Lesson 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

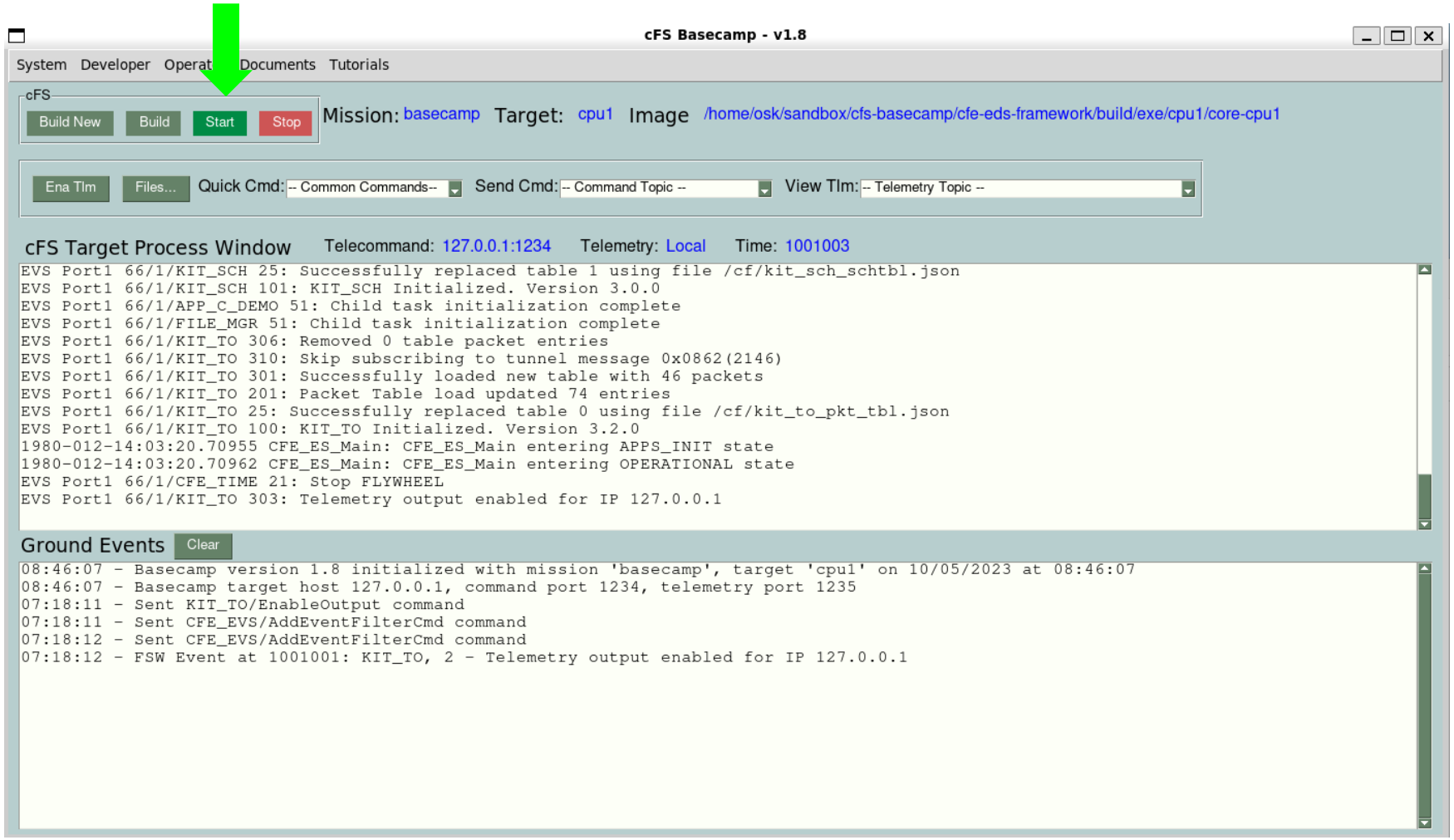
- This tutorial introduces *APP_C_DEMO*, refer to the Basecamp Application Developer's Guide for a complete description

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

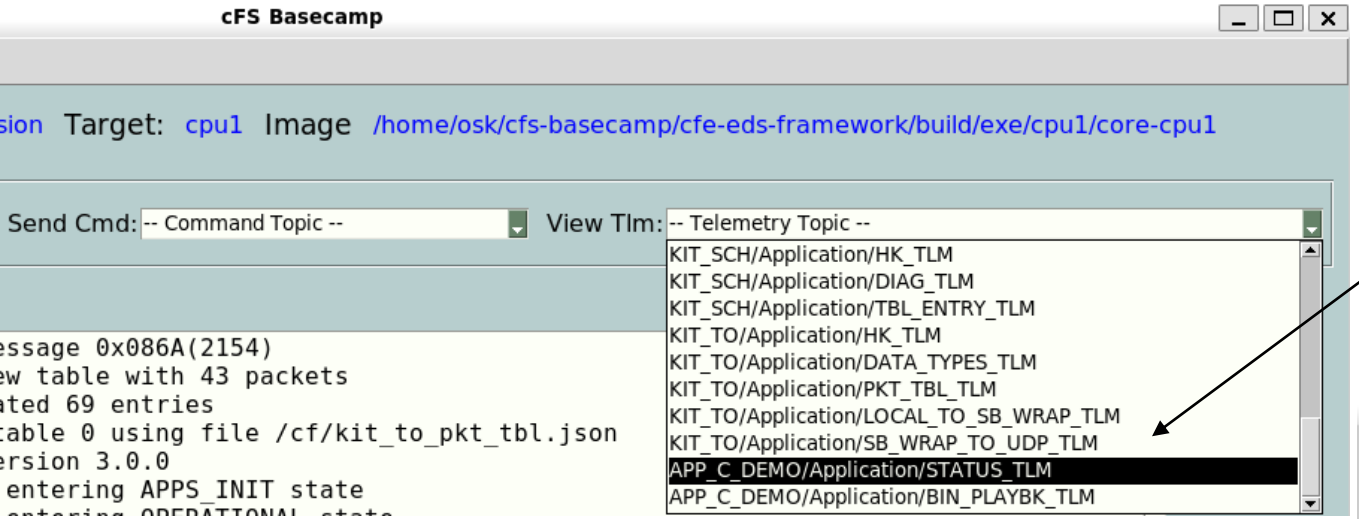
Install Basecamp and Start the cFS

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

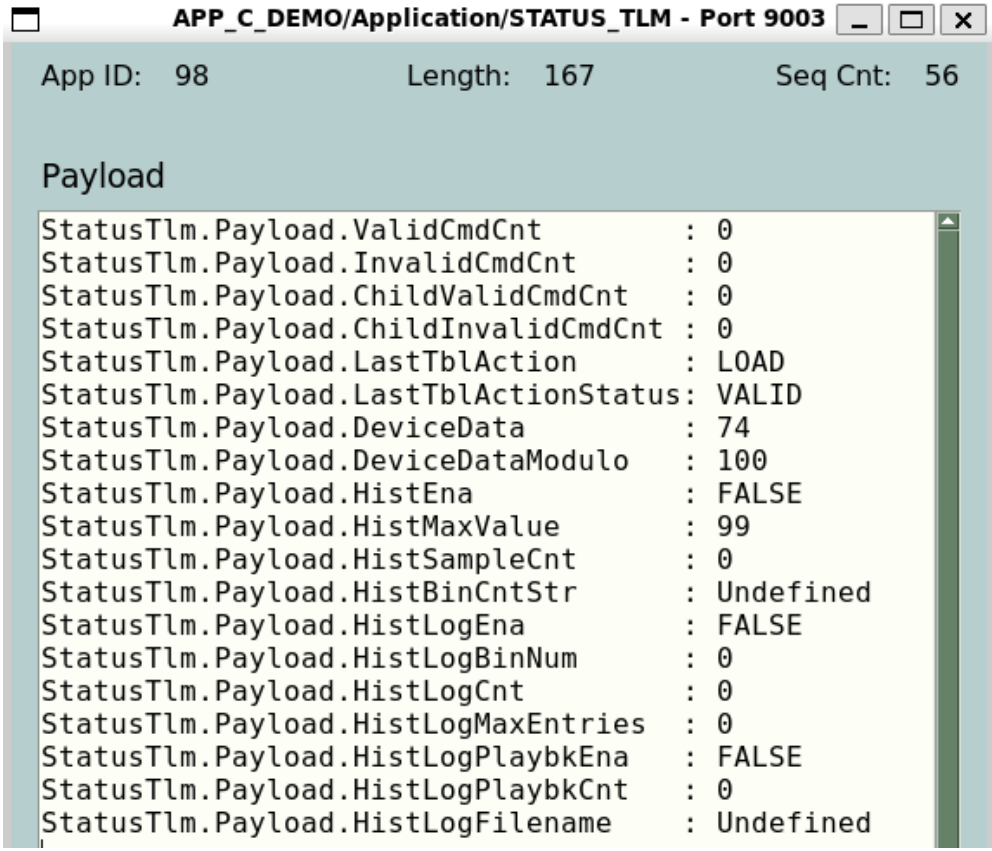


The cFS initialization messages should appear in the cFS Process Window

Display APP_C_DEMO Status Telemetry



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

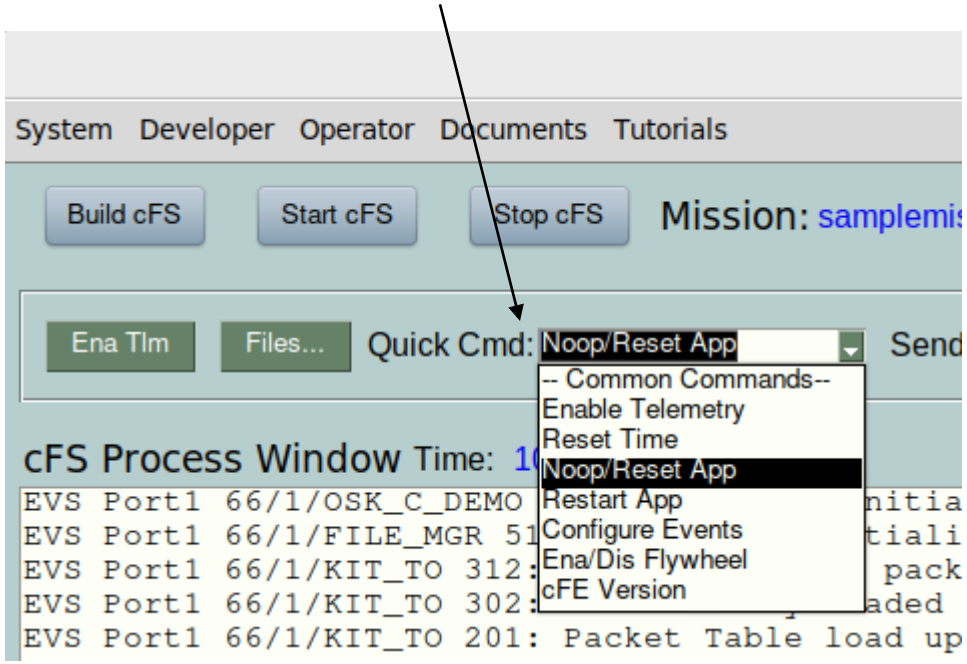


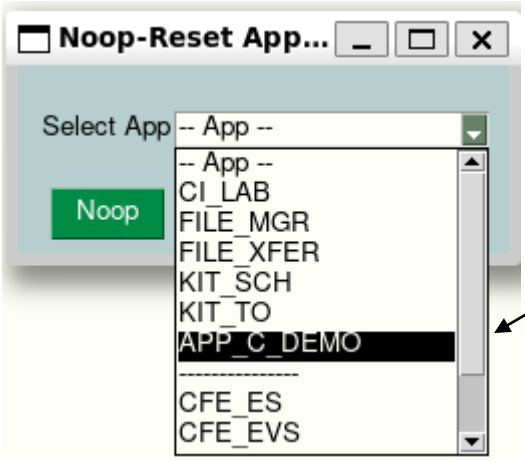
2. **Note the following default states**
   - Command counters are zero
   - Randomly generated *DeviceData is updating*
   - Histogram disabled

Send Noop Command

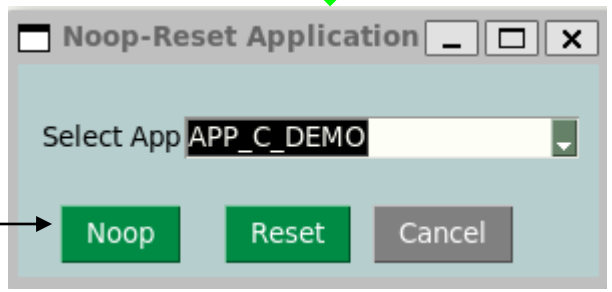
The *Quick Cmd* dropdown allows users to send commonly used command without going through the Send Command menus

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





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

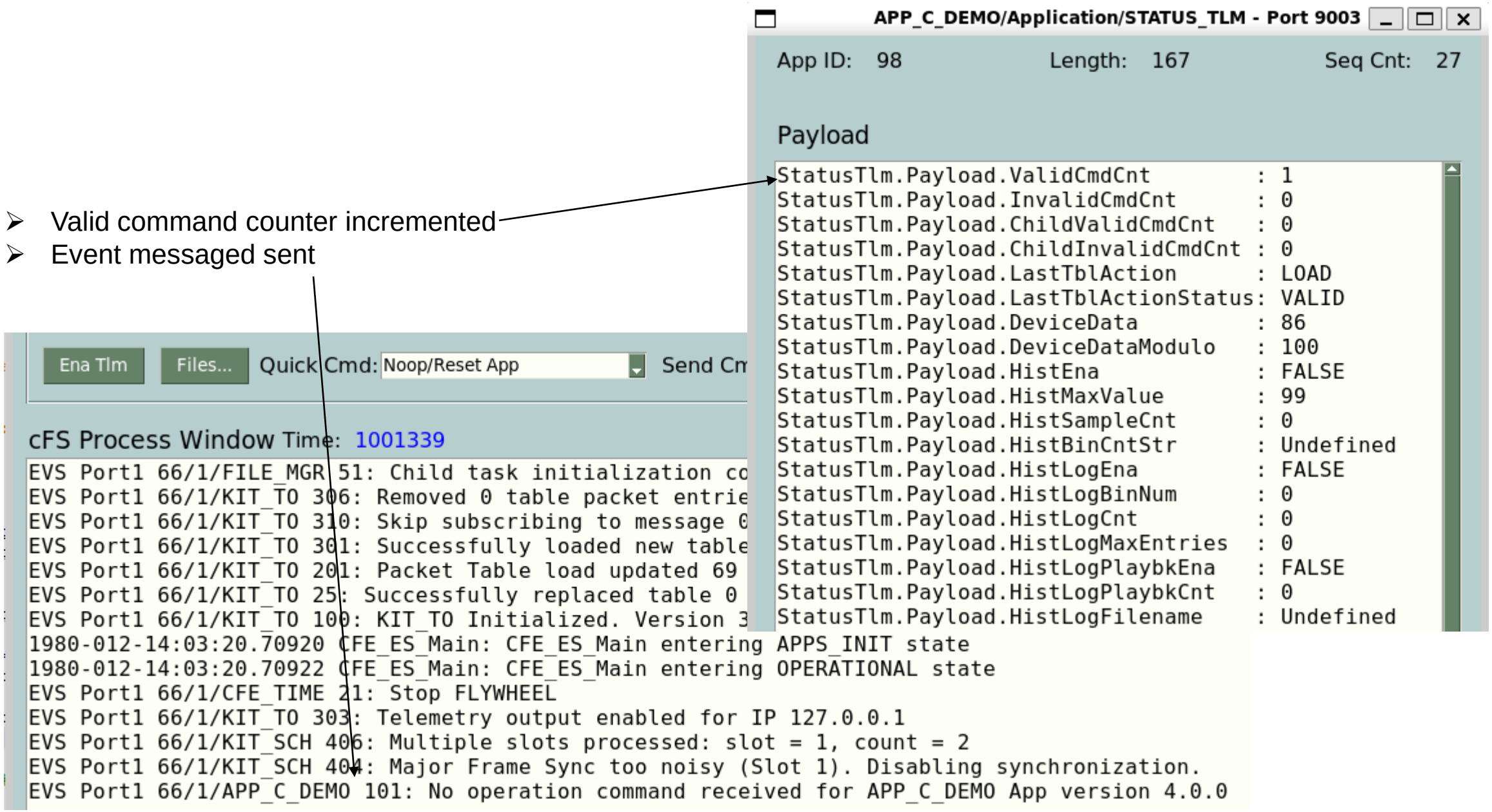


3. **Select the <Noop> button to send the Noop command**

Command response on next slide

Noop Command Response

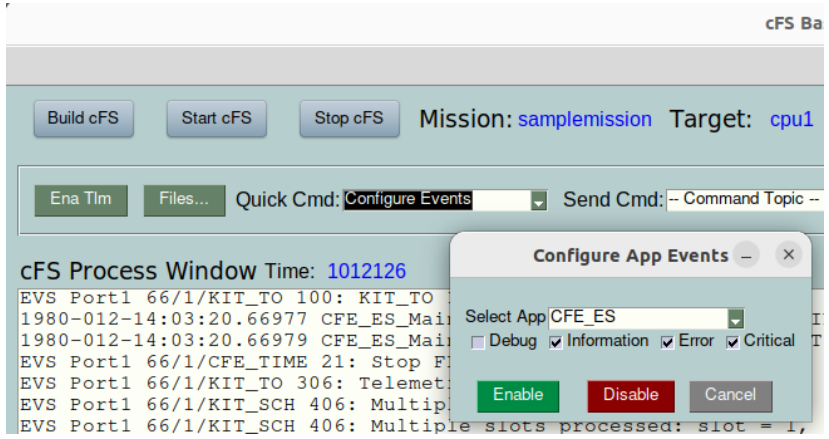
- Valid command counter incremented
- Event messaged sent

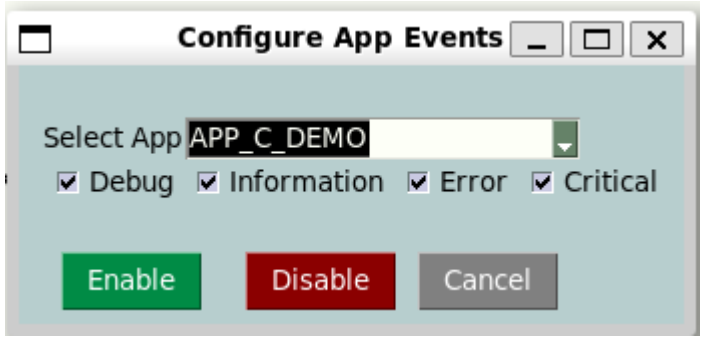


Enable APP_C_DEMO Debug Events

- 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.



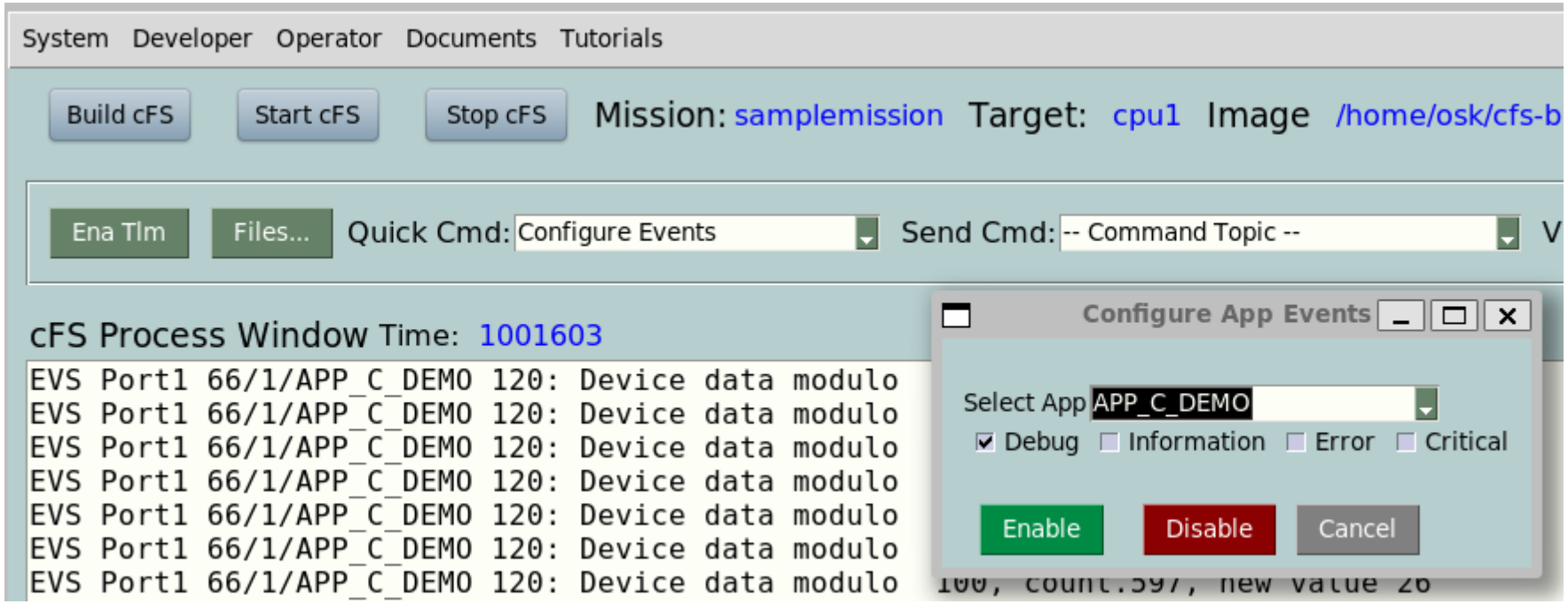


2. Select APP_C_DEMO, check the Debug box, and click <Enable>

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

Disable APP_C_DEMO Debug Events

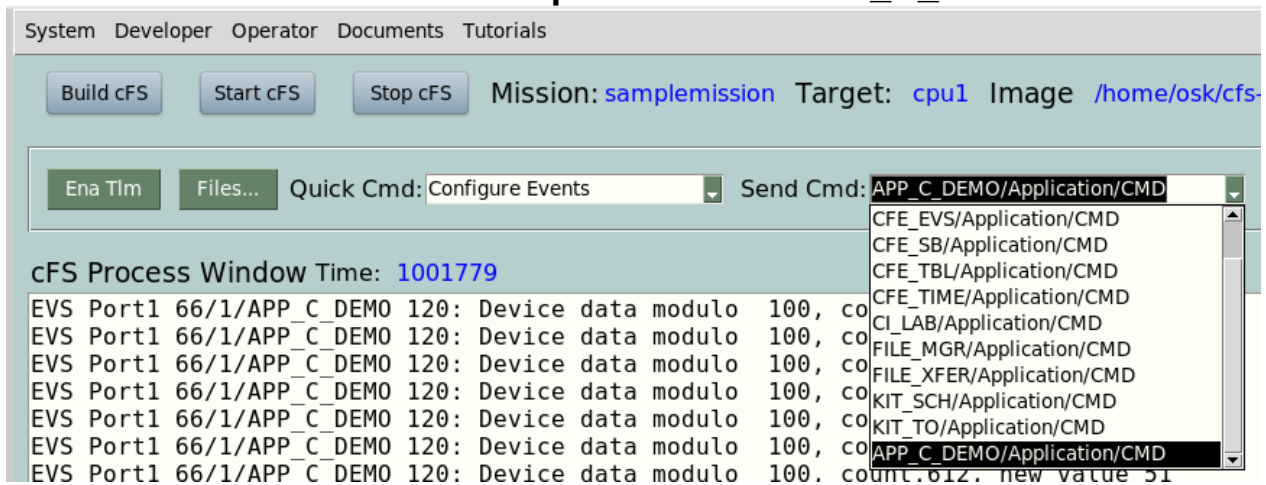
1. From the Quick Cmd dropdown select the Configure Events option
2. In the popup select APP_C_DEMO, check the debug box, unselect the other event types, and click <Disable>

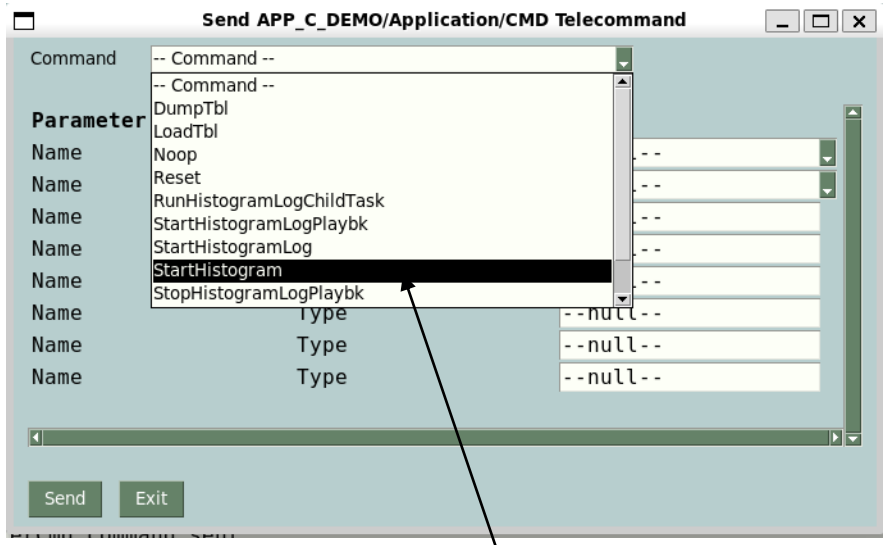


Enable Histogram

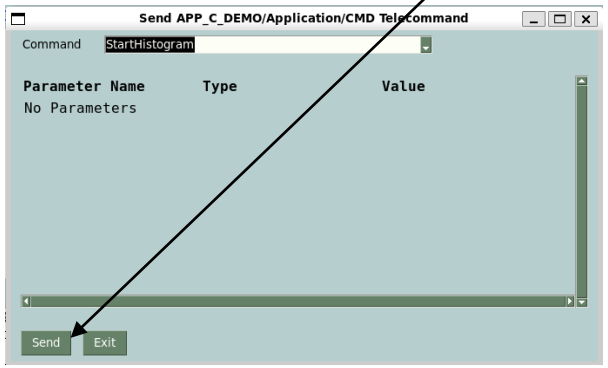
- The Send Cmd dropdown provides access to all flight app commands
- The command menu system accommodates commands with and without parameters
- When a commands with parameters selected the final input menu will only display the required parameters

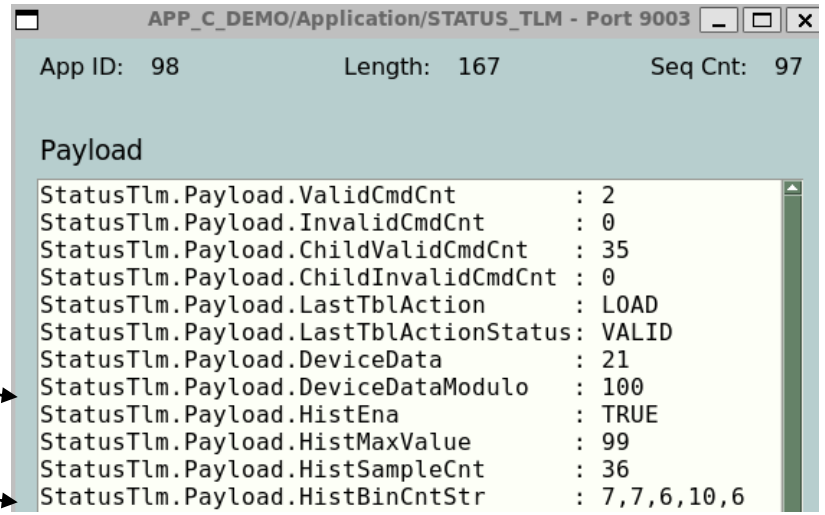
1. From the Send Cmd dropdown select APP_C_DEMO





2. Select Start Histogram
3. Click <Send>

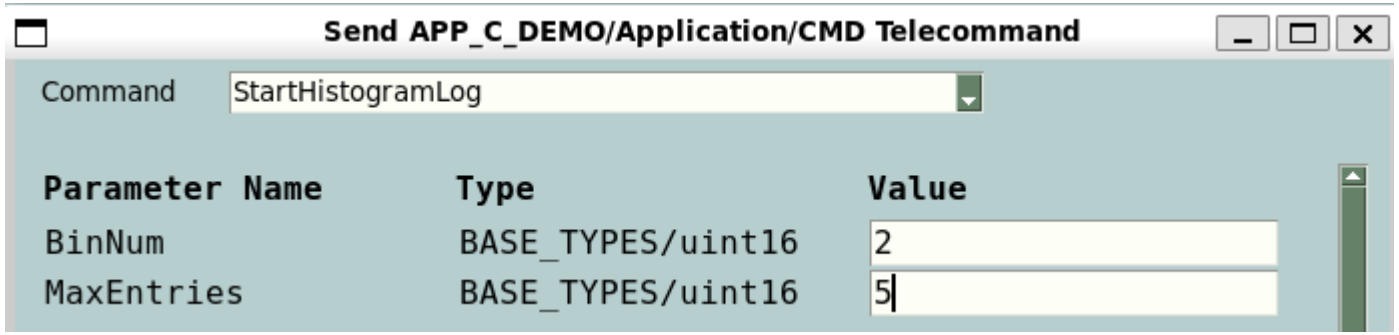




Telemetry reports
- Histogram enabled
- Running bin counts

Enable Histogram Log

1. **Using the Send Cmd dropdown Navigate to the StartHistogramLog command**
   - This example creates a log file for bin number 2



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

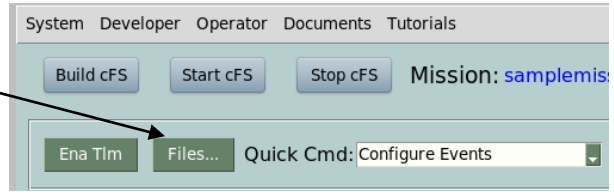
```
StatusTlm.Payload.HistLogEna          : TRUE
StatusTlm.Payload.HistLogBinNum       : 2
StatusTlm.Payload.HistLogCnt          : 0
StatusTlm.Payload.HistLogMaxEntries   : 5
StatusTlm.Payload.HistLogPlaybkEna    : FALSE
StatusTlm.Payload.HistLogPlaybkCnt    : 0
StatusTlm.Payload.HistLogFilename    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

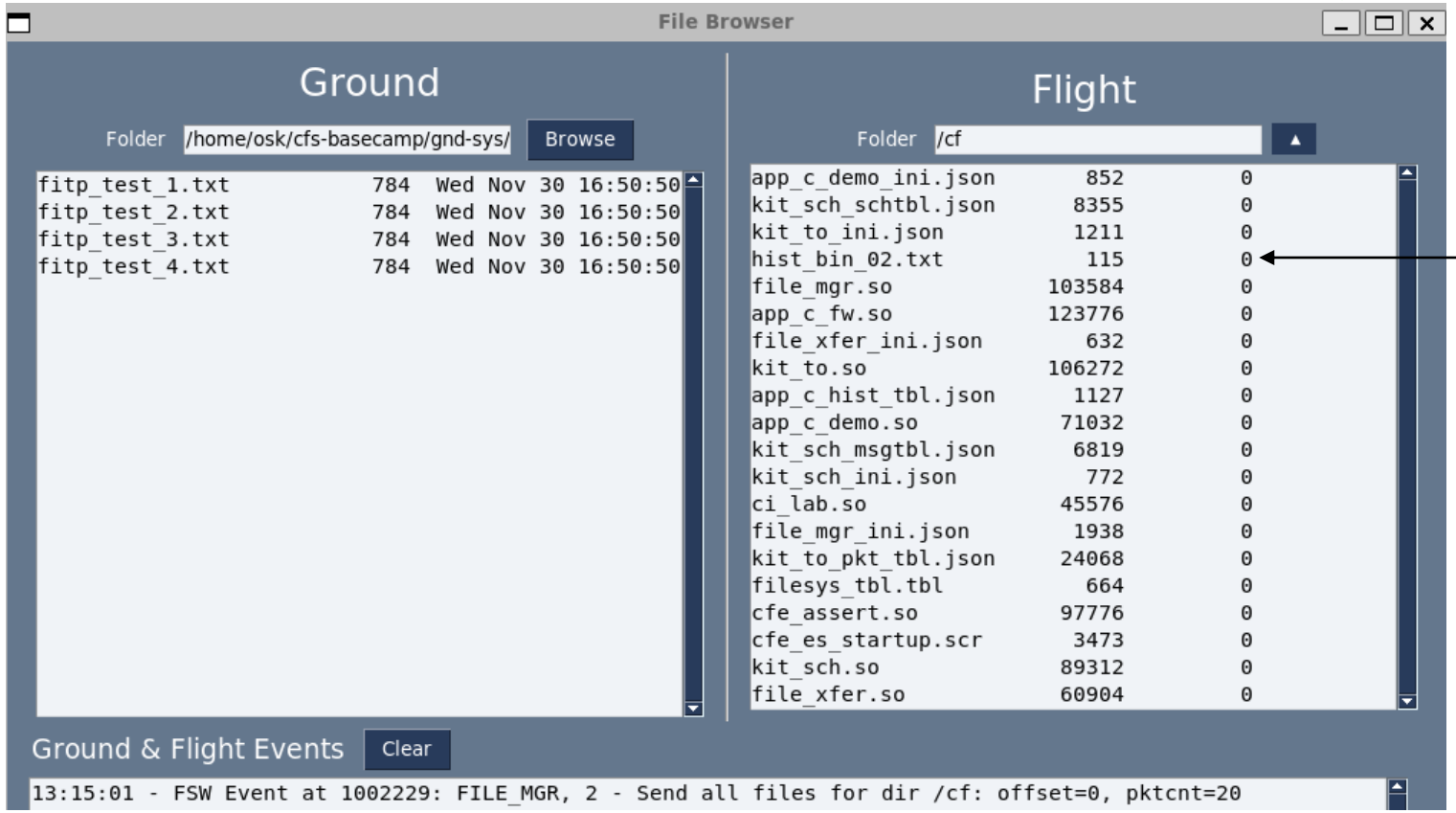
Information events are sent when the log file is created and closed

```
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

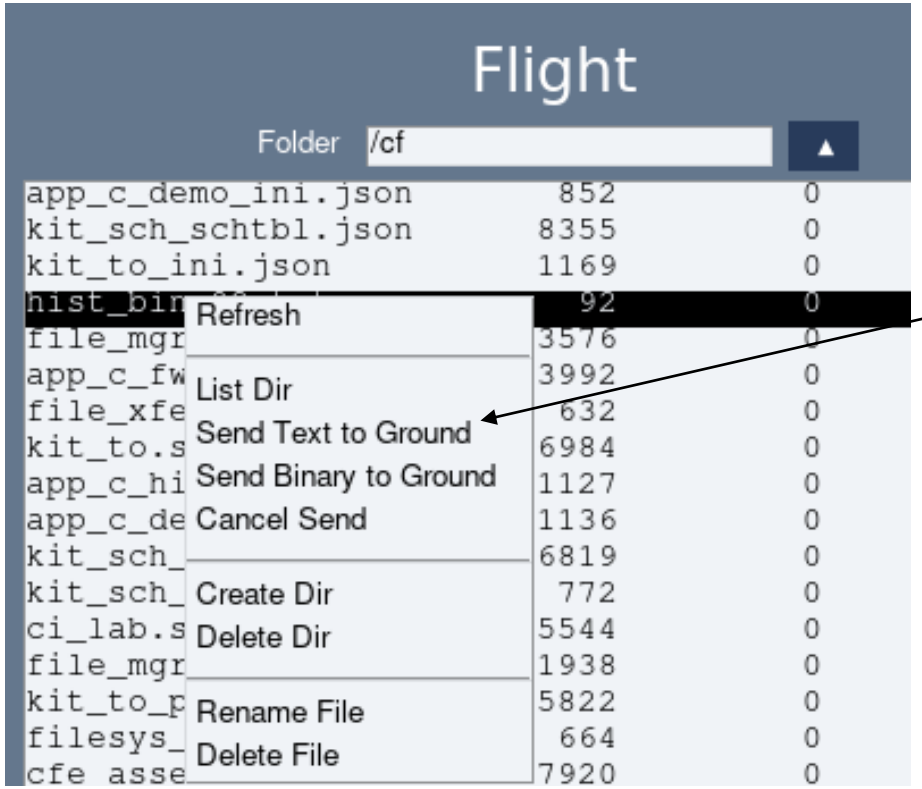
1. **After the log file is created launch the file browser**





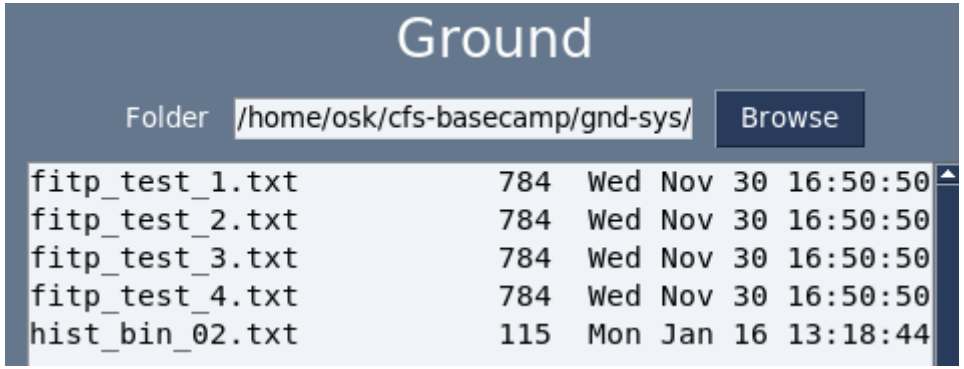
Histogram log file

Transfer the Histogram Log File

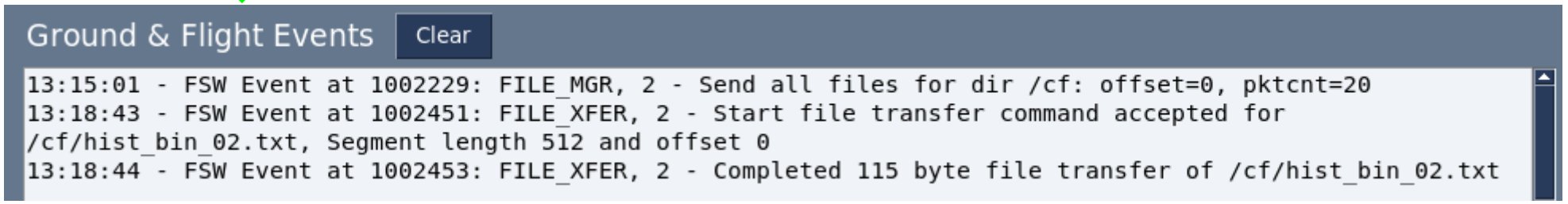


1. **Select the histogram log filename using the left mouse button**
2. **Right click to bring up a menu**
3. **Choose *Send Text to Ground***
   - **When StatusTlm.Payload.HistLogEna is FALSE the log file is complete and can be transferred**

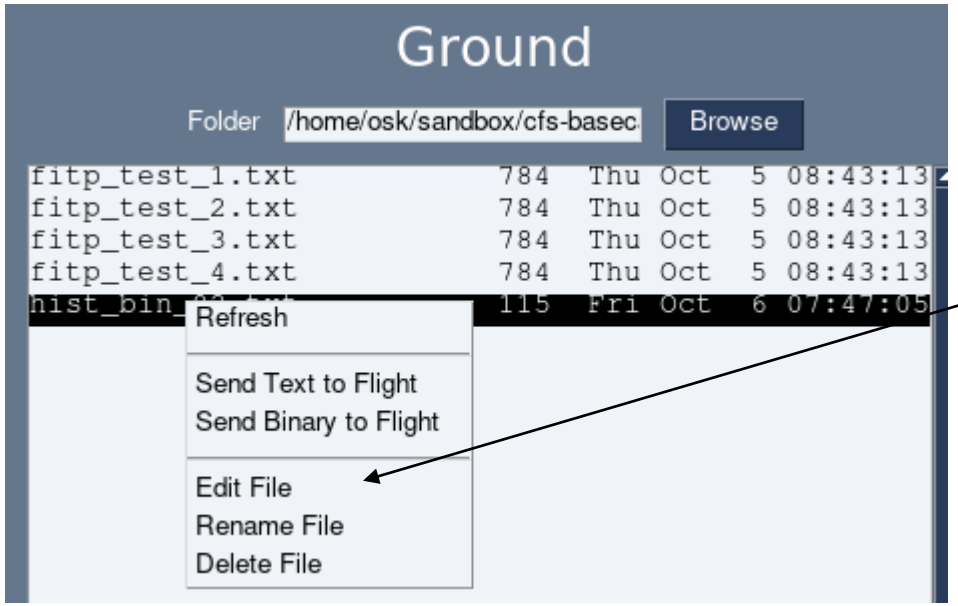
Ground listing shows log file



Events show file transfer succeeded

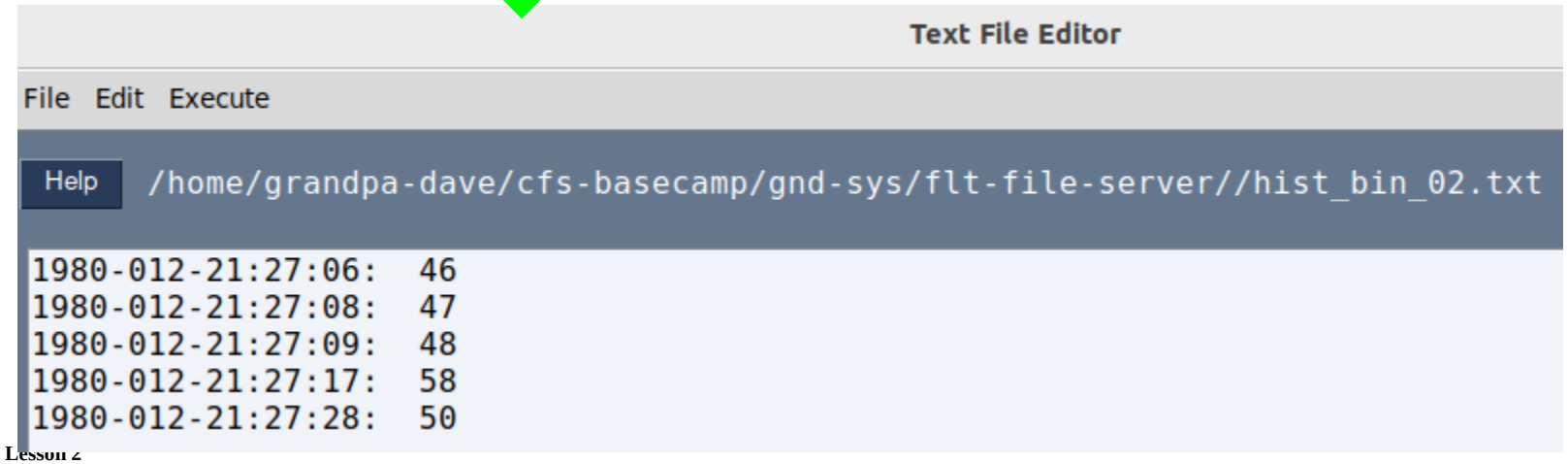


View the Histogram Log File



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

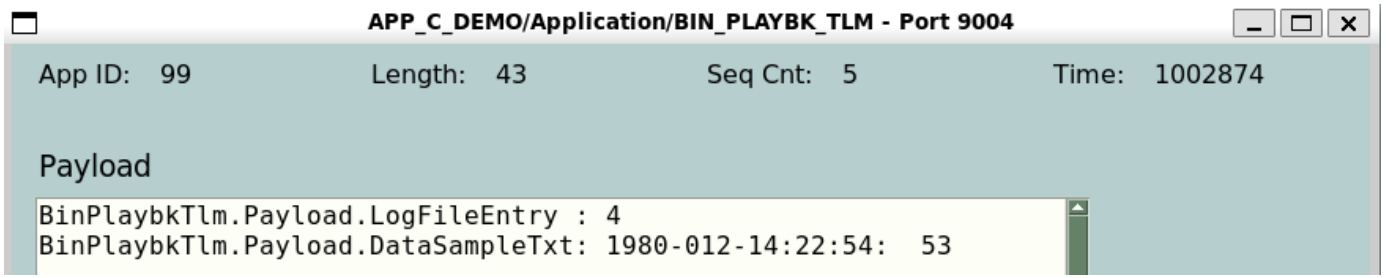


3. **Close the text editor and file browser**

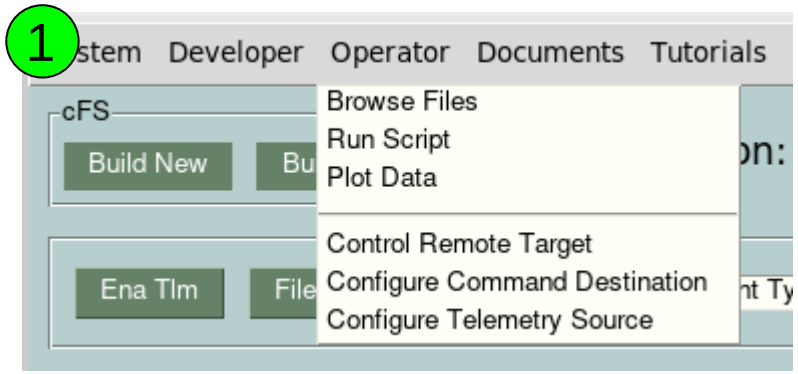
Playback Logfile in Telemetry

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



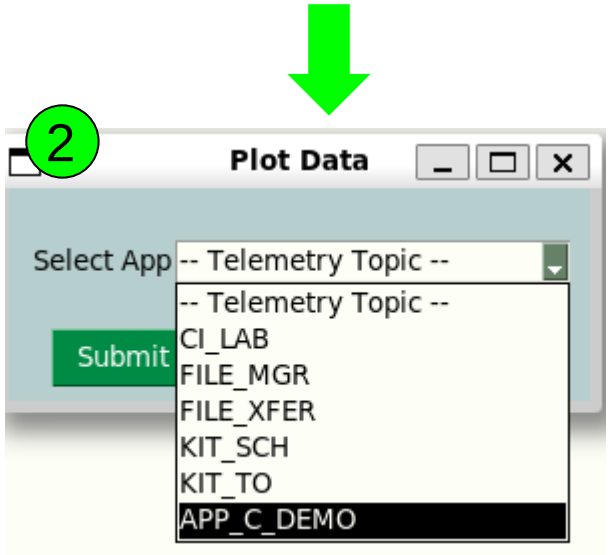
Plot Playback Log File Entry Index

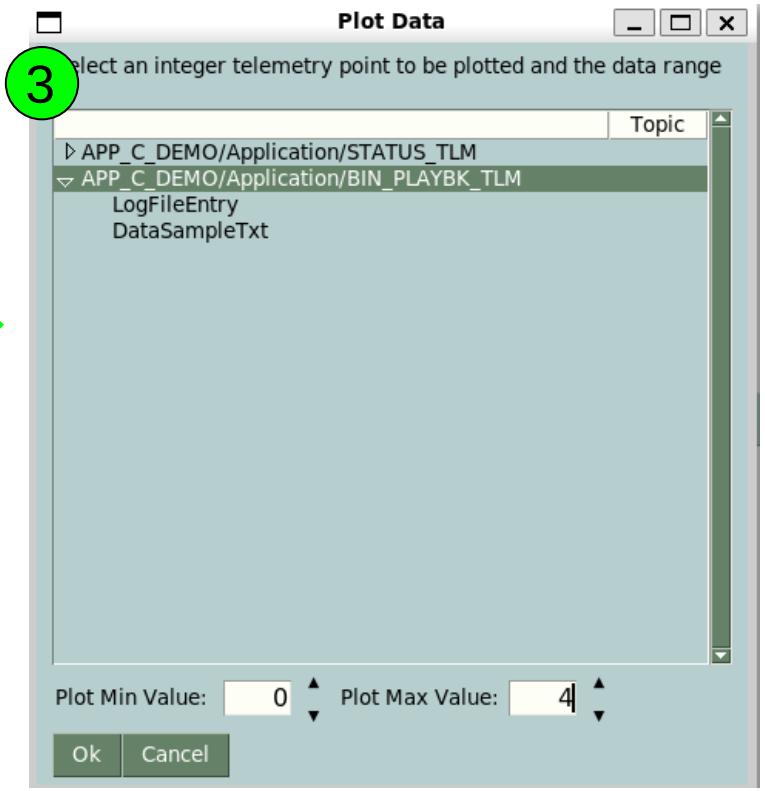


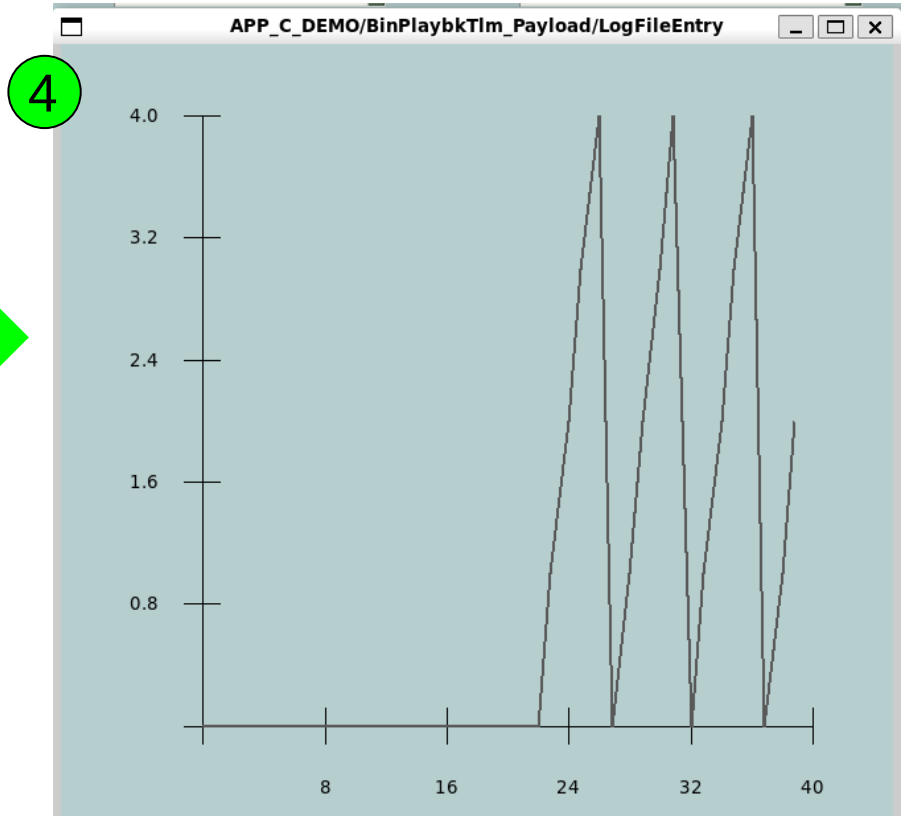
1. **Select Plot Data from the Operator menu**

2. **Select APP_C_DEMO from the Plot Data app dropdown and click <Submit>**

3. **Select LogFileEntry from the BIN_PALYBK_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



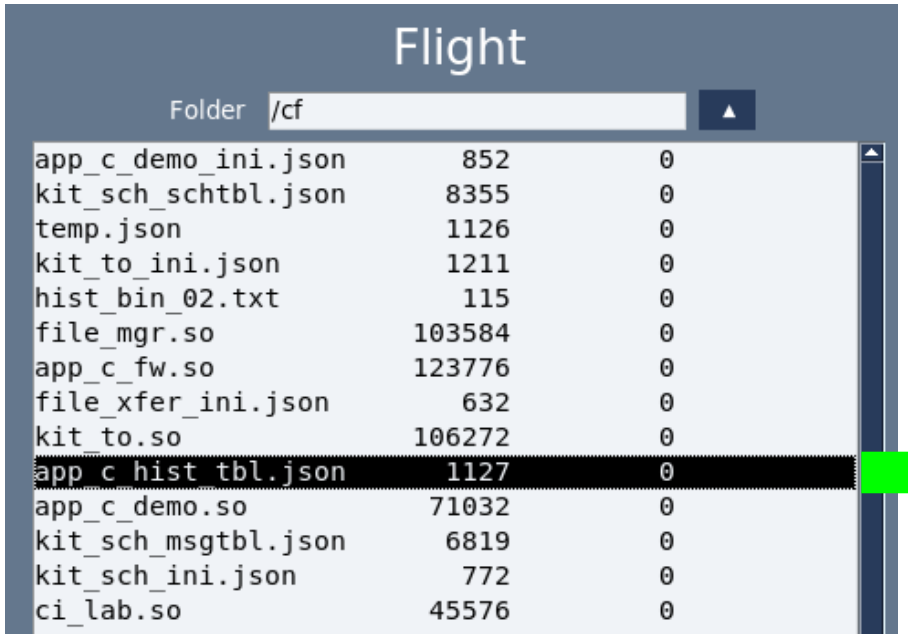


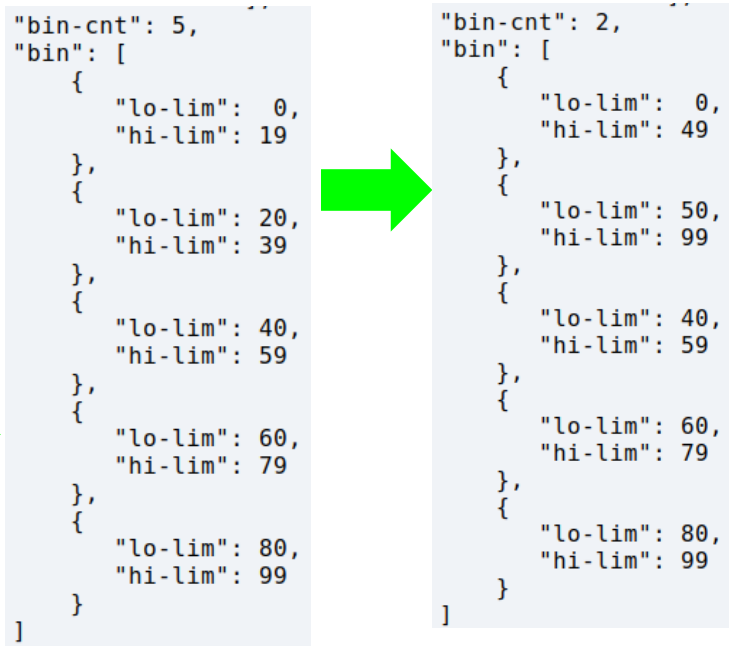


Change Bin Definition Table (1 of 2)

- 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**

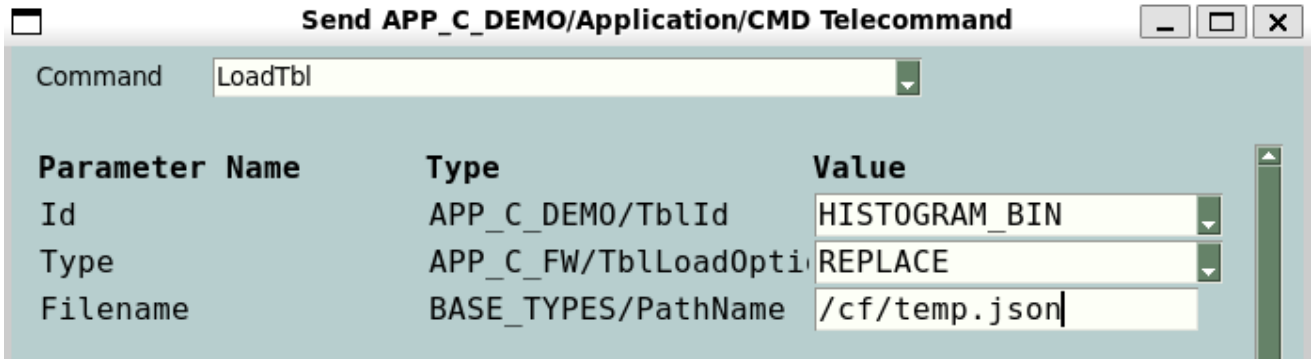




2. **Change bin-cnt from 5 to 2**
3. **Change the first two bin array entries as shown to the left**
   - The remaining bin entries must be present, and they will be ignored
4. **Save and close the file**
5. **Rename the file to temp.json**
6. **Transfer temp.json to flight**

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.HistMaxValue         : 99
StatusTlm.Payload.HistSampleCnt        : 17
StatusTlm.Payload.HistBinCntStr        : 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

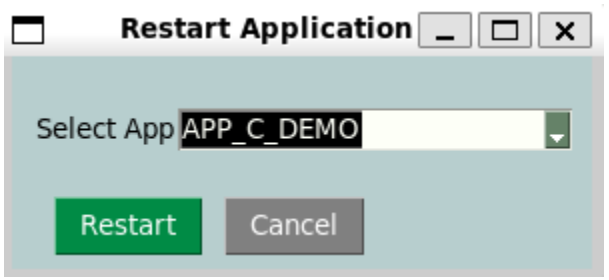
1. **Using the File Browser transfer *app_c_demo_ini.json* from flight to ground and open in the text editor**

```
"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.HistMaxValue         : 59
StatusTlm.Payload.HistSampleCnt        : 29
StatusTlm.Payload.HistBinCntStr        : 11,10,8,0,0
```