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ASE Watch List

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Federal Aviation Administration

Introduction

- NAARMO developed a tool in 2010 to identify aircraft with poor ASE performance using AGHME data.
  - Results identified cases of potential technical problems in altimetry systems and long-term adverse trends in ASE stability.
  - Informal notifications were distributed informing operators/inspectors.
  - In rare instances, the need to take action immediately was identified and the expected level of performance was re-established.
  - In more routine cases the requirement to improve airframe performance was again handled on a case-by-case basis.

ASE-R

- Altimetry System Error Report (ASE-R)
  - The means by which State regulatory authorities, operators and RMAs are informed of large ASE events of concern.
- The large ASE watch list process was developed to establish criterion for identifying candidate aircraft for ASE-Rs.

Watch List

- The program scanned through approximately 5.5M records to identify airframes with an ASE of 300ft. or greater.
  - Resulting in ~2000 aircraft with potential large ASE
- A manual review of the list became very time consuming
  - Many detections which were not cases of concern
- Furthermore, there was a need to prioritize the more extreme cases so that the request for corrective action could be initiated.

Criteria

- A more realistic and manageable approach was needed
  - Focus on aircraft with greater risk-bearing ASE performance
- A new set of watch list criteria was determined to better manage the problem at hand.
  - Mean ASE plus one standard deviation (SD) of 200ft. or greater
  - Watch level indicator of 1-5, with 1 being the lowest level of concern and 5 being the highest level of concern.
- Resulted in a list of approximately 100 aircraft with an ASE value of greater concern

Indicators and Frequency

Watch Level	Watch Level Assignment Criteria	Evaluation Frequency
W1	Poor sampling of ASE average and a low number of large individual measures	Less frequent unless significant changes in ASE performance are observed
W2	Poor sampling of ASE average and multiple large ASE measures	Less frequent unless significant changes in ASE performance are observed
W3	Moderate ASE average and high ASE standard deviation with stable trend	Cases where the mean + one SD has increased are evaluated during each review session
W4	High average ASE with moderate standard deviation with stable trend	Cases where the mean + one SD has increased are evaluated during each review session
W5	High ASE average and standard deviation with potential degrading trend in performance	Every review session

Details

- An SQL query gathers AGHME data (FL290-410) over the past year that has passed quality control.
  - Average ASE and SD of each airframe calculated.
  - ASE + SD > 200 ft. and count >= 5 added to list
  - ASE + SD > 245 ft. and count < 5 added to list
    - Many of these remain until more measurements become available.
    - Data from other RMAs have been useful in confirming AGHME measurements when available.
- Check for trend analysis and ASE-R determination.
- Foreign aircraft with questionable performance are sent to the responsible RMA for further action or analysis.

Details

- Charts generated for each airframe on the watch list
  - designate as an ASE-R to be created
  - assigned a watch level (1-5)
  - or removed from watch list due to improvement or outliers.
- Each time the process is run (quarterly), a new list is generated and compared to the previous to determine
  - what is new
  - what remains unchanged
  - what has improved or declined in performance.

Typical View

MODES	OBS	AVG ASE	SD	Prev M+S	M+S	OPR	TYPE	ADSB	Already ASER?	Prev W Level	New W Level
[illegible]	20	-203	58	206	261		B763	N	No	W5	YES
	25	-157	48	205	205		C56X	N	No	W5	W5
[illegible]	5	-111	94	204	204		B734	N	No	W5	W5
	9	-182	107	324	290		B763	N	No	W4	W4
[illegible]	10	-182	89	268	271		B763	N	No	W2	W4
	32	-159	73	251	232		B763	N	No		Send to RMA
[illegible]	10	-150	75	225	225		B763	N	No		Send to RMA
	7	180	40	220	220		GLF5	Y	No	NO	
[illegible]	8	-154	71	245	225		BLCF	N	No		W3
	26	-166	54	220	220		A320	N	No		W4
[illegible]	130	-182	35	205	217		B763	N	No		Send to RMA
	15	-172	39	213	210		B763	N	No		W3
[illegible]	6	-242	136	378	378		B763	N	No		Send to RMA
	6	-179	109		289		B763	N	No		W4
[illegible]	6	198	76	288	274		H25B	N	No		W3
	5	147	121		269		CRJ7		No		W2
[illegible]	25	-176	89	227	264		E45X	N	No		YES
	5	-142	119		261		GLF5		No		W4
[illegible]	5	-178	81		260		CL60		No		W4
	10	-172	85		257		A320		No		W3

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ASE Reports (ASE-Rs)

ASE-R Progress	Total Number
Watch List Review / Month	100
ASE-Rs since new Watch List process	28
Operator In-Progress	4
Performance Monitoring In-Progress	11
Closed	87
Total Number of ASE-Rs	102

Recent ASE-Rs

Control Number	AC Type	Notes
074	B733	Closed - both DADCs out of limits, both replaced.
075	B737	Closed - replaced both ADMs for the static source systems
076	A320	Closed - Performed extensive maintenance but closed based on stable performance.
077	A320	Closed - Performed extensive maintenance but closed based on stable performance.
078	ASTR	Closed – Repair status undetermined.
079	B744-10	Closed – Left ADC replaced, marginal improvement.
080	B744-10	Closed - Removed and replaced both original ADCs.
081	B744-5	Performance Monitoring In-Progress
082	B744-5	Performance Monitoring In-Progress
083	B752	Closed – removed and replaced both ADCs despite being within limits, showed improvement.
084	B762	Performance Monitoring In-Progress
085	B747-LCF	Performance Monitoring In-Progress
086	C441	Performance Monitoring In-Progress
087	C560	Performance Monitoring In-Progress

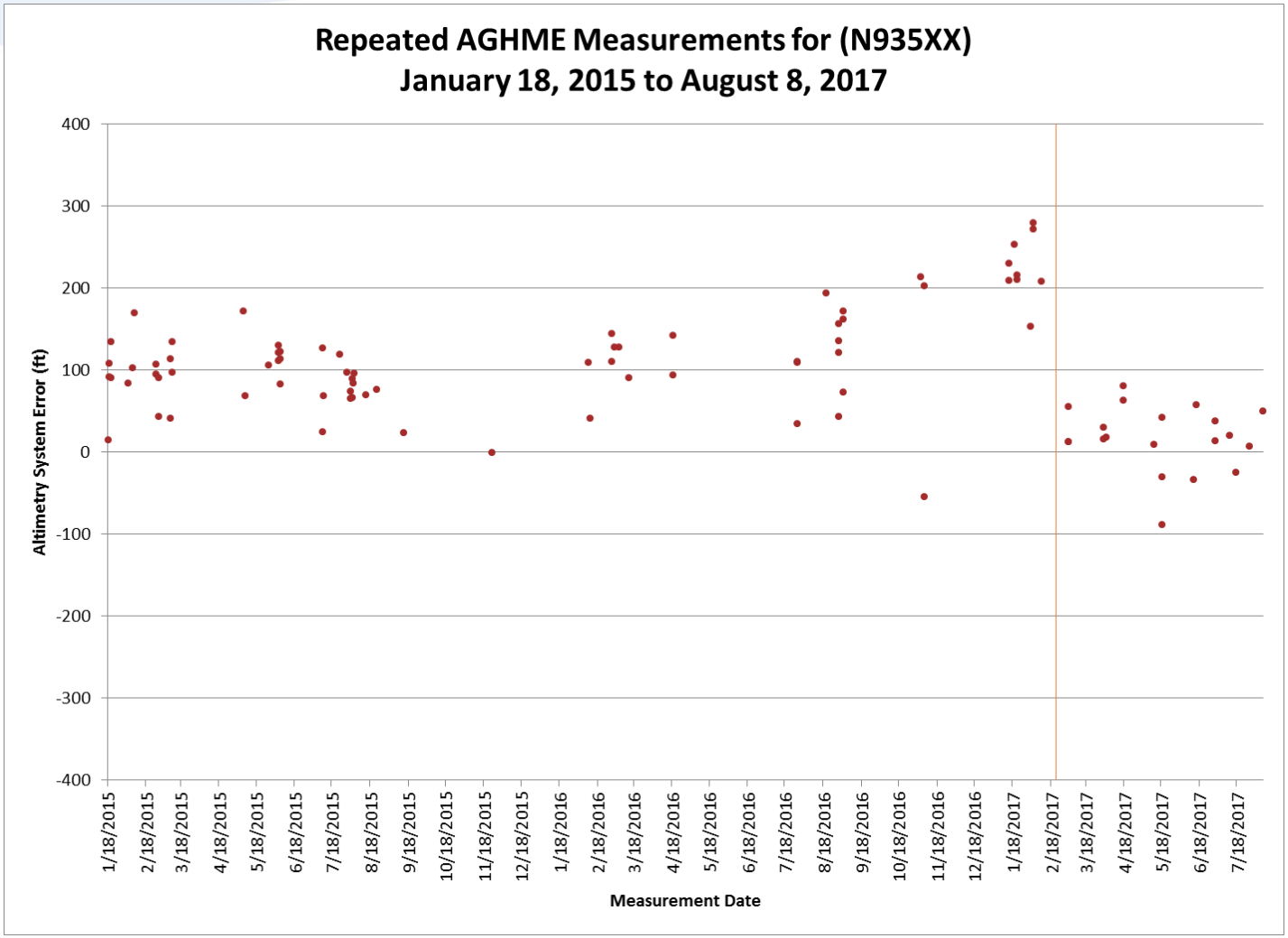
Recent ASE-Rs

Control Number	AC Type	Notes
088	E145	Closed - Replacement of ADC 1 & 2
089	FA20	Closed - Removed and Replace ADIRU #3, Replaced right-hand (FIN 19FP5 & 19FP7) and left-hand (FIN 19FP4 & 19FP6) ADMs
090	GLF5	Performance Monitoring In-Progress
091	H25B	Performance Monitoring In-Progress
092	A319	Closed
093	A321	Closed - Replaced right-hand (FIN 19FP5 & 19FP7) and left-hand (FIN 19FP4 & 19FP6) ADMs
094	A321	Closed - Replaced right-hand (FIN 19FP5 & 19FP7) and left-hand (FIN 19FP4 & 19FP6) ADMs
095	GLF5	Performance Monitoring In-Progress
096	B763	Operator In-Progress
097	B752	Performance Monitoring In-Progress
098	B752	Operator In-Progress
099	A321	Closed - Replaced L/R ADMs, inspected static ports and performed leak check.
100	B762	Closed - Maintenance indicates rr of captains PS probe during C check.
101	CRJ9	Closed - conducted standard RVSM Inspections.
102	A319	Operator In-Progress

Examples

- Improvement: cluster of measurements at approximately 250 ft. returns to approximately 0 ft. after maintenance.
- Given the number of measurements after maintenance, there is high confidence in the new performance stability.
- This aircraft will remain on the watch list with a low level watch value until enough data is available and it is no longer triggered.

Improvement



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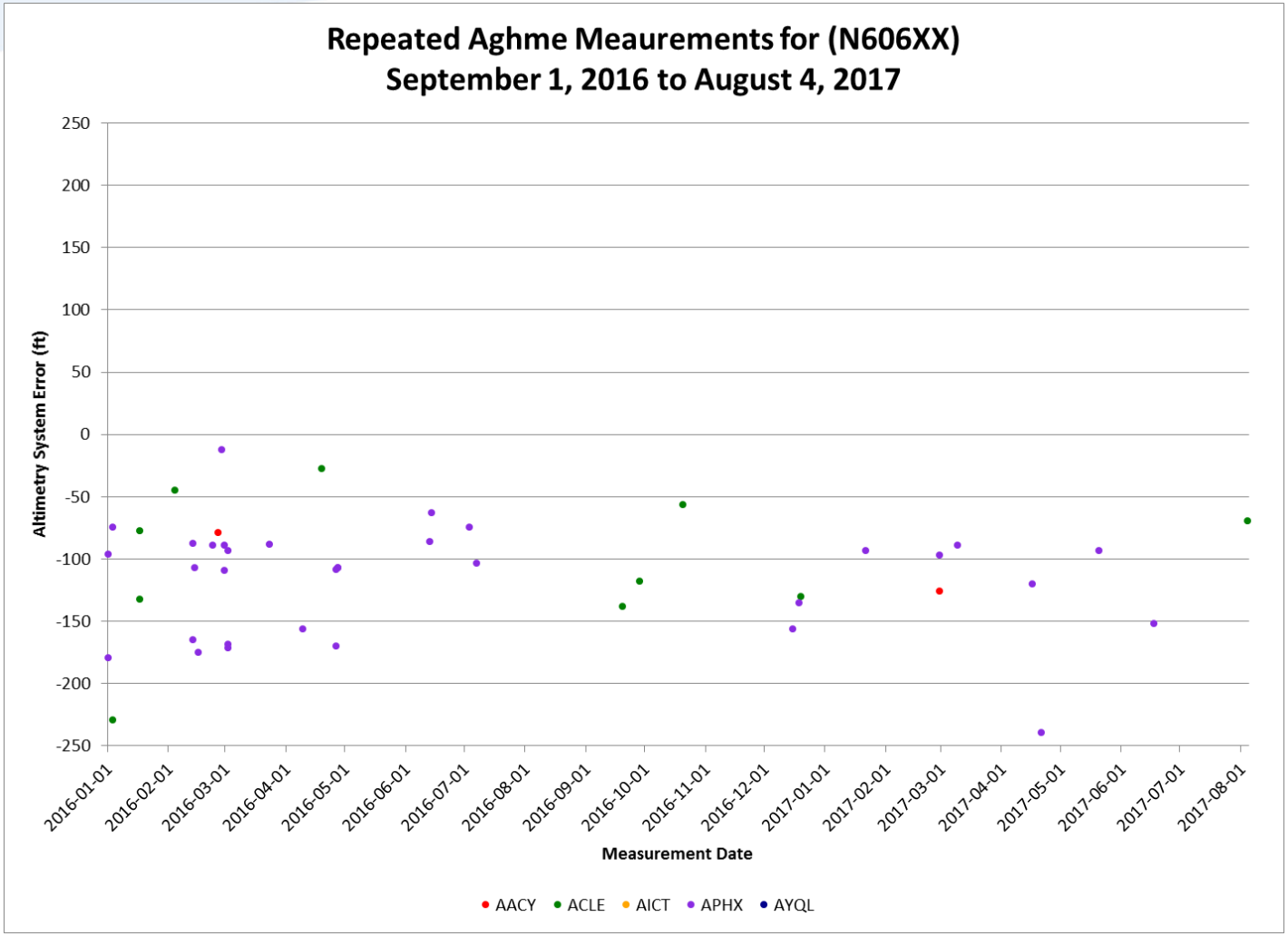
Challenging Case

- The most recent measurement is moderately close to zero.
- The ensemble of the observations indicate a substantial variation in ASE.
- Given the dispersion of measurements, the most recent measurement of near zero feet holds less value.
- In this case, NAARMO would continue to monitor this aircraft with a moderate or low level of concern (i.e. watch level 2).

Challenging Case



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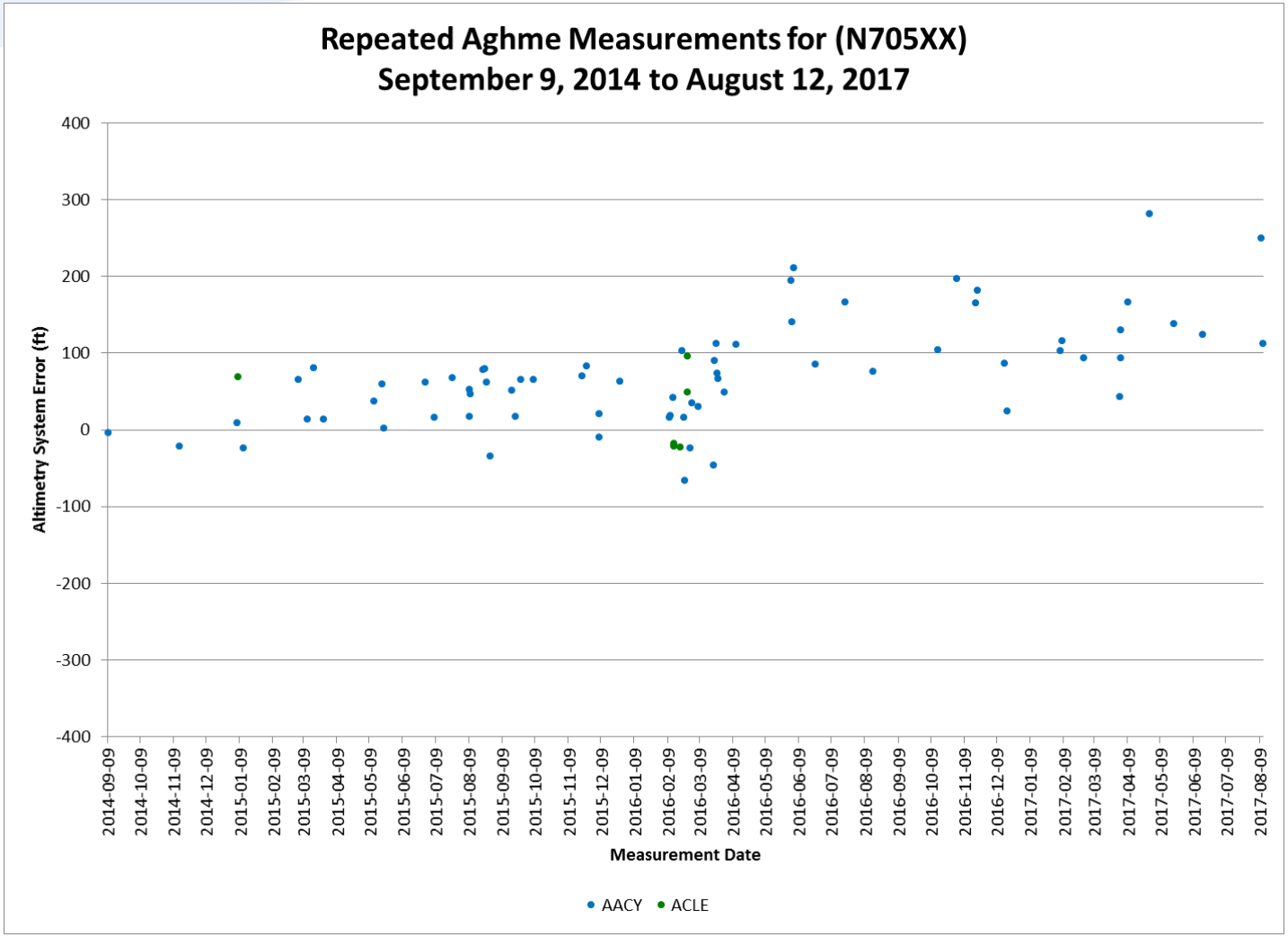
Shift

- Sudden decline in performance is shown next
- Mean ASE estimates recorded shift from approximately 50 ft. to above 150 ft.
- In this case, a watch level 5 was assigned because the mean was still below non-compliant levels.

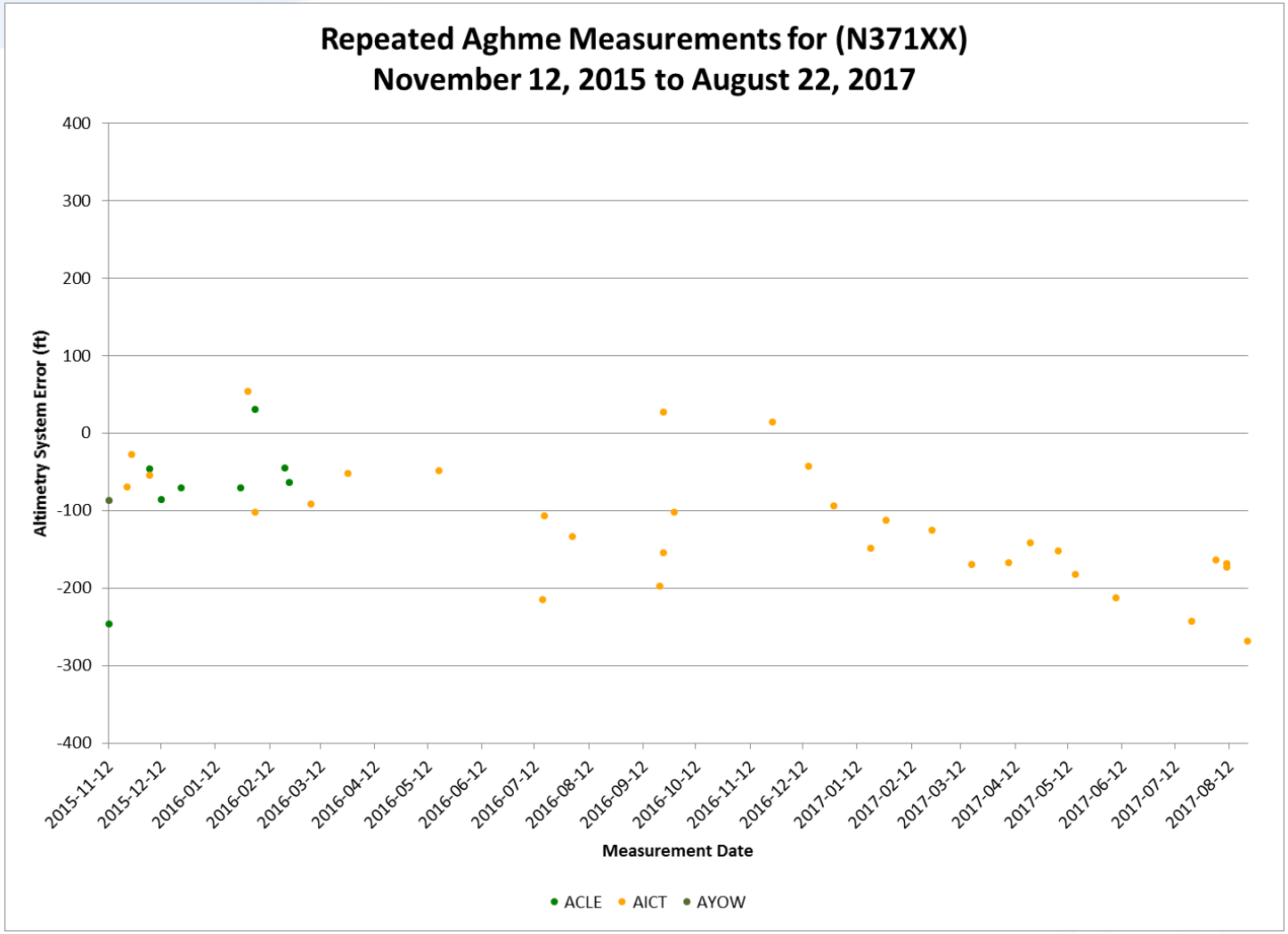
Shift


Repeated Aghme Measurements for (N705XX)
September 9, 2014 to August 12, 2017
Altimetry System Error (ft)
400
300
200
100
0
-100
-200
-300
-400
2014-09-09
2014-10-09
2014-11-09
2014-12-09
2015-01-09
2015-02-09
2015-03-09
2015-04-09
2015-05-09
2015-06-09
2015-07-09
2015-08-09
2015-09-09
2015-10-09
2015-11-09
2015-12-09
2016-01-09
2016-02-09
2016-03-09
2016-04-09
2016-05-09
2016-06-09
2016-07-09
2016-08-09
2016-09-09
2016-10-09
2016-11-09
2016-12-09
2017-01-09
2017-02-09
2017-03-09
2017-04-09
2017-05-09
2017-06-09
2017-07-09
2017-08-09
Measurement Date
AACY
ACLE

Trend

- A negative trend in ASE performance
- The mean ASE values of this airframe degraded from approximately 50 ft. to approximately -250 ft. over a 10 month observation period.
- Since the degraded ASE values were limited in quantity, a high watch level was given to this airframe.

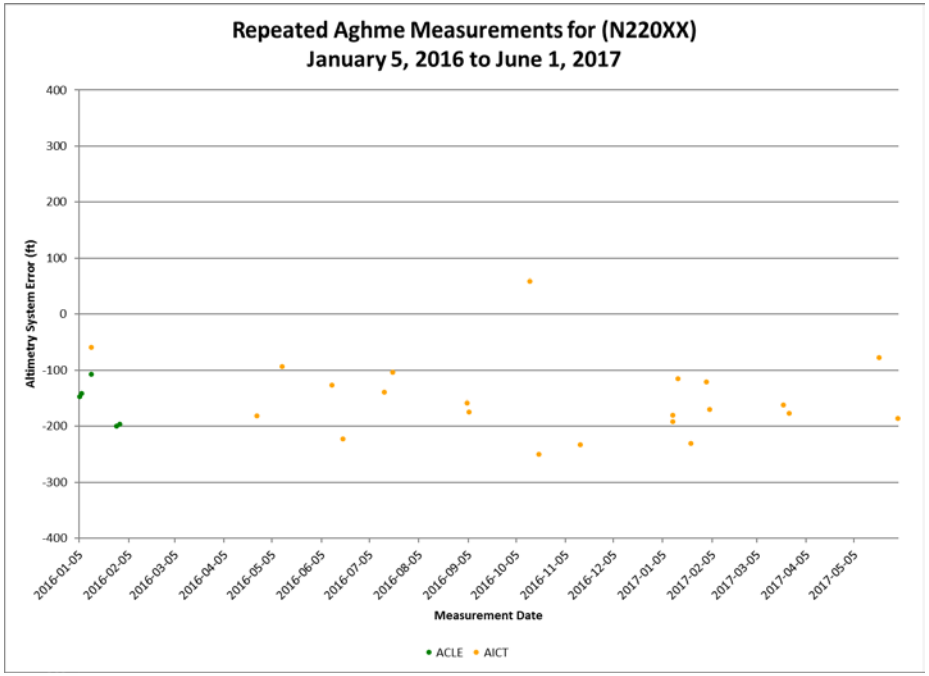
Trend

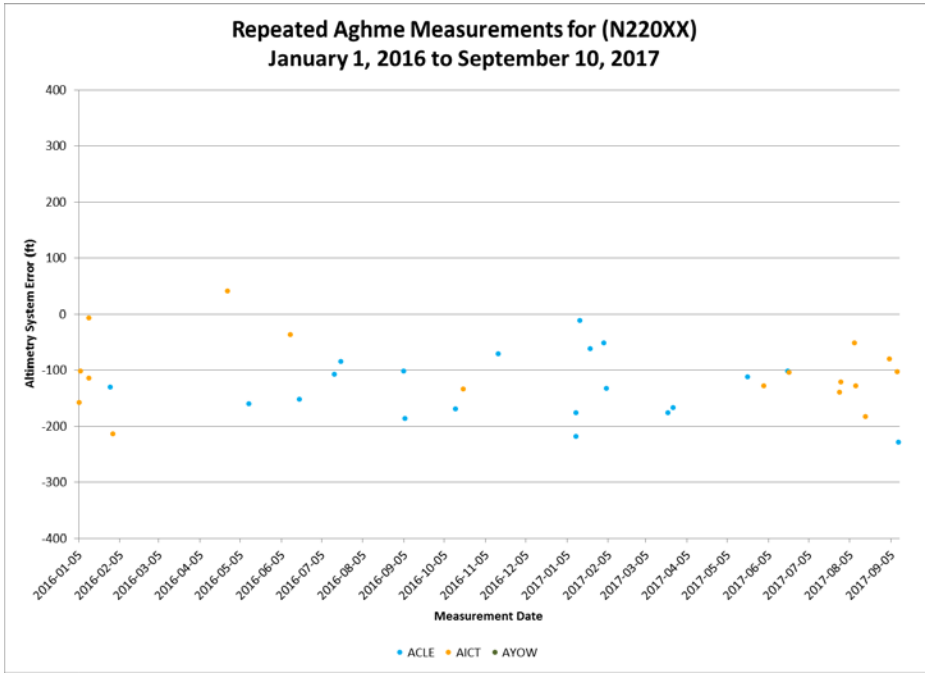

Repeated Aghme Measurements for (N371XX)
November 12, 2015 to August 22, 2017
Altimetry System Error (ft)
400
300
200
100
0
-100
-200
-300
-400
2015-11-12
2015-12-12
2016-01-12
2016-02-12
2016-03-12
2016-04-12
2016-05-12
2016-06-12
2016-07-12
2016-08-12
2016-09-12
2016-10-12
2016-11-12
2016-12-12
2017-01-12
2017-02-12
2017-03-12
2017-04-12
2017-05-12
2017-06-12
2017-07-12
2017-08-12
Measurement Date
ACLE
AICT
AYOW

More Observation

- Same aircraft in two consecutive watch list reviews.
- In the first review (left-hand side), NAARMO qualified this airframe as a watch level 5 due to large values nearing -200 ft.
- During the subsequent review (right-hand side), additional measurements confirmed that there had been no improvement in performance; therefore an ASE-R was issued.

More Observation





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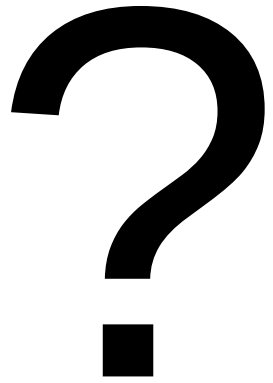
Conclusions

- Challenges associated with analyzing ASE performance
- ASE analysis cannot be conducted solely through automation.
- Refined criteria reduced the number of aircraft to a manageable level, facilitated better focus and allowed for a reasonable amount of manual determination to be made for each aircraft.
  - Allows for variation however, each judgement is decided by a group.

Questions/Comments



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