2017 ASPECT Preliminary Report
Rapids Needs Assessment

September 6, 2017
0700 hrs to 2000 hrs

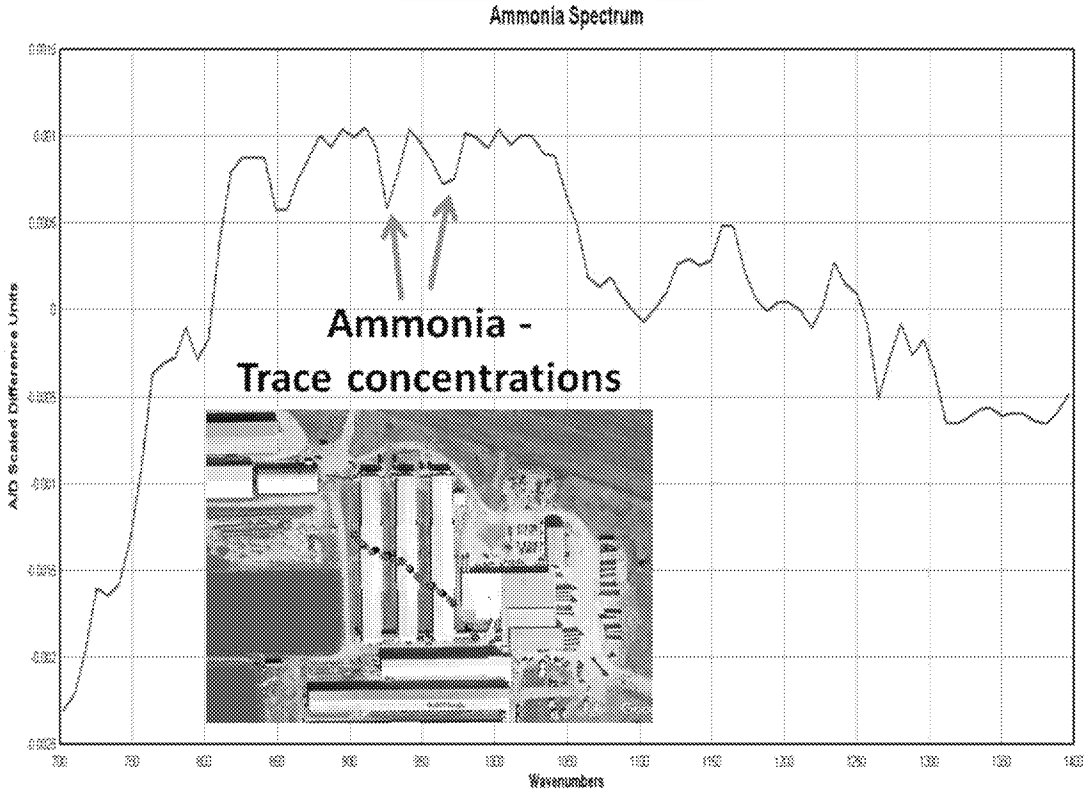

Figure 1: Ammonia detection during the Rapid Needs Assessment Survey on 5 September 2017.

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1 ASPECT Description

The U.S. EPA ASPECT Program is the nation's only 24/7/365 emergency response airborne platform equipped with special chemical, radiological, and situational awareness instruments. ASPECT stands for Airborne Spectral Photometric Environment Collection Technology. It detects chemicals and radiation while collecting aerial photos and videos for situational awareness during an emergency (night or day). Critical information is automatically processed in the aircraft and transmitted via satellite to a team of highly skilled scientists who quickly review it before sending the results to decision makers on the ground. This can be done within 5 minutes. Because of its ability to quickly arrive onsite and turn data, ASPECT serves as an initial screening tool to help the field responders make more informed decisions based on actual measurements. ASPECT does not fly through the hazard or take air samples. All the information is collected from a safe distance using remote sensing technologies. It usually flies at about 3,000 ft above the ground but can fly much lower (or higher) if needed. A crew of 4 fly and operate the aircraft. The size of the reachback team varies depending on the type and scale of an emergency, and can provide support at the command post or from anywhere in the world via satellite communications and secure internet coordination.

2 Background

On 30 August 2017 at 0445 hrs the US EPA Region 6 On-Scene Coordinator Byrant Smalley contacted ASPECT Program Manager, Dr. Mark Thomas, to activate the ASPECT aircraft and respond to the Arkema facility explosion located in Crosby, Texas. The facility produces liquid organic peroxides that are used mainly in the production of plastic resins. The explosion was a result of a loss of refrigeration in temporary storage trailers. By 3 September 2017, all the remaining trailers containing benzoyl peroxide were destroyed by controlled burns.

On 3 September 2017, the ASPECT reachback team moved its base of operations from the Million Air Terminal to the Airborne ASPECT Inc. hanger at Addison Airfield. The move was required because the Million Air network triggered ASPECT internet traffic as a potential cyber-attack due to the large amounts of data and bandwidth used by the program. On a typical day, the ASPECT can transfer up to 50 GB.

After 3 September 2017, ASPECT is focused only on the Rapid Needs Assessment (RNA) mission. The mission is to collect high resolution photos over target sites provided by the Region. In addition, chemical sensors were activated over sites associated with industrial facilities but this was later changed to monitor all sites surveyed after 3 September 2017. The RNA mission will continue in geographic zones created by the ASPECT reachback team. These are generally designed based on proximity to the airfield, length of flight, flight restrictions (if any), and number of sites. Some zones will be larger than others Every photo collected as part of the RNA mission will be geo-corrected and validated by the reachback team and then made available on the ASPECT "n-link" file. The validation process will delay the distribution/access to these files for at least one day.

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ASPECT changed its flight coordination from the U.S. Coast Guard to the Texas National Guard. The temporary flight restriction has be lifted and ASPECT currently flies under a standard assigned squawk code by the FAA. The ASPECT aircrew moved their base of operations from Addison Airfield to Hobby Airfield to position the aircraft closer to the target areas which reduced the transit time by more than one hour. The ASPECT technical reach-back team remains in Addison, TX.

A detailed summary of the ASPECT operations from 8/31 to 9/5 are available in different reports. This report will begin with a detailed summary of the ASPECT operations scheduled for 6 September 2017. Table 1 provides a brief summary of the ASPECT products to date. Detailed statistics for each flight, zone, and the rapid needs assessment mission are provided in Section 6: ASPECT Status Tables.

Table 1. Summary Metrics from ASPECT Operations

Date	*# Sorties*	*Aerial Photos*	*Oblique Photos#*	*FTIR spectra**	*Videos*	
					IR	Vis
8/30	1	39	52	21,000	0	8
8/31	3	173	221	117,000	6	30
9/1	3	257	88	171,000	16	29
9/2	3	310	31	177,000	19	32
9/3	2	330	381	210,000	4	58
9/4	2	195	13	198,000	0	56
9/5	2	162	0	171,000	0	57
9/6	2				0	

Some photos may not be viewable/usable due to poor lighting or weather conditions at the time they were taken.
* The collection frequency of FTIR spectra is 70 spectra per second.

3 Aircraft Capabilities used on this survey

Chemical Detection:
The US EPA ASPECT system collects airborne infrared (IR) images and chemical screening data from a safe distance over the site (about 3,000 ft AGL). The system consists of an airborne high speed Fourier transform infrared spectrometer (FTIR) coupled with a wide-area IR line scanner (IRLS). The ASPECT IR systems have the ability to detect compounds in both the 8 to 12 micron (800 to 1200 cm-1) and 3 to 5 micron (2000 to 3200 cm-1) regions. The 8 to 12 micron region is typically known as the atmospheric window region since the band is reasonably void of water and carbon dioxide influence. Spectrally, this region is used to detect carbon - non-carbon bonded compounds. The 3 to 5 micron region is also free of water and carbon dioxide but typically does not have sufficient energy for use. This band does show use in high-energy environments such as fires. The carbon - hydrogen stretch is very common in this region.

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Photo Capabilities:
A digital Nikon DX2 camera (12.4 mega pixel CMOS 3:5 aspect ratio, 28 mm wide-angle lens) collects visible aerial imagery as part of the core data product package. The camera timing system is connected to the primary IR sensors and provides concurrent image collection when other sensors are triggered. All imagery is geo-rectified using both aircraft attitude correction (pitch, yaw, and roll) and GPS positional information. Imagery can be processed while in flight or approximately 600 frames per hour can be processed once the data are downloaded from the aircraft.

An Imperx mapping camera (29 mega pixels; mapping focal plane array) provides a similar aspect ratio and aerial coverage. Like the Nikon DX2, it is connected to the primary IR sensors and provides concurrent image collection when other sensors are triggered. These images are often digitally processed in lower resolution so they can be transmitted via satellite communication. The high resolution images (>20 MB) are pulled from the ASPECT after the sortie and are available at a later time.

Automated Processing
Data are processed using automated algorithms onboard the aircraft and preliminary results are sent using a satellite system to the ASPECT reachback team for QA/QC analysis.

4 Results

0700 hrs: The technical reachback team prepared the flight mission, held a pre-flight briefing, and continues to do data management and photo validation for Flights #17 (162 aerial photos). These should be available on the n-link by mid-day 7 September 2017.

The reachback team is consolidating all positive chemical detections from all flights and preparing tabular and geospatial products for the Region.

Flight #18
0840 hrs: ASPECT is airborne and en route to W Harris County to start Zone 10 (80 targets, 49 flight lines) and then may proceed to Zone 8 (E Brazoria County, 115 targets,104 flight lines) or Zone 9 (E Brazoria & Galveston Counties, 132 targets, 89 flight lines) pending weather conditions.

Figure 2 shows current progress to date of the completed zones (4, 5, 6, 7) and zones in progress (8, 9, 10).

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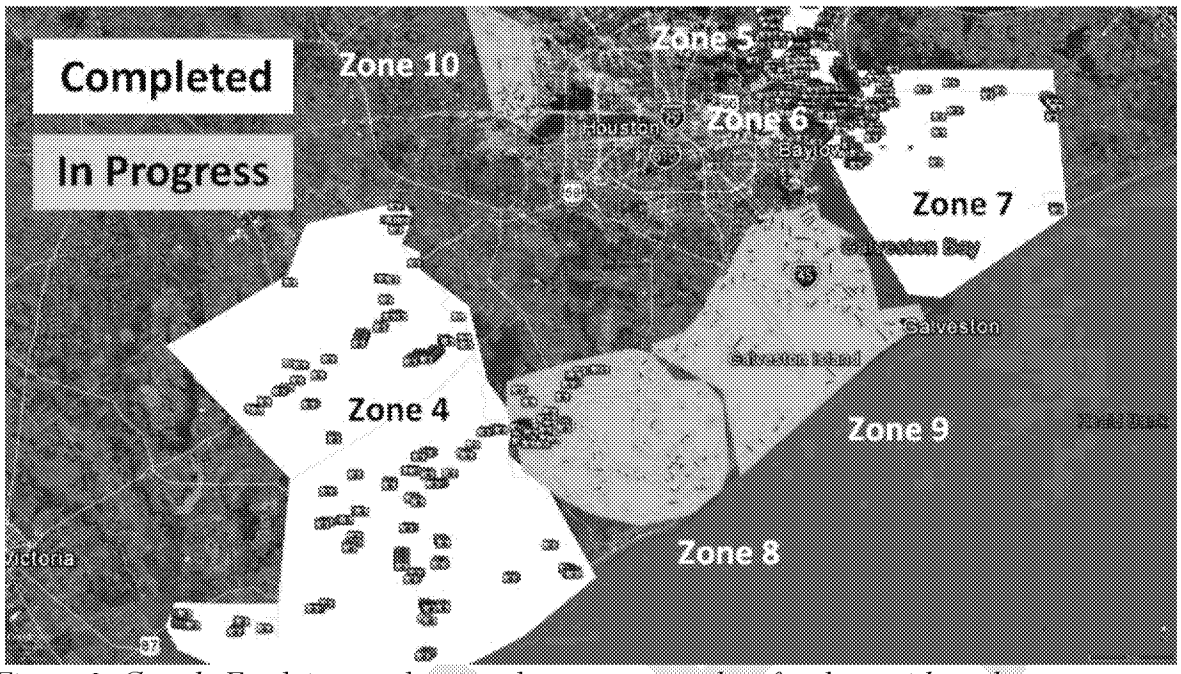

Figure 2: Google Earth image showing the progress to date for the rapid needs assessment mission. Zone 8 (115 targets; 104 flight lines), Zone 9 (132 targets, 89 flight lines) and Zone 10 (80 targets, 49 flight lines) are currently in progress. Additional Zones continue to be developed by the ASPECT reachback team.

0900 hrs: ASPECT arrives on station in Zone 10.

1000 hrs: ASPECT completes Zone 10 and reported no positive chemical detections. The crew heads toward Sugar Land Airfield to refuel, each lunch, and continue the RNA survey in Zone 8.

1200 hrs: ASPECT lands are Sugar Land Airfield.

Flight #19

1400 hrs. ASPECT is airborne and en route to resume Zone 8 RNA surveys (E Brazoria County, 92 targets, 83 flight lines remaining).

1545 hrs. ASPECT completes 34 of 83 remaining flight lines in Zone 8 and heads toward Addison Airfield.

1745 hrs: ASPECT lands at Addison Airfield. The reachback team will install and test fly the repaired IRLS.

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5 Operational Challenges

1. The technical reachback team continues to actively address recording issues with the infrared line scanner (IRLS) system. The recording computer failed in the aircraft on 31 August 2017. The team replaced the IRLS motherboard and conducted a test flight the evening of 31 August 2107. Initial results indicated that the issue had been resolved but during Flight 6 (1 September 2017) similar faults were observed, suggesting that the cause is more complex. Currently this capability is not available. The night vision camera has been reconfigured as a thermal imaging system as a backup. The aircraft landed at Addison Airfield on 3 September so the team could remove and perform maintenance on the IRLS. It is expected the IRLS will be installed and flight tested this evening. It should be back in operation and ready for service on 7 September 2017.

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6 ASPECT Status Tables

ASPECT Flights

Flight #	Date	Primary Mission	Comments
1	8/29	Systems Check	
2	8/30	Arkema Site	
3	8/31	Arkema Site	Foggy Conditions
4	8/31	Arkema Site	
5	8/31	Arkema Site	
6	9/1	Arkema Site	
7	9/1	Arkema Site & Zone 5 RNA	Started Zone 5 RNA
8	9/1	Arkema Site	Fires
9	9/2	Arkema Site & Zones 5 & 6 RNA	Completed Zone 5 RNA Started Zone 6 RNA
10	9/2	Arkema Site & Zone 6 RNA	
11	9/2	Arkema Site	Aborted Controlled Burn
12	9/3	Zone 6 & 7 RNA	Completed Zone 6 RNA Started Zone 7 RNA
13	9/3	Arkema Site	Controlled Burn
14	9/4	Zone 7 RNA	Completed Zone 7 RNA
15	9/4	Zone 4 RNA	Started Zone 4 RNA (Matagorda County)
16	9/5	Zone 4 RNA	Zone 4 RNA (Wharton County) Clouds in the area delayed the flight.
17	9/5	Zones 4 & 8 RNA	Completed Zone 4 RNA (Wharton County) Started Zone 8 RNA (SW Brazoria County)
18	9/6	Zone 10 RNA	Start & Complete Zone 10 RNA (W Harris County)
19	9/6	Zone 8 RNA	Resume Zone 8 RNA (SW Brazoria County)

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ASPECT Rapids Needs Assessment Status
as of 6 September 2017

Zone	Date	Flight #s	#Targets	#Flight Lines	# locations with positive detections	Comments
1						
2	Cancelled (3 September 2017)					
3						
4	9/4 9/5	15 16, 17	120	85	4	Matagorda & Wharton Counties
5	9/1 9/2	7 9	50	36	1	E Harris and SW Liberty Counties Contains Arkema Site
6	9/2 9/2 9/3	9 10 12	71	49	4	E Harris County South of Arkema Site
7	9/3 9/4	12 14	60	46	1	Chambers County
8	9/5 9/6	17 19	114	104	4	SW Brazoria County
9	TBD		129	89		E Brazoria County and most of Galveston County
10	9/6	18	80	49		W Harris County, N of Katy
11	TBD		166	114		
12	TBD					
RMP	TBD					
…	TBD					
		Totals	790	572		

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ASPECT Rapids Needs Assessment Detailed Status
Flights 18 & 19 for 6 September 2017

Zone*	Target Type@	Target #s	Targets Surveyed	% Complete#	Comments
4	RMP	16	1	100	Matagorda & Wharton Counties
	DW	87	16	100	85 of 85 flight lines complete
	WW	17	87	100	Flight #s: 15, 17
5	RMP	1	1	100	E Harris and SW Liberty Counties
	DW	45	45	100	Contains Arkema Site
	WW	4	4	100	36 of 36 flight lines complete Flight #s: 7, 9
6	RMP	11	11	100	E Harris County
	DW	50	50	100	South of Arkema Site
	WW	10	10	100	49 of 49 flight lines complete Flight #s: 9, 10, 12
7	RMP	3	3	100	Chambers County
	DW	42	42	100	46 of 46 flight lines complete
	WW	15	15	100	Flight #s: 12, 14
8	RMP	10	7	70%	SW Brazoria County
	DW	95	49	51%	55 of 104 flight lines complete
	WW	9	5	55%	Flight #s: 17, 19
9	RMP	21			E Brazoria County and
	DW	79			most of Galveston County
	WW	29			X of 89 flight lines complete
10	RMP	1	1	100	W Harris County
	DW	58	58	100	49 of 49 flight lines complete
	WW	21	21	100	Flight #: 18
11	RMP		0		?
	DW		129		0 of 114 flight lines complete
	WW		37		Flight #:
12	RMP				
	DW				
	WW				
RMP					

@ RMP: Risk Management Plan; DW: Drinking Water; WW: Wastewater
* Zones 1 - 3 were cancelled on 3 September 2017. Blue highlighted rows represent the **daily progress** for **6 September 2017**
# Yellow highlights represent work in progress.

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ASPECT Flight Statistics

Flight #	Aerial	Oblique	FTIR*	Videos IR	Videos Vis	Comments	FTP	n-link
1						System Test		
2	39	52	21,000	0	8	Arkema	☑	☑
3	38	96	24,000	0	12	Arkema	☑	☑
4	97	107	63,000	1	13	Arkema	☑	☑
5	38	18	30,000	5	5	Arkema	☑	☑
6	35	0	30,000	5	3	Arkema	☑	☑
7	162	19	75,000	8	18	Arkema & Zone 5 RNA	☑	☑
8	60	69	66,000	8	11	Fire ER	☑	☑
9	222	5	108,000	3	22	Arkema & Zones 5 & 6 RNA	☑	☑
10	88	26	45,000	5	10	Arkema & Zone 6	☑	☑
11	0	0	24,000	11	0	Arkema Aborted Controlled Burn	☑	☑
12	263	5	156,000	1	44	Zone 6 & 7 RNA	☑	☑
13	67	376	54,000	3	14	Arkema Trailer Burn	☑	☑
14	43	13	42,000	0	6	Zone 7 RNA	☑	☑
15	152	0	156,000	0	50	Zone 4 RNA; Clouds delayed flight	☑	☑
16	0	0	0	0	0	Weather delay		
17	162	0	171,000	0	57	Zones 4 & 8 RNA	☑	
18	214	0	159,000	0	50	Zone 10 RNA		
19	81	0	102,000	0	35	Zone 8 RNA		
TOTALS	1,761	786	1,326,000					

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7 ASPECT Team and Crew

Mr. Paul Kudarauskas, Chief Field Operations Branch
Dr. Mark Thomas, ASPECT Program Manager
Dr. John Cardarelli II, ASPECT Radiological / Tech Lead
Mr. Timothy Curry, ASPECT Logistics/Finance Lead
Dr. Robert Kroutil, Kalman Co Inc.ASPECT Chemical / GIS Lead (contractor)
Dr. Brian Dess, Kalman Co Inc. ASPECT Chemical / IT support (contractor)

Sam Fritcher, Airborne ASPECT Inc., CEO
Beorn Leger, Airborne ASPECT Inc., Chief Pilot
Ned Conner, Airborne ASPECT Inc., Pilot
Tom Cruise, Airborne ASPECT Inc., ATP/Operator
Dallas Sley, Airborne ASPECT Inc., Equipment Operator
Robert Kirby, Airborne ASPECT Inc., Engineer
Bruce Dingman, Airborne ASPECT Engineering Tech.

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