



Jet Propulsion Laboratory
California Institute of Technology

Mars 2020 Project

Introduction to Rover Operations

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Drawings by Erin Murphy
User Interface Design Lead





- Day in the life of a rover
- Day in the life of an operations team
- Martian shiftwork: tactical schedules and phasing



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~~Day~~ **Sol** in the Life of a Rover

**The rover wakes
up at the start of
the sol around
Earthrise**





**The bundle file
containing everything
needed for the next
sol's plan is sent
directly to the rover
from Earth**



**The rover carries out
the sequence of
activities commanded
in the plan**







The afternoon orbiter overflight approaches



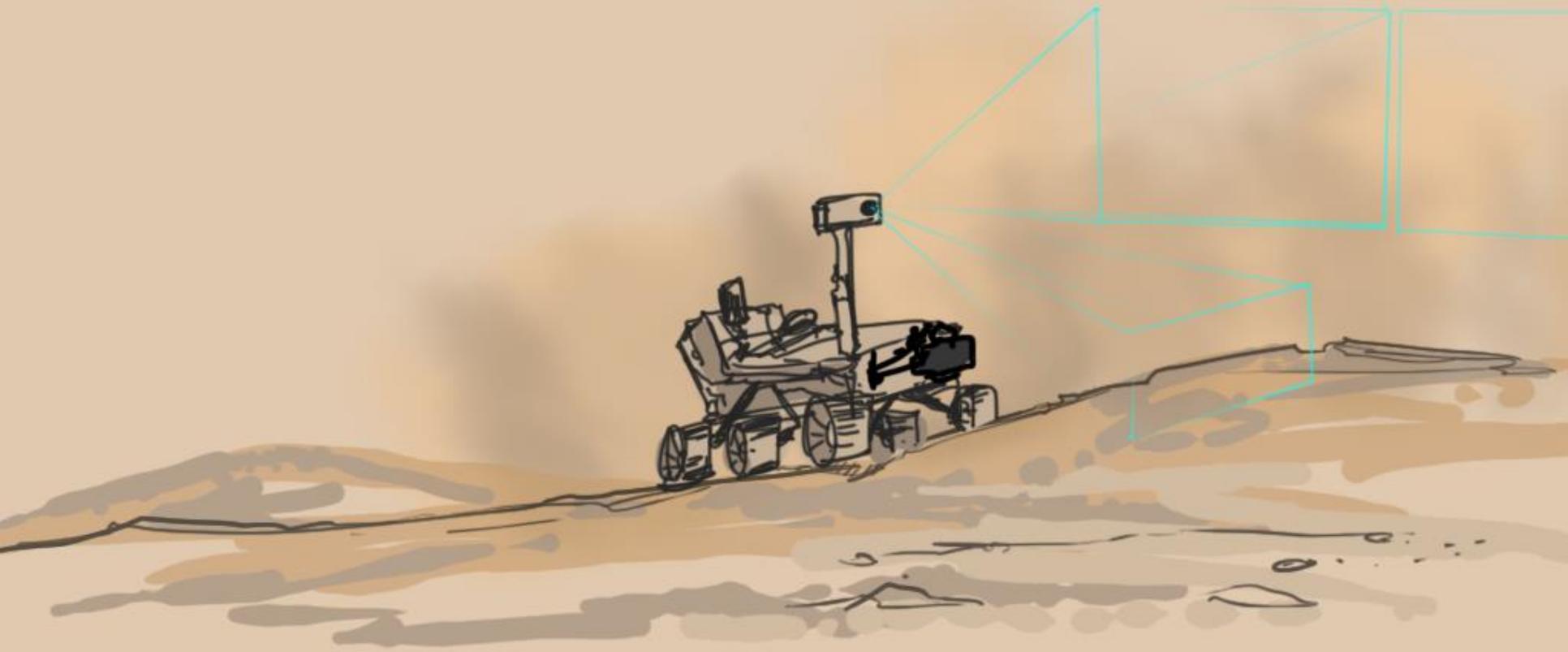
**The rover sends
some of the collected
data to the orbiter
(according to the
data's priority)**



**The orbiter records
the rover data and
relays it to Earth**



The rover continues to carry out the sequence of activities commanded in the plan



**The rover may continue
working at night, but
must spend some time
sleeping to recharge the
batteries**



**The rover wakes up for
the early morning
orbiter overflight**



**The orbiter records
the rover data and
relays it to Earth**





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Day in the Life of a Tactical Operations Team

The team reviews what was planned yesterday, the high-level plan for the next few days, and the science context for today's decisions



Downlink:
the data that the rover
sent in the afternoon
pass is relayed to Earth
by the orbiter and
received at the DSN



DSN



**the JPL Ground Data System (GDS)
processes the data and assembles it into
telemetry and housekeeping information,
initial data products, etc**



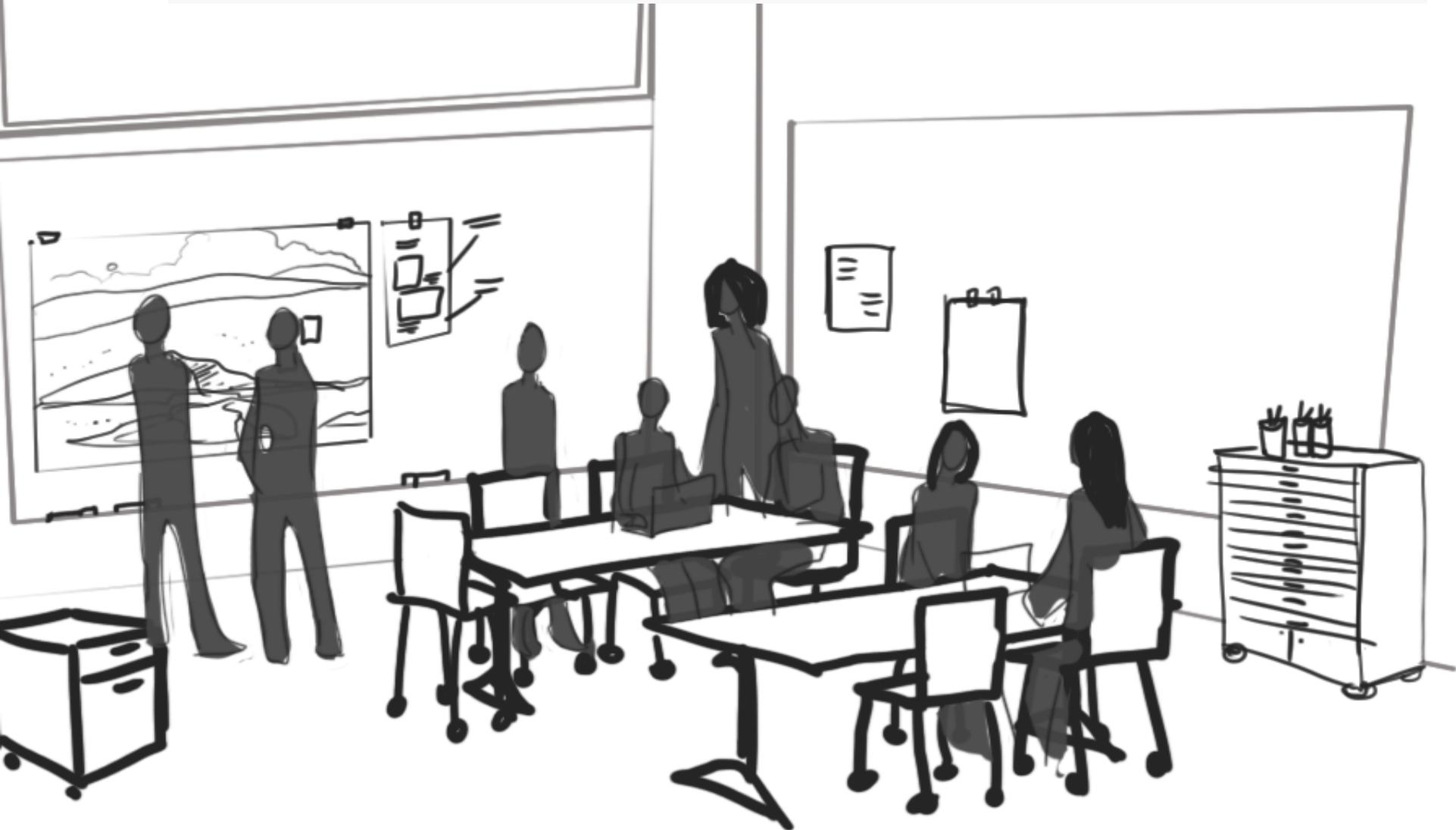
You

Downlink Assessment:

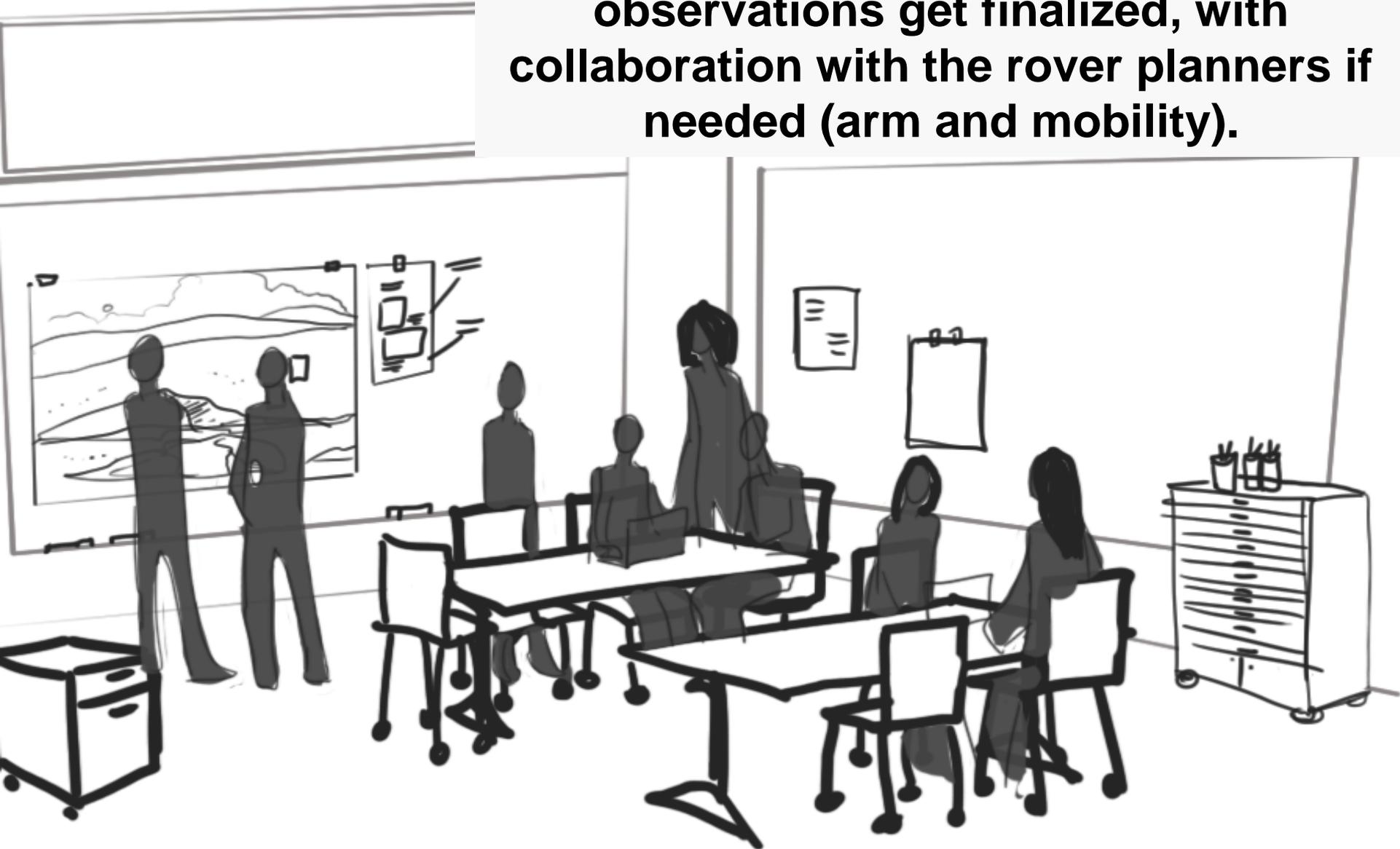
the team assesses instrument and rover health & safety status and produces tactical science data products



The team reviews the science data and decides what the rover should do when it wakes up tomorrow morning. This is sometimes called activity planning

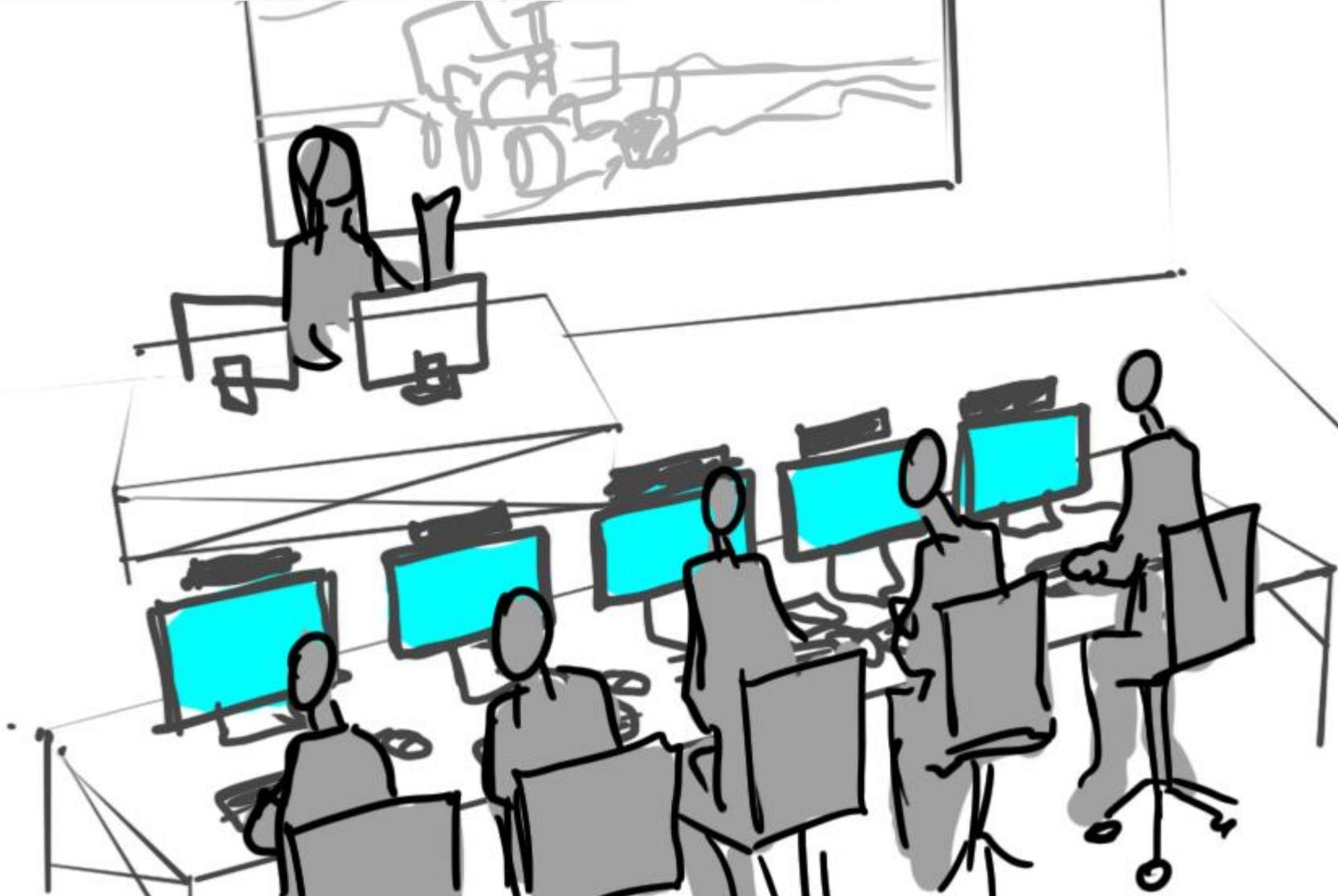


Targets and other settings for observations get finalized, with collaboration with the rover planners if needed (arm and mobility).

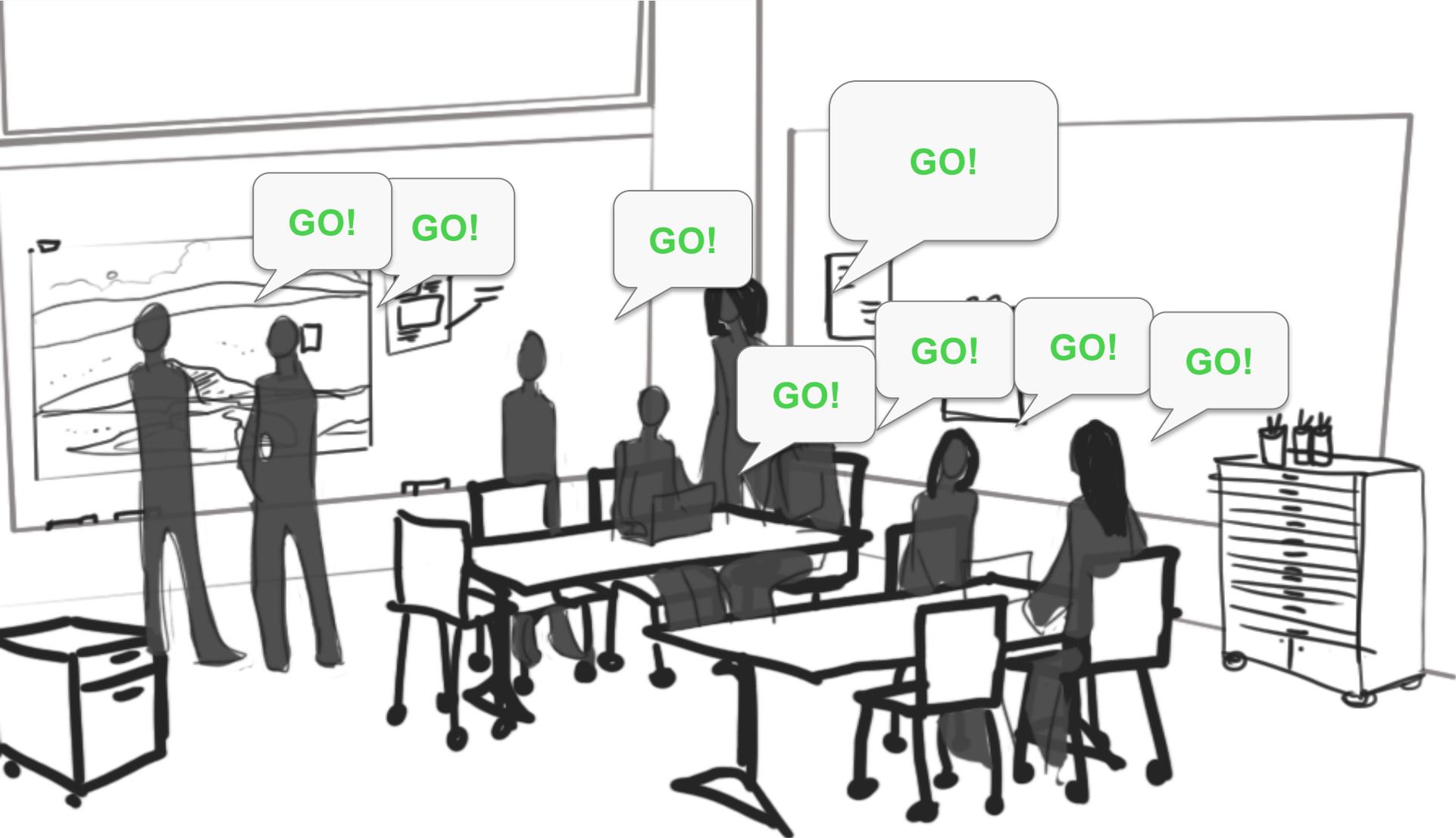


PLANNING SOL:
1 392

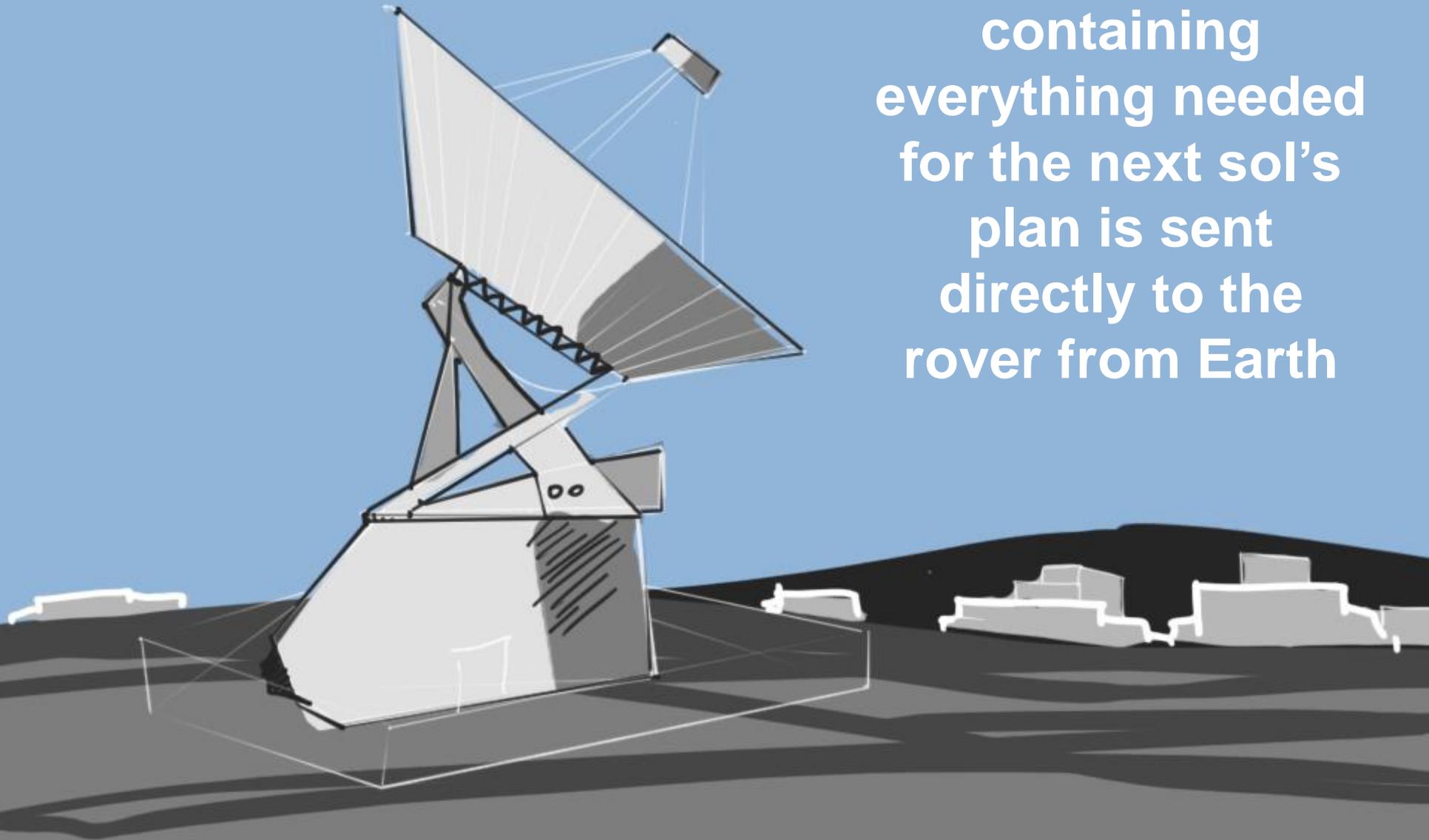
**Uplink products are generated,
validated, and reviewed**



The team approves the result of the day's work for uplink



Uplink:
The bundle file
containing
everything needed
for the next sol's
plan is sent
directly to the
rover from Earth





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Martian Shiftwork

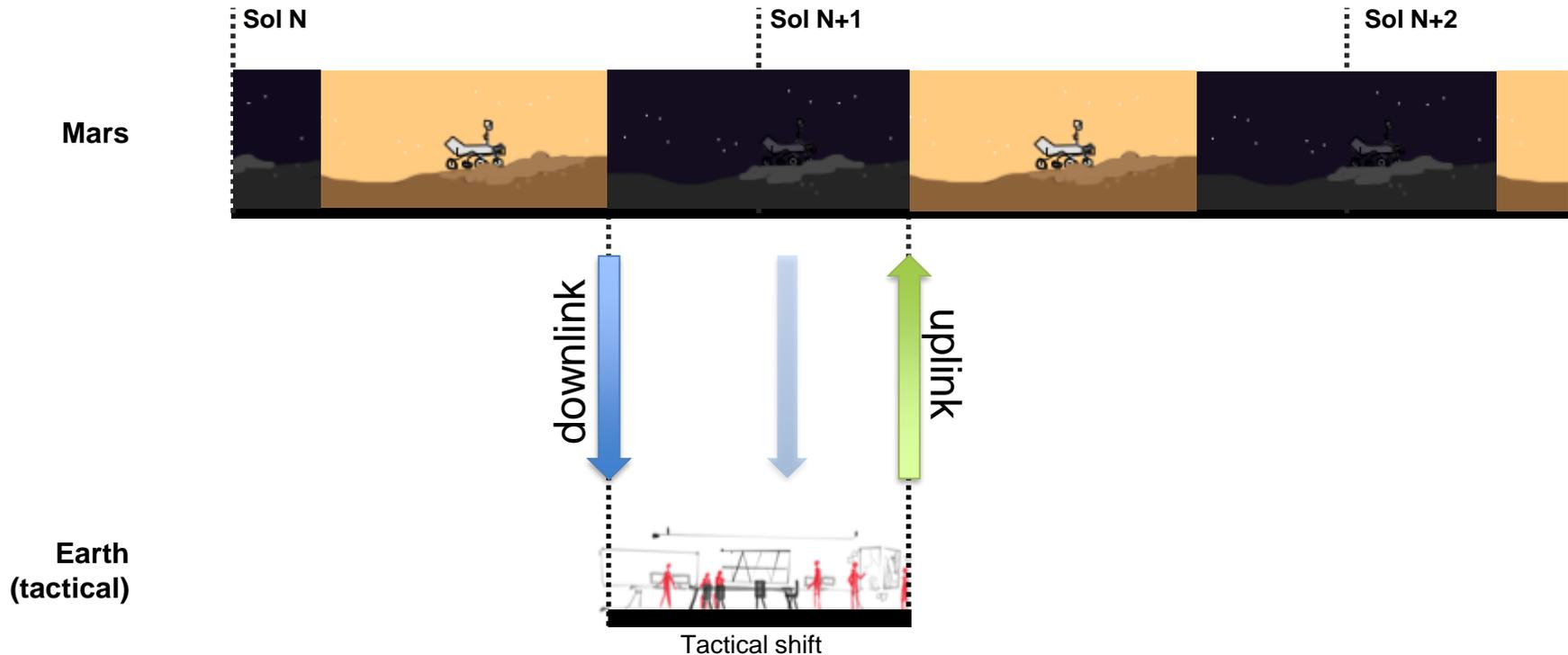
Tactical Schedules and Phasing

Martian Shiftwork: “Mars Time”



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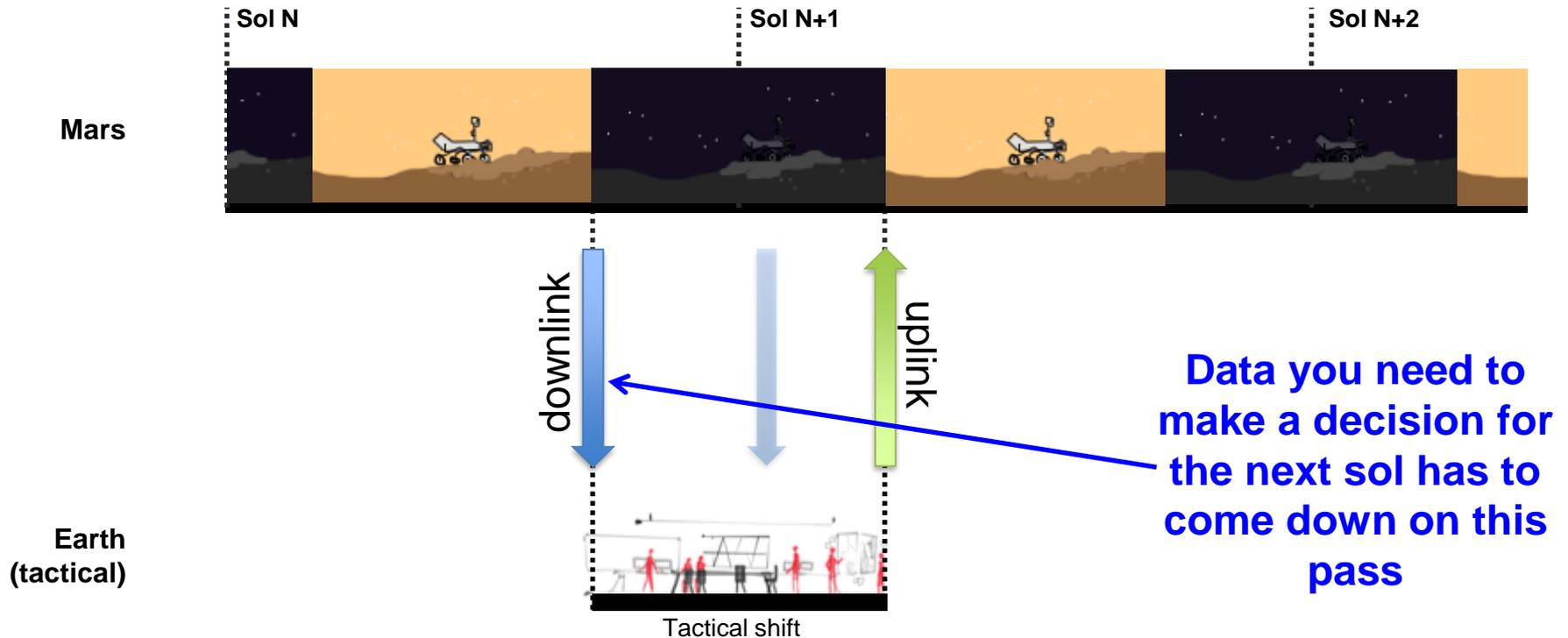


Mars time

Shift start time is pinned to decisional downlink time

Downlink time moves every day, dependent on orbiter overflights and general drift of Mars sol (24 hrs 40 min) compared to Earth day

Martian Shiftwork: “Mars Time”



Mars time

Shift start time is pinned to decisional downlink time

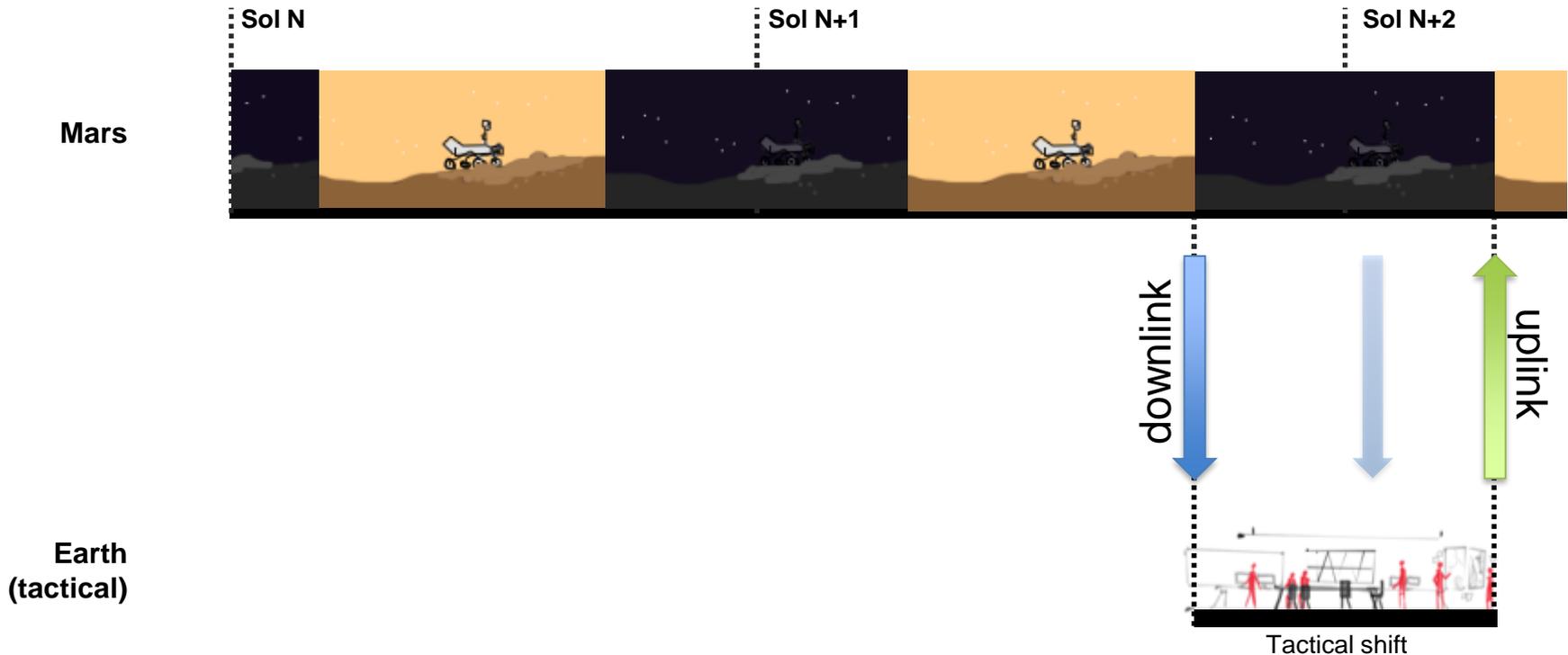
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Martian Shiftwork: “Mars Time”



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Mars time

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Martian Shiftwork: “Earth Time”



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Ability to
work tactical:



6am

11pm

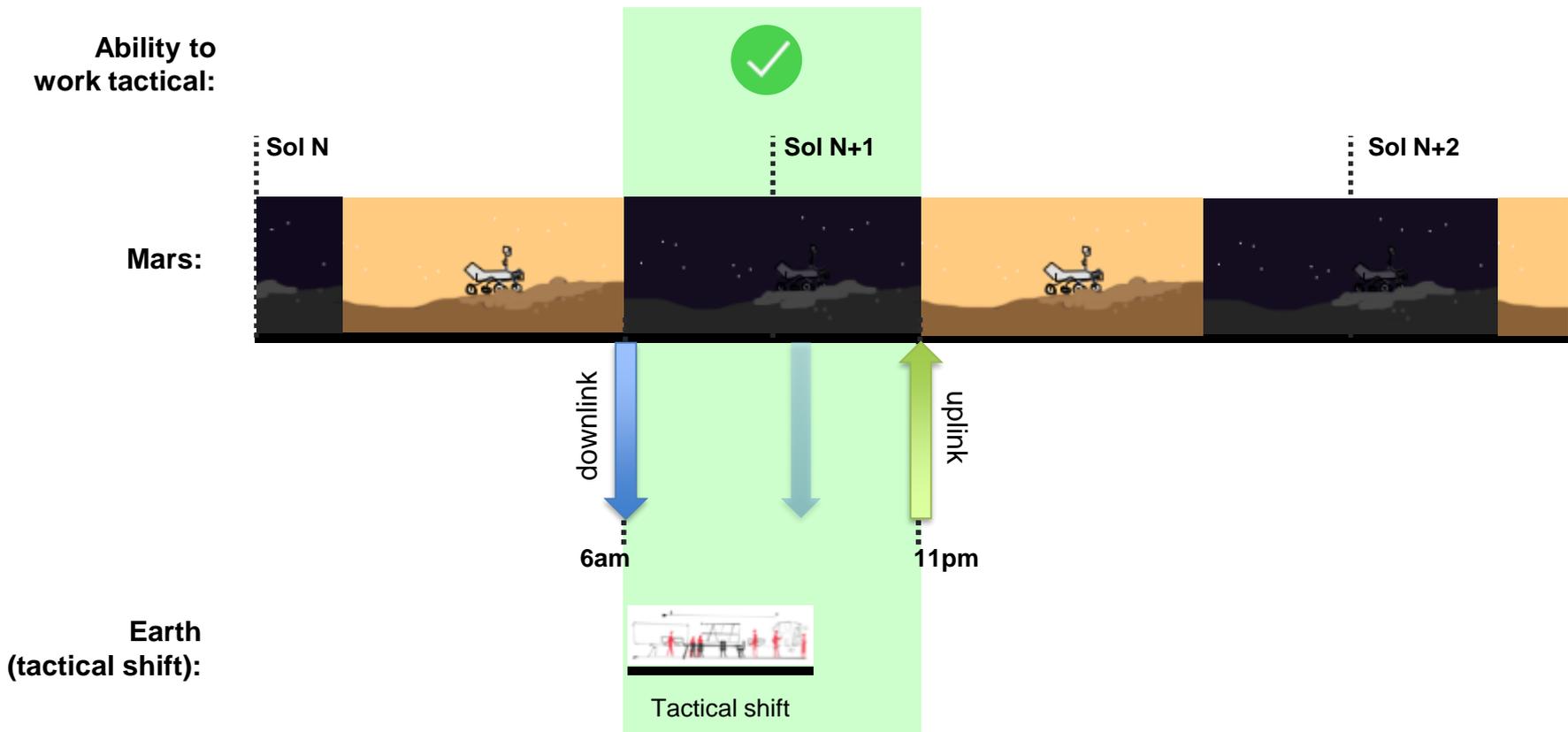
Earth
(tactical shift):

Earth time

Shift must fit within the 6 am – 11 pm Pacific envelope

Downlink time moves every day, dependent on orbiter overflights and general drift of Mars sol (24 hrs 40 min) compared to Earth day

Martian Shiftwork: “Earth Time”



Earth time

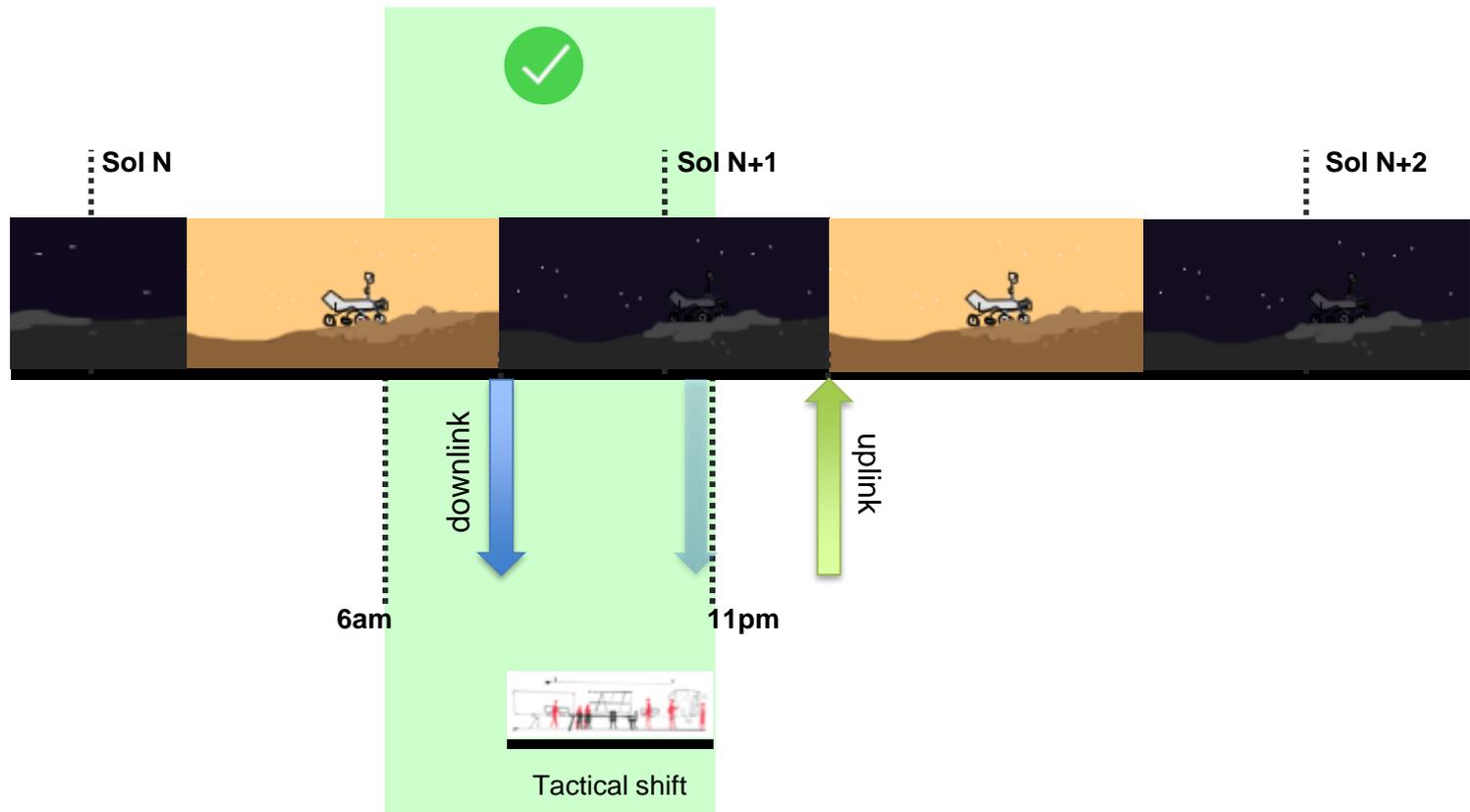
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Martian Shiftwork: “Earth Time”



Ability to
work tactical:



Earth time

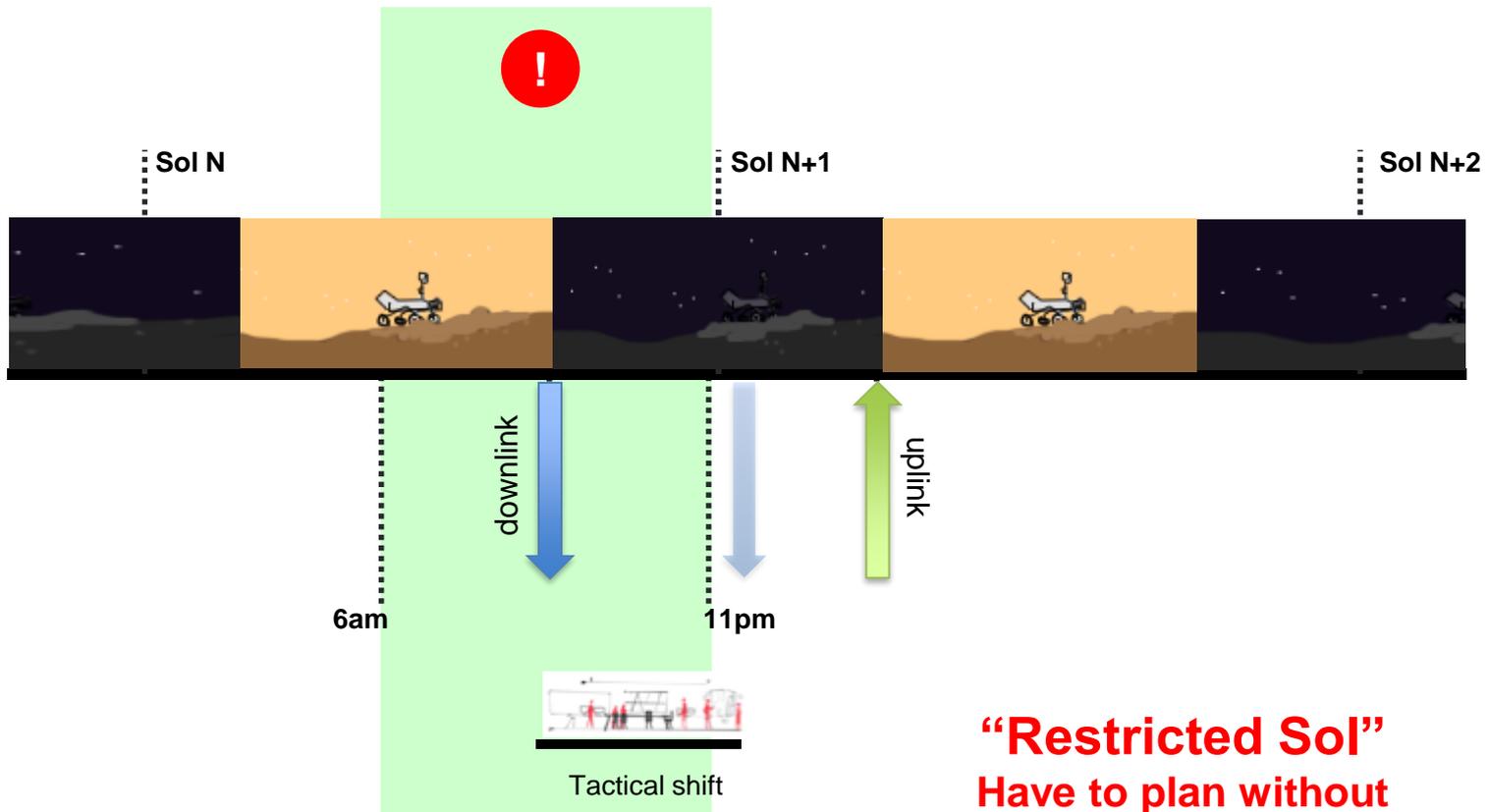
Shift must fit within the 6 am – 11 pm Pacific envelope

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Martian Shiftwork: "Earth Time"



Ability to
work tactical:



Earth
(tactical shift)

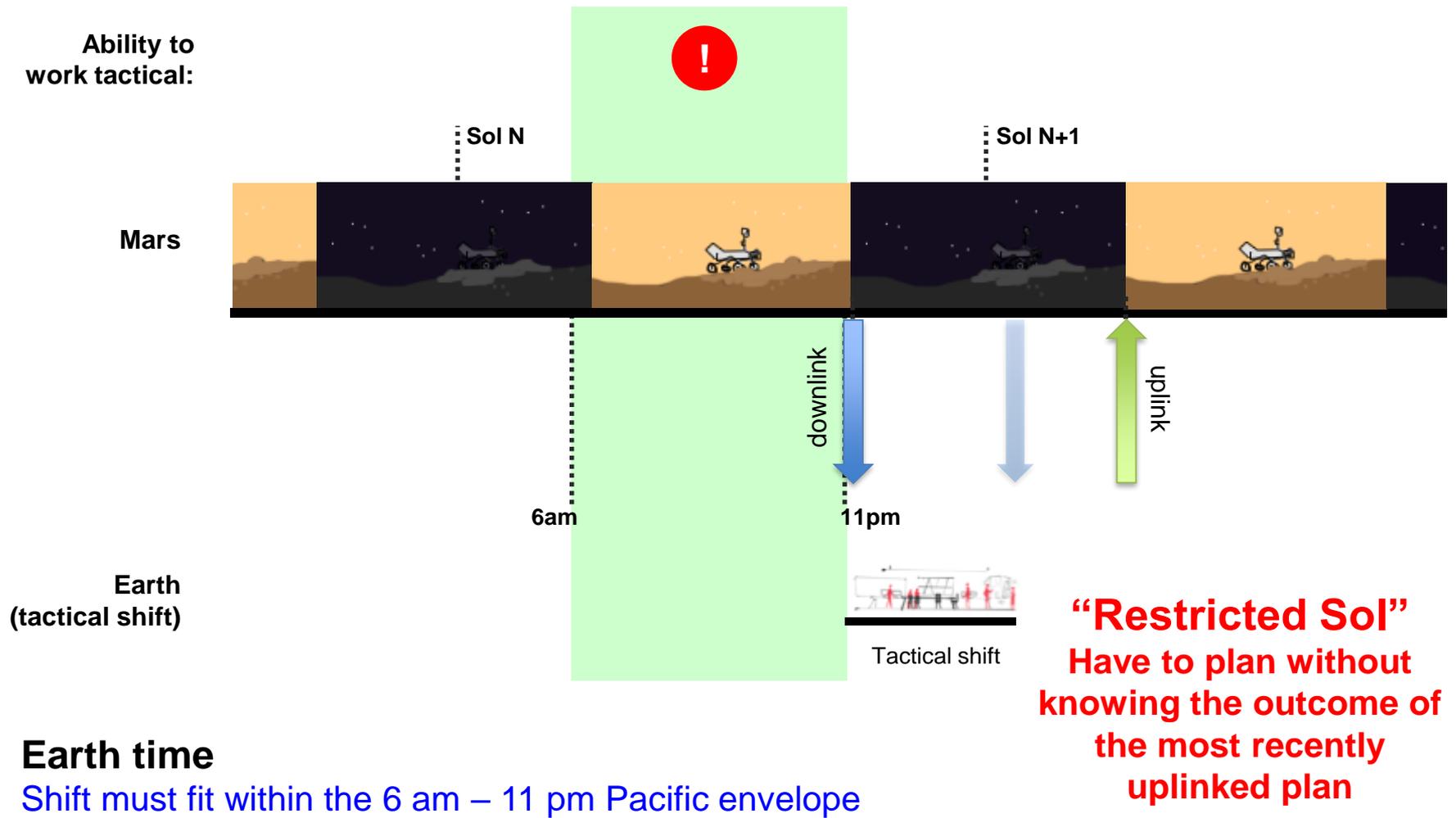
"Restricted Sol"
Have to plan without
knowing the outcome of
the most recently
uplinked plan

Earth time

Shift must fit within the 6 am – 11 pm Pacific envelope

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Martian Shiftwork: "Earth Time"



Downlink time moves every day, dependent on orbiter overflights and general drift of Mars sol (24 hrs 40 min) compared to Earth day