



# Overview of Dragonfly Entry Aerosciences Measurements (DrEAM)

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## What is DrEAM?

- Dragonfly Entry Aerosciences Measurements (DrEAM) is an instrumentation suite for the Dragonfly mission's entry vehicle heat shield and backshell
- Satisfies NASA's Engineering Science Investigation requirement for a New Frontiers mission
- Led by NASA's Ames Research Center, in partnership with NASA's Langley Research Center and DLR
- The Huygens probe was the last mission to Titan, but it carried no TPS instrumentation.
- Key *in-situ* measurements will be made in Titan's atmosphere for the first time
  - The first in a non-oxidizing environment
- Sensors with flight heritage from previously flown missions will be leveraged as much as possible:
  - Mars Entry, Descent, and Landing Instrumentation 2 (MEDLI2) [1]
  - ExoMars Schiaparelli [2]

## DrEAM Instruments:

The DrEAM project includes several different sensor types:

- Dragonfly Sensors for Thermal Reconstruction (DragSTR)
  - Instrumented thermal plugs
- Dragonfly Atmospheric Flight Transducer (DrAFT)
  - Hypersonic pressure transducers
- DLR-provided Combined Sensor System for Titan Atmosphere (COSSTA)
  - Total heat flux sensor, pressure sensor, and two narrowband radiometers
  - Broadband radiometer
- DLR-provided Data Acquisition System to acquire the measurements from the sensors and pass them on to the Dragonfly Lander flight computer.
  - Total of 24 channels available on the heat shield and another 24 on the backshell.

## DrEAM Science

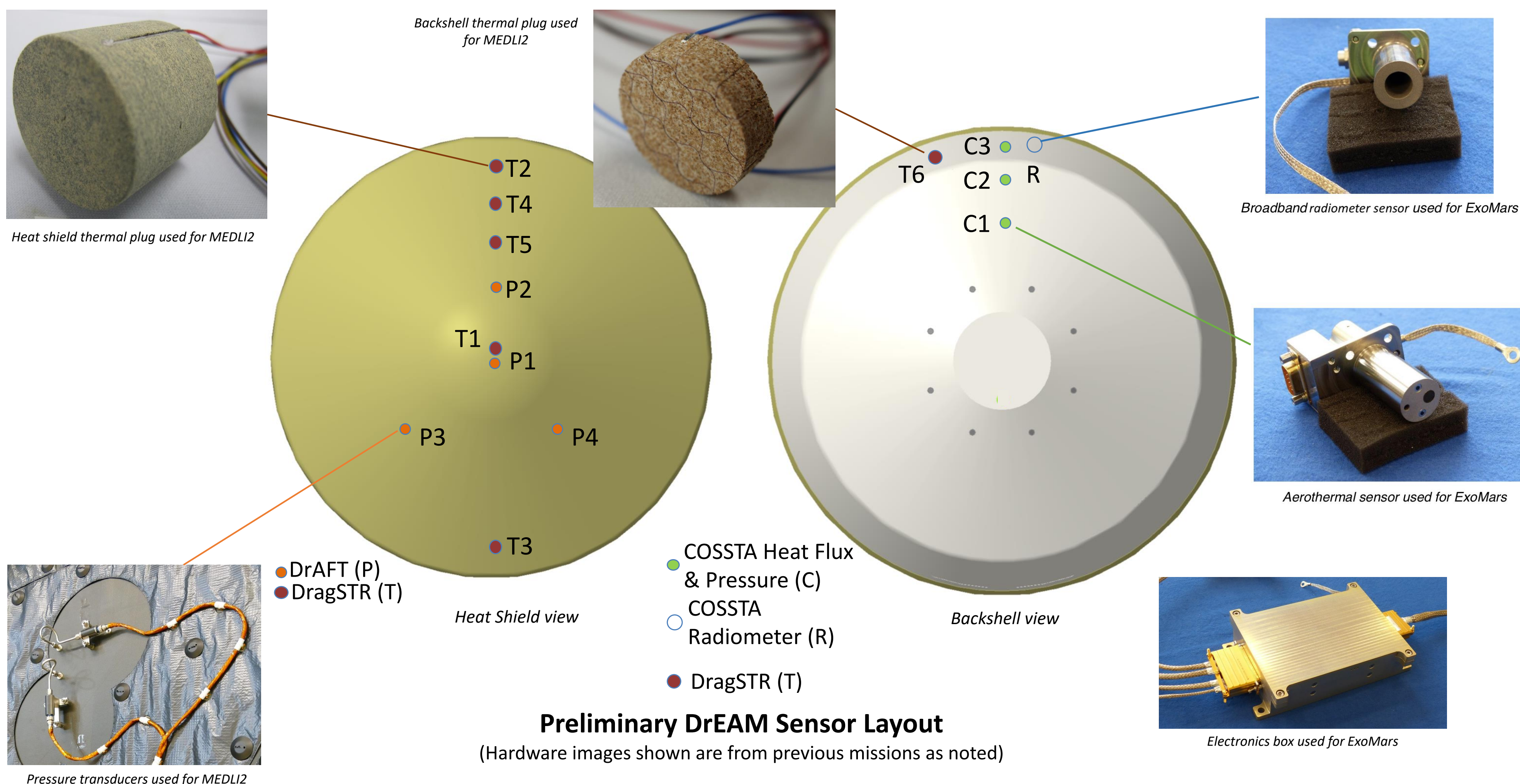
- High level DrEAM project goals:
  - Measure heat shield near surface and in-depth temperatures
  - Measure backshell near surface and in-depth temperatures
  - Measure pressure at the heat shield and backshell surface
  - Measure backshell radiative and total heat flux

*Value of DrEAM sensor data to the Titan science community:*

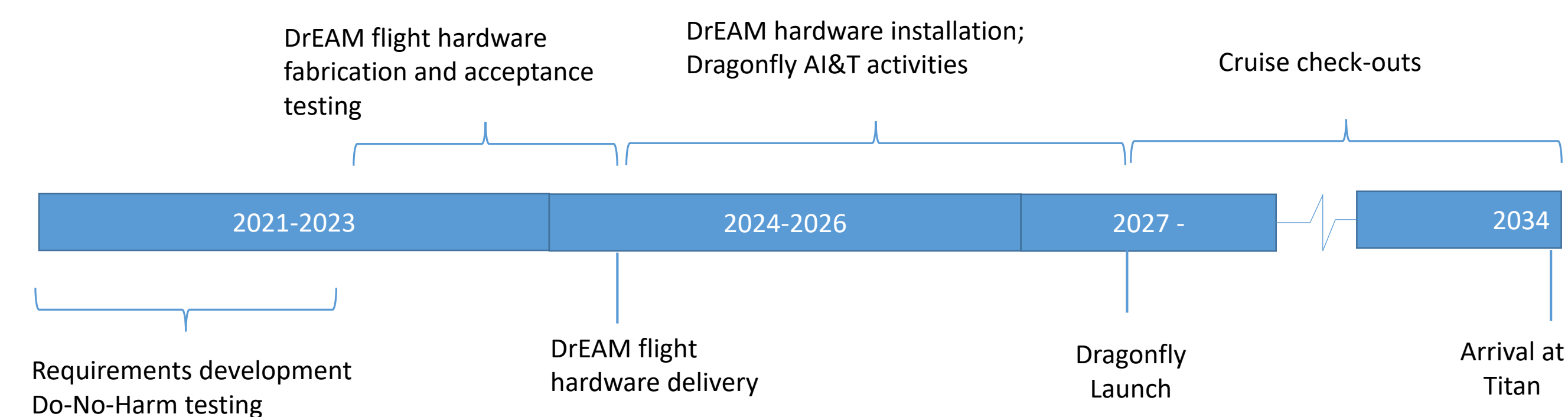
- Infer CH<sub>4</sub> abundance in the upper atmosphere
- Reconstruct atmospheric winds
- Enhance Dragonfly trajectory reconstruction

*Value of DrEAM sensor data to the aerothermal community:*

- Flight data on the performance of PICA and SLA-561V TPS materials
- Data to infer the aerothermal environment around the aeroshell
- Validate models used in spacecraft design



## DrEAM Project Timeline:



## References:

- [1] H. Hwang, et. al. "Mars 2020 Entry, Descent and Landing Instrumentation 2 (MEDLI2)," 41<sup>st</sup> AIAA Thermophysics Conference, 13-17 June 2016, Washington, D.C., AIAA 2016-3536.
- [2] A. Gülhan, et. al., "Aerothermal Measurements from the ExoMars Schiaparelli Capsule Entry," Journal of Spacecraft and Rockets, Vol. 56, No. 1, January 2019