the *StartHistogramPlaybk* command
 - Playback continuously cycles through log file until it is commanded to stop



Plot Playback Log File Entry Index



1. Select Plot Data from the Tools menu
2. Select APP_C_DEMO from the Plot Data app dropdown and click <Submit>
3. Select LogFileEntry from the BIN_PLAYBK_TLM topic and set the maximum plot value to 4
 - The value is the log file entry index, and it should cycle from 0 to 4

Change Bin Definition Table (1 of 2)

- JSON table files are used as a convenient method to management many functionally related configuration parameters
- APP_C_DEMO uses a table to define the number of bins and the lower and upper limits of each bin

1. Use the File Browser to transfer app_c_hist_tbl.json from flight to ground and open the file in the text editor

The screenshot shows a file browser window titled "Flight". The current folder is "/cf". The contents of the folder are:

File	Size	Last Modified
app_c_demo_ini.json	852	0
kit_sch_schtbl.json	8355	0
temp.json	1126	0
kit_to_ini.json	1211	0
hist_bin_02.txt	115	0
file_mgr.so	103584	0
app_c_fw.so	123776	0
file_xfer_ini.json	632	0
kit_to.so	106272	0
app_c_hist_tbl.json	1127	0
app_c_demo.so	71032	0
kit_sch_msghtbl.json	6819	0
kit_sch_ini.json	772	0
ci_lab.so	45576	0

A large green arrow points from the selected file in the browser to its JSON content on the right. The JSON content shows the original state of the file:

```
"bin-cnt": 5,  
"bin": [  
    {  
        "lo-lim": 0,  
        "hi-lim": 19  
    },  
    {  
        "lo-lim": 20,  
        "hi-lim": 39  
    },  
    {  
        "lo-lim": 40,  
        "hi-lim": 59  
    },  
    {  
        "lo-lim": 60,  
        "hi-lim": 79  
    },  
    {  
        "lo-lim": 80,  
        "hi-lim": 99  
    }]
```

Another green arrow points from the original JSON to the modified version:

```
"bin-cnt": 2,  
"bin": [  
    {  
        "lo-lim": 0,  
        "hi-lim": 49  
    },  
    {  
        "lo-lim": 50,  
        "hi-lim": 99  
    }]
```

2. Change bin-cnt from 5 to 2

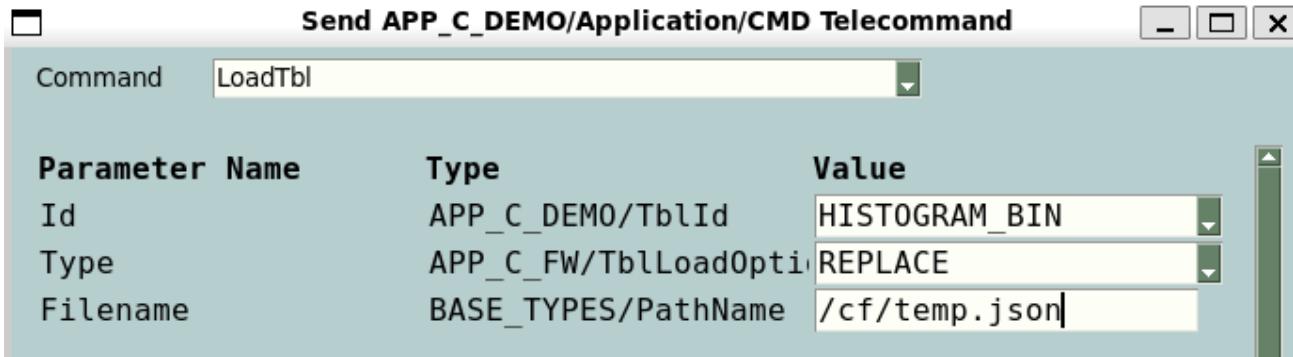
3. Change the first two bin array entries as shown to the left

➤ The remaining bin entries must be present, and they will be ignored

4. Save and close the file
5. Rename the file to temp.json
6. Transfer temp.json to flight

Change Bin Definition Table (2 of 2)

1. Configure APP_C_DEMO's *LoadTbl* command a shown blow and send it



Events verifies successful load

EVS Port1 66/1/APP_C_DEMO 25: Successfully replaced table 0 using file /cf/temp.json

2. Send a *StartHistogram* command



Status shows histogram enabled and 2 bins being used

StatusTlm.Payload.HistEna	:	TRUE
StatusTlm.Payload.Hist.MaxValue	:	99
StatusTlm.Payload.Hist.SampleCnt	:	17
StatusTlm.Payload.Hist.BinCntStr	:	6,11

Change Random Number Range (1 of 2)

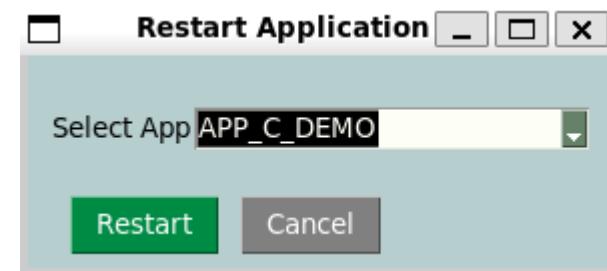
- Every Basecamp app has a JSON initialization table that defines runtime configurations
- APP_C_DEMO's random number range limit is defined in this table

1. Using the File Browser transfer *app_c_demo_ini.json* from flight to ground and open in the text editor

```
"config": {  
    "APP_CFE_NAME": "APP_C_DEMO",  
    "APP_PERF_ID": 127,  
  
    "APP_CMD_PIPE_DEPTH": 5,  
    "APP_CMD_PIPE_NAME": "APP_C_DEMO_CMD",  
  
    "APP_C_DEMO_CMD_TOPICID": 6236,  
    "BC_SCH_1_HZ_TOPICID": 6224,  
    "APP_C_DEMO_STATUS_TLM_TOPICID": 2146,  
    "APP_C_DEMO_BIN_PLAYBK_TLM_TOPICID": 2147,  
  
    "CHILD_NAME": "APP_C_DEMO_CHILD",  
    "CHILD_PERF_ID": 128,  
    "CHILD_STACK_SIZE": 16384,  
    "CHILD_PRIORITY": 80,  
  
    "DEVICE_DATA_MODULO": 100,  
  
    "HIST_LOG_FILE_PREFIX": "/cf/hist_bin_",  
    "HIST_LOG_FILE_EXTENSION": ".txt",  
  
    "HIST_TBL_LOAD_FILE": "/cf/app_c_hist_tbl.json",  
    "HIST_TBL_DUMP_FILE": "/cf/app_c_hist_tbl~.json"  
}
```



2. Change DEVICE_DATA_MODULO from 100 to 60
 - This will cause the random number to range from 0 to 59
3. Save and close the file then transfer it from ground to flight
 - Do not change the filename
4. Using the main window's Quick Cmd dropdown select the Reset App command, select APP_C_DEMO in the popup window and click <Restart>



Change Random Number Range (2 of 2)

1. The following event messages trace APP_C_DEMO's restart activities

```
1980-012-15:56:54.21213 CFE_ES_RestartApp: Restart Application APP_C_DEMO Initiated  
1980-012-15:56:54.96055 APP_C_DEMO App terminating, run status = 0x00000005  
EVS Port1 66/1/APP_C_DEMO 102: APP_C_DEMO App terminating, run status = 0x00000005  
1980-012-15:56:54.96059 CFE_ES_ExitApp: Application APP_C_DEMO called CFE_ES_ExitApp  
EVS Port1 66/1/CFE_ES 10: Restart Application APP_C_DEMO Completed, AppID=34668556  
EVS Port1 66/1/APP_C_DEMO 4: JSON initialization file successfully processed with 17 parameters  
EVS Port1 66/1/APP_C_DEMO 25: Successfully replaced table 0 using file /cf/app_c_hist_tbl.json  
EVS Port1 66/1/APP_C_DEMO 100: APP_C_DEMO App Initialized. Version 4.0.0  
EVS Port1 66/1/APP_C_DEMO 51: Child task initialization complete
```

2. Send the StartHistogram command

- When APP_C_DEMO restarts the default app_c_hist_tbl.json will be used and not the temp.json table file used in a previous step
- Therefore, there will be 5 bins defined, however, the new device data range of 0..59 means only the first three histogram bins should count data occurrences

StatusTlm.Payload.HistEna	:	TRUE
StatusTlm.Payload.Hist.MaxValue	:	59
StatusTlm.Payload.Hist.SampleCnt	:	29
StatusTlm.Payload.Hist.Bin.Cnt.Str	:	11,10,8,0,0