

Undetectable by collision avoidance systems

Undetectable by the flight crew

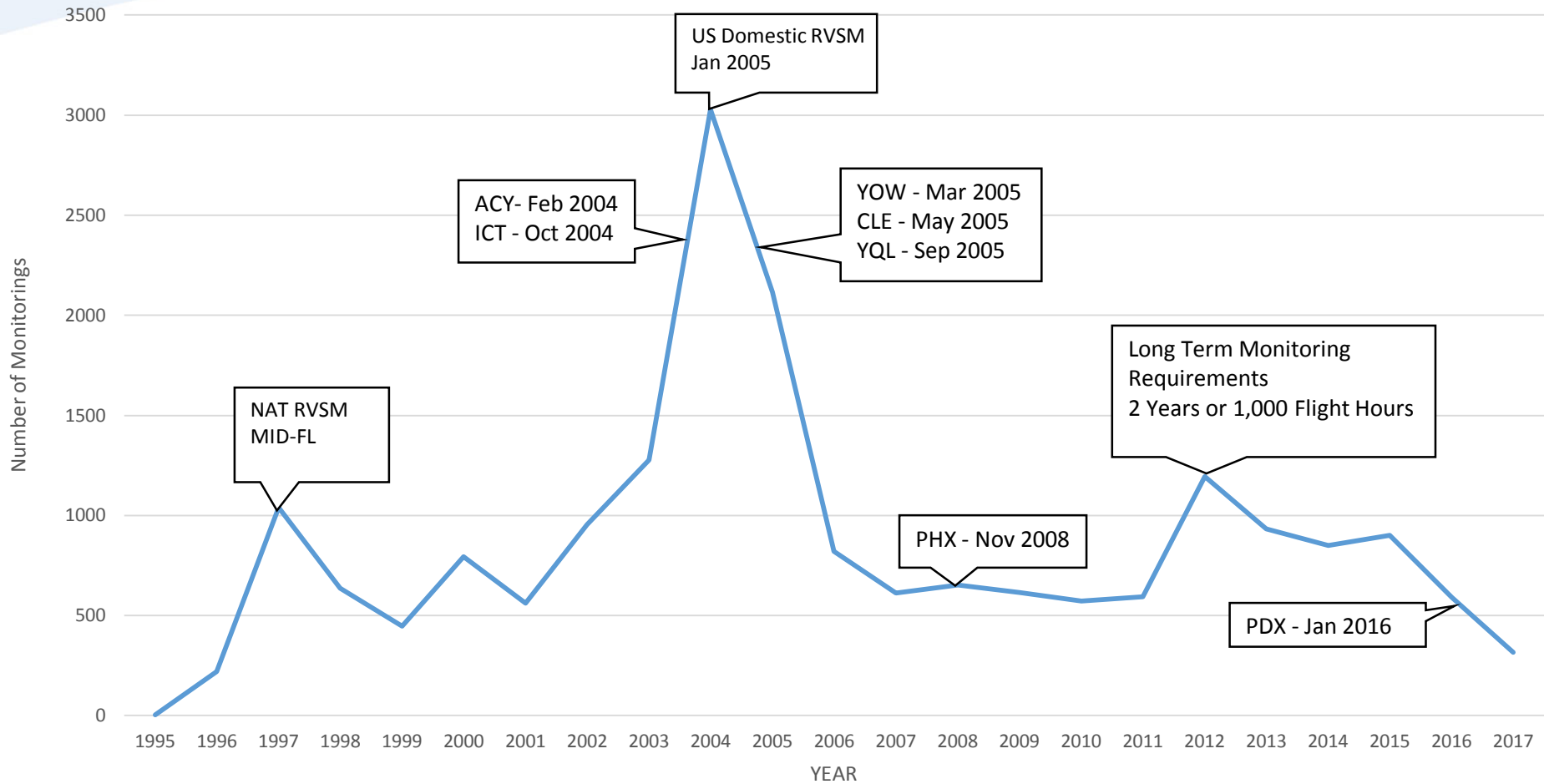
### GPS Monitoring System History

Undetectable by air traffic control



**Federal Aviation  
Administration**

# GMS Monitoring Flights Totals by Year



# Total GMS Monitoring by Year

- GMS Monitoring began in 1995. Only a few test flights. This continued through the first half of 1996.
- Last half of 1996 the monitoring began to produce results for users.
- By 1997 we had 1040 monitoring flights which is the fifth highest yearly total. This was because the NAT (mid - FL were requiring RVSM approved aircraft) began in March 1997.
- From 1998-2001 we had a steady flow of monitoring flights.
- 2002-2005 produced the highest 3 years of monitoring flights.
- 20 January 2005 was the beginning of Domestic US RVSM.

# Total GMS Monitoring by Year

- 2006-2011: Again there was a constant steady flow of monitoring flights.
- In 2012: The monitoring doubled from the year before. The reason for the large increase is the 2012 Long Term Monitoring Requirements of 1000 hours or 2 years went into effect.
- 2013-2015: It was three more years of higher than normal rate of monitoring (about 900 per year).
- 2016-Present: There has been a large drop off in GMS Monitoring Flights.
- More aircraft are making use of the AGHME (cost savings)

# Total GMS Monitoring by Year

- Future of GMS Monitoring
  - ✦ Users are making use of the AGHME, it is free and it is a savings for the user.
  - ✦ In 2017 we are going to average about 1 aircraft monitoring per day.
  - ✦ As we head into the future of ADS-B we will probably use the GMS monitoring system less and less.
- When the 20,000<sup>th</sup> flight occurs, it may be a milestone for me to head into retirement.

# GMS Monitoring Flights by Month

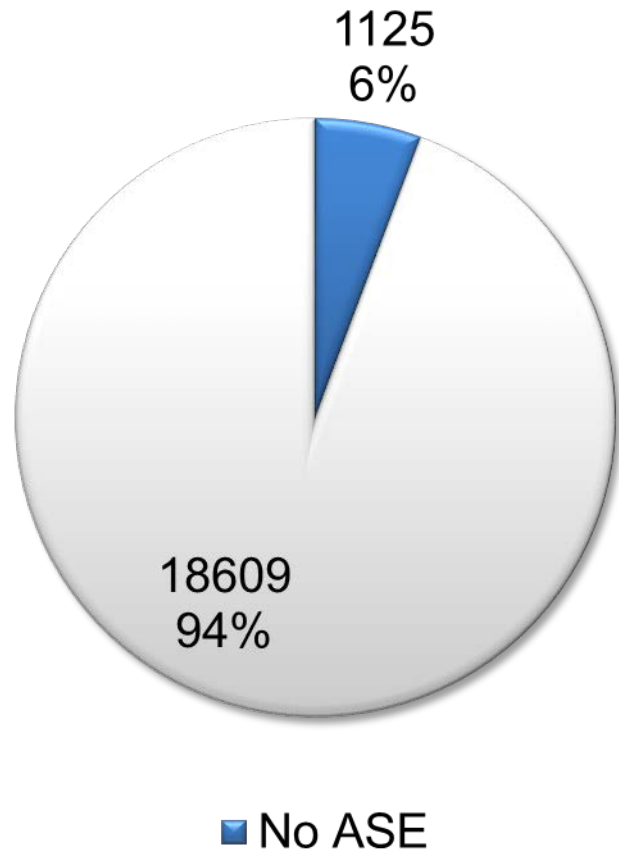
Year	Total Of SeqNo	01	02	03	04	05	06	07	08	09	10	11	12
1995	4	0	0	0	0	0	0	0	1	0	0	1	2
1996	221	0	1	2	4	4	16	29	18	10	20	40	77
1997	1040	68	110	128	74	79	72	72	81	113	120	60	63
1998	636	67	55	53	53	85	58	55	49	47	46	32	36
1999	447	21	37	37	25	42	33	31	35	34	30	73	49
2000	795	65	63	83	86	81	89	51	50	56	50	60	61
2001	562	38	31	28	29	48	63	32	43	54	60	58	78
2002	953	83	64	57	96	81	82	92	77	83	74	87	77
2003	1278	89	85	92	99	108	101	89	99	114	130	134	138
2004	3028	122	175	210	225	218	275	212	318	297	259	299	418
2005	2116	303	217	231	199	218	226	209	120	116	106	85	86
2006	821	82	71	79	64	78	61	56	62	70	60	74	64
2007	613	48	48	51	39	43	73	33	44	59	59	61	55
2008	653	47	41	59	53	48	51	65	73	43	59	58	56
2009	614	48	63	57	46	52	75	42	41	51	48	55	36
2010	573	37	42	63	47	39	61	50	50	41	44	54	45
2011	594	35	44	50	32	58	54	45	48	53	51	74	50
2012	1195	65	61	65	41	68	65	66	122	111	197	249	85
2013	934	77	85	120	101	77	64	61	84	66	62	65	72
2014	850	83	62	67	51	84	64	55	58	86	86	80	74
2015	900	42	70	84	80	95	90	65	69	77	95	58	75
2016	592	56	81	78	29	51	48	39	57	35	50	48	20
2017	327	42	45	50	38	39	40	14	34	14	11		



**FAA**



# Percentage of GMS Measurements with and without ASE values



- As of today there have been 19745 monitoring flights using a GMU
- 94% (18609) had success in obtaining an ASE value
- While 6% (1125) had no ASE value

# GMS Monitoring Flights with and without ASE Values

From 1996-2017 in 22 years there were approximately 50 GMS monitoring per year where no ASE could be calculated.

Possible causes for no ASE calculation:

- a) In the beginning, test flights were conducted which we knew would not produce an ASE value.
- b) No GPS data collected
- c) Installers of equipment had installation issues
- d) GPS antenna signal issues which resulted in large data gaps
- e) No Mode C (radar data) was collected
- f) In the early stages of a domestic flight we had to deal with 20 ARTCC to supply the data.



# GMS Monitoring Flights with and without ASE Values

- c) (Con't) Coordination issues - data stored only 2 weeks. Now have all the CONUS radar streamed into the FAATC. Success rate improved with GMU upgrade to EGMU where the unit collects the Mode C data.
- d) U.S. Military Flights continue to have a difficult time obtaining data. The monitored aircraft are not located where the monitoring coordinator works and then the aircraft moves to another location and the data does not get extracted and sent to the coordinator. Possible security issues.
- e) Missing Weather data - on rare occasions the weather data is not available.



**FAA**

Next**GEN**

•Flight Information Form (FIF)

**INFORMATION TO BE RECORDED PRIOR TO FLIGHT**

Airline/Operator: Monarch Air, LLC		•Please Fax to the WJHTC at 1+609 485 5078 and GMU Containe Number: 107	
Point of Contact for Operator: Pilot Name: Dillon Lohmer Phone: 612-360-5218 Email: djlohmer(a?gmail.com Fax:			
Aircraft Type/Series: Cessna / Citation 550		!Aircraft Registration Number: N888RL	
Call Sign: N888RL		Airframe Serial Number: 550-0254	
Planned: Origin: KBZN	Departure Date (UTC): 10/12/17	Departure Time (UTC): 14:00Z	
Planned: Destination: KBZN	Arrival Date (UTC): 10/12/17	Arrival Time (UTC): 15:30Z	
Installer (Name/Org.): Randy Dill / Duncan Aviation		!Retriever (Name/Org.): Randy Dill / Duncan Aviation	
Mode S Equipped (Yes/No): No	Separation Between Mounted Antennas (ft.): 6'		
Insta ller/Operator Comments:			
1) Good 3D Nav. before taxi. 2) Depart KBZN @ 14:26Z, Squawk code 4316. 3) Begin recording @ 14:29Z. 4) Reach flight level 290 @ 14:43Z. 5) Reach flight level 310 @ 14:47Z. 6) Leave flight level 310 @ 15:16Z. 7) Leave flight level 290 and stop recording @ 15:18Z. 8) Arrive back KBZN @ 15:50Z.			

**INFORMATION TO BE RECORDED BY FLIGHT CREW/GMU OPERATOR**

Data Collection: !Start Date (UTC): 10/12/17	Start Time (UTC): 14:29Z
GMU File Name: EGMU1071710121427	
Departure Time (UTC): 14:26Z	Origin (ICIAOID): KBZN

- Please record the requested information as soon as practical when:
1. Aircraft is first established in level flight at or above FL 290, or
    - The ATC assigned transponder code is changed at or above FL 290, or
  3. There is a flight level change and aircraft remains at or above FL 290, or
  4. An autopilot change is initiated at or above FL 290, or
  5. The ARTCC or FIR changes.

Time (UTC)	Assigned FL	Mach/Air Speed	Xpndr Code/Source	Altimeter Reading		Autopilot		FMS/PMS (Y/N)	ARTCC/FIR (ICAO ID)
				Pilot	Co-pilot	Pilot	Co-pilot		
14:51Z	310	55/200Kt.	4316	30,980	30,980	X		Yes	KZLC
									<i>f.l.t.c.</i>
									<i>(fM)</i>

Data Collection: !End Date (UTC): 10/12/17	End Time (UTC): 15:18Z
Arrival Time (UTC): 15:50Z	Destination ICIAO (ID): KBZN
Comments on flight conditions affecting height keeping performance, i.e. turb, and location continuous light chop@flight level 310 from 14:49Z to 14:55Z.	

