# *2017 ASPECT Preliminary Report*
# *Arkema Plant Response*
# *Crosby, TX*

***August 31, 2017***
***0600 hrs to 1300 hrs***

*Figure 1: Google Earth Image of the facility, February 2017*



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# 1 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.

A mission order was developed and a pre-flight briefing was completed by 0550 hrs. ASPECT was airborne at 0605 hrs and was over the target at 0720 hrs.

A second flight was initiated at 1050 hrs and the team continues to monitor the site.

# 2 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 2,800 AGL). The ASPECT System is an emergency response aircraft permitting remote chemical detection in support of the first responder. The system consists of an airborne high speed Fourier transform infrared spectrometer (FTIR) coupled with a wide-area IR line scanner. 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 still digital Nikon DX2 camera collects visible aerial imagery as part of the core data product package. It consists of a 12.4 mega pixel CMOS camera supporting a 3:5 aspect ratio frame. The system uses a 28 mm wide-angle lens and is slaved 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 the aircraft is in flight status or approximately 600 frames per hour can be automatically batch processed once the data is downloaded from the aircraft.

An Imperx mapping camera provides a similar aspect ratio and aerial coverage at a much higher resolution (29 mega pixels). Like the Nikon DX2, it is slaved to the primary IR sensors and provided concurrent image collection when other sensors are triggered. These images are often digitally processed in lower resolution so they can be transmitted via



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satellite communication. The high resolution images are pulled from the ASPECT after the sortie and often made available at a later time.

Data are processed using onboard algorithms while the aircraft is in flight and preliminary results are sent using a satellite system to the ASPECT reach back team for QA/QC analysis. The reach back team is operating from small hanger offices located at Million Air, Addison, TX.

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# 3 Results

Weather Conditions and Crew Report

0725 hrs: Weather conditions (Crosby, TX) at the time of data collection consisted of cloudy skies with about 10 miles of visibility. Winds were reported from the northwest at 1-2 Kts at ground level (pressure 1013 mbar). Upper level winds up to about 3,000 the winds remain calm. Above this altitude the wind speeds increase from the west to about 40 Kts. The surface temperature was 23°C with a humidity of 85%. Flight conditions at altitude were reported to be turbulent. The crew reported that they can see the fire but there was no visible plume over the facility.

1230 hrs: Weather conditions (Crosby, TX) at the time of data collection are clear with about 10 miles of visibility. Flight conditions at altitude were reported to be smooth.

Aerial Photographs

Figures 2 & 3 show a visible image of the facility with no observed plume and the flight path highlighted when IR sensors were active.

*Figure 2: Low resolution aerial images pulled from the aircraft while in flight over the facility, 30 August 2017 at about 0730 hrs CST.*

Oblique Photos:

High-resolution oblique photos provide an alternative view of the area. Figures 3 - 4 show visual conditions when the aircraft arrived on site. Cloudy weather combined with low light conditions are reflected in these images.



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*Figure 3: Oblique photo prior to explosion/fire on 30 August 2017.*

*Figure 4:Oblique photo after explosion/fire on 31 August 2017*



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High-resolution aerial photos provide downward view of the area. Figures 5 has been enhanced due to poor visual conditions when the aircraft arrived on site. Foggy weather combined with low light conditions is reflected in this image.

*Figure 5: Aerial photo over the site captured during the morning flight on 31 August 2017.*

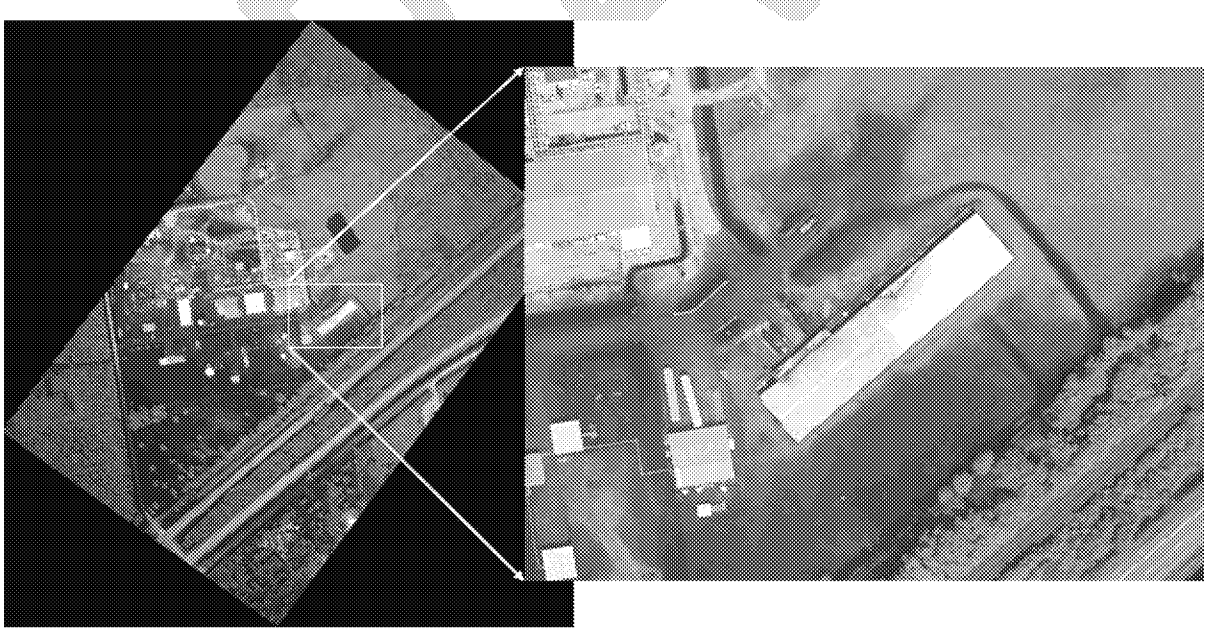

*Figure 6: Low resolution aerial image retrieved from the aircraft during the afternoon sortie, approximately 1335 hrs. A copy of the entire image will be provided in an email. A portion of the photo was enlarged to show the affected building.*



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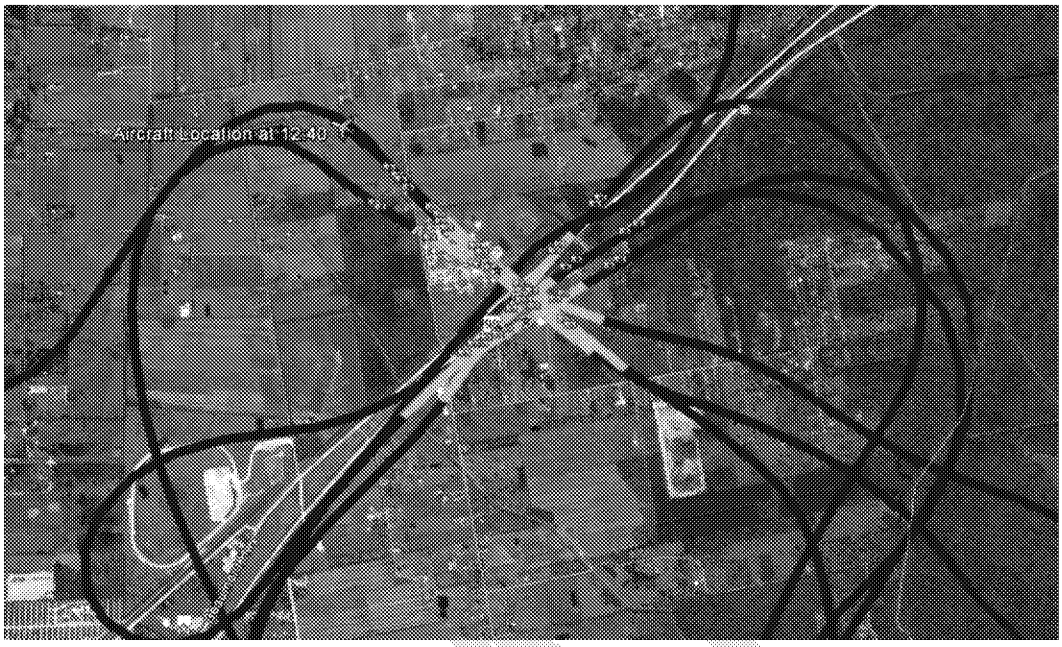


*Figure 7: Flight path over the facility at 0731 hrs CST (1231 hrs UTC) showing several passes where aerial imagergy and IR sensors were active.*

0810 hrs: The aircraft crew reported that it appears the fires has burned out.

0830 hrs: The aircraft was requested to return to base for high resolution data download.

There were ***no automated chemical detections in the morning sortie.*** There are no significant or anomaly detections reported during the afternoon sortie, which is currently ongoing..

The ASPECT technical reach back team manually inspected and analyzed 21,000 FTIR spectral measurements from the morning sortie. No significant deviations or anomalies were associated with the explosion and subsequent fire, however ozone was detected which was likely created during the fire.

Commonly occurring air pollutants such as ozone and PAN (Peroxyacytyl nitrate) are being detected which confirms that the FTIR spectrometer is operating properly. Spectra images of these constituents are shown in Figures 7 & 8.



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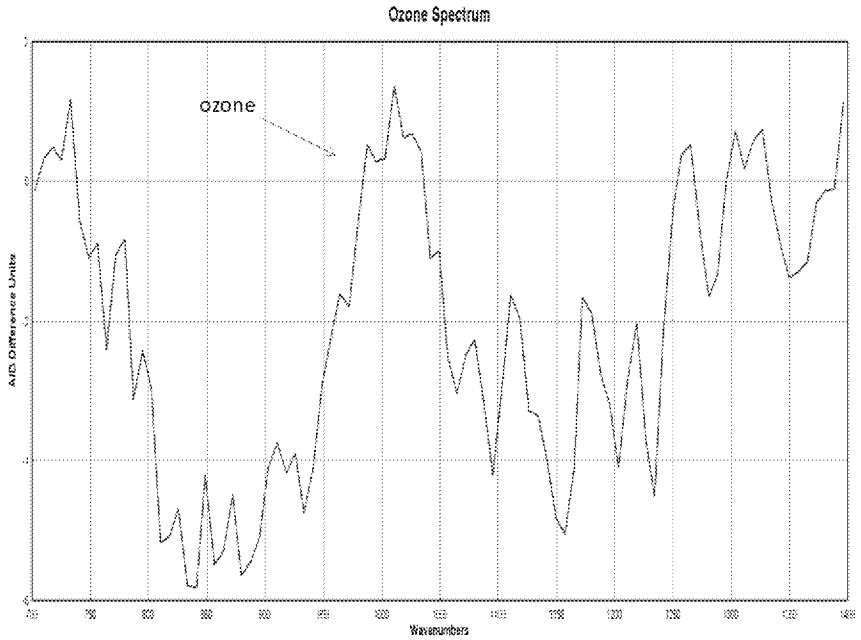


*Figure 8: Passive (remotely detected at 2,800 ft AGL) FTIR spectra showing ozone, a commonly occurring air pollutant. This confirms that the instrument was operating properly.*

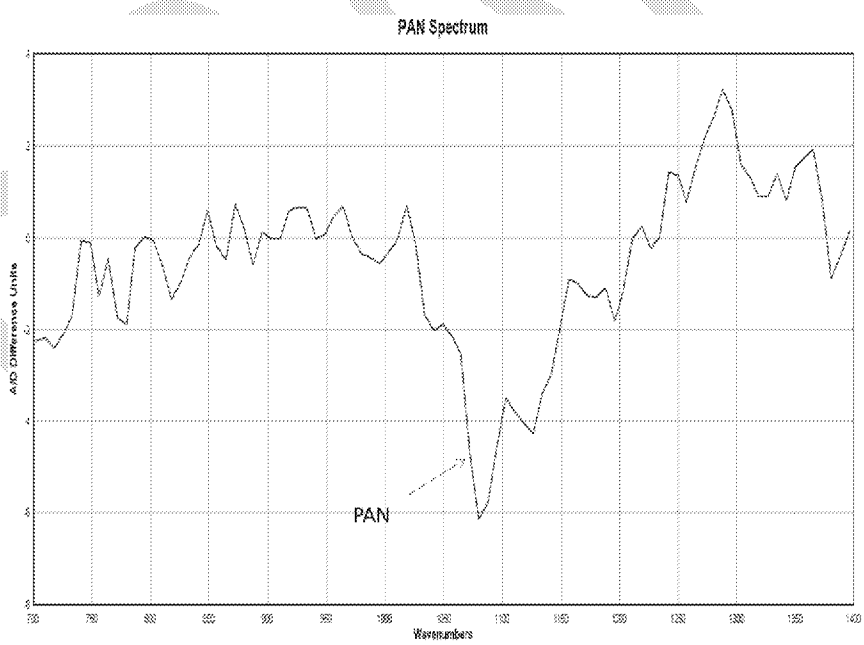


*Figure 9: Passive (remotely detected at 2,800 ft AGL) FTIR spectra showing ozone, a commonly occurring air pollutant, but this measurement suggests that ozone is being generated by the fire (e.g., the spectral image shows that the ozone is hotter than the background). This confirms that the instrument was operating properly.*



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0930 hrs: ASPECT landed at it based of operations, Addison Airport.

1330 hrs. ASPECT continue to monitor the site with no significant detections. Additional imagery continue to be collected and some are included in this report.

# 4 Observations

Operational Challenges

1. Satellite communications continue to limit the amount of data that can be pulled from the aircraft. Aerial photos create the largest demand on the system. Another demand on the system is multiple users. We are experiencing a transmission rate of about 1/10 normal.

2. Actively addressing recording issues with the IR system. It appears that the recording computer is failing in the aircraft. The team will work to replace the parts this evening.

3. Byrant Smalley, R6 OSC, requested that ASPECT be returned to operation ASAP. The aircraft was airborne at 1050 hrs and is conducting its second flight. The purpose of the flight is to continue chemical monitoring and photographing the site.

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