DRACO7RT · OPERATOR GUIDE · UPDATED 10 NOVEMBER 2026

COSMOS Operator Guide

Click by click: what to open, what to press, and what you should see at every stage of the mission

Written for someone who has never used the system. No terminal is needed: everything starts at **https://draco.efsi.com** in Chrome or Edge.

Slides 2 to 8 get you signed in, oriented and checked. Slides 9 to 16 fly the mission one stage at a time. Slide 19 is what to do when something looks wrong. Slides 20 and 21 cover Yamcs, the second ground station, and PlanDev planning. Words in bold are buttons or page names exactly as they appear on screen.

IF COSMOS IS NEW TO YOU

Five ideas, then the rest of this guide reads itself

What you are driving

- A simulated spacecraft: real NASA flight software running on an emulated flight computer on the server
- **COSMOS** is the ground system: the web pages an operator uses to send commands and watch what comes back
- **NASA 42** is the physics simulator. It feeds the spacecraft its GPS and gyro (IMU) data; without 42 those read NO_FIX and NO_DATA (STALE if 42 stopped after running)
- The spacecraft runs its own autonomy: once launched, most of the mission happens without you

How things are named

- **Target:** one thing you talk to: ACS (attitude and propulsion), NAV (GPS), IMU (gyros), LC and SC (onboard autonomy)
- **Packet:** a group of values that arrive together, such as HK_TLM_PKT (housekeeping)
- **Item:** one value. "ACS HK_TLM_PKT H_MAG" reads target, packet, item: the wheel momentum
- **Colors:** green = within limits, yellow = caution, red = out of limits. A blank value (null) means no data has arrived

The pages you will use

- **Home › Mission home:** the hub, one box per subsystem
- **Mission › Events:** the spacecraft narrates what it is doing: the latest line, and **Open scrolling event log** for the history
- **Tools › Cmd/Tlm Server:** is the spacecraft connected? Its **Log Messages** list shows warnings
- **Tools › Command Sender:** send one command by hand (**Select Target**, **Select Packet** = the command, fill **Value or State**, **Send** at the top right)
- **Tools › Telemetry Grapher:** plot any value over time

How to read the stage slides: **Open** = where to click, **Do** = what to press, **You should see** = the values that mean it worked, **If not** = what to try.

START HERE

The front door: sign in, read the status strip, find the way in

1. Sign in

1. Open **https://draco.efsi.com/**
2. The card **Mission control sign-in**: press the big blue **Sign in with Microsoft**, or type the shared COSMOS password in the box under it and press **Sign in with password**
3. Every COSMOS page opens on that sign-in: nobody types the COSMOS password a second time
4. You are in when the status strip at the top fills with values; top right: your email (or **Shared password**), **Sessions**, **Sign out**

2. Read the status strip (top)

- **VEHICLE** (top left): FRESH · launch-ready = on the pad, ready to go. FLOWN · this boot = a mission already ran
- **ACS MODE, FUEL KG, DEPLOYED:** SAFE, 12.000, 0b0000 before launch
- **IMU, NAV:** VALID and FIX only while 42 runs
- **42 VIEW:** running or stopped
- **STACK:** draco7 5/5 · cosmos 8 = the vehicle containers, the downlink tee and COSMOS are up
- **JOB:** idle, or the button action now running
- **COMMANDING:** COSMOS (normal) or YAMCS in amber: then hold your commands

3. Middle of the page

- **Ground stations** panel, four cards: COSMOS **Open COSMOS**, Yamcs **Open Yamcs**, PlanDev **Open Plan**, Downlink tee (counters only)
- Under it the tiles. This guide uses **Mission Control** (the COSMOS pages), **Telemetry Wall**, **Grafana Wall** and **Live 3D view**
- Others: Table Workbench, Notebooks (Python), Tutorials, Training: step by step, Presentations, Evidence, Operator guide
- At the bottom: **Demo control** (next slide)

The **Mission Control** tile (or **Open COSMOS**) opens the COSMOS pages with button rows across the top (slides 5 and 6). **Control**, top right of those pages, brings you back here.

The Demo control buttons, at the bottom of the front door

Group (label on screen)	Buttons	What they do
STACK	**Start stack**, **Fresh vehicle**, **Shut down**	Whole system on or off; Fresh vehicle = back on the pad, full tank, about 1 minute
MISSION	**LAUNCH (RTS-005)**, **Mission test (COSMOS)**	Start the mission; or launch plus an automatic check of every stage
3D VIEW	**42 start**, **42 stop**	The physics simulator and its 3D view
HEALTH	**Verify**, **Clear saved data**, **Downlink / map**	Health check; wipe the stored histories; reconnect telemetry
COMMANDING STATION	badge, **Switch to Yamcs**, **Switch to COSMOS**	Which station commands (slide 20)
YAMCS	**Mission test (Yamcs)**, **CFDP file-transfer test**	The same mission test from Yamcs; every file-transfer case

How they behave

- Each opens a confirm box saying what it will do: **Cancel** or **Run**
- Greyed = not possible now; hover any button for what it does or why it is grey
- One action at a time; every request is audited
- Under the buttons: tab **Job output** streams the log; tab **Serial console** shows the flight computer’s console, read-only; **recent jobs…** at the right reopens an earlier log

GETTING AROUND

Mission Control: two rows of buttons reach every page

Press the **Mission Control** tile (https://draco.efsi.com/viewer/). The top row picks a group, the second row a page of that group. This guide writes that as **Group › Page**.

Group	Pages (second row, left to right)	Use it for
Home	Mission home, Overview	The hub; its boxes have Open buttons
Wall	Wall (3 screens), All-in-one, GNC wall, Sensors wall, Mission wall	Big screens for a projector
GNC	Attitude & rates, ACS, GNC sensors, IMU, NAV (GPS gate), GPS from 42, IMU from 42	Pointing, spin rates, momentum, sensors
Mission	Deployments, Propulsion, Limits & autonomy, Sequences (ATS/RTS), File transfer (CFDP), Table Workbench, Tutorials, Training (step by step), Events, Event catalog, App health, SpaceCop	The mission stages and their buttons
cFS	cFS core, ES, EVS, SB, TBL, TIME, LC, SC, SCH, CI, TO, HS, CS, DS, FM, MD, MM	Flight software internals, for engineers
Tools	Command Sender, Script Runner, Limits Monitor, Packet Viewer, Telemetry Grapher, Data Viewer, Data Extractor, Notebooks (Python), Cmd/Tlm Server, Admin	The COSMOS tools
Grafana	Mission wall, IMU wall	History graphs
Yamcs	Home, Links, Packets, Parameters, Events, Archive browser, Commanding, Command history, File transfer (CFDP), Open MCT	The second station (slide 20)
3D view · Plan ↗	NASA 42 (one page, no second row) · Plan ↗ opens PlanDev in a new tab	Show the 42 picture; planning (slide 21)

GETTING AROUND, CONTINUED

What else is on every Mission Control page

Top bar, right end

- The UTC clock
- **COSMOS menus: off** (COSMOS pages only): press it to show COSMOS's own menu bar; it then reads **COSMOS menus: on**
- **Open in tab** opens the page on its own, full size
- **Control** returns to the front door; so does **DRACO7RT** at the far left

The Events dock, along the bottom

- Left: ▾ **Events** opens or closes it, **Expand** makes it tall (or drag its top edge); then the latest event line
- Right: **Source** (Yamcs or COSMOS), severity chips **DEBUG INFO ERROR CRITICAL**, a filter box, **Pause**, **Clear**, **Full page**, **Catalog**
- Hover a row to name the event; click it to open the app's page

Good to know

- A COSMOS page shows **Select Target**, **Select Screen**, **Show** at the top and the screen below in a window titled, for example, FOGI HOME; it can take 10 to 20 s to appear
- A page says **404 Not Found … was not routable**: COSMOS was slow to load it. Press F5 to reload
- Every page refreshes itself about once a second; you never need to reload to see new values
- F11 = full screen for presenting, F11 again to come back

BEFORE YOU LAUNCH · ABOUT 3 MINUTES

Stage 0: put a fresh vehicle on the pad

Open

- The front door, **https://draco.efsi.com/**
- Status strip at the top
- **Demo control** buttons at the bottom

Do

1. Read **VEHICLE**. If it says FRESH · launch-ready, go to step 3
2. Anything else (FLOWN): Demo control › STACK › **Fresh vehicle**, then **Run**. Wait about 1 minute until JOB reads idle and VEHICLE reads FRESH
3. Read **42 VIEW**. If it is not running: 3D VIEW › **42 start**, **Run**, wait about 20 seconds
4. Press the **Mission Control** tile. **Home › Mission home** opens
5. Go on to the next slide: the connection check

You should see

- VEHICLE = FRESH · launch-ready
- ACS MODE = SAFE, FUEL KG = 12.000, DEPLOYED = 0b0000
- 42 VIEW = running, IMU = VALID (about 9 Hz), NAV = FIX
- RATE SRC = IMU while 42 runs, INTERNAL when it does not; COMMANDING = COSMOS
- Mission home: every box shows numbers, none blank: MODE SAFE, SA_STATE and ANT_STATE STOWED, FUEL_STATE OK

If not: blank values everywhere: HEALTH › **Downlink / map** (reconnects telemetry). Still wrong: HEALTH › **Verify**; no line of its log (tab **Job output**, under the buttons) should read FAIL.

BEFORE YOU LAUNCH · 1 MINUTE

Stage 0, continued: is COSMOS connected, and what is it warning about?

Open

- **Tools › Cmd/Tlm Server**
- The **Interfaces** tab is open on top (first of seven tabs); the **Log Messages** list is below it

Do

1. In Interfaces find the row **CFS_INT**: COSMOS's link to the spacecraft
2. Note the number under **Tlm pkts**, wait 5 seconds, look again
3. In Log Messages open the drop-down **Filter by log level** (it shows INFO) and pick **WARN**: only warnings and errors remain
4. Read the **Message** column, newest at the top, and sort each line using the right-hand box of this slide

You should see

- **Connected** = CONNECTED in green; **Tlm pkts** bigger each time you look
- **Fine, ignore:** a YELLOW line followed within a second or two by GREEN for the same item, such as IMU HK_TLM_PKT STATE = STALE is YELLOW, then = VALID is GREEN; or ACS HK_TLM_PKT RATE_SOURCE = INTERNAL is YELLOW, then = IMU is GREEN
- **Needs attention:** a value that stays YELLOW, anything RED or at ERROR level, or "received with actual packet length"

If not: CFS_INT is not CONNECTED, or Tlm pkts stops growing: front door › Demo control › HEALTH › **Downlink / map**. A warning that does not clear: write down the message and see slide 19.

T+0 TO T+15 S

Stage 1: launch and separation

Open

- **Mission › Events**, box “Latest Event — with time tags”, for the narration; button **Open scrolling event log** for the full history
- A second tab: **GNC › Attitude & rates**

Do

1. Front door › Demo control › MISSION › **LAUNCH (RTS-005)**, then **Run** (or **Mission › Limits & autonomy**, box Actions, button **LAUNCH (RTS-005)**)
2. Watch. From here on the spacecraft flies itself; you press nothing until Stage 5
3. Prefer it fully automatic? MISSION › **Mission test (COSMOS)** instead of LAUNCH flies every stage and checks each one; follow it in the front door’s **Job output**, or **Tools › Script Runner**, menu Script › Execution Status

You should see

- Events: ACS: LIFTOFF, separation in 10 s, then ACS: SEPARATION confirmed, tipoff rates applied
- MODE goes SAFE to DETUMBLE
- WX, WY, WZ jump to about 0.03 to 0.04 rad/s (plus or minus)
- The RATE_MAG graph spikes

If not: LAUNCH is greyed and its hover says the vehicle is not fresh: do Stage 0 again (**Fresh vehicle**). Nothing in Events after 15 s: check Cmd/Tlm Server (slide 8).

T+15 TO T+40 S

Stage 2: the solar array and antenna deploy

Open

- **Mission › Deployments**: boxes Solar Array (channel 0), Antenna (channel 1), Confirmation, Safety
- Optional: **Mission › Events**

Do

1. Nothing. Two stored sequences arm and fire each deployment by themselves
2. Watch each channel climb its ladder

You should see

- Each channel steps STOWED, ARMED, FIRING, DEPLOYING, DEPLOYED
- Events: ACS: solar array ARMED, PYRO FIRED, DEPLOYING, DEPLOYED (microswitch closed); then the same for antenna
- At the end: SA_STATE = DEPLOYED, ANT_STATE = DEPLOYED, DEPLOYED_BITS = 3, PYRO_COUNT = 2

If not: a channel stops at ARMED: look in Events for "FIRE rejected". Fresh vehicle and launch again.

T+20 TO T+60 S

Stage 3: detumble, then point

Open

- **GNC › Attitude & rates**: box “Momentum & Rates — live trend” holds the RATE_MAG graph
- Optional: **GNC › GNC sensors** for the attitude estimator

Do

1. Nothing. The wheels absorb the spin from separation by themselves
2. Watch the RATE_MAG graph come down

You should see

- RATE_MAG decays toward zero
- Events: ACS: detumble complete, rates below 0.005 rad/s
- MODE goes DETUMBLE to POINT
- H_MAG (wheel momentum) starts to climb

If not: MODE stays in DETUMBLE for more than 2 minutes: note the rates and see slide 19.

ABOUT 1.5 MINUTES AFTER POINT, THEN REPEATING

Stage 4: the autonomous momentum dump

Open

- **GNC › Attitude & rates** (the H_MAG graph, box “Momentum & Rates — live trend”)
- A second tab: **Mission › Limits & autonomy**

Do

1. Nothing. This is the point of the demo: nobody touches anything
2. Watch H_MAG climb to 4.0, the limit printed on the page (“LC dumps autonomously above 4.0”)
3. On Limits & autonomy, box Limit Checker: AP_SAMPLE_COUNT ticking shows the onboard limit checker is watching

You should see

- At 4.0: MODE goes POINT to DELTA_H and back to POINT
- Events: ACS: momentum dump complete
- H_MAG drops from 4.0 to about 0.3, a cliff
- DUMP_COUNT goes up by 1; FUEL_KG goes down a little
- Then it repeats about every 100 s: a sawtooth

If not: H_MAG passes 4.0 and nothing happens: on Limits & autonomy, box Limit Checker, check ACTIVE_APS (the actionpoint is enabled); see slide 19.

ANY TIME IN POINT · OPERATOR-COMMANDED

Stage 5: a station-keeping burn

Open

- **Mission › Propulsion**: buttons in the Actions box; graph in “Fuel — live trend”

Do

1. Box Actions: press **Station-Keep 0.5 m/s**; it sends at once, with no confirmation
2. Watch DV_MS and the fuel graph
3. The burn stops itself at 0.5 m/s

You should see

- MODE: POINT to STATIONKEEP and back to POINT by itself
- DV_MS ramps to 0.5 over about 25 s
- THR0 and THR1 on-times grow (box Thrusters); FUEL_KG slopes down
- Events: ACS: station-keeping burn complete
- BURN_COUNT goes up by 1

If not: Events says "burn REJECTED - propellant exhausted": press **Refuel (12 kg)** in the same Actions box and try again.

OPTIONAL · FAULT MANAGEMENT

Stage 6: running the fuel low

Open

- **Mission › Propulsion**
- A second tab: **Mission › Events**

Do

1. Box Actions: press **Fuel demo: set LOW (2 kg)**
2. To go further: **Tools › Command Sender**, **Select Target** ACS, **Select Packet** SET_FUEL, FUEL_GRAMS 400 under **Value or State**, **Send** (CRITICAL); then FUEL_GRAMS 1 and press **Station-Keep 0.5 m/s** (EXHAUSTED)
3. Finish with **Refuel (12 kg)**

You should see

- FUEL_STATE: OK to LOW (yellow) to CRITICAL (red) to EXHAUSTED
- Events: ACS: propellant LOW, then CRITICAL, then EXHAUSTED - thrusters ineffective
- MODE goes to SAFE by itself
- Dumps and burns are REJECTED while empty
- After Refuel: FUEL_STATE = OK

If not: the buttons do nothing: check Tools › Cmd/Tlm Server (slide 8), CFS_INT must be CONNECTED. After an EXHAUSTED refuel MODE stays SAFE: send ACS SET_MODE with MODE 2 (POINT).

NEEDS 42 RUNNING

Stage 7: GPS, and the spoof response

Open

- **GNC › NAV (GPS gate)**: boxes Navigation State, Plausibility Gate, Commands, Spoof Recovery (LC AP1)
- Plus **Mission › Events** and **Mission › Limits & autonomy**

Do

1. Make sure 42 is running (front door strip: 42 VIEW = running, else 3D VIEW › **42 start**)
2. Watch FIX_COUNT climb
3. To see a spoofed fix rejected: run MISSION › **Mission test (COSMOS)** from a fresh vehicle. Its last phase sends a forged GPS fix and recovers from it

You should see

- STATE = FIX, FIX_COUNT up about 3 per second, REJECT_COUNT = 0
- LAST_GAP_S about 0.3; altitude about 400 km, speed about 7.67 km/s
- During the spoof: Events: NAV: GPS fix REJECTED; the limit checker starts RTS-006; REJECT_LATCHED = SET
- The next genuine fix is still accepted

If not: REJECT_COUNT climbs on every fix after 42 was restarted: on the NAV page, box Commands: **Gate OFF**, wait 3 s, **Gate ON**; then box Spoof Recovery: **1. Clear reject latch**, then **2. Re-arm LC AP1 (after REJECT_LATCHED = CLEAR)**.

NEEDS 42 RUNNING

Stage 8: the IMU (gyros) and sensor fusion

Open

- **GNC › IMU**: boxes Sample Stream, Validation Gate, Fault Recovery (LC AP2), ACS Rate Source
- Plus **Mission › Events**

Do

1. Make sure 42 is running
2. Watch SAMPLE_COUNT climb and RATE_SOURCE
3. A bad gyro by hand: **Tools › Command Sender**, IMU SAMPLE with GYRO_X 5.0. Afterwards press, in order, **1. Clear fault latch**, **2. Re-arm LC AP2** (box Fault Recovery), **ACS AUTO** (box ACS Rate Source)

You should see

- STATE = VALID, RATE_HZ about 9, FAULT_LATCHED = CLEAR
- GYRO_X/Y/Z small and noisy around zero while pointing
- ACS RATE_SOURCE = IMU (the spacecraft trusts the gyros)
- After a fault: FAULT_LATCHED = SET, RATE_SOURCE = INTERNAL, the mission carries on

If not: STATE = NO_DATA or STALE: 42 is not running, front door › Demo control › 3D VIEW › **42 start**. A brief STALE that returns to VALID by itself is harmless (slide 8).

GRAPHING

Telemetry Grapher: the whole mission in one picture

Set it up

1. **Tools › Telemetry Grapher**
2. At the top: **Select Target** ACS, **Select Packet** HK_TLM_PKT, **Select Item** H_MAG, then **Add Item**; repeat for RATE_MAG and FUEL_KG
3. Leave it running through the mission
4. Menu **File** (top left) › **Save Configuration** (for example acs_activity); next time **File › Open Configuration**
5. For GPS add NAV HK_TLM_PKT FIX_COUNT and REJECT_COUNT

What the shapes mean

- **H_MAG sawtooth:** momentum builds, the autonomous dump cuts it back; about every 100 s. Each tooth is the onboard loop firing with no ground
- **RATE_MAG:** one spike at separation, decays through detumble, flat near zero in POINT
- **FUEL_KG:** steps down at each dump, slopes during a burn, flat at zero when exhausted
- **FIX_COUNT:** a straight ramp while 42 feeds; REJECT_COUNT flat unless a spoof

FOR DEVELOPERS

Edit, rebuild, restart and debug the flight software from VS Code

Set up once

- VS Code on your PC with the free Remote-SSH and C/C++ extensions
- F1 › **Remote-SSH: Connect to Host...**, then File › Open Folder /home/efsi/draco7_0 (not /var/www: the stack scripts and Docker need the home path)
- The repo's .vscode folder brings the tasks, debug configurations and include paths with it
- No copy or sync: you edit the real source tree

The loop

- Edit any file: apps, tables, cFE, OSAL, PSP
- **Ctrl+Shift+B** (task **vehicle: build + restart vehicle**): cross-build for PowerPC/RTEMS, sync the dev /cf, reboot the QEMU vehicle, wait for OPERATIONAL, re-map COSMOS, restart the 42 view. About four minutes
- Run and Debug (Ctrl+Shift+D) › **Vehicle: attach to QEMU (PowerPC/RTEMS, GDB server)** › F5: set breakpoints, step, inspect variables and the call stack in the real flight image
- Apps are linked into the image, so new code always goes through a rebuild and restart

What debugging the vehicle means

- QEMU runs a GDB server; GDB talks to the emulated CPU and reads symbols from the ELF. The image is built with symbols and no optimization, so values display correctly
- You see one thread, the CPU, and the stack of whatever task was running. RTEMS tasks are not listed; the RTEMS in-target debugger does not support this board
- A breakpoint stops the whole vehicle: telemetry pauses, COSMOS shows stale values until you continue. Keep stops short
- Need per-task breakpoints? **Native: launch core-cpu1 (all apps as threads)** runs the same mission as a Linux process with every app as a thread

Claude Code runs on the server in the VS Code terminal and can do each step: /fsw-change edits, tests, rebuilds and verifies; /fsw-debug attaches GDB and reports; /cosmos-screen builds a telemetry page and checks it live. A person reviews before commit. Full notes: tools/dev/README.md.

WHEN IT DOES NOT LOOK RIGHT

Troubleshooting: what you see, what to press

What you see	What to do
A page says 404 Not Found … was not routable	Press F5. COSMOS was slow to load the page
Blank values (null) on every page	Front door › Demo control › HEALTH › **Downlink / map**. Still blank: HEALTH › **Verify**, then STACK › **Fresh vehicle**
Blank values on one page only	Front door › HEALTH › **Downlink / map** (re-links ACS, NAV and IMU)
Values shown but never change	Tools › Cmd/Tlm Server, row CFS_INT: is Tlm pkts growing? If not, **Downlink / map**
IMU NO_DATA or STALE, NAV NO_FIX or STALE	42 is off: front door › 3D VIEW › **42 start**
Yellow STALE / INTERNAL that turns green again	Nothing; see slide 8
NAV rejects every fix after 42 restarted	GNC › NAV (GPS gate): **Gate OFF**, 3 s, **Gate ON**, **1. Clear reject latch**, **2. Re-arm LC AP1 (after REJECT_LATCHED = CLEAR)**
RATE_SOURCE stuck at INTERNAL after a fault	GNC › IMU: **1. Clear fault latch**, **2. Re-arm LC AP2**, **ACS AUTO**
LAUNCH or a Mission test greyed or refused	Hover it for the reason. Not fresh: **Fresh vehicle**, wait for FRESH · launch-ready
Anything else odd	STACK › **Fresh vehicle** (about 1 minute). Tell an engineer what you saw

SECOND GROUND STATION

Yamcs: a second ground station on the same telemetry

What and where

- **Yamcs** is open-source mission control software. Here it runs beside COSMOS
- Open it: front door › Ground stations › **Open Yamcs**, or Viewer › Yamcs › **Home**; both open the **draco** instance's Home page (live packet table)
- Address: **https://draco.efsi.com/yamcs/**. The front-door sign-in covers it; Yamcs asks for no password of its own
- In the left sidebar: Telemetry › **Packets** and **Parameters**, and **Archive browser**, show the telemetry; **Events** shows the flight event messages
- It keeps up to 30 days (Start stack and Clear saved data empty it). Viewer › Yamcs › **Open MCT** draws displays from it

How it relates to COSMOS

Vehicle → **Downlink tee** → **COSMOS**, **Yamcs**

- The vehicle sends **one** telemetry stream. The downlink tee copies every packet to both stations
- Same packet and field names as COSMOS: Yamcs's list of packets is generated from the COSMOS one
- Yamcs stamps each packet with the time it arrived
- **COSMOS stays primary:** the screens and the Demo control MISSION buttons use COSMOS. Demo control › YAMCS › **Mission test (Yamcs)** flies the same test from Yamcs

Commanding: one station at a time

- Yamcs can command the vehicle too, but that is **off** by default. The strip cell **Commanding** shows **COSMOS**
- To command from Yamcs: front door › Demo control › COMMANDING STATION › **Switch to Yamcs** (badge: YAMCS commanding), then Yamcs › Commanding › **Send a command**
- When done: **Switch to COSMOS** (same group). A Yamcs restart also switches back
- **Never command from both at once.** Both reach the same vehicle and move the same command counters
- Nothing enforces this: anyone signed in can switch it on in Yamcs › Links. Agree who commands first

The front door's **Ground stations** panel shows a dot for COSMOS, Yamcs, PlanDev and the downlink tee: green = working, amber = up but no telemetry arriving (for Yamcs also: commanding switched on), red = down.

PLANNING

PlanDev: the mission day, planned and simulated before it flies

What it is

- **PlanDev** (NASA, formerly called Aerie) plans, schedules and simulates spacecraft activities
- It **only plans**. It never sends a command to the vehicle
- The DRACO model has 10 activity types, almost all a real command or stored sequence: Launch, Deploy, MomentumDump, StationKeep and more
- Its graphs (ACS mode, wheel momentum, propellant, NAV gate and more) use the flight software's own rates and limits

Open plan 11

1. Front door › Ground stations › **Open Plan** (or **Plan ↗**, right end of Mission Control's top row). A new tab opens **plan.draco.efsi.com**
2. PlanDev's own login: type **any** name and password, press Login. Everyone is an administrator, so change only what you made
3. In the Plans list, **double-click** ID 11, **DRACO launch day**
4. Top: one timeline row per activity type. Middle: the graphs. Bottom: every activity with its start time

What plan 11 shows

- One hour from 2026-10-23 14:00 UTC (PlanDev writes the date as **2026-296**)
- **First 10 minutes:** the mission test in order: downlink on, pre-launch checks, launch, station-keeping burn, IMU fault and recovery, GPS spoof check
- **7 automatic momentum dumps** by minute 14: the vehicle's own autonomy, at $|H| > 4.0$ N m s
- **From minute 15:** 34 MomentumDumps placed by the scheduler keep $|H|$ at or below 3.5 N m s
- Simulated propellant: 12.000 → 9.445 kg in the hour

Direct link once signed in: **https://plan.draco.efsi.com/plans/11**. Flown on the vehicle on 22 October: 155 of 155 checks (Ground System deck). It predicts this QEMU vehicle, not a real spacecraft.