

# What is the Telemetry Stream?

## NASA SUITS 2021

Hello SUITS-Teams,

The telemetry stream for SUITS 2021 is best described as a replica of what Mission Control would monitor during an EVA. This includes important information such as suit pressure, oxygen rate, battery capacity, etc. Currently there are two main data streams that will be provided when teams are onsite for testing: suit status and DCU (Display and Control Unit) status. Data from both of these sources will be sent to the telemetry stream to be utilized by each team in their implementation. This document is meant to be a high level overview of how to access this data.

The server will be running on Heroku, a cloud platform that processes web applications and is connected to a GitHub repository, outputting data into a local MongoDB database. We will be using Heroku because it allows for the teams to be able to access the stream within the NASA network. The telemetry stream must be running in order to access any of the data that gets generated. All data is generated as JSON (JavaScript Object Notation) code through API. When the application is running (simulation is started), it will begin to create mock data in JSON format. The server will always publish the most recently created data, if accessed through one of the URL's found below. If you want to access the spacesuits logical switches, the HoloLens will have to create a GET request on the address, to which the server will reply with a JSON answer.

### Suit/DCU Status

In a separate tab, go to the following URL's to see the most recent data and confirm that the telemetry stream is running properly.

<a href="https://localhost:3000/api/simulation/state">https://localhost:3000/api/simulation/state</a>	Recent suit data
<a href="https://localhost:3000/api/simulation/uiastate">https://localhost:3000/api/simulation/uiastate</a>	DCU/UIA recent data

**Please make your connection to the telemetry stream modular because modifications to the telemetry stream are possible before and during test week!!!!**

This is what the data should look like for [/api/simulation/state](#)

```
{"_id":"6018701acfbad92200763c80","time":2370.0979999999999,"timer":"00:39:30","started_at":"2021-02-01T21:18:18.394Z","heart_bpm":117,"p_sub":"4.00","p_suit":"3.95","t_sub":"31.7","v_fan":"39902","p_o2":"773.40","rate_o2":"0.5","batteryPercent":83.54098611111102,"battery_out":83,"cap_battery":30,"t_battery":"03:20:30","p_h2o_g":"15.38","p_h2o_l":"15.60","p_sop":"882","rate_sop":"0.8","t_oxygenPrimary":"78.05464814814894","t_oxygenSec":"100","ox_primary":"78","ox_secondary":"100","t_oxygen":"05:20:29","cap_water":88.02980808080783,"t_water":"04:50:30","__v":0}
```

This is what the data should look like for </api/simulation/uiastate>

```
{"_id":"60187011cfbad92200763c7f","started_at":"2021-02-01T21:18:08.820Z","emu1":"OFF","emu2":"OFF","o2_supply_pressure1":29,"o2_supply_pressure2":29,"ev1_supply":"CLOSE","ev2_supply":"CLOSE","ev1_waste":"CLOSE","ev2_waste":"CLOSE","emu1_O2":"CLOSE","emu2_O2":"CLOSE","oxygen_supp_out1":29,"oxygen_supp_out2":29,"O2_vent":"CLOSE","depress_pump":"FAULT","__v":0}
```

## TELEMETRY DATA TYPES

The data to be handled is divided into two categories, numerical data and Boolean analog switch data. The numerical data contains the information spacesuit sensors would deliver primarily pertaining to life support systems. The analog switches are logic gates that are driven by numerical data points or other triggers. These sensors are an important instrument to signal to the astronaut, mission control, and/or the intravehicular crew member, that there is an anomaly.

### SPACESUIT DATA

EVA Time – [time value]

Duration of the current EVA. EVA Time is displayed in the format “hh:mm:ss”

PRIMARY OXYGEN – [percent]

Percentage left in the primary oxygen supply.

SECONDARY OXYGEN – [percent]

Percentage left in the secondary oxygen supply.

HEART RATE – [bpm]

Heart rate of the astronaut measured in beats per minute. Expected range is from 80 to 100 bpm.

SUB PRESSURE – [psia]

External Environment pressure. Expected range is from 2 to 4 psia.

#### SUIT PRESSURE – [psid]

The pressure inside the spacesuit needs to stay within certain limits. If the suit pressure gets too high, or if the pressure exceeds nominal limits, the movement of the astronaut will be heavily reduced. Expected range is from 2 to 4 psid.

#### TEMPERATURE – [degrees Fahrenheit]

External Environmental temperature measured in degrees Fahrenheit. Temperatures are expected to be standard low earth orbit Day/Night-cycles without anomalies.

#### FAN TACHOMETER – [RPM]

Speed of the cooling fan. Expected range is from 10,000 to 40,000 RPM.

#### OXYGEN PRESSURE – [psia]

Pressure inside the Primary Oxygen Pack. Expected range is from 750 to 950 psia.

#### OXYGEN RATE – [psi/min]

Flowrate of the Primary Oxygen Pack. Expected range is from 0.5 to 1 psi/min.

#### BATTERY CAPACITY – [amp-hr]

Total capacity of the spacesuit's battery. Expected range is from 0 to 30 amp-hr.

#### H2O GAS PRESSURE – [psia]

Gas pressure from H2O system. Expected range is from 14 to 16 psia.

#### H2O LIQUID PRESSURE – [psia]

Liquid pressure from H2O system. Expected range is from 14 to 16 psia.

#### SOP PRESSURE – [psia]

Pressure inside the Secondary Oxygen Pack. Expected range is from 750 to 950 psia.

SOP RATE – [psi/min]

Flowrate of the Secondary Oxygen Pack. Expected range is from 0.5 to 1 psi/min.

TIME LEFT BATTERY – [time value]

The remaining time until the battery of the spacesuit is completely discharged. Battery life is usually displayed in the format “hh:mm:ss” Expected range is from 0 to 10 hours.

TIME LIFE OXYGEN – [time value]

The remaining time until the available oxygen is depleted. Time life oxygen is usually displayed in the format “hh:mm:ss” Expected range is from 0 to 10 hours.

TIME LIFE WATER – [time value]

The remaining time until the water resources of the spacesuit are depleted. Time life water is usually displayed in the format “hh:mm:ss” Expected range is from 0 to 10 hours.

### **Analog Inputs/Outputs**

The Umbilical Interface Assembly (UIA) is located in the airlock and provides controls which the astronaut uses to prepare the suit for EVA. The telemetry stream provides both input and output on the UIA. The values generated by the telemetry stream should reflect the inputs in the UIA control section.

The Display and Control Unit (DCU) is a wearable device that controls the suit during the EVA. Use these inputs to respond to suit anomalies.

UIA	DCU
EMU1	Suit Power
EMU2	Fan Switch
EV1 Supply	O2 Switch

EV2 Supply	RCA
EV1 Waste	AUX
EV2 Waste	Pump
EV1 Oxygen	
EV2 Oxygen	
O2 Vent	
Depress Pump	