

LOFT ORBITAL

SatDevOps

Loft Orbital's approach to Satellite Operations

COMET CNES – March 30th

What is SatDevOps?

SatDevOps is a *satellite operations methodology and philosophy* with which we can:

- operate satellites
- develop systems
- create a feedback loop between operations & development
- scale sustainably

to ***provide space infrastructure.***

There is no dedicated *satellite operations team* at Loft.

Company



FUNDING
~ \$200M

EMPLOYEES
> 135



Toulouse, France



San Francisco, California



Golden, Colorado

Space Infrastructure

Loft is building a **space infrastructure** to enable its customers to fly and operate any mission faster, simpler and safer.



UNIVERSAL

Any payload: physical or software-defined.

Support from one-off to mega-constellations.



FAST

Accelerate schedule from design to orbit.

Integrate within days, not months.

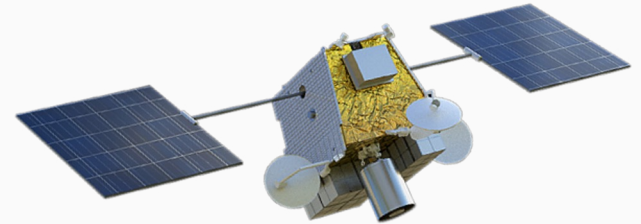
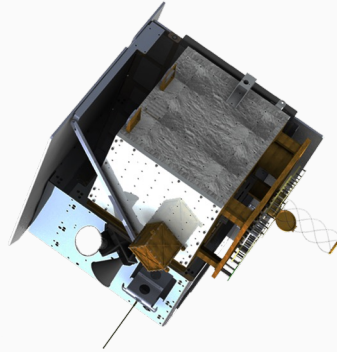
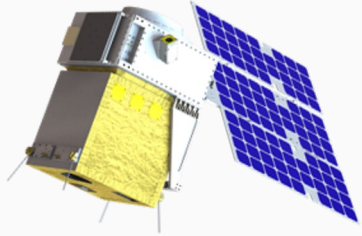


SIMPLE

No specific knowledge required to operate mission.

Full automation focusing on scalability and performance.

Platforms



Customers

OUR CLIENTS

**INSTITUTIONAL & COMMERCIAL
CUSTOMERS TRUST US**



0 TO 70 KG PAYLOAD CAPACITY
> 70 KG IN DEDICATED CONFIGURATION



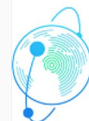
**PHYSICAL AND MASSLESS
PAYLOADS**



**SUPPORTS ANY APPLICATION
IN LEO**



**SINGLE PAYLOADS
AND CONSTELLATIONS**



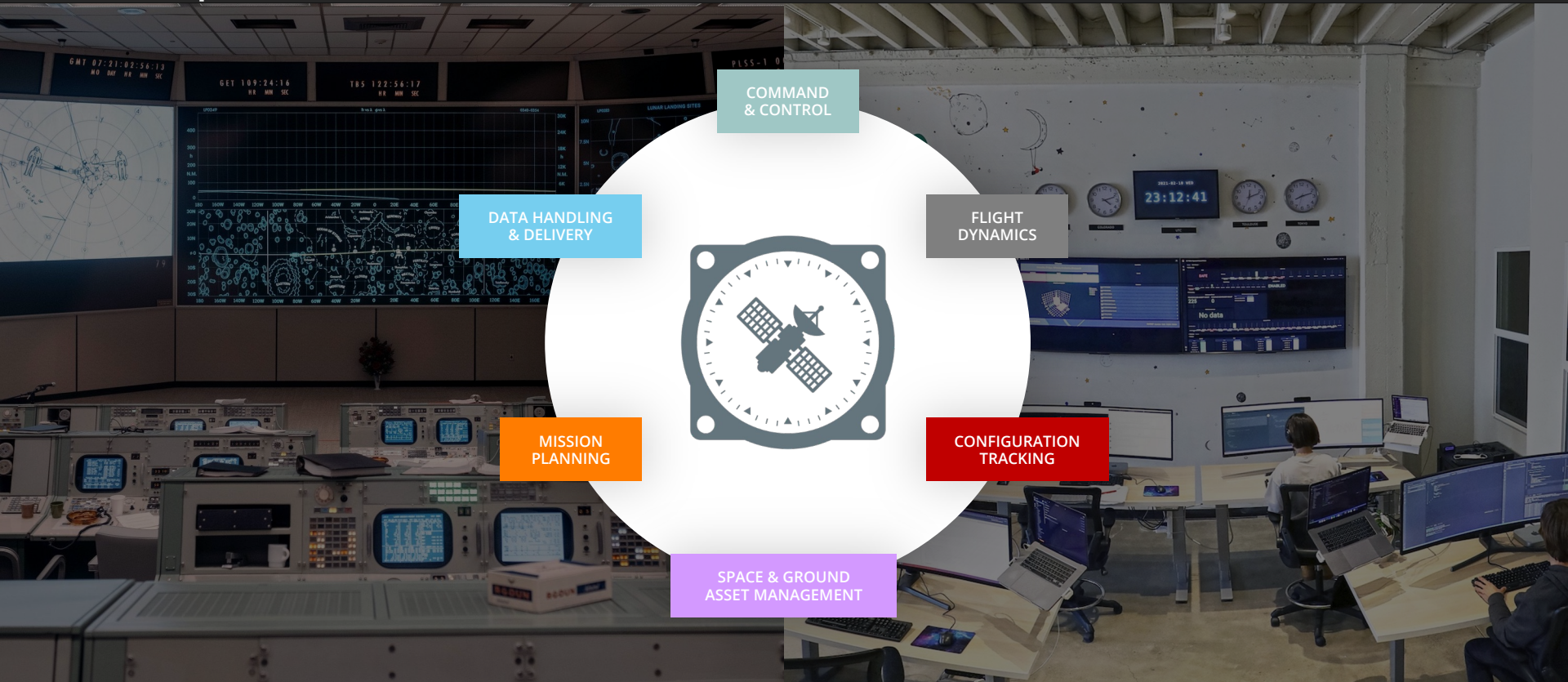
EarthDaily
analytics



Ball Aerospace
& Technologies Corp.

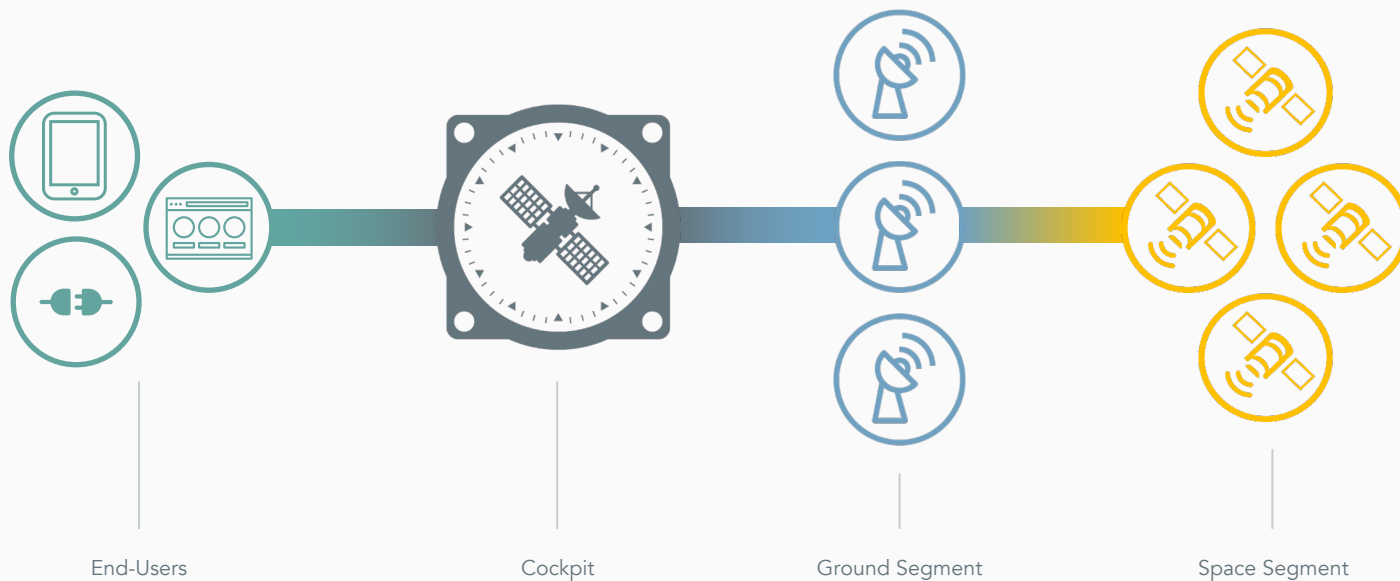


Cockpit Mission Control System



Background: Space Infrastructure

Cockpit empowers end-users with powerful satellite constellation management capabilities while **abstracting away** the complexity of spacecraft operations.



High levels of automation

1

Customer tasks
payload
Via Cockpit's UI or API



2

Cockpit schedules
spacecraft
commands



3

Schedule sent
to satellite
via ground station



4

Data is delivered
to the client



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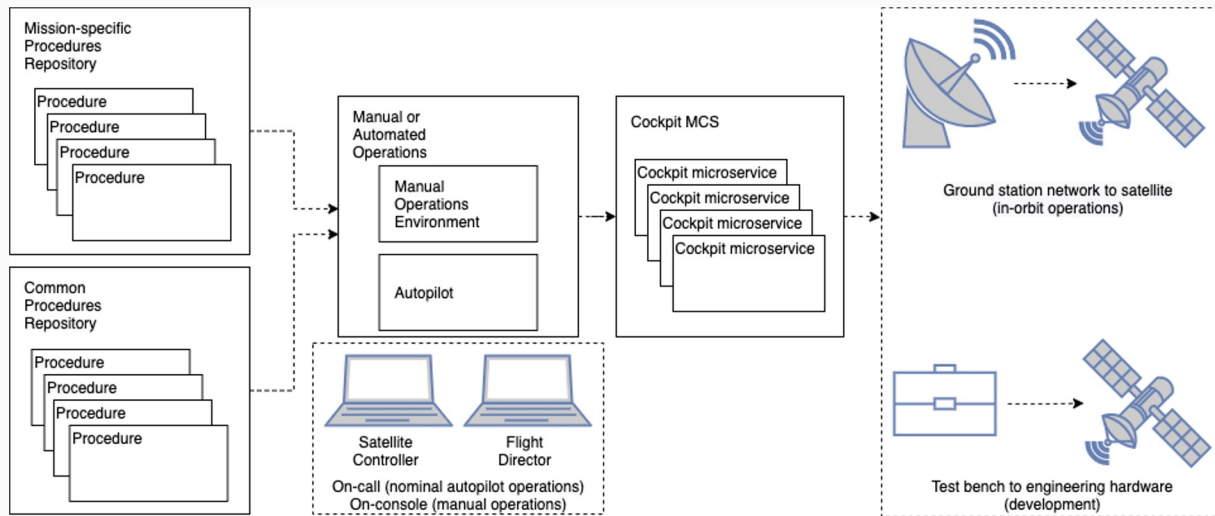
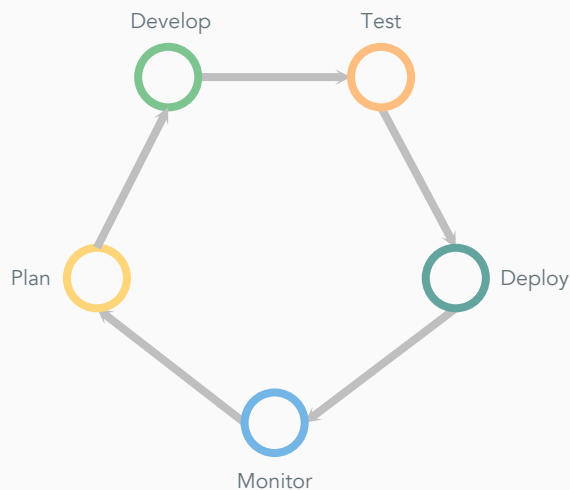
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SatDevOps Core Competencies

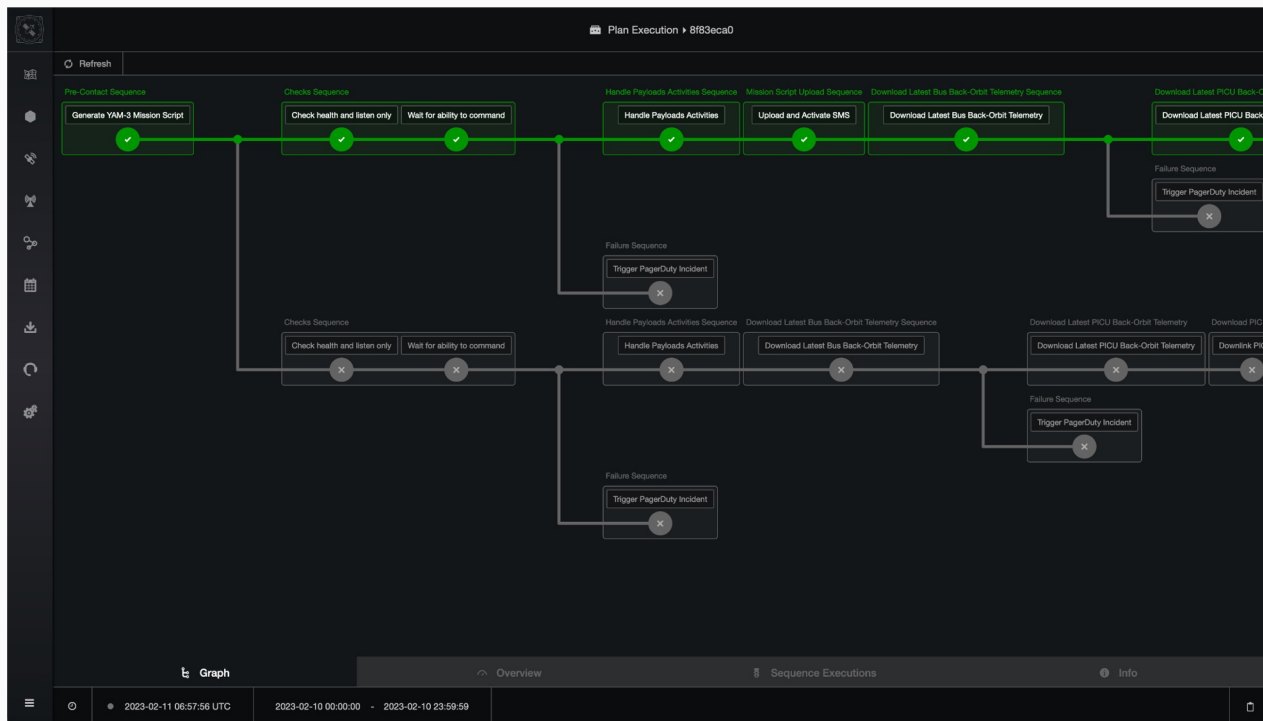
1. Build processes, then automate them
2. Abstracted automation for a heterogeneous fleet
3. Infrastructure for on-call (not on-shift) operations
4. Test-as-you-fly
5. Unified interfaces usable by both software and people
6. Train developers and engineers as operators

1. Build processes, then automate them



DevOps heritage; SatOps rigor: operations velocity.

2. Abstracted automation for space infrastructure



Reusability, standardization, modularity—simplify for both the operator and developer.

3. Infrastructure designed for on-call



On-call



On-shift

3. Infrastructure designed for on-call


Context:
Cluster:
Users:
K8s Rev:
CPU: 2%
MEM: 23%

<0> all
<1> cockpit
<2> default

<a> Attach
<ctrl-d> Delete
<d> Describe
<e> Edit
<t> Help
<ctrl-k> Kill

<l> Logs
<p> Logs Previous
<shift-f> Port-Forward
<s> Shell
<n> Show Node
<f> Show PortForward

<y> YAML

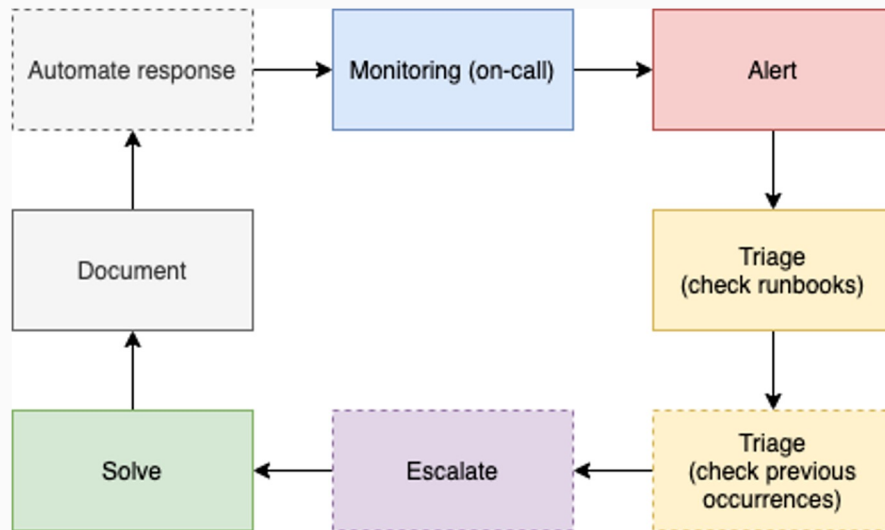


NAME	PF	READY	RESTARTS	STATUS	CPU	MEM	%CPU/R	%CPU/L	%MEM/R	%MEM/L	IP	NODE	AGE
satellite-operator-7f5c8675cf-5lrgj	●	3/3	0	Running	2	859	0	0	15	15		gke-main-highcpu-non-preemptible-b02a47c2-z1ri	2d21h
satellite-operator-celery-beat-85f78b6c5c-94z8w	●	2/2	0	Running	2	199	0	0	30	30		gke-main-highcpu-non-preemptible-b02a47c2-anog	2d21h
satellite-operator-celery-worker-6cfff69b8c5-wszrg	●	2/2	0	Running	8	565	0	0	22	22		gke-main-standard-2f15e217-yq8g	2d21h
satellite-operator-celery-worker-6cfff69b8c5-x4kwh	●	2/2	0	Running	56	1514	5	4	65	65		gke-main-highcpu-non-preemptible-b02a47c2-0hob	2d21h
satellite-operator-celery-worker-connection-659598c6b6-jwzd6	●	2/2	0	Running	8	1513	0	0	65	65		gke-main-highcpu-non-preemptible-b02a47c2-0c6i	2d21h
satellite-operator-celery-worker-connection-659598c6b6-zshp7	●	2/2	0	Running	35	1506	3	2	65	65		gke-main-highcpu-non-preemptible-b02a47c2-cizv	2d21h
satellite-operator-celery-worker-connection-659598c6b6-zxx4l	●	2/2	0	Running	8	1513	0	0	65	65		gke-main-highcpu-non-preemptible-b02a47c2-1qga	2d21h
satellite-operator-celery-worker-operation-9d7d75856-9gk9	●	2/2	0	Running	32	1513	3	2	65	65		gke-main-highcpu-non-preemptible-b02a47c2-2yng	2d21h
satellite-operator-celery-worker-operation-9d7d75856-jwvp9	●	2/2	0	Running	39	498	3	3	21	21		gke-main-standard-2f15e217-ohra	2d21h
satellite-operator-celery-worker-sub-connection-565f76fbfb2d64c	●	2/2	0	Running	46	1517	4	3	66	66		gke-main-highcpu-non-preemptible-b02a47c2-0hob	2d21h
satellite-operator-celery-worker-sub-connection-565f76fbfbchmzc	●	2/2	0	Running	46	497	4	3	21	21		gke-main-standard-2f15e217-b036	2d21h
satellite-operator-celery-worker-sub-connection-565f76fbfbjnwppq	●	2/2	0	Running	7	499	0	0	21	21		gke-main-standard-2f15e217-kcal	2d21h
satellite-operator-celery-worker-sub-connection-565f76fbfbnswm	●	2/2	0	Running	45	495	4	3	21	21		gke-main-standard-2f15e217-a119	2d21h
satellite-operator-celery-worker-sub-connection-565f76fbfbw7jd	●	2/2	0	Running	44	494	4	3	21	21		gke-main-standard-2f15e217-q5am	2d21h
satellite-operator-celery-worker-transaction-76b9b4cc5d-2smbg	●	2/2	0	Running	8	1521	0	0	66	66		gke-main-highcpu-non-preemptible-b02a47c2-anog	2d21h
satellite-operator-celery-worker-transaction-76b9b4cc5d-kgdv7	●	2/2	0	Running	42	499	4	3	21	21		gke-main-standard-2f15e217-201k	2d21h
satellite-operator-celery-worker-transaction-76b9b4cc5d-q2q9r	●	2/2	0	Running	8	495	0	0	21	21		gke-main-standard-2f15e217-b036	2d21h

<namespace>
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Software Infrastructure

3. Infrastructure designed for on-call



Process Infrastructure

3. Infrastructure designed for on-call



Human Infrastructure

4. Test-as-you-fly



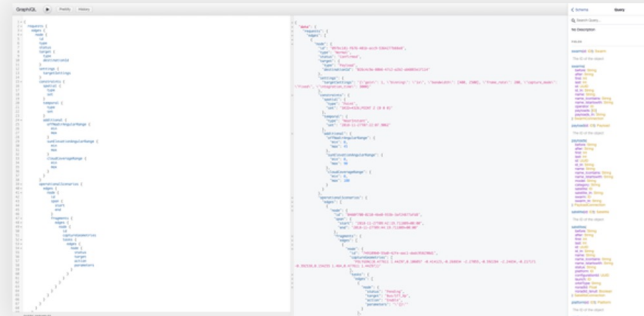
Test/Fly: same systems, automated, operations-oriented.

5. Unified Interfaces

Leveraging the latest **web technologies**,
Cockpit exposes interfaces for interactive and programmatic access.



Graphical Web Apps



APIs

GraphQL

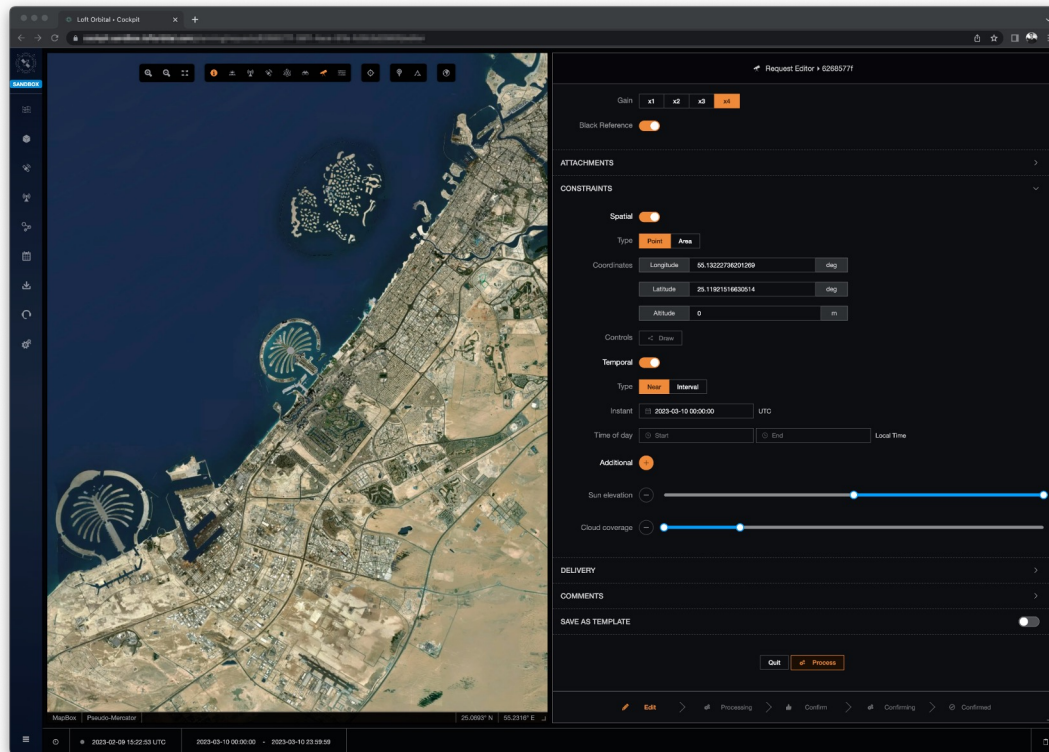
5. Unified Interfaces

```
from cockpit.asset import Payload
from cockpit.mission import Request

# Create request
request = Request.create(
    target=Request.Target(
        type=Request.Target.Type.Payload,
        destination=Payload.get(name="My Thermal Infrared Imager")
    ),
    settings=Request.Settings(
        target_settings={"exposure_time": 1000, "gain": 4},
    ),
    constraints=Request.Constraints(
        spatial=Request.Constraints.Spatial(
            type=Request.Constraints.Spatial.Type.Point,
            set="SRID=4326;POINT Z (55.2962 25.2770 0.0)",
        ),
        temporal=Request.Constraints.Temporal(
            type=Request.Constraints.Temporal.Type.NearInstant,
            set="2023-03-10T00:00:00Z",
        ),
        additional=Request.Constraints.Additional(
            sun_elevation_angular_range=(0.0, 90.0),
            cloud_coverage_range=(0.0, 20.0),
        ),
    ),
    comments="Collecting thermal infrared data over Dubai.",
)

# Submit request for processing
await request.process()

# Select and confirm first available operational scenario
await request.confirm(request.operational_scenarios.first())
```



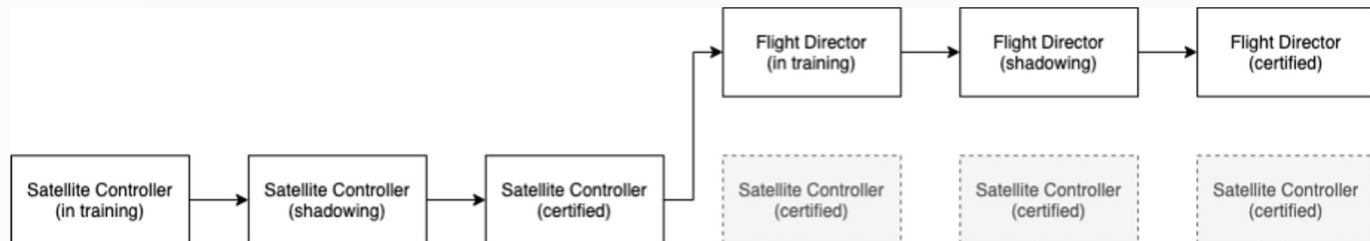


6. Training



SatDevOps Academy

- › SatDevOps Academy
 - Course: Loft Orbital
 - › Course: Cockpit
 - ▼ Course: Satellite Operations
 - › OPS-1.1: What is Satellite Operations?
 - › OPS-1.2: Spacecraft Overview
 - › OPS-1.3: SatOps Tools and Infrastructure
 - › OPS-1.4: Communication & Alerting
 - › OPS-1.5: Procedures
 - OPS-1.6: SatCon Workflows and Responsibilities
 - [WIP] OPS-2.1: Flight Director Workflows and Responsi...
 - › Cohorts

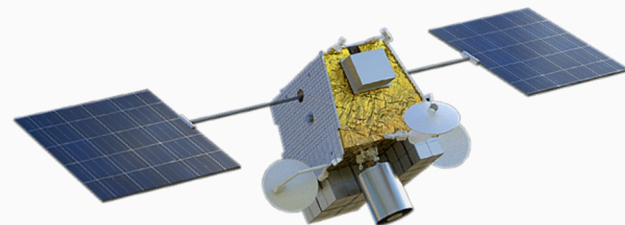
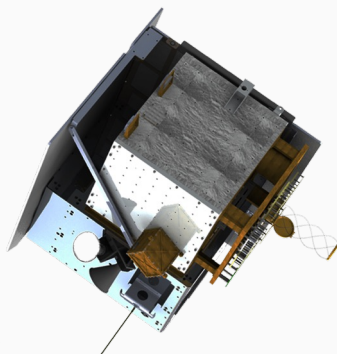
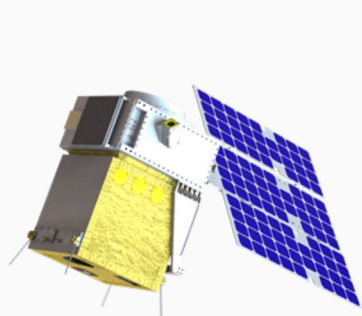


SatDevOps Academy

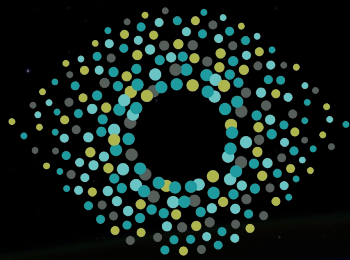
Implications

- Space made simple—for everyone
- Efficiency, velocity, & quality
- Create better mutual understanding
- Build a good product—and build the *right* product

Case Study: YAM-2, YAM-3, YAM-5, Beyond

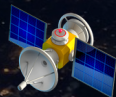


- Monday to Friday: SatCon to implementation
- The *wisdom of production*
- Beyond operations



LOFT ORBITAL

THANK YOU



Space Made Simple.