U.S. Dept. of Commerce / NMAO / NOAA / Aircraft Operations Center

Flt ID: 20120618H1	From: KMCF	To: KMCF
Flt. No: 12 –	Blk In: 1612 z	Time On: 1604 z
ETD: 102	Blk Out: 0953 z	Time Off: 1000 z
ETE: 6 +	Blk Time: + 6.3 Hrs	Flt Time: + 6.1 Hrs
Sponsoring Org: AOC	Program: PSM	Purpose: WIND/SFMR CAL

AOC Flight Crew

13

Aircraft Commander: HALVERSON	Data System: NAEHER
Co-Pilot: SWEENEY , KIBBEY	AVAPS: MASCARO
Navigator: BRAKOB ,	System Eng: LYNCH, C
Flight Eng: KLIPPEL , HEYSTEK	A A: RICHARDS
Flight Director: WILLIAMS ,	A A: WARNECKE
Avionics: PEEK	Crew Chief:

Participating Scientists / Visitors

Name (Last, First)	*Activity on Aircraft*	*Affiliation*

Remarks (Storm Name, Mission ID, Recco Times, Fix Times)

Recco Times *Fix #* *Fix Time*

Storm Name: WXWXA TRAIN

Mission ID:

(See reverse for additional remarks)

U.S. Dept. of Commerce / NMAO / NOAA / Aircraft Operations Center

Flight ID: 20120618H1	Time Off: 1000	Time On: 1604

	A/C - Takeoff	Wx Station - Takeoff	A/C - Land	Wx Station - Land
Pressure	PS2 1014.9 / PS1 1012.2	29.99 1015.1	1017.5 / 1016.1	30.04 1016.8

	Number	Data Disposition / Date / Quality
Flight Level Tapes		
Radar Tapes		
Cloud Physics Tapes / CDs		
Video Tapes		
Dropsondes	2	Good: 2 Bad:
AXBT	1	
AXCP		
AXCTD		

Remarks:

42002 27

✓ HDOB

1515Z 12009 10SM CLR 25/20
10Z 22/20

NO PCAB in D.S. or SFMR

TDM 2 went out @ 1430Z

NO NOVATEL

NO HDOBS (update for SONIC)

NO SFMR ON screens or WMM / HDOBS bad but yes in display app

15kts sfc

Power shift shuts everything down

printer? where?

NO scr 800 ON windows

W: Vista, FD logger, R: AVAPS

~~SKA restarted~~?

BT came in but NOT show up in AAMPS Data Sys - or display App - Resolved this should work for next flt

Old Sys NOT picking it up

NOAA • AOC • SED N42RF AVAPS DROP LOG Lead Tech: Joe Bosko

Project: Hurricane 2012 Mission: WIND CAL 2012 Flight ID: 20120618H1

Take Off : 1000Z Landing: 1604Z Flt Dir : JESS WILLIAMS

Drop #	Sonde Serial #	Rcvr #	Press Offset	Launch Time	Operator	Charge $$ To	Comments	Good ?
1	11745312	1	0	1124Z	JW	AOC		✓
2	11755701	1	.6	1503Z	JW	AOC		
3	~~10915309~~	2	+.6		~~JW~~	~~AOC~~		
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
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28								
29								
30								
31								
32								
33								
34								

WD WS WZ 120 pts

P9A pdA roll pitch

↓ 5 of

121 pts per leg

726 pts 5.933497

2.2618303

P3 Wind Calibration Exercises

P9A 83

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	~~Notes:~~
1,500	with	180	.8 / .6		102237	102437	
1,500	into	180	.3 / .08		103201	103401	
1,500	with	210	.4 / .2		104310	104510	
1,500	into	210	.5 / .3		105202	105402	
1,500	~~with~~ into	240	.6 / .3		111458	111658	
1,500	with	240	.6 / .4		112332	112532	

15k

.999 Cor

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
5,000	into	180	.8 / .7		113420	113620	
5,000	with	180	.5 / .3		114130	114330	114232 114312
5,000	into	210	.7 / .5		115144	115344	
5,000	with	210	.2 / .04		120358	120558	
5,000	into	240	.2 / .09		121100	121136	121314-121438
5,000	with	240	.3 / .09		121915	122115	

10k

84+

726

6.064407

2.33452

.998 Cor

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
10,000	into	180	1.0 /		123642	123842	
10,000	with	180	.5 / .3		124345	124545	
10,000	into	210	.3 / .09		125258	125458	
10,000	with	210	.2 / .07		125920	130120	
10,000	into	240	.4 / .2		132120	132320	
10,000	with	240	.8 / .7		132808	133008	

5k

726

6.096507

2.3375418

.999 Cor

14059 - 16914

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
15,000	into	180	.9 / .8		134218	134418	
15,000	with	180	1 / 1		135000	135200	
15,000	into	210	.9 / .8		135759	135959	
15,000	with	210	.4 / .2		140522	140722	
15,000	with	240	1 / 1		142050	142250	
15,000	into	240	.6 / .4		142753	142953	

15

726

5.575264

2.220125

0.999

18171 - 21079

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
20,000	with	180	.3 / .1		145050	145250	
20,000	into	180	.3 / .1		150040	150210	150325 150355
20,000	with	210	.7 / .6		150810	151010	
20,000	into	210	.5 / .3		151645	151845	
20,000	with	240	.9 / .8		152920	153120	
20,000	into	240	.8 / .7		153718	153918	

726

90

6.216913

2.2963745

.997

OLD

6.108560

2.277652

2.55

7.203803

0.22

ALL - SURF 6.002433889 COR 3630

INT 2.291311227 0.996

Slip

> Length of slope

PQB PDB

PDB -15 when straight + level

15k 110053 -15 - 110535 283pts Slope 7.21228847 89

141058 - 141606 309 Slope 6.81840972

Batn 592 7.04486082 1

OLD 6,108560
2.277652
0.22
7.203803

15k

AA

Plot WD WS UW2 for ALL legs + circles

Chg w Amp of WD + S + UW2 in circles +
equalize URAD b/4 + after 90/270 turns 130300
circles 133100

0.22

0.15

U→2.5

90/270
123830 124145

PD Bake off -15

070 240

P3 Wind Calibration Exercises

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
~~1,500~~	with	180	60/12	240	1021	1024	
~~4,500~~	into	180	60/10	060	1029	1035	extended
~~1,500~~	with	210	60/15	240	1041	104530	SFMR
~~1,500~~	into	210	30/5	060	1052		
~~4,500~~	into	240	60/7	060	1111		
~~1,500~~	with	240	62/12	210			sonde

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
5,000	into	180	065/13	~~060~~ 070	1235		
5,000	with	180		250	1242		
5,000				070	1250		SFMR
5,000				250	1259		SFMR
5,000				070			
5,000				250			BT

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
10,000	into	180	070/12	070	1133	1136	
10,000	with	186	068/18	250	1140	1144	
10,000	into	210	073/10	070			
10,000	with	240	068/13	250			
10,000	into	240	075/10	070			
10,000	with	240	076/11	~~250~~			

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
~~15,000~~	into		98/15	105			
15,000	with		163/20	285	1348		
15,000	into		100/12	105	1356	13	
15,000	with			285	1403		
15,000	with		162/18	285			
15,000	into		102/10	105	1426		extended b/a turn

Level	Into/with Wind	IAS	wdir/wspd	Track	Start Time	Stop Time	Notes:
20,000			127/8	310	1450		
20,000			073/3	130	1458		
20,000				310			
20,000				130			
20,000				310			
20,000				130	1536		

15K

180 102238 - 102437 ✓

180 ~~102953 - 103152~~ 103152 - 103351 ✓

210 104310 - 104510 ✓

105206 - 105405 ✓

240 111310 - 111510 X

1123 15 - 112515 X

1.18

3628

5.97316

2.28302

.996

150120 - 150210

50

5K

180 123642 - 123842 ✓

124215 - 124415 +

210 125200 - 125400 +

125920 - 130120 ✓

20 20

240 132125 - 132325 ✓

132800 - 133000 ✓

10K

180 113410 - 113610 ✓ .9X

114120 - 114320 15 15

210 115405 - 115605 .83X

120350 - 120550 ✓

240 121239 - 121438 X .485

121920 - 122120 ✓

1.025

20K

180 145053 - 145252 ✓

150120 - 150210 +

150310 - 150420

210 150810 - 151010 ✓

151659 - 151858 +

240 152925 - 153125 ✓

153710 - 153910 +

1.5K

180 134220 - 134420

134955 - 135155

210 135758 - 135958

140526 - 140720

240 141925 - 142125 +

142700 - 142900 +

.024

.127

.37

20K	6.16044	~~2.28356~~	
15K	5.92633	2.28356 / 2.26052	.9974 / .9992
10K	6.05185	2.33625	.9977
5K	5.96403	2.30510	.9985
1.5K	5.60606	2.21801	.9888

All

5.97312

2.28302

.9964

P3 Wind Calibration Exercises

Suggested Order of Operations

SFMR Calibration: Needs to be done before 9AM with legs centered over buoy

15,000 ft PA

- Racetrack Leg Into Wind, 180 kts IAS, 3 mins
- Racetrack Leg With Wind, 180 kts IAS, 3 mins
- Racetrack Leg Into Wind, 210 kts IAS, 4 mins
- Racetrack Leg With Wind, 210 kts IAS, 4 mins
- **Yaw Maneuver, 200 kts IAS, 5 complete cycles, ± 5 ° Sideslip, Roll < ± 3°
- Racetrack Leg Into Wind, 240 kts IAS, 3 mins
- Racetrack Leg With Wind, 240 kts IAS, 3 mins
- Dropsonde on last leg

10,000 ft RA

- Racetrack Leg Into Wind, 180 kts IAS, 3 mins
- Racetrack Leg With Wind, 180 kts IAS, 3 mins
- Racetrack Leg Into Wind, 210 kts IAS, 4 mins
- Racetrack Leg With Wind, 210 kts IAS, 4 mins
- Racetrack Leg Into Wind, 240 kts IAS, 3 mins
- Racetrack Leg With Wind, 240 kts IAS, 3 mins

5,000 ft RA

- Racetrack Leg Into Wind, 180 kts IAS, 3 mins
- Racetrack Leg With Wind, 180 kts IAS, 3 mins
- Racetrack Leg Into Wind, 210 kts IAS, 4 mins
- Racetrack Leg With Wind, 210 kts IAS, 4 mins
- 3 Concentric Circles to the Left, 30° Roll, 210 kts IAS
- 3 Concentric Circles to the Right, 30° Roll, 210 kts IAS
- Racetrack Leg Into Wind, 240 kts IAS, 3 mins
- Racetrack Leg With Wind, 240 kts IAS, 3 mins
- AXBT on last leg (need to be depressurized)

1,500 ft RA

- Racetrack Leg Into Wind, 180 kts IAS, 3 mins
- Racetrack Leg With Wind, 180 kts IAS, 3 mins
- Racetrack Leg Into Wind, 210 kts IAS, 3 mins
- Racetrack Leg With Wind, 210 kts IAS, 3 mins
- Yaw Maneuver, 200 kts IAS, 5 complete cycles, ± 5 ° Sideslip, Roll < ± 3°
- Racetrack Leg Into Wind, 240 kts IAS, 3 mins
- Racetrack Leg With Wind, 240 kts IAS, 3 mins

20,000 ft PA

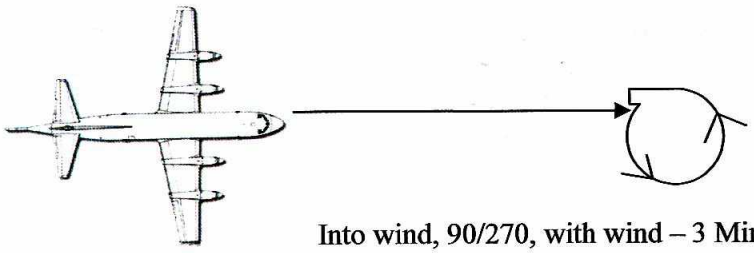
- Racetrack Leg Into Wind, 180 kts IAS, 3 mins
- Racetrack Leg With Wind, 180 kts IAS, 3 mins
- Racetrack Leg Into Wind, 210 kts IAS, 3 mins
- Racetrack Leg With Wind, 210 kts IAS, 3 mins
- Pitch Maneuver, 210 kts IAS, 5 complete cycles, ± 5 ° Pitch
- Racetrack Leg Into Wind, 240 kts IAS, 3 mins
- Racetrack Leg With Wind, 240 kts IAS, 3 mins
- ~~Dropsonde Deployment on first leg 180kts~~

** *If running late save 15,000ft Yaw maneuver for during climb from 1,500ft to 20,000ft*

P3 Wind Calibration Exercises

Legs:

- 1 leg tracking true into wind and 1 leg tracking true with the wind at each IAS at each altitude (total of 30 legs)
- Must be at least 3 mins long
- DO NOT CHANGE TRACK/HEADING!!
- If wind speed > 13kts and wind direction changes by > 10° then Re-Do!
- Do 90/270 turns at the end of leg between into/with wind to head back on reciprocal course.

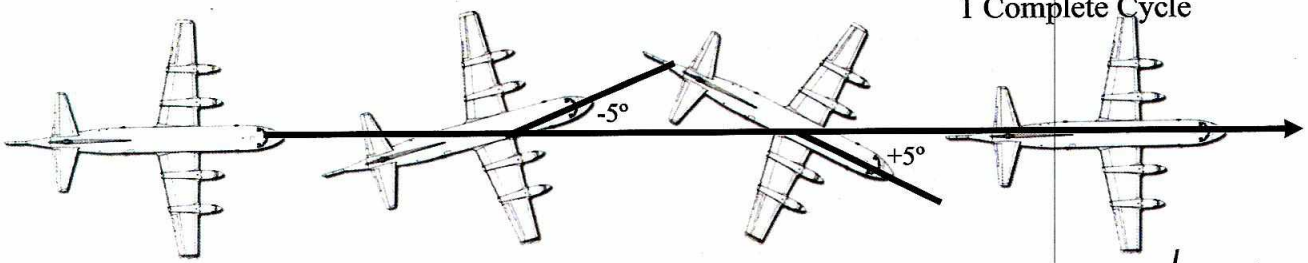


A/C speeds:	Altitudes:
180 kts	1,500 ft RA
210 kts	5,000 ft RA
240 kts	10,000 ft RA
	15,000 ft PA
	20,000 ft PA

Into wind, 90/270, with wind – 3 Minutes

Yaw Maneuvers:

1 Complete Cycle

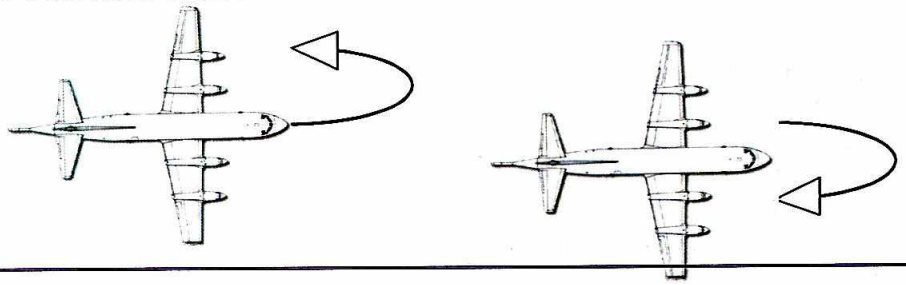


- Do at 1,500 ft RA and 15,000 ft PA
- Do at 200 kts IAS (See WP-3 Standard Op Notes)
- TRY NOT TO FLUCTUATE IAS!!
- Yaw by ~ ± 5° sideslip, Roll < ± 3°
- Do 5 cycles (above picture is 1 cycle)

1 min per cycle
~5-6 mn
+/- 55 PSI

---

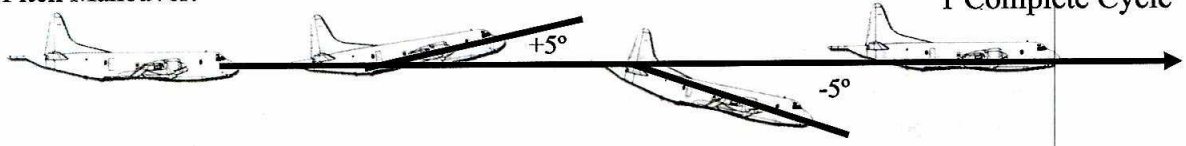
3 Concentric Circles:



- 5,000 ft RA
- 30° roll
- 3 left turns
- 3 right turns
- At 210 IAS racetrack legs

Pitch Maneuver:

1 Complete Cycle



- Do at 20,000 ft PA
- Do after the 210 IAS racetrack and before you start the 240 IAS racetrack
- Do at 215 kts IAS
- Do 5 Cycles of ± 5 ° Pitch (above picture is 1 complete cycle)

N42RF Calibration Results
From June 18, 2012 Wind Cal Flight

N42RF flew a 6 hour mission on June 16, 2012 over the USF buoy 42022 to the WSW of Macdill, at 27.5N 83.7W. Several maneuvers were executed in order to determine the coefficients for the attack and slip angles. Yaw maneuvers were performed at 1500 feet and 15000 feet to provide input for deriving the slope for the aircraft's slip angle. Several speed runs, tracking into and out of the wind, were flown at five pre-determined altitudes. The data collected from these maneuvers were used to determine the slope and intercept for the aircraft's attack angle.

The data, images and results can be found on the server at /acdata/2012/MET/20120618H1 directory. The coefficients were determined using ZR_TPCAL.xls, an excel program created by 2010 Hollings Scholar Zeljco Raic.

One hundred twenty one (121) points were selected for each leg flown into and with the wind for each airspeed (180, 210, 240 IAS), making a total of 242 points per indicated airspeed per altitude for statistical significance. The following table shows the attack angle coefficients for each of the five altitudes:

	Slope	Intercept
1500 feet	5.575209	2.220725
5000 feet	6.096507	2.337542
10000 feet	6.064407	2.334522
15000 feet	5.933497	2.261431
20000 feet	6.216913	2.296375

The above table is for reference purposes only. To obtain the "final" slope and intercept for attack angle all of the selected data points, ZR_TPCAL.xls was used. For this calibration flight the slope and intercept for the attack angle are as follows:

For all levels (3630 points) Slope: **6.002434** Intercept: **2.291311**

The program computes a correlation coefficient and it is .996 for all legs combined.

The input data to determine the slope for the slip angle came from the two yaw maneuvers. A minimum of, but not limited to, 120 points are required per maneuver. ABD_TPCAL on the HP1000 computes a slope for the slip angle for each maneuver. For this flight the derived slip angle slopes are as follows:

1500 feet	Slope: 6.818409	for 309 points
15000 feet	Slope: 7.212288	for 283 points

As was for the attack angle derivation, both sets of data were entered into the ABD_TPCAL program. The "final" slip angle slope from the 831 points was calculated to be **7.044861**.

To determine the slip intercept, a subjective technique is employed using plots of wind direction, wind speed and vertical wind from the circle maneuvers conducted at 5000 feet. Several plots of the aforementioned parameters were made, varying the intercept value for the slip angle. Through some simple statistics and a "meteorological eyeballing" of the plots, a determination for the slip angle intercept is made. For this flight the slip angle intercept was determined to be **+0.15**. As previously stated this method is very subjective. However it does provide a hands-on view of what is happening to the horizontal and vertical wind values when the value for the slip angle intercept is modified.

From Monday's SFMR / Wind calibration flight overall things worked very well! However, below are a few instrument concerns still, and some that were fixed from the 8 June flight.

Instruments:
--Total Temp 2 (TTM.2) is still extremely noisy, with 3-4 degrees C of noise. This is being looked into. See *TTMnoise_zoom.png*
--Dewpointer #2 (TDM.2) a different dewpointer than on the 8 June test flight, did not get cold enough in the high altitudes, nor did it trend with #1 or the TDL ,and was slightly too cold at the low altitudes. *See TDM2unresponsive.png*
Dewpointer #1 (TDM.1) appears to be the best, trends with the TDL and reliable compared to sonde data, though it spiked up just before landing as it normally does. *See dewpointers.png*
--Novatel data (AltGPS.3, LatGPS.3 and LonGPS.3) at first was not working but this was fixed in flight. Then it worked fine with the exception of one spike where the GPS Quality went down. *See Novatel_spike.png*
--Static Pressures The new AOC A-D box was collecting data for Fuselage (PSM.2). This was compared with PSM.2 and wingtip (PSM.1) from AAMPS data sys before t/o and after landing. The static pressures from this box appear much more stable and consistent, and are closer to the elevation corrected station pressure than PSM.2 from data system. *See StaticPressureCompare.png - in this image red line is from new box.* We will look at this data further to see how it performs at the different altitudes compared with sonde data.

--Dynamic Attack Pressure (PQAlpha.1) works great (fixed after last flight).
--No gaps in pure GPS data in fast file and no drop-outs in Radar Altitude data (was seen on previous flight).
All other instruments looked good.

Other:
-SFMR data not in screens or WMM app, but in display app, netCDF and hdobs - Sonia / Leonard have fixed or are fixing this. SFMR data looked reasonable compared to surface wind observations.
-New AXBT system worked for the BT drop but it didn't show up in AAMPS (screens, netCDF, etc) however Dana and Todd already fixed this in flight and it should work next time.
-Remote avaps worked great. I did not see any issues with the sonde data either.
-FD computer is networked to AVAPS and MDS to access files. Tail radar display on FD-2 Linux machine worked good and so did all the other programs.

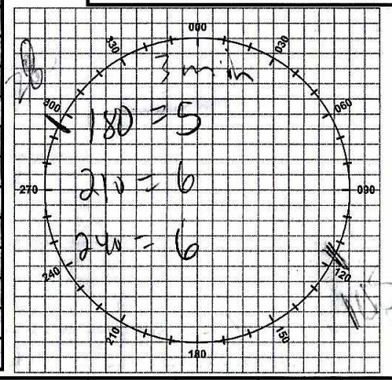
"E"; 08557 110/5 V10 SKY CLR 12K 22/20 2998 -48 04 ILS

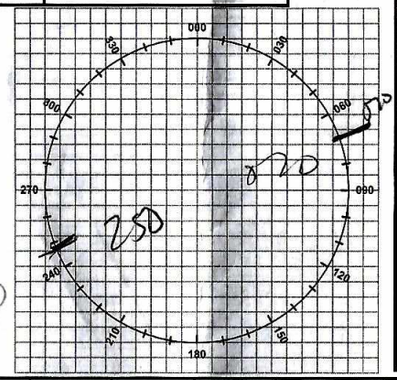
MISSION LOG

PAGE 1 OF 2

CLEARANCES

FREQ	ALT	HDG	OTHER
119.65	1.6	RWY	PIE 250/60 AT 15K 410
		L 19OR	sq 4725
		TK	
		BLOWD → MCP	





POSITION REPORT

1. POSITION
2. TIME
3. ALTITUDE
4. NEXT POSITION
5. ETA
6. NEXT POSITION

EMERGENCY MESSAGE

TRANSMIT THE FOLLOWING MESSAGE TO ANY AGENCY ON THE AIR-GROUND FREQUENCY IN USE. IF UNABLE TO ESTABLISH COMMS, ATTEMPT CONTACT ON ANY OF THE FOLLOWING EMERGENCY FREQUENCIES:

UHF/VOICE	VHF/VOICE	MF/VOICE	HF/CW	MF/CW
243.0	121.5	2182 KHZ	8364 KHZ	500 KHZ

MAYDAY, MAYDAY, MAYDAY
THIS IS NOAA _____, NOAA _____, NOAA 42

- POSITION _____ N / S
  _____ E / W AT _____ Z
- HEADING _____ TRUE/MAG
- AT _____ KTS TRUE/INDICATED
- FLIGHT LEVEL OR ALTITUDE 13
- WE ARE A P-3 AIRCRAFT WITH _____ SOULS ON BOARD
- NATURE OF EMERGENCY
- ASSISTANCE DESIRED
- PILOT INTENTIONS
- WE HAVE _____ ENDURANCE REMAINING

TIME	FIX TYPE	POSITION	INS 1 POSITION	K ERR	INS 2 POSITION	K ERR	MH	VAR +E==>	TH	DR +R==>	TRK	GS	WD	WS	ALT	TAS	NEXT PT	DIST	TIME	ETA	REMARKS
0941 0953	ENG TAXI	N W	N W		N W																NYR 6640 #1 3/3 SEQ 3
0953 1000	BLK T/O																				
1010	X	27-38.1 83-00.2	27-38.1 83-00.2	0 0	27-38.1 83-00.2	0 0					267	235	047	12	12K	225					
1102	△	27-31.2 83-40.9	27-31.6 83-40.8	-.4 +.1	27-31.8 83-40.9	-.6 0					244	266	080	12	15K	255					
1202	△	27-32.0 83-36.7	27-32.5 83-36.6	-.5 +.1	27-32.9 83-36.7	-.9 0					250	262	046	14	10K	249					
1302	△	27-27.9 83-49.5	27-28.5 83-49.1	-.6 +.4	27-29.5 83-48.9	-1.6 +.6					206	290	064	19	5K	226					
1400	△	27-29.1 83-34.9	27-29.8 83-34.7	-.7 +.2	27-31.5 83-34.2	-2.4 +.7					160	207	098	11	1.5K	212					
1504	△	27-26.3 83-38.2	27-27.0 83-37.9	-.7 +.3	27-29.3 83-37.5	-3.0 +.7					149	256	260	9	200	257					NYR 13348 #1 5/5 SEQ ✓
1604	LAND																				
1612	BLK																				