# ESAW 2017

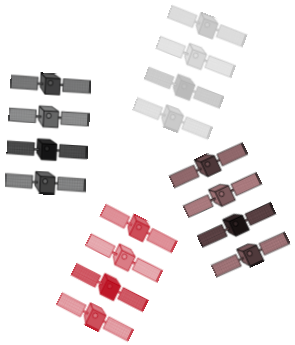
## Architecting a massive satellite constellation ground system



Jun-2017

INNOVATING SOLUTIONS

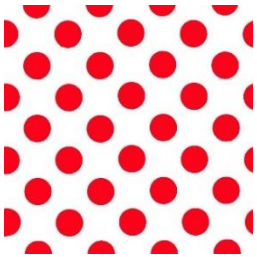
# HIGHLIGHTS



GMV is developing a Command and Control system for a 1000+ LEO telecom satellite fleet

The system is based on ***hifly***, the GMV suite of COTS for satellite fleet monitoring and control

hifly



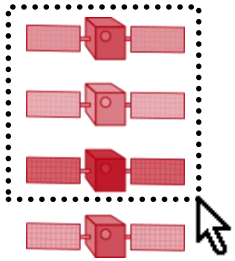
***hifly*** will be left largely unmodified, adaptations for: massive fleet support:

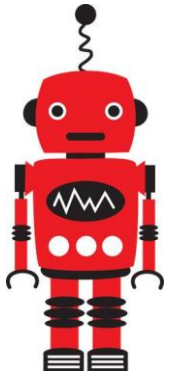
- Downsizing
- Fleet HMIs (groups of satellites)
- Massive fleets awareness (***fleetDashboard***)

# HIGHLIGHTS

Satellites are ECSS PUS compliant: supported by ***hifly*** out-of-the-box

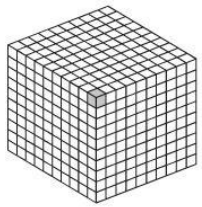
Grouping of satellites is essential: changing an out-of-limits definition for a set of satellites at the same time…





Nominal operations can be fully automated; (known) anomaly recovery will also be automated as mission evolves

# HIGHLIGHTS



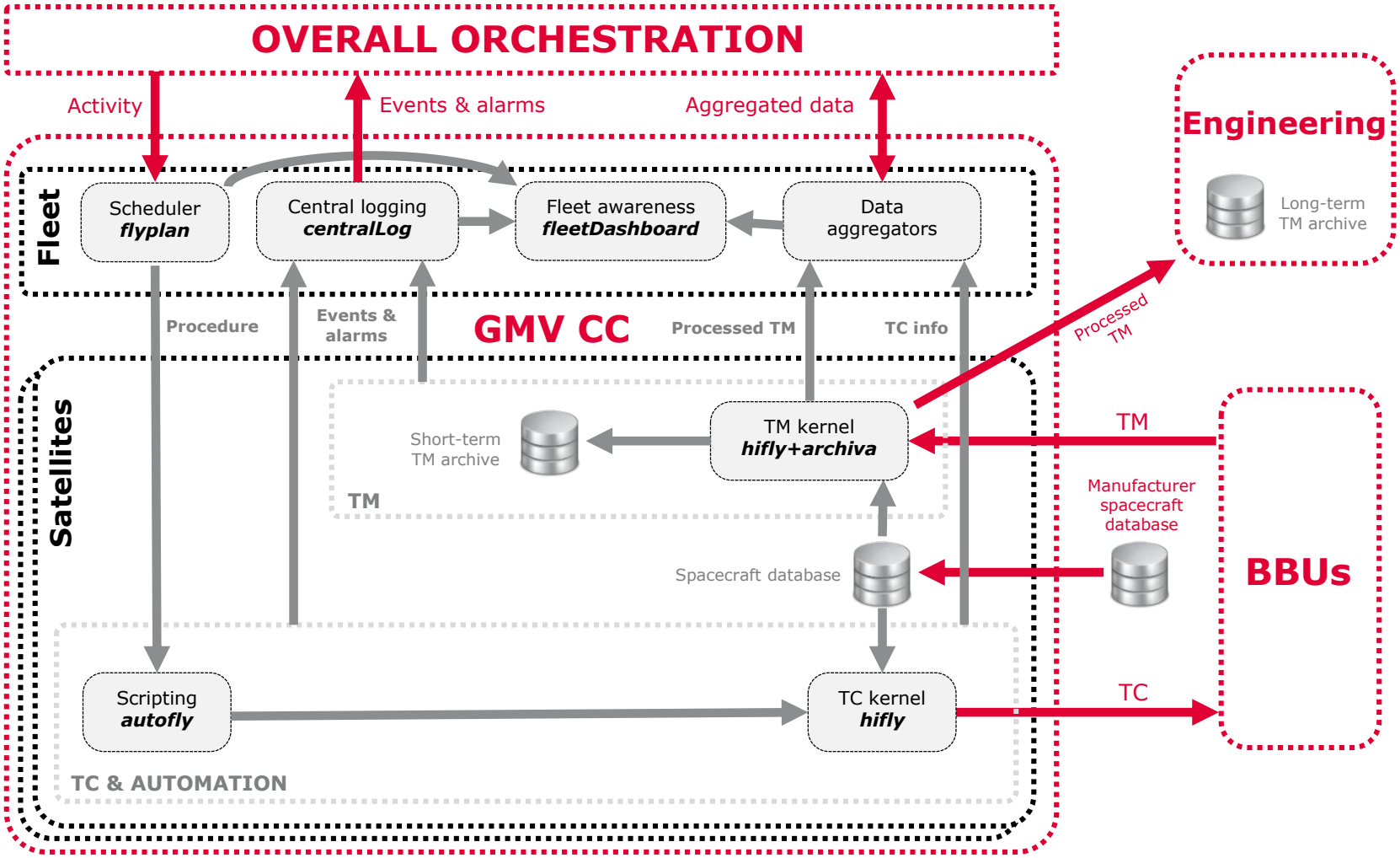
The deployment model is very simple:

- One (redundant) ***hifly*** core instance per satellite
- One (redundant) set of fleet tools for the complete fleet

Aimed for real-time operations: the archive is short-term (say 1 month): processed TM is forwarded to engineering for long-term archive

The Command and Control system features many interfaces, particularly for overall orchestration of the fleet operations

# ARCHITECTURE

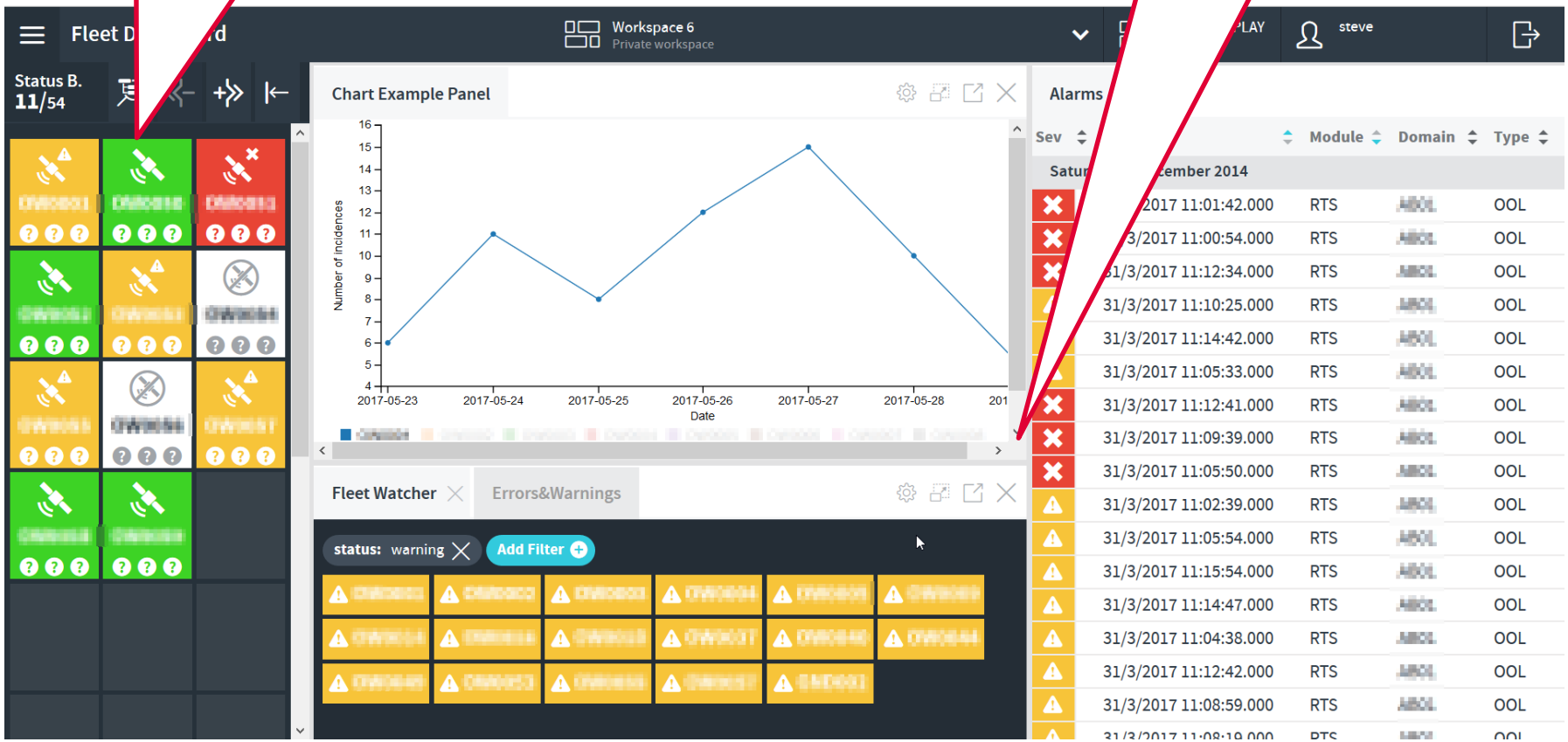


# FLEET AWARENESS – STATUS BOARD

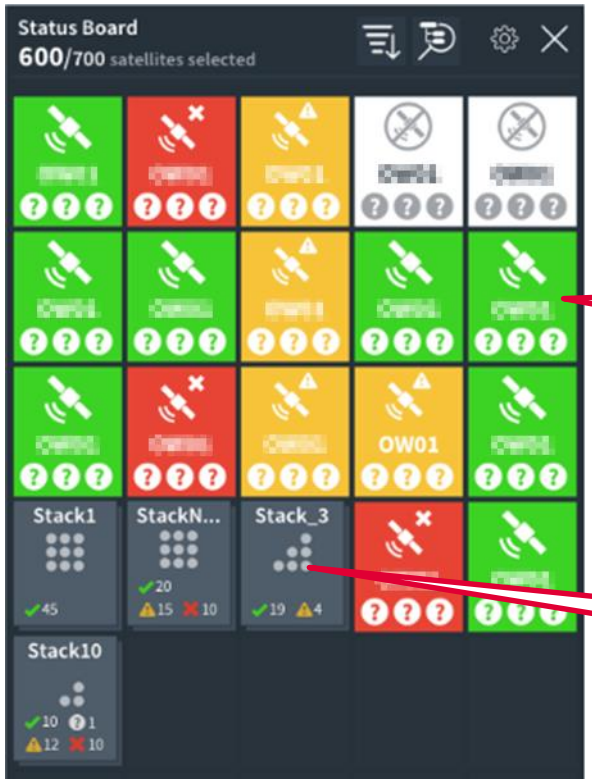
Status board: subset of satellites in the fleet

Panels: data about the subset of satellites in the status board



# FLEET AWARENESS – STATUS BOARD

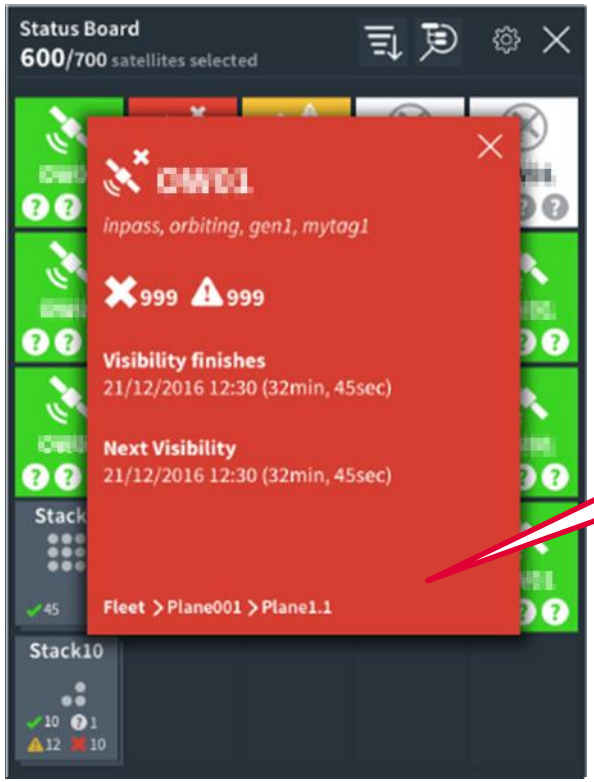



Cards are individual satellites…

…and can be stacked

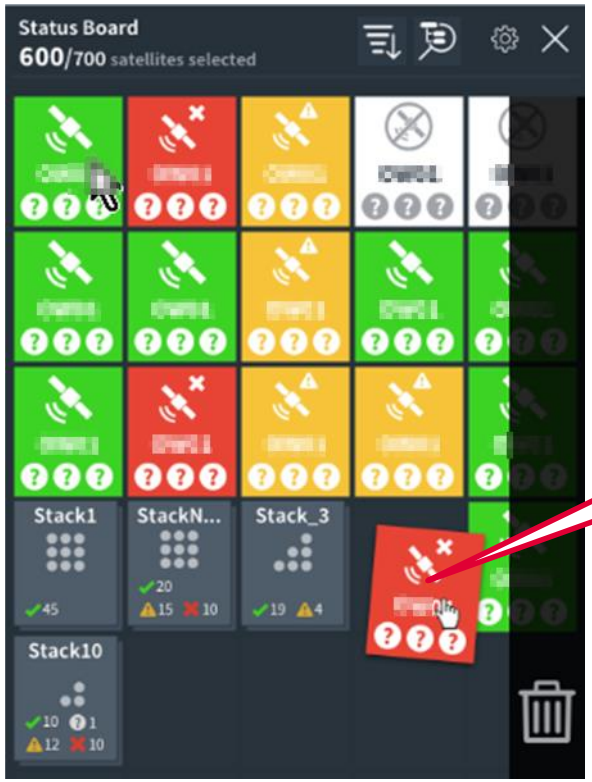
# FLEET AWARENESS – STATUS BOARD




Cards can be flipped for further information

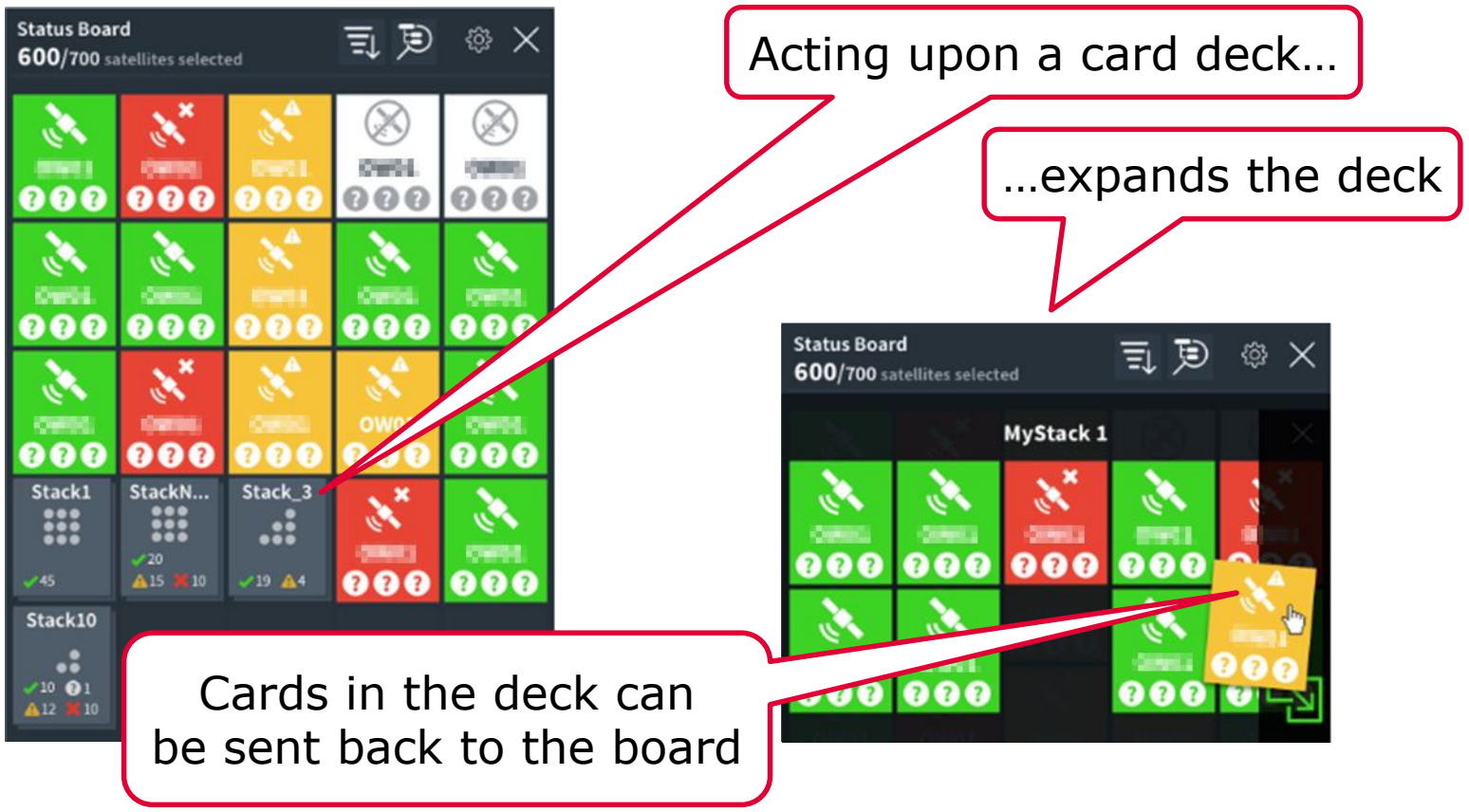
# FLEET AWARENESS – STATUS BOARD




Cards can be dragged onto the trash bin

# FLEET AWARENESS – STATUS BOARD



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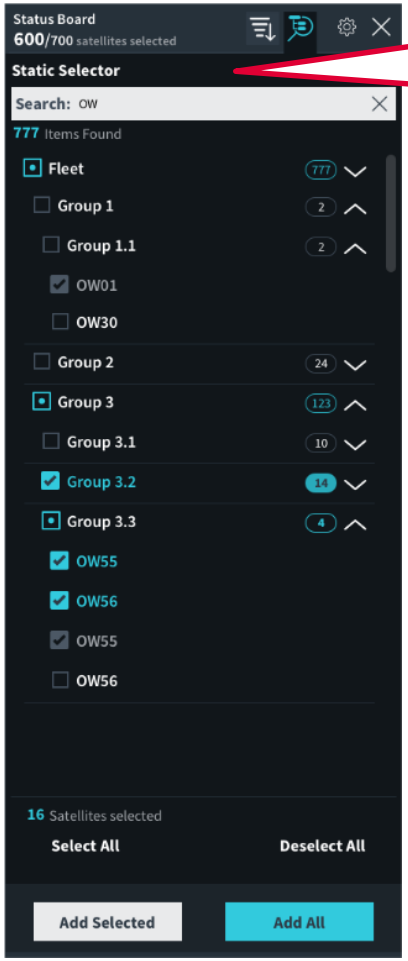
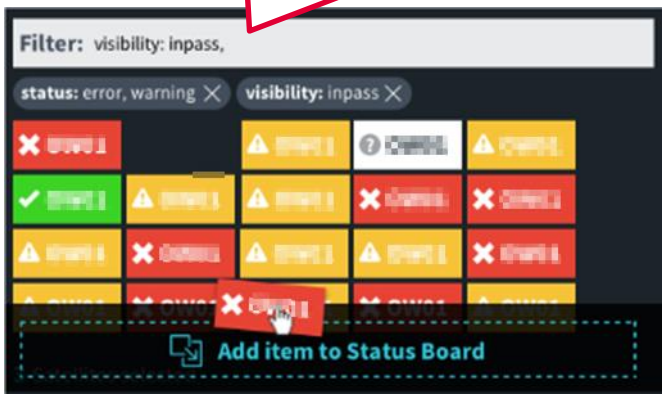



Satellites can be added to the board with a static selector…

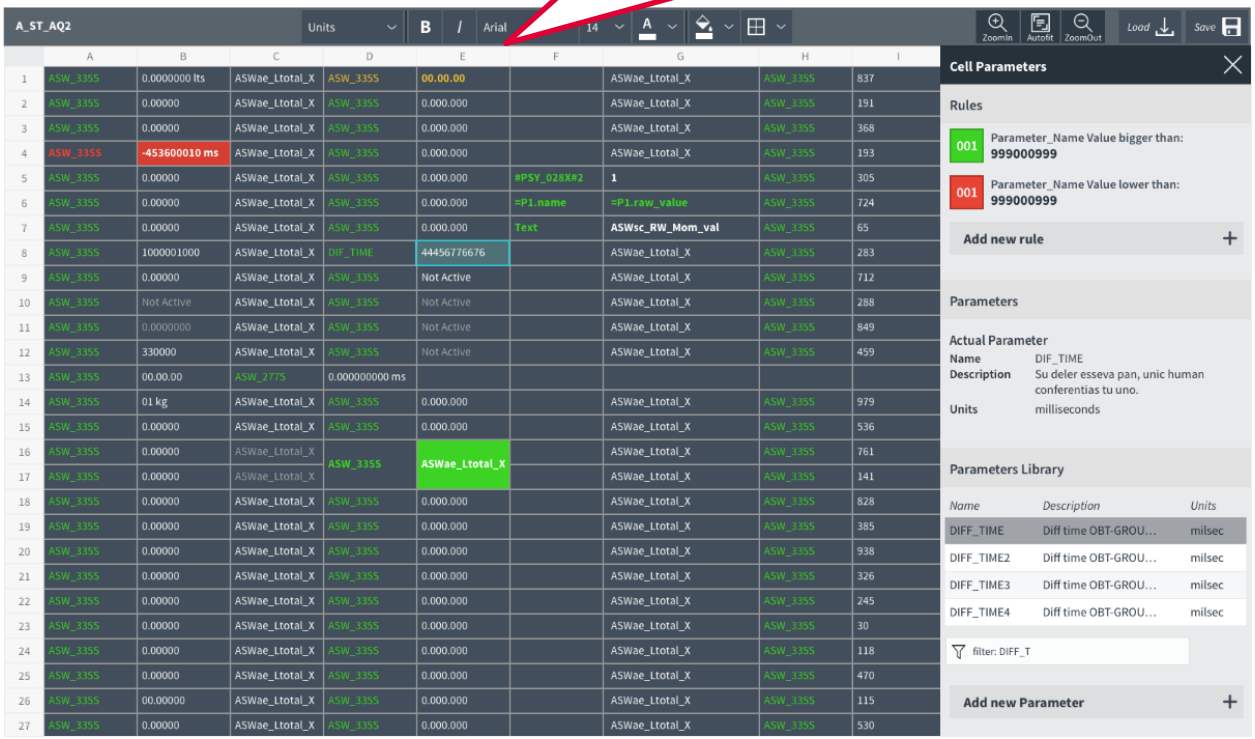
… or with a dynamic one ("show satellites in pass")



# FLEET AWARENESS – PANELS

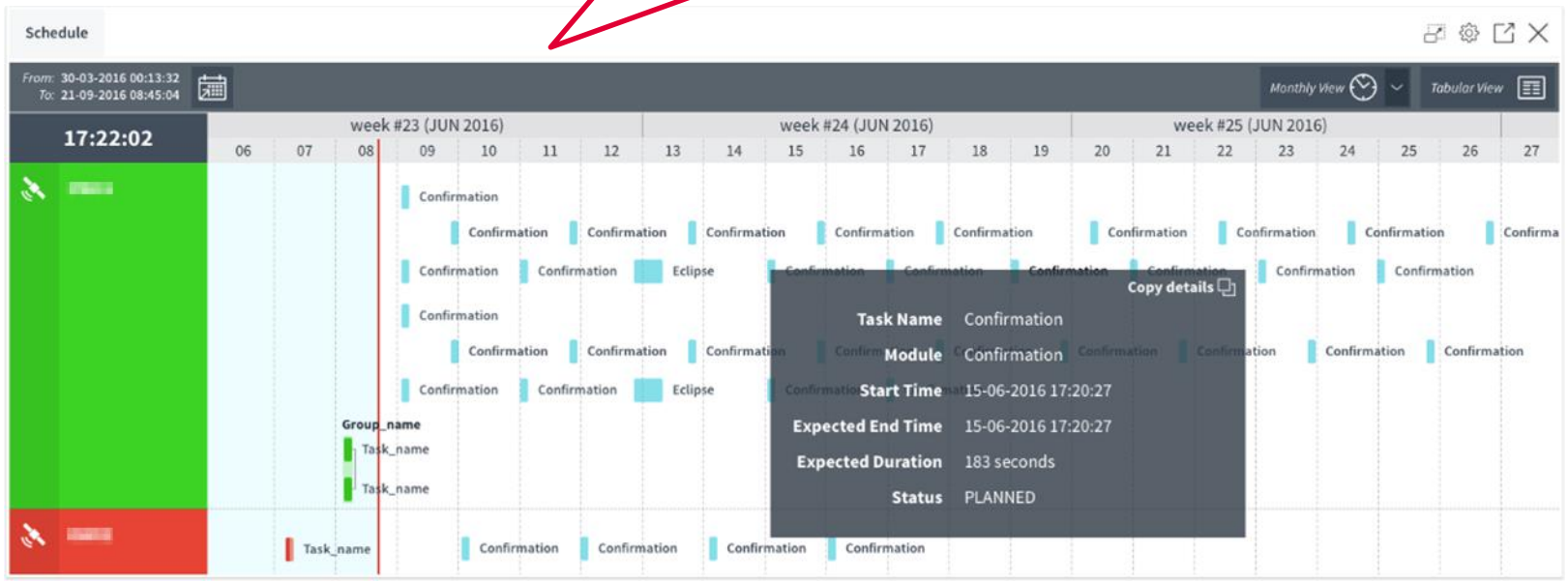
Spreadsheet panel: satellite and aggregated telemetry



# FLEET AWARENESS – PANELS

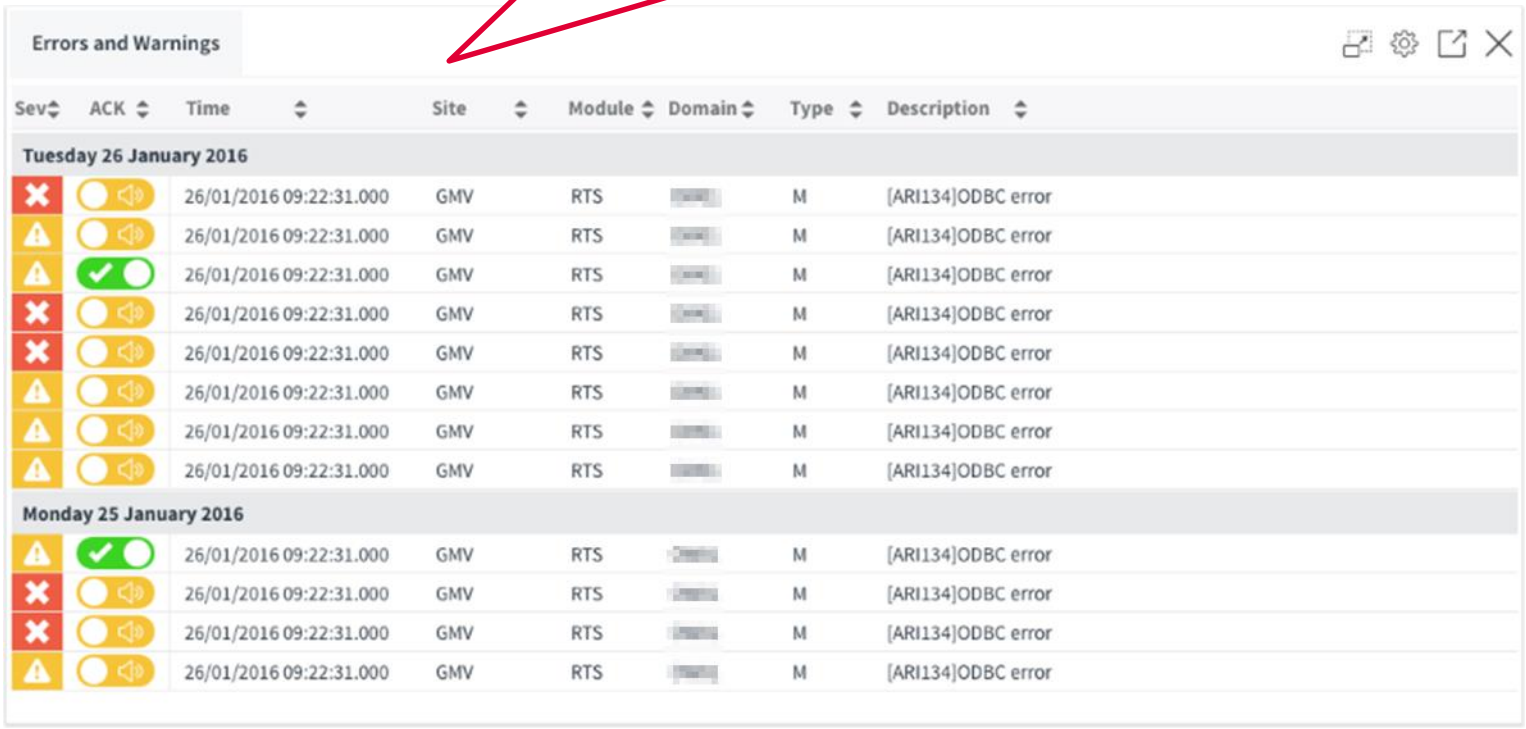
Scheduler panel: satellite operations Gantt chart



# FLEET AWARENESS – PANELS

Events & alarms panel



# CONCLUSIONS

- With such a massive fleet, the CONOPS shall focus on the fleet rather than individual satellites (*each satellite may be dispensable*)
- Virtualization and robust COTS such as ***hifly*** enables massive scaling
- Unattended operations: do not bother the human team until a (new) anomaly arises
- Effective Dashboard. More than 1000 satellites at a glance
- Flexible grouping/filtering/selection. Drill down the fleet to the satellites you want
- Lessons learnt still to come!!


Thank you
gmv
INNOVATING SOLUTIONS