2017 ASPECT Preliminary Report
Rapids Needs Assessment

September 5, 2017
0730 hrs to 1900 hrs

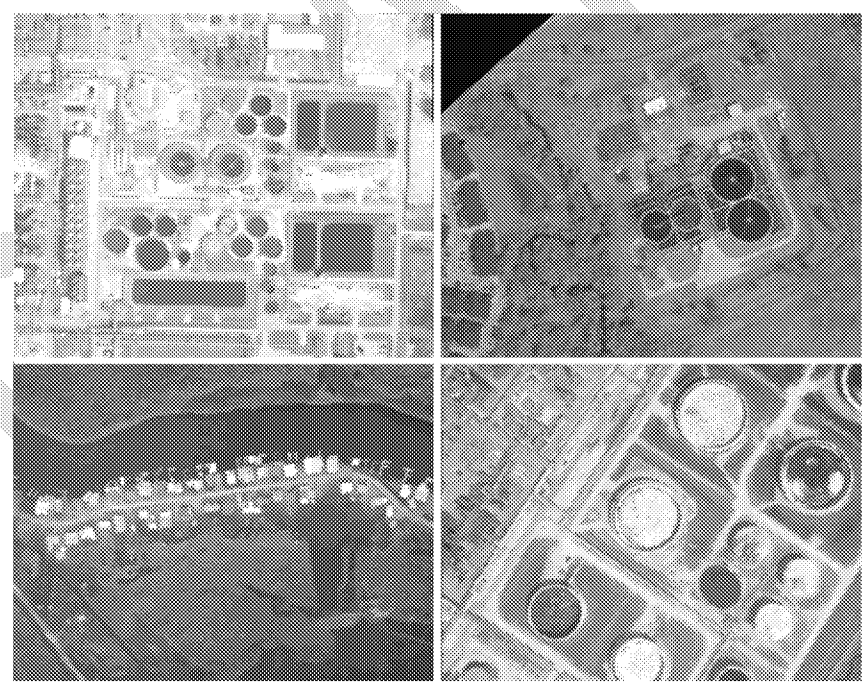

Figure 1: Clockwise from top left: Water treatment facilities showing a range of effects from Harvey and houses near the coast.

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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. 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.

After conducting three flights on 31 August 2017, the ASPECT aircrew moved their base of operations from Addison Airfield to Hobby Airfield. Pending any maintenance issues, this will position the aircraft closer to the target areas and reduce 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 9/3 are available in different reports. This report will begin with a detailed summary of the ASPECT operations scheduled for 4 September 2017. Table 1 provides a brief summary of the ASPECT products to date.

Table 1. Summary Metrics from ASPECT Operations

Date	*# Sorties*	*Aerial Photos*	*Oblique Photos*[#]	*FTIR spectra**
30 August 2017	1	39	52	21,000
31 August 2017	3	173	221	117,000
1 September 2017	3	257	88	171,000
2 September 2017	3	310	31	177,000
3 September 2017	2	330	381	210,000
4 September 2017	2	195	13	198,000
5 September 2017	2	TBD	TBD	TBD

[#] Some photos may not be viewable/usable due to poor lighting or weather conditions at the time they were taken. Highlight cells will be updated after the data is processed.

* The collection frequency of FTIR spectra is 70 spectra per second.

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ASPECT continues to fly in the TFR area (Temporary Flight Restriction) under an assigned squawk code in close coordination with the U.S. Coast Guard. **The aircraft does not fly through known chemical plumes or take air samples.** It uses a passive remote sensing technology that can detection vapors at its routine survey altitude of about 3,000 ft above the hazard.

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.

All of the trailers containing benzo peroxide at the Arkema site have burned. The last six trailers burned on 3 September 2017. ASPECT is now focused 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. Every photo 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.

The RNA mission will continue in geographic zones as 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

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.

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

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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

0730 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 #14 and (43 aand 152 aerial photos respectively). These should be available on the n-link by mid-day 6 September 2017.

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

Flight #16
0910 hrs: ASPECT is airborne and en route to Matagorda and Wharton Counties (Zone 4) to complete Zone 4 (34 remaining flight lines) and then will proceed to start Zone 8 (Brazoria County, >110 targets,.104 flight lines). Figure 2 shows current progress (aerial image overlays) in Zone 4 and the remaining flight lines.

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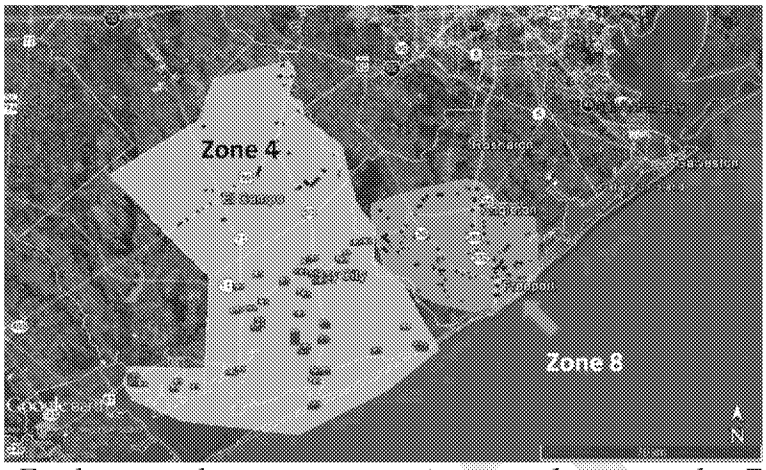

Figure 2: Google Earth image showing remaining areas to be surveyed in Zone 4 (primarily in Wharton County) and Zone 8 (Brazoria County). Only the flight lines (to be surveyed) and camera icons (completed surveys) are shown in this figure. Every photo will be geo-corrected and validated by the reachback 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.

0945 hrs: ASPECT arrives on station in Zone 4 and reports low clouds (1,000 ft AGL) which will adversely affect the aerial photographs. They diverted to Zone 8 (Brazoria County) to see if the weather conditions were better.

1000 hrs: ASPECT had to return to Hobby Airfield and will wait for the areas in Zones 4 & 8 to clear. Flight planning for Zone 9 (east Brazoria County and most of Galveston County) and Zone 10 (W Harris County) are being developed.

Flight #17

1300 hrs: ASPECT is airborne and en route to resume the Zone 4 RNA mission.

1540 hrs: ASPECT completes the Zone 4 RNA surveys and begins surveying Zone 8 (SW Brazoria County).

1700 hrs: ASPECT completes 21 of 104 flight lines in Zone 8 and heads back to Hobby Airfield due to storms developing in the area.

1730 hrs: ASPECT lands at Hobby Airfield. The crew is uploading data from Flights 16 & 17.

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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 perform maintenance on the IRLS. It is expected the IRLS will 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		

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ASPECT Flight Statistics

Flight #	Aerial	Oblique	FTIR*	Comments
1				System Test
2	39	52	21,000	Arkema
3	38	96	24,000	Arkema
4	97	107	63,000	Arkema
5	38	18	30,000	Arkema
6	35	0	30,000	Arkema
7	162	19	75,000	Arkema & Zone 5 RNA
8	60	69	66,000	Fire ER
9	222	5	108,000	Arkema & Zones 5 & 6 RNA
10	88	26	45,000	Arkema & Zone 6
11	0	0	24,000	Arkema Aborted Controlled Burn
12	263	5	156,000	Zone 6 & 7 RNA
13	67	376	54,000	Arkema Trailer Burn
14	43	13	42,000	Zone 7 RNA
15	152	0	156,000	Zone 4 RNA; Clouds delayed flight
16	0	0	0	Weather delay
17	TBD	TBD	TBD	Zones 4 & 8 RNA
TOTALS	1,109	773	894,000	

* FTIR estimates were based on an average of 3,000 spectra per pass.

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ASPECT Rapids Needs Assessment Detailed Status
Flights 16 & 17 for 5 September 2017

Zone*	Target Type@	Target #s	Targets Surveyed	% Complete#	Comments
4	NPL	1	1	100	Matagorda & Wharton Counties 85 of 85 flight lines complete Flight #s: 15, 17
	RMP	16	16	100	
	DW	87	87	100	
	WW	17	17	100	
5	NPL	0	0	100	E Harris and SW Liberty Counties Contains Arkema Site 36 of 36 flight lines complete Flight #s: 7, 9
	RMP	1	1	100	
	DW	45	45	100	
	WW	4	4	100	
6	NPL	4	4	100	E Harris County; South of Arkema Site 49 of 49 flight lines complete Flight #s: 9, 10, 12
	RMP	11	11	100	
	DW	50	50	100	
	WW	10	10	100	
7	NPL	0	0	100	Chambers County 46 of 46 flight lines complete Flight #s: 12, 14
	RMP	3	3	100	
	DW	42	42	100	
	WW	15	15	100	
8	NPL	1	0	0%	SW Brazoria County 21 of 104 flight lines complete Flight #s: 17
	RMP	10	2	20%	
	DW	95	20	20%	
	WW	9	1	11%	
9	NPL	3			E Brazoria County and most of Galveston County X of 89 flight lines complete
	RMP	21			
	DW	79			
	WW	29			
10	NPL				W Harris County X of 49 flight lines complete
	RMP				
	DW				
	WW				
11	NPL				TBD
	RMP				
	DW				
	WW				
	Totals to date		291		

@ NPL: National Priority List; 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 **5 September 2017**

Yellow highlights represent work in progress.

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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)
Mr. Jeff Stapleton, Kalman Co Inc. (remote support)
Ms. Malia Smolenski, Kalman Co Inc. (remote support)

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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