

Existing mission concepts

Large scale (50-70 S, 0-14 km altitude) atmospheric O₂ and CO₂ distributions, characterizing the size and temporal growth of the zonal atmospheric O₂ plume, and constraining zonal fluxes on monthly to seasonal time scales.

Basin scale vertical atmospheric O₂ and CO₂ gradient ratios through the mid-troposphere and spatial distributions to support flux estimation over full campaign time period and spatial extent.

Regional scale pseudo-Lagrangian flights for localized daily flux estimates and O₂ and CO₂ gradient ratios across the top of the ABL.

Remote sensing of hyperspectral ocean color over daily flux influence regions and along the Antarctic Peninsula.

Biogenic reactive gas measurements to quantify emissions of chemically and radiatively important species.

New concepts

Upwind and downwind cross-sections (90 W and 40 W)

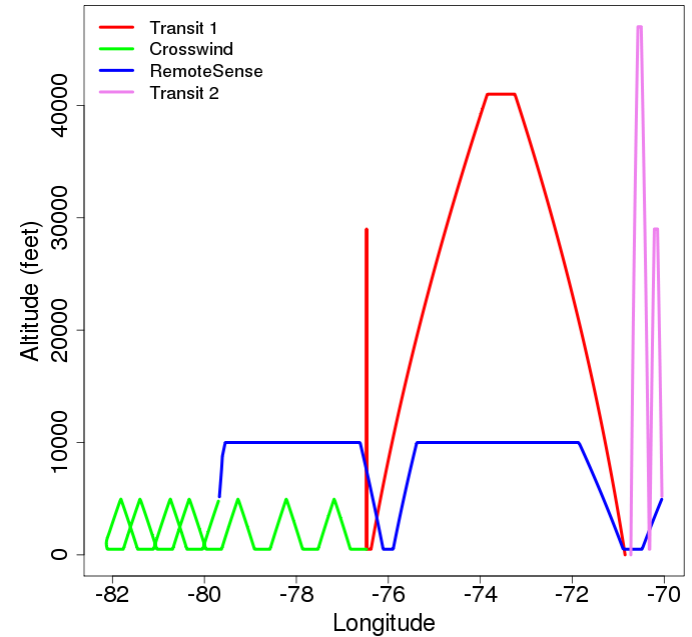
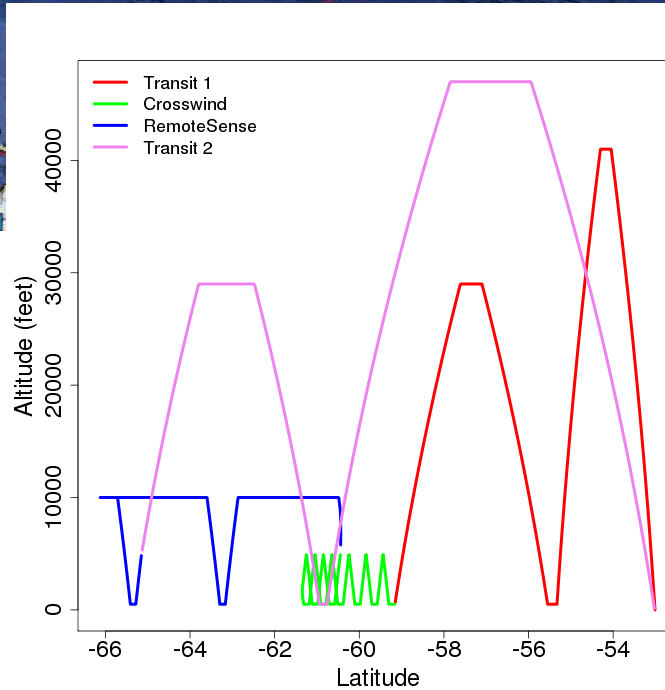
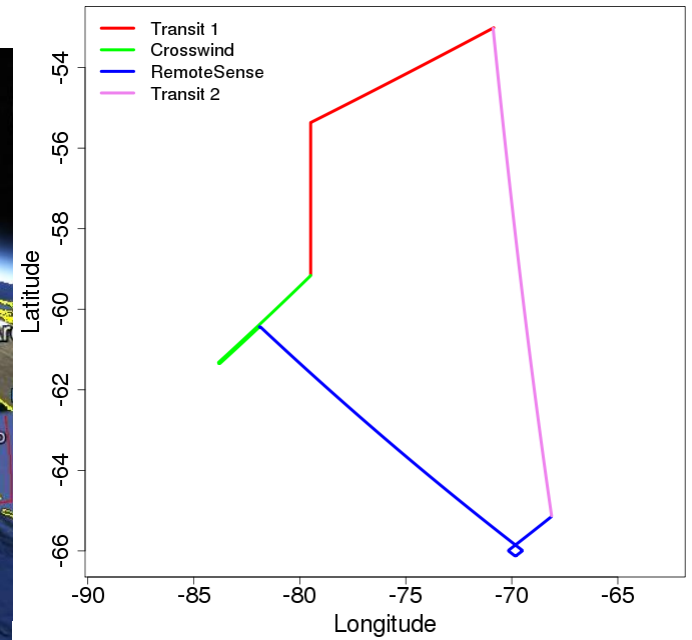
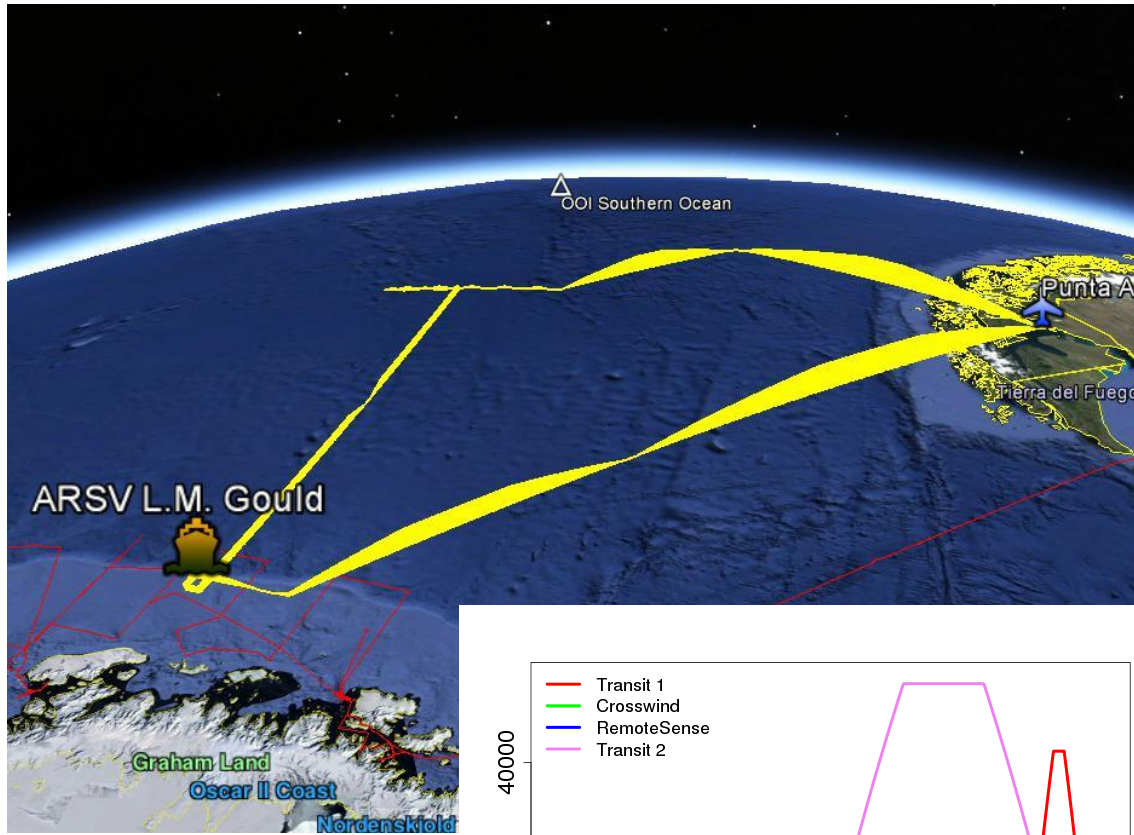
“Peninsula Blooms” sampling concentrations in BL over / downwind of coast

ORCAS Nominal Flight Plan			
Assumptions:			
Maximum Altitude		47000 ft	
Initial Climbout Altitude		41000 ft	
Cruise Altitude		29000 ft	
Remote Sensing Altitude		10000 ft	
Crosswind Top Altitude		5000 ft	
PBL Sampling Altitude		500 ft	
Max. Altitude Ground Speed		460 kts	
PBL Sampling Ground Speed		220 kts	
All other Ground Speeds Linearly Interpolated by Altitude			
Takeoff Fuel at Sea Level		41300 lbs	
Max. Altitude Fuel Burn		2000 lbs/hr	
PBL Sampling Fuel Burn		5500 lbs/hr	
All other Burns Linearly Interpolated by Altitude			
Ascent/Descent Rate		1500 ft/min	
Wind speed		15 kts	

Phase of flight	Component	Alt1	Alt2	Min	GS	Dist.	ave FB	Fuel	Min	Dist	Fuel	Min	Dist	Fuel
Transit to Study Area	Initial climb	0	41000	27.3	323	147.2	3995	1820	27.3	147	1820			
	Cruise	41000	41000	5.0	429	35.8	2452	204	32.3	183	2024			
	Descent	41000	500	27.0	325	146.0	3976	1789	59.3	329	3813			
	PBL Leg	500	500	3.0	220	11.0	5500	275	62.3	340	4088			
	Ascent	500	29000	19.0	294	93.0	4427	1402	81.3	433	5490			
	Cruise	29000	29000	5.0	367	30.6	3355	280	86.3	464	5770			
	Descent	29000	500	19.0	294	93.0	4427	1402	105.3	557	7172	105.3	557	7172
Boundary layer sampling	PBL Leg	500	500	3.0	220	11.0	5500	275	108.3	568	7447			
	Ascent	500	5000	3.0	232	11.6	5331	267	111.3	579	7713			
	Descent	5000	500	3.0	232	11.6	5331	267	114.3	591	7980			
	PBL Leg	500	500	3.0	220	11.0	5500	275	117.3	602	8255			
	Ascent	500	5000	3.0	232	11.6	5331	267	120.3	613	8521			
	Descent	5000	500	3.0	232	11.6	5331	267	123.3	625	8788			
	PBL Leg	500	500	3.0	220	11.0	5500	275	126.3	636	9063			
	Ascent	500	5000	3.0	232	11.6	5331	267	129.3	647	9329			
	Descent	5000	500	3.0	232	11.6	5331	267	132.3	659	9596			
	PBL Leg	500	500	3.0	220	11.0	5500	275	135.3	670	9871			
	Ascent	500	5000	3.0	232	11.6	5331	267	138.3	682	10138			
	Descent	5000	500	3.0	232	11.6	5331	267	141.3	693	10404			
	PBL Leg	500	500	3.0	220	11.0	5500	275	144.3	704	10679			
	Ascent	500	5000	3.0	232	11.6	5331	267	147.3	716	10946			
	Descent	5000	500	3.0	232	11.6	5331	267	150.3	727	11212			
	PBL Leg	500	500	3.0	220	11.0	5500	275	153.3	738	11487			
	Ascent+180	500	5000	3.0	232	11.6	5331	267	156.3	750	11754			
	Descent	5000	500	3.0	232	11.6	5331	267	159.3	762	12020			
	PBL Leg	500	500	3.0	220	11.0	5500	275	162.3	773	12295			
Ascent	500	5000	3.0	232	11.6	5331	267	165.3	784	12562				
Descent	5000	500	3.0	232	11.6	5331	267	168.3	796	12828				
PBL Leg	500	500	3.0	220	11.0	5500	275	171.3	807	13103				
Ascent	500	5000	3.0	232	11.6	5331	267	174.3	818	13370	69.0	262	6198	
Remote Sensing	Ascent+90	5000	10000	3.3	256	14.2	4973	276	177.7	832	13646			
	Downwind	10000	10000	45.0	269	201.8	4785	3589	222.7	1034	17235			
	Descent	10000	500	6.3	245	25.8	5142	543	229.0	1060	17778			
	PBL Leg	500	500	3.0	220	11.0	5500	275	232.0	1071	18053			
	Ascent	500	10000	6.3	245	25.8	5142	543	238.3	1097	18595			
	Downwind	10000	10000	45.0	269	201.8	4785	3589	283.3	1299	22184	109.0	480	8814
	Descent	10000	500	6.3	245	25.8	5142	543	299.7	1369	23524			
LMG Overflight and Profile	Cross pattern	10000	10000	10.0	269	44.8	4785	797	293.3	1343	22982			
	Descent	10000	500	6.3	245	25.8	5142	543	299.7	1369	23524			
	PBL Leg	500	500	3.0	220	11.0	5500	275	302.7	1380	23799	19.3	82	1615
Transit from Study Area	Ascent	5000	29000	16.0	305	81.4	4258	1135	318.7	1462	24935			
	Cruise	29000	29000	13.0	367	79.5	3355	727	331.7	1541	25662			
	Descent	29000	500	19.0	294	93.0	4427	1402	350.7	1634	27064			
	PBL Leg	500	500	3.0	220	11.0	5500	275	353.7	1645	27339			
	Ascent	500	47000.0	31.0	340	175.7	3750	1938	384.7	1821	29276			
	Cruise	47000	47000	15.0	460	115.0	2000	500	399.7	1936	29776			
	Final Descent	47000	0	31.3	339	176.9	3769	1968	431.0	2113	31744	128.3	732	7945
Flight Totals				431.0		2112.7		31744				431.0	2113	31744
			Hours	7.2		Ave FB	4419lbs/hr				Remaining Fuel (lbs)			9556

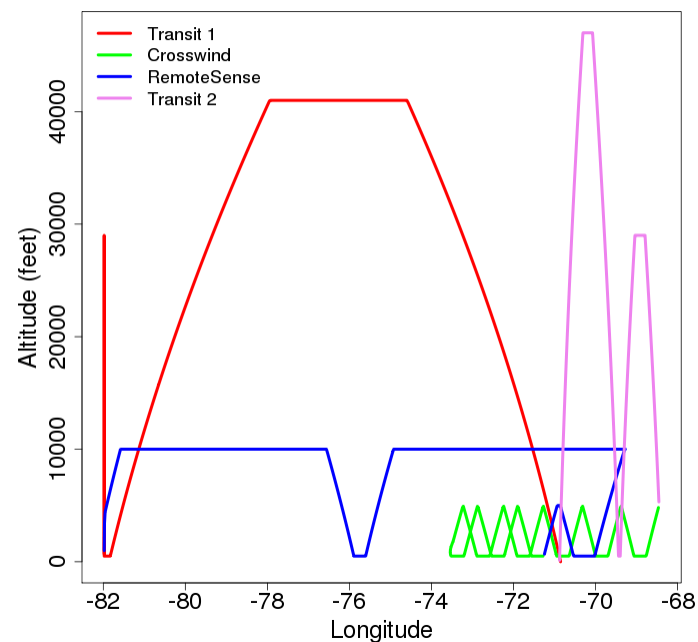
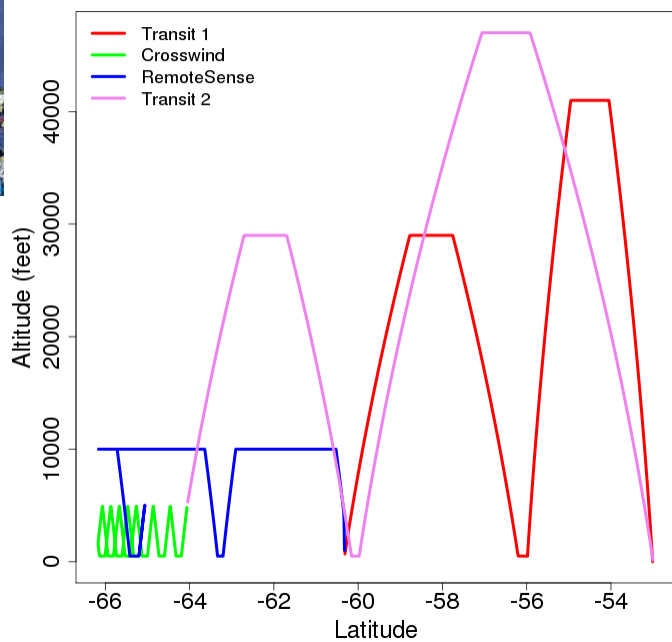
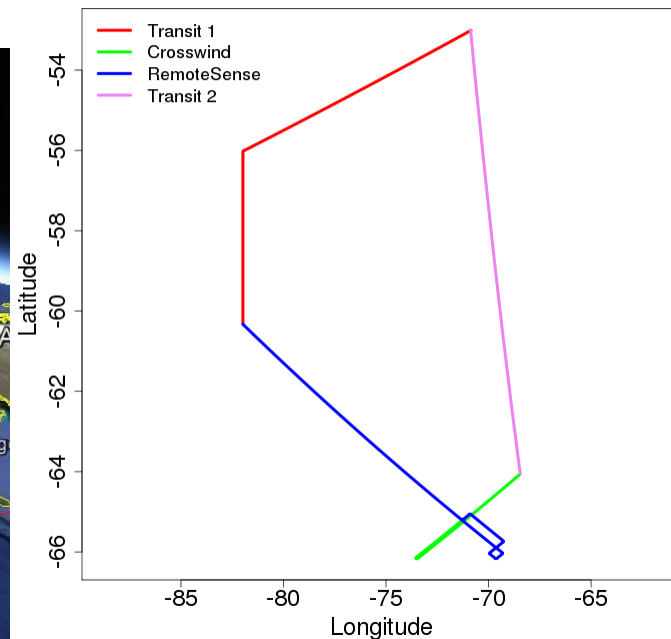
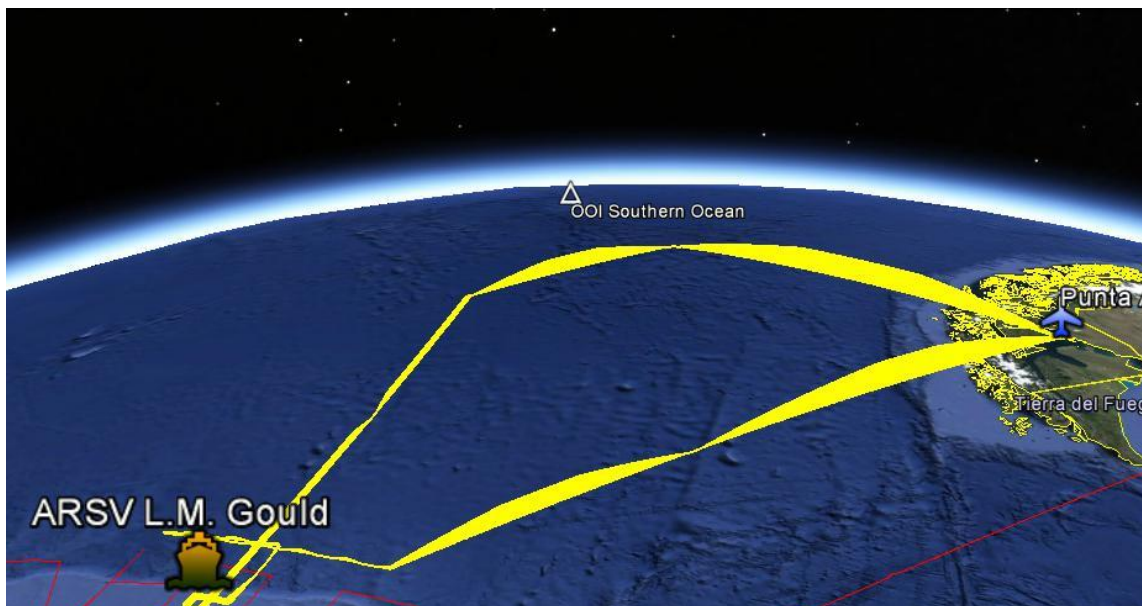
Very approximate and uncertain – pilots have much better performance tools

Pseudo-lagrangian Day 1

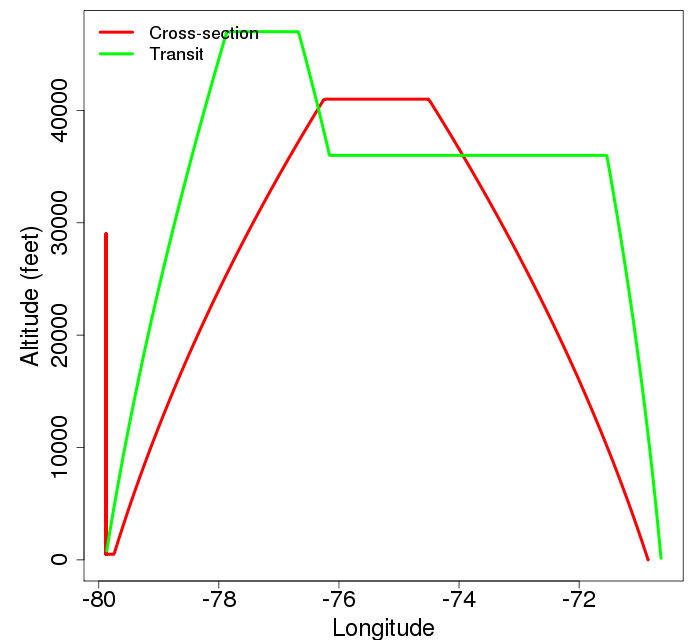
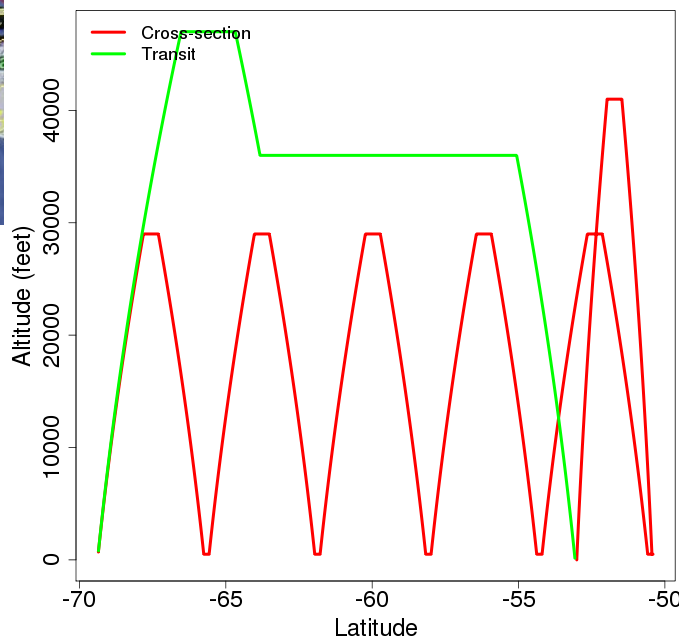
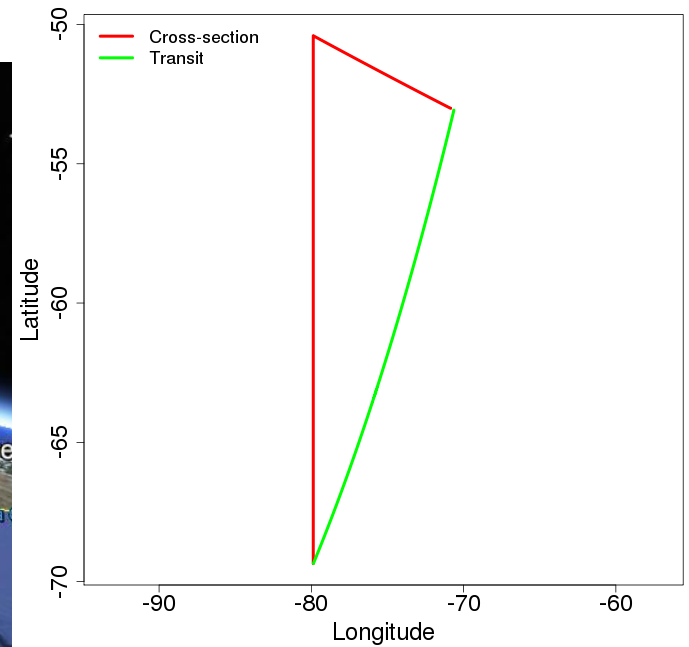
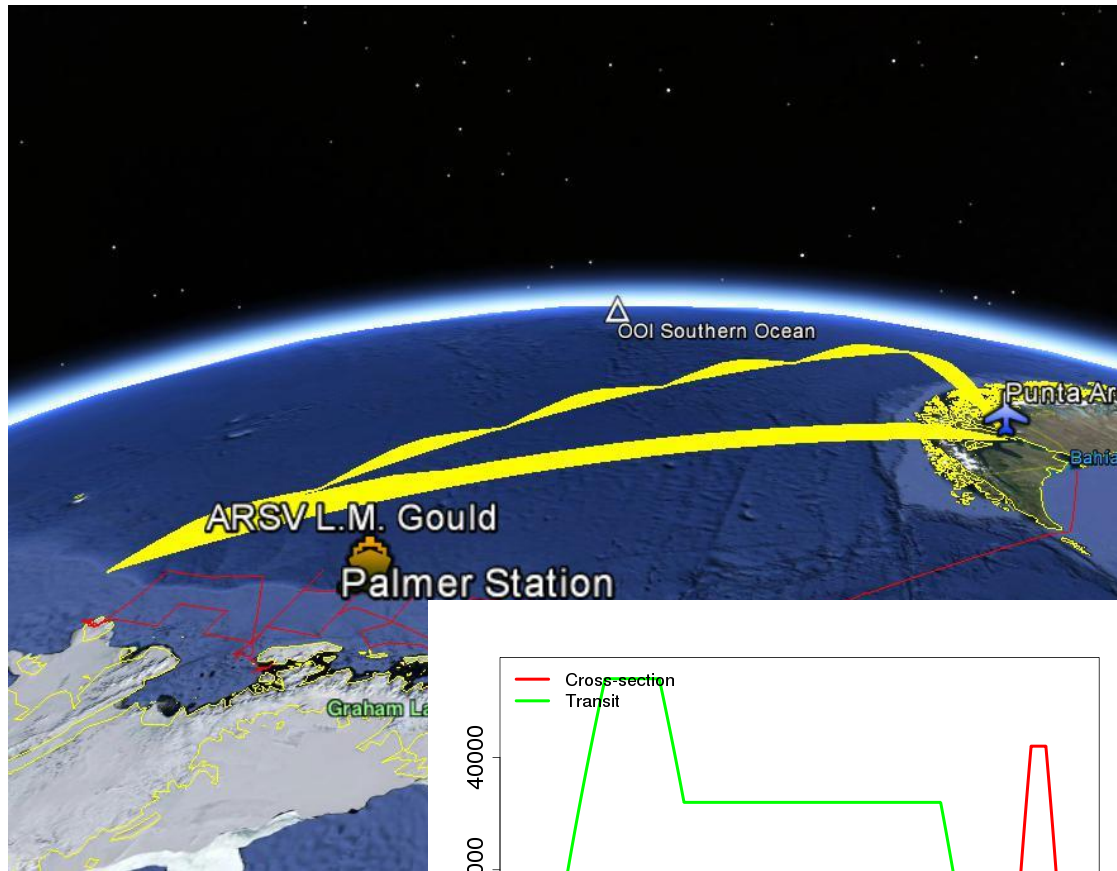


~ 560 nmi outbound
 ~ 480 nmi R.S. leg
 ~ 730 nmi inbound

Pseudo-lagrangian Day 2



HIPPO-like



50-70 S = 1200 nmi

Very approximate
and uncertain –
pilots have much
better performance
tools

ORCAS Max Distance Flight Plan														
Phase of flight	Component	Alt1	Alt2	Min	GS	Dist.	ave FB	Fuel	Cumulative			Phase totals		
									Min	Dist	Fuel	Min	Dist	Fuel
Transit to Study Area	Initial climb	0	41000	27.3	323	147.2	3995	1820	27.3	147	1820			
	Cruise	41000	41000	195.0	429	1394.4	2452	7968	222.3	1542	9788			
	Descent	41000	500	27.0	325	146.0	3976	1789	249.3	1688	11577	249	1688	11577
Boundary layer sampling	PBL Leg	500	500	3.0	220	11.0	5500	275	252.3	1699	11852			
	Ascent	500	5000	3.0	232	11.6	5331	267	255.3	1710	12118			
	Descent	5000	500	3.0	232	11.6	5331	267	258.3	1722	12385			
	PBL Leg	500	500	3.0	220	11.0	5500	275	261.3	1733	12660			
	Repeat profile 4 more times			36.0	232	139.0	5331	3198	297.3	1872	15858			
	Ascent+180	500	5000	3.0	232	11.6	5331	267	300.3	1883	16125			
	Descent	5000	500	3.0	232	11.6	5331	267	303.3	1895	16391			
	PBL Leg	500	500	3.0	220	11.0	5500	275	306.3	1906	16666			
	Repeat profile 1 more times			9.0	232	34.7	5331	800	315.3	1941	17466	66	253	5889
Transit from Study Area	Ascent	500	47000	31.0	340	175.7	3750	1938	346.3	2116	19403			
	Cruise	47000	47000	180.0	460	1380.0	2000	6000	526.3	3496	25403			
	Final Descent	47000	0	31.3	339	176.9	3769	1968	557.7	3673	27371	242	1733	9906
Flight Totals				557.7		3673.2		27371				558	3673	27371
			Hours	9.3		Ave FB	2945lbs/hr				Remaining Fuel (lbs)			13929

750 nmi and 1500 nmi ranges

