

**Flight Report**  
**ARCTAS P-3B Data Flight 20, flown July 6 2008**  
**(ARCTAS Summer)**

Submitted by Antony Clarke

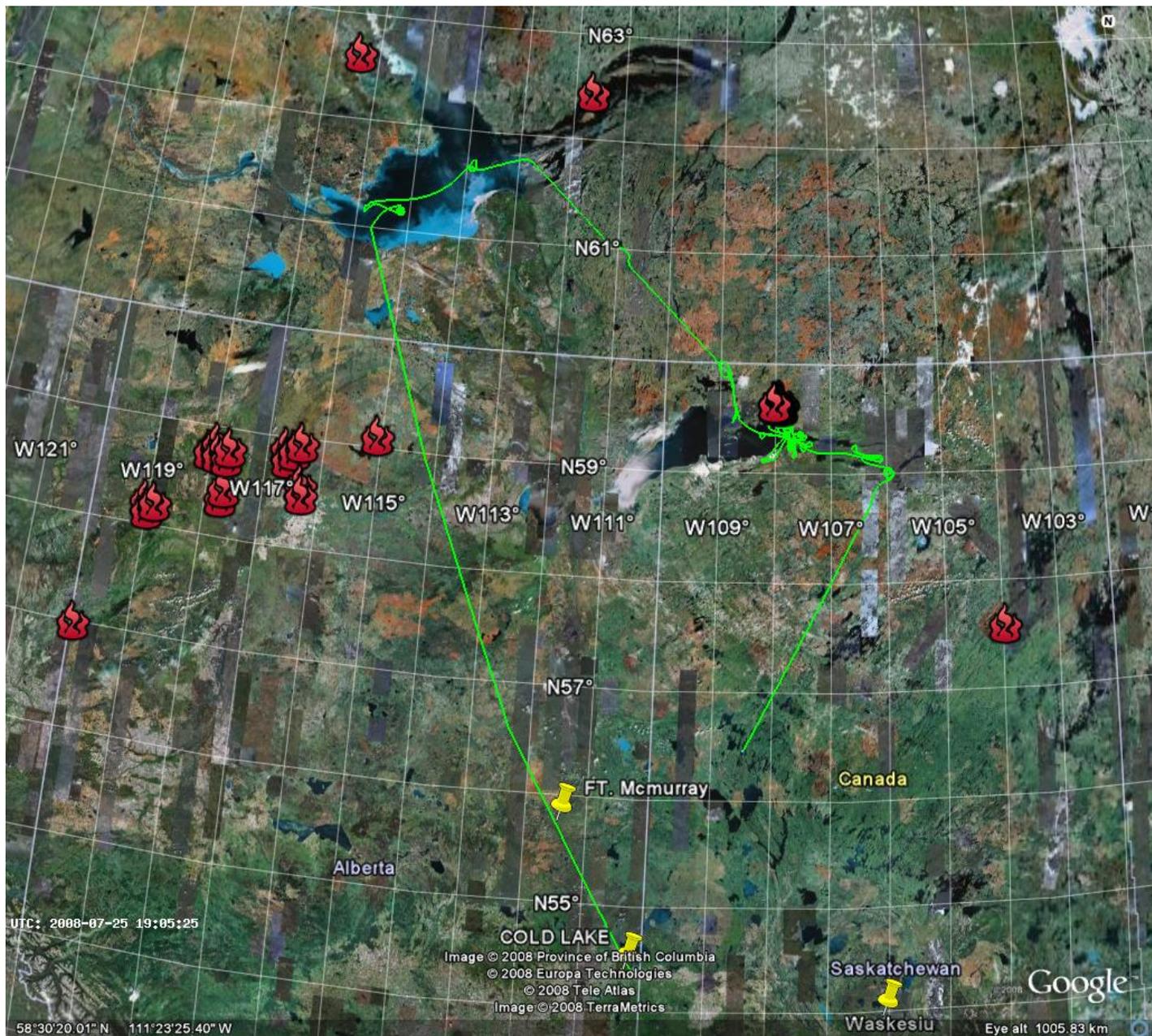
**Objectives**

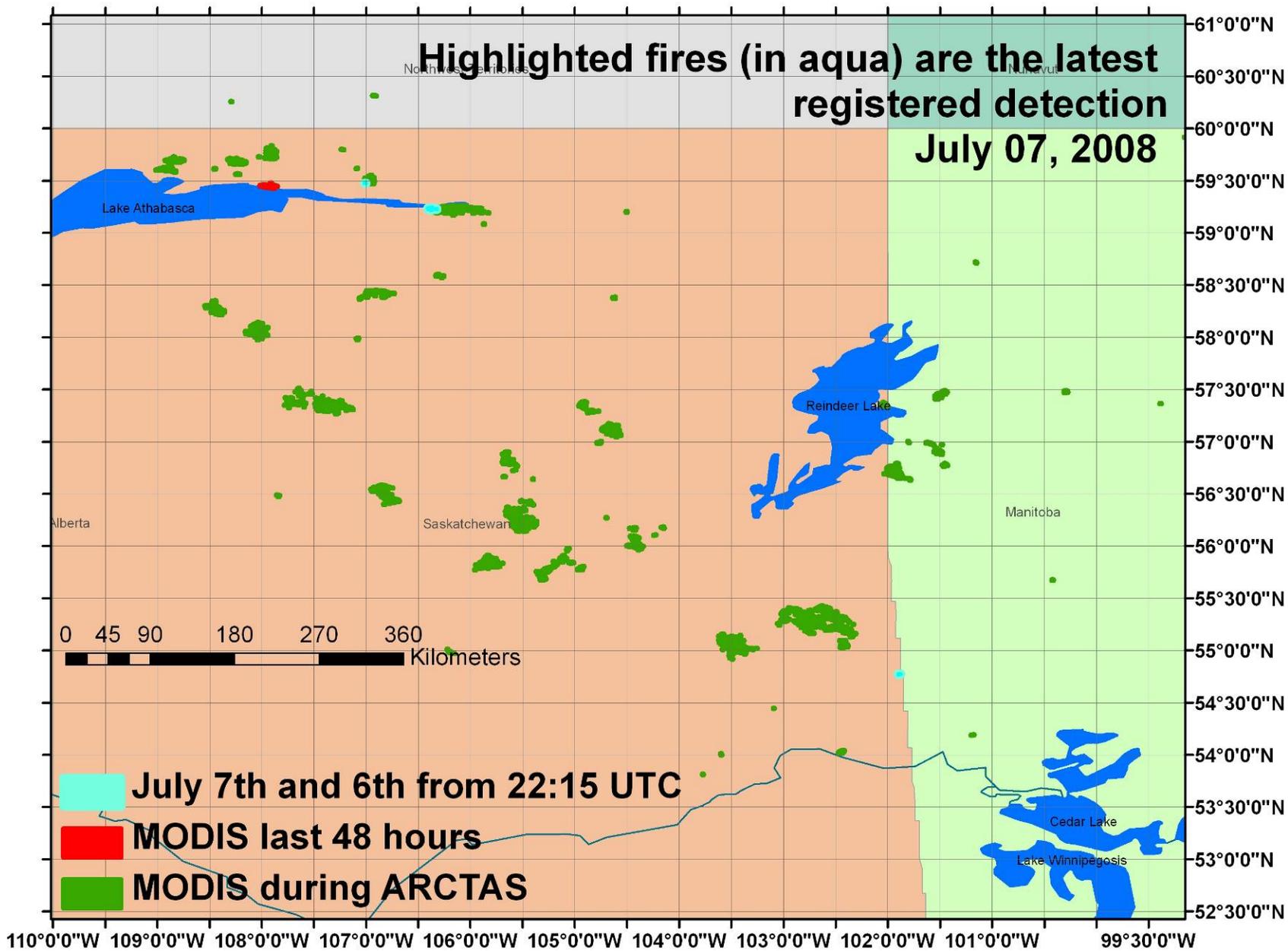
- 1) Coordination with B200 for isolated plume near Great Slave Lake with TERRA-MISR underpass
- 2) Cloud and smoke interaction study for radiation, aerosol and CCN near fires – Lake Athabasca
- 3) Explore aerosol and optical differences in flaming (dark) and smoldering (light) fire plumes near source.
- 4) Fly fire PyroCu outflow for aerosol chem. and optics
- 5) CAR opportunities in smoke and clouds
- 6) Model validation

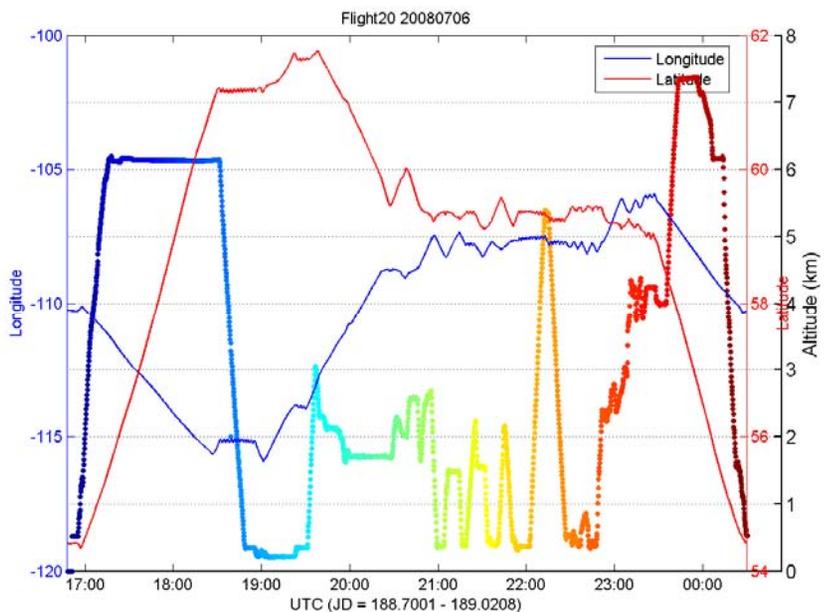


*Photos courtesy C. McNaughton  
Athabaska fires and PyroCumulus sampled by P3b*

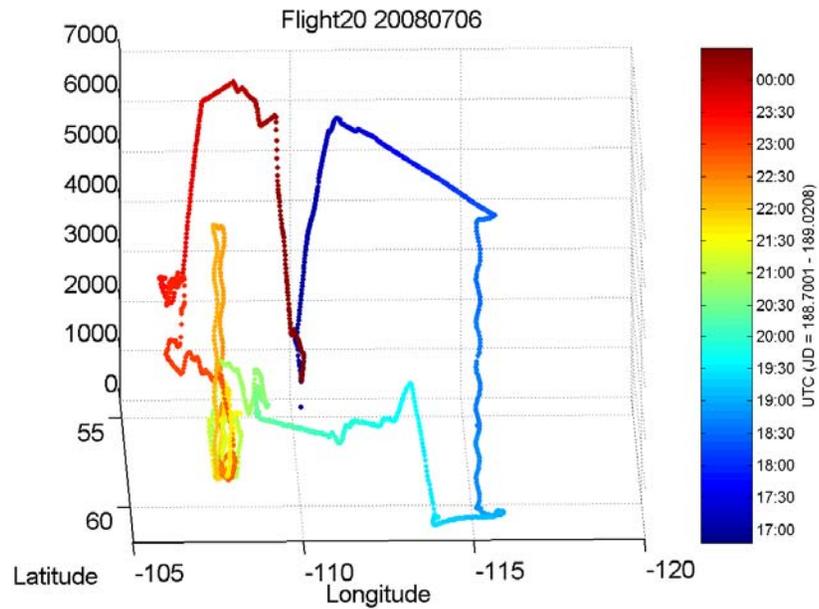
Flight track of P3b as flown



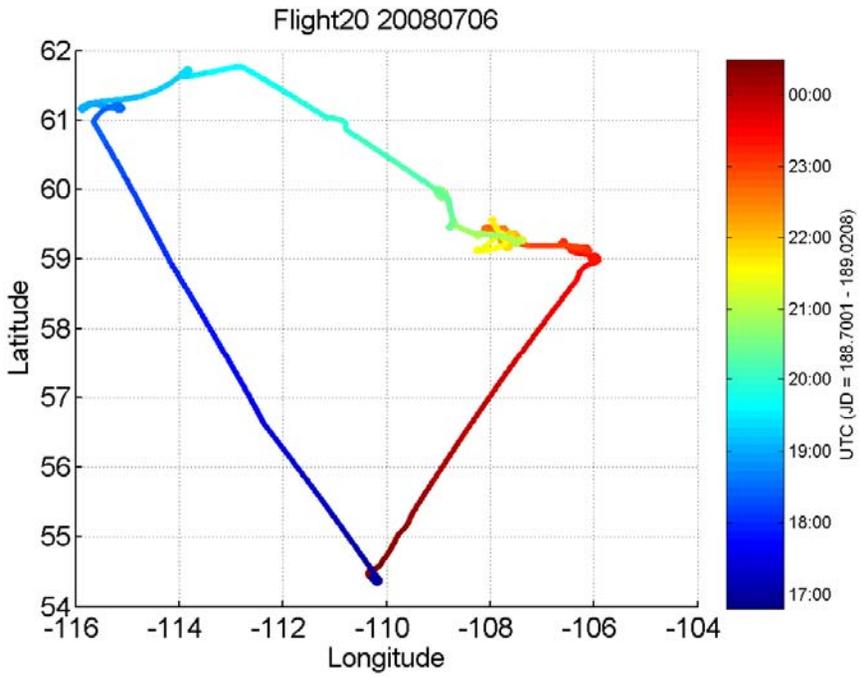




ASFlight20\_20080706timeserieslonlatatv3.fig, proplottimeserieslonlatatv3.m, Yohei, 2008-07-07



ASFlight20\_200807063dfighttrackcolortimev3.fig, proplot3dfighttrackcolortimev3.m, Yohei, 2008-07-07



ASFlight20\_200807062dfighttrackcolortimev3.fig, proplot2dfighttrackcolortimev3.m, Yohei, 2008-07-07

Color coded time and location plots  
courtesy of Y. Shinozuka

## Time History

HHMM (UT Time- approx.)

- ~1655 UT TAKEOFF (10:55:04 LST) and climb between low and higher clouds
- ~1701 9000'
- ~1715 B200 takes off from Great Slave Lake; large clouds ahead too high to climb over
- ~1717 20,000' possible icing
- ~1720 RTMM still down
- ~1800 RTMM up
- ~1801 Broken stratus and Cu below, B200 sees no plume so goes to refuel and join us later at fires.
- ~1831 Perfect conditions over lake – no Ci; start descent 1500'/min at 62.64N and -115.472 W
- ~1840 continue descent at 1000'/min, Aeronet site near at 62 27' 7"N, -114 24'25"W
- ~1854 MISR overpass; end descent; AOD at 20,000' = 0.015; at 5000' = 0.03 and at 200' 0.056,
- ~1856 complete two CAR circles over clear water, head SW looking for gradient in AOD at 200'
- ~1900 Heading 190; AOD 0.061,
- ~1917 AOD 0.39
- ~1924 CAR circles over muddy brown water in Lake
- ~1932 end CAR circles and spiral to thin layer between 6000' and 9000'waiting
- ~1935 9500' top of boundary layer
- ~1938 AOD - 0.02
- ~1939 on flight line to fires w/ B200 8 mi behind us
- ~1941 Flying below cloud base 7500' in broken Cu; try as test run for "cloud edge effect" under B200 lidar
- ~1947 Precipitating Cloud, try to avoid, Bumpy; scattering increase to 20Mm-1, AOD 0.05
- ~2008 Aerosol variable with lots of structure
- ~2023 Fly plume in older burn area – plumes scattered.
- ~2026 Turn around and do low cloud base leg
- ~2031 in cloud at base – in cloud and plume, ground occasionally visible
- ~2035 Turn for second pass higher in cloud for CAR. Need no ground in view for CAR
- ~2040 Start cloud leg heading to fire, middle of cloud, smoky; CO @ 250, Good cloud hit.
- ~2045 Do comparison run in nearby clean (non smoky) cloud; CO @ 120
- ~2053 Over major plume AOD 0.05
- ~2058 Spiral down to 500'
- ~2059 Start 500' leg under plume layer near 7000'; lower plumes headed north with upper plume folding back to south over lake.
- ~2101 AOD = 0.5 in plume
- ~2104 AOD = 0.1 out of plume
- ~2105 Reverse and fly plume at 4800'
- ~2107 Peak concentration near 59 20'N -105 47'W; run gradient
- ~2115 AOD 0.15

~2117 Spiral up with AOD varying above 1 and up to 2  
~2119 at 4800' scattering is 500Mm-1, CO~1000; AOD - 2  
~2125 Drop to 5000' and head downwind w B200  
~2138 Manouever to head toward plumes  
~2138 AOD ~3  
~2146 Reverse course and do flat descent for Anthony Bucholtz  
~21 47 Cross our other circles done earlier  
~2157 CAR circle for some clouds embedded in smoke  
~2202 end CAR circles and climb to 12500'  
~2206 AOD 0.057 @ 8000'  
~2208 B200 flying our circles for lidar curtain  
~2212 B200 gone home  
~2218 Spiral down in plume to west (cloud free)  
~2224 AOD – 2.5; CO-400ppb, run LIGHT and DARK plumes downwind; fly W-E in plume-front along lake shore on N side of Athabasca. Fly E-W with first plumes apparently darker; Fly W-E again  
~2252 Climb and look for plume-cloud interaction using CO  
~2300 Fly pass under PyroCb outflow in smoke just below pyro-cloud at 8800'- lot of smoke n the cloud  
~2303 location 59 10'N, -106 12'W, start in-cloud PyroCb run 500' above last run, CO-1200ppb  
~2307 Climb for above cloud run  
~2312 Bumpy – cloud processed run  
~2314 Fly cloud-smoke edge – detraining cloud  
~2317 Fly cloud processed smoke w/ embedded clouds. Heading east over cloud  
~2325 Do radiation runs for Anthony Bucholtz over clouds with smoke and w/o smoke  
~2336 encounter layer w/ elevated CO, AOD 0.05-0.028 about 18,000' enhanced OC and SO4 in layer  
~2341 Thin layer visually evident off to east  
~2356 Start slow ramp down 500'/min from 24000' to 20800'  
~2400 Approaching altostratus ahead – aerosol and CO drop  
~2404 continue ramp down to 20000'  
~2408 thin cloud  
~2428 Touchdown

## Summary

**Excellent Flight:** Hints of cloud openings and plume opportunities in the COAMPS model led us to attempt a MISR underpass with the B200 over Great Slave Lake in the morning and a radiation/aerosol/cloud study of fires north of Lake Athabaska in the afternoon. An early survey flight by the B200 revealed that the fires near Yellowknife had died early. In-flight communication with B200 allowed us to revise our plan. The B200 refueled while the P3b completed radiation profiles and legs under Terra in clean but cloud free air over Great Slave Lake. A dramatic separation of blue and muddy waters on the lake allowed us to do BRDF circles over both calm surfaces back to back under the same light conditions. We then rejoined the B200 to fly under it just below broken Cu en-route to the Athabaska fires. This provided preliminary statistical data for examining cloud edge effects.

We then worked the Athabaska fires in close co-ordination with the B200 lidar curtain and completed AATS/Aerosol spirals in dense smoke plumes over the lake. We were able to complete numerous objectives including gradient flights into plumes, radiation stacks, flux measurements, in-cloud CAR data, CAR circles, SSFR, and BBR measurements in and over smoke with embedded clouds. All of the above were carried out with concurrent full size resolved chemical and optical properties including cloud condensation nuclei (CCN). These were done along with in-cloud measurements of liquid water content (LWC), droplet surface area and effective radiance. Concurrent optical, physical and chemical characterizations were carried out on a range of plume types from “black” to “white” as well as an integrated assessment of these diverse plume types present during several cross wind runs for miles along the entire fire front. An excellent sampling of Pyro-Cu outflow included aerosol and radiation measurements below in and above the outflow region.

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## Flight Report

<b>Aircraft :</b>	NASA P-3B
<b>Operating Site(s) From / To :</b>	CYOD/CYOD
<b>Flight Date :</b>	July 6, 2008
<b>Flight Number / Data Flight # :</b>	597/ ARCTAS Science Flight # 20
<b>Time out:</b>	<b>1049 (L)</b>
<b>Time in:</b>	<b>1833 (L)</b>
<b>Flight Time :</b>	
<b>Flt Request # / PI:</b>	<b>8P301/ Phil Russell</b>
<b>Purpose of Flight :</b>	<b>Data [ X ] Ferry [ ] Functional Check [ ] Other [ ]</b>
<b>Sensor Payload :</b>	ARCTAS ( flight)
<b>Comments :</b>	Aircraft is in an up status and ready for the next flight. All science instruments are functioning nominally. Flight #597 Data Flight #20 was 7.7 hours with a departure time of 1049 (L) and landing 1833 (L). Once again TEAM P3B knocks out a Golden Day when dark clouds threatened to rain on our parade. Hints of cloud openings and plume opportunities in the COAMPS model led us to attempt a MISR underpass with the B200 over Great Slave Lake in the morning and a radiation/aerosol/cloud study of

fires north of Lake Athabaska in the afternoon. An early survey flight by the B200 revealed that the fires near Yellowknife had died early. While the B200 refueled for Athabaska the P3B completed radiation profiles and legs under Terra in clean but cloud free air over Great Slave Lake. A dramatic separation of blue and muddy waters on the lake allowed us to do BRDF circles over both calm surfaces back to back under the same light conditions. We then rejoined the B200 to fly under it just below broken Cu en-route to Athabaska. This provided preliminary statistical data for examining cloud edge effects.

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REVEAL: Due to the power switching from GPU to APU, REVEAL lost its ground connection about 15 minutes before takeoff. This was finally corrected after takeoff, and the flight tracks and data were uploaded. XChat was good for the whole flight, with only a few drop offs. The XChat server was able to recover in a short period of time (a couple of minutes) after these drop offs. We started to use elinks to upload inflight GOES imagery, and it was much faster than the method we used in previous flights. We will keep using this method for data transfer in future flights.

Instrument Report 06 July 2008

<b>AATS-14</b>	<b>Worked Well -</b>	<b>Set</b>
Status during flight (up/down)	Good Data	
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>Aero 3X</b>	<b>Good Blue Channels</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>BBR</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>CAR &amp; CANS</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>CCN</b>	<b>Good</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>COBALT</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		

Status for next flight	
Postflight requirements	
Comments	

<b>HIGEAR</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>AMS</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>PDS</b>	<b>Fully Operational entire flight</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		

<b>REVEAL &amp; RTMM</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		

Comments	
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<b>SSFR</b>	<b>Good Data</b>	<b>Set</b>
Status during flight (up/down)		
Accomplishments		
Issues encountered		
Status for next flight		
Postflight requirements		
Comments		