

Airborne Observations of Re-entering Space Debris

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General

Re-entry trajectories

Trajectories of observed entries are similar – depending on superorbital/LEO.

Typical main break-up altitude: 85-75km

	Observation Time
ATV1	~3:36min
Cygnus OA6	~5min
Hayabusa	~45sec
WT1190F	~25sec



WT1190F - Hayabusa



[R. Dantowitz]



[R. Dantowitz]

CYGNUS OA6 - ATV-1



[J. Feely]

[Ed Schilling]

", simple" video observation not sufficient for an analysis of the break-up analysis – spectroscopy?

Observation Strategy

Short notice

Commercial aircraft (Gulfstream, Global Express)

Limited space (5 windows)

Acrylic windows

Comparably simple access worldwide



[Loehle et al., ApJ, 2017] [Loehle et al., MAPS, 2019, under review]

Observation Strategy

Long(er) preparation time

Availability of experimental aircraft (NASA, DLR, FAA)

Many (and optical) windows (for ATV-5: DC-8 with 46 cameras, 11 windows)

Experienced flight crew

~1 year planning required





Results from ATV-1



Results from WT1190F



Identification of materials lead to the conclusion that the object is a Translunar Insertion Stage.

Spectra for different fragments are available.



Results from CYGNUS



Meteor observation

Meteor astronomy community: High expertise for observations.

Only few useful ground tests.

Spectral measurements required for the identification.





Meteorite in Ground Testing Facility



EM132, H chondrite



EM132, H chondrite



[Vojacek et al., A&A, 2015] [Loehle et al.,ApJ, 2017] 13

...to be continued...

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