2023 BRIDGESTONE WORLD SOLAR CHALLENGE

TELEMETRY INSTRUCTIONS

During the 2023 Bridgestone World Solar Challenge, the event will publish telemetry data supplied by teams. For Cruiser teams, telemetry data will enable meaningful comparisons of relative performance during the event, to answer the question "who is winning?".

Data will be stored in an InfluxDB 2.0 database. Influx is a cloud-hosted database suitable for storing time series data. It is widely used, and well supported by the open-source community. The database will include:

- data from the event's GPS trackers
- telemetry data submitted by teams
- historical data.

The instructions below are for solar car teams who will be submitting data.

If you have any questions or need help, please email teams@worldsolarchallenge.org or reach on out in the Team Portal Forum.

UPLOADING DATA

Most teams will not have an internet connection between control stops. Data generated since the last upload can be uploaded in bulk at control stops and in Adelaide.

DATA FORMAT

Teams must upload data in InfluxDB Line Protocol format. This is a plain text format. Each line contains a combination of:

- a *measurement* name ("telemetry" for the BWSC2023)
- *tags,* which contain identifying information about the event, team and car
- *fields,* which contain values relating to a
- a *timestamp,* which specifies the time to which the fields relate.

Here is an example line:

```
telemetry,event=BWSC2023,class=Cruiser,team=World\ Solar\ Challenge\
Faculty,car=Solar\ Wombat\ 3,shortname=WSC\ Faculty
longitude=135.26007,latitude=-
30.24246,altitude=187.3,distance=432162,solarEnergy=20914846,batteryEnergy=5227
8368 1673131589
```

Note that this is all one line, with a space between `WSC\ Faculty` and `longitude` to separate the tags from the fields. Any spaces, commas or '=' signs in the tags must be escaped with a preceding \.

There are many software libraries that support line format, or the data can be formatted manually.

The measurement name is `telemetry`.

Tag set:

- The `event` tag value must be `BWSC2023`.
- The `class` tag value must be `Challenger`, `Cruiser` or `Adventure`.
- The `team` tag value is the full name of the team, e.g. `World\ Solar\ Challenge\ Faculty`.
- The `car` tag value is the name of the car, e.g. `Solar\ Wombat\ 3`.
- The `shortname` tag value is a short name used to refer to the team, e.g. `WSC\ Faculty`.

There is a space separating the tag set and the field set.

Field set:

- The `longitude` value is in decimal degrees with at least 5 decimal places.
- The `latitude` value is in decimal degrees with at least 5 decimal places.
- The `altitude` value is in metres, with as much accuracy as possible—typically to the nearest metre if using GPS.
- The `distance` value is the distance travelled since the start line in Darwin, in metres.
- The `solarEnergy` value is the energy collected by the solar collector since the start of the event, in Joules.
- The `batteryEnergy` value is the energy taken from the battery since the start of the event, in Joules. It will decrease when energy is put into the battery.

There is a space separating the field set and the timestamp.

The timestamp is the Unix timestamp, i.e., seconds since 1970-01-01T00:00:00Z, in whole seconds

The data submitted should have an entry at least every 60 seconds. Entries should start when the car departs from the start line in Darwin and finish when the car arrives in Adelaide. Entries should continue while you are solar charging or charging from external sources (Cruiser class). You do not have to measure overnight while the car is turned off (i.e., while the field values are not changing).

Contact us if you would like to include additional field values in your data.

SUBMITTING THE DATA

Data must be submitted to the InfluxDB database via direct DB writes. These writes are relayed through a data scrubbing process to ensure the data is formatted correctly. The API used is the InfluxDB v2 API.

There are software libraries available for different programming languages to implement this API.

Each team will be provided with the required access details:

- a `url` specific to the team
- a `token` specific to the team
- an `org`, which is `BWSC` for all teams.

The data will be passed through an ingress process which throttles the data and performs checks to ensure validity.

We will create a repository containing samples of code for writing to the InfluxDB database.

TESTING

You should create your own InfluxDB database for testing, using InfluxDB Cloud.

Create a [free InfluxDB Cloud 2.0 account](#).

When you get to the "Getting Started" page, click "Load your data". There are two ways to get data into InfluxDB:

1. You can upload a text file in line protocol format. Set the precision to "Seconds" before uploading.
2. Find a [client library](#) and example code for writing directly to the InfluxDB.

The free account limits you to 30 days storage.

Create a bucket called `test`. Generate a token that lets you read and write the `test` bucket. Your org is specific to your InfluxDB.

Once you have uploaded some data (and therefore validated that it is in the correct format), the "Explore" button in the InfluxDB Cloud server allows you to make and plot queries, using a graphical query builder or the Flux language. In the query builder, some fields may not show up until you search for them.

The "Boards" button takes you to a page where you can create basic dashboards.