

Proposed CRYSTAL-FACE WB-57F Rocket Plume Wake Sortie

⇒ Description

⇒ Motivation

⇒ Science Objectives



Atlas IIAS plume image obtained during
990412 ACCENT plume wake mission

Description

- ⇒ Fly single WB-57F sortie to Cape Canaveral to sample rocket plume wake in upper troposphere and lower stratosphere
- ⇒ Continuation of ongoing NASA and USAF efforts to better understand aerospace engine emissions and atmospheric impacts
- ⇒ Plume wake sortie to be flown on a non-interference basis with respect to CRYSTAL-FACE objectives

Description (cont)

⇒ Opportunities:

Space Shuttle (STS-107)
20 July
SRM and LOX/H₂

Atlas V (Hotbird 6)
08 July
LOX/kerosene

- launch times T(0) are TBD
- launch dates subject to change

⇒ Approximate WB-57F flight events from T(0) launch time:

takeoff from KW	T(0) - 90 min
begin plume encounters:	T(0) + 5 min
complete plume encounters:	T(0) + 60 min
land at KW:	T(0) + 120 min
total flight duration:	~ 3.5 hours

Motivation

- ⇒ Rocket combustion emissions affect stratospheric chemistry
 - CO, H₂O, Cl_x, NO_x, HO_x, volatile (ice) and non-volatile (alumina, soot) particles
 - consensus: present day ozone changes from rocket emissions are small

- ⇒ Significant knowledge gaps remain
 - liquid propellant rocket emissions and impacts
 - particle emissions and heterogeneous kinetics

- ⇒ Anticipated changes in space transport industry....
 - increasing numbers of launches
 - new rockets (Shuttle replacement, Reusable Launch Vehicles, methane fuel)

- ⇒demonstrate need to reduce knowledge gaps in order to maintain accuracy of predictive capability

C-F Plume Wake Sortie Science Goals and Associated WB-57F Measurements

- What are alumina and soot EIs?
 - non-volatile particle concentrations and size distributions
 - combustion tracers CO₂ and total H₂O
- How do condensed H₂O phases influence plume wake chemistry?
 - volatile particle concentrations and size distributions
 - particle composition
 - ice/vapor partitioning
 - combustion tracers CO₂
 - O₃, CH₄, NO_x, NO, NO_y,
 - solar irradiance
- What are NO_x and CO EIs?
 - CO, NO_x, NO, NO_y,
 - particle concentrations and size distributions
 - combustion tracers CO₂ and total H₂O