

# TexAQS II 2005 Field Study Team

March 15-16, 2005 Meeting

Presentations and Meeting notes will be posted on the web in the next few days. Go to website <http://www.harc.edu/harc/Projects/AirQuality/> and on the left hand side under "Meetings", a link the TexAQS Field Study Team presentations will be provided.

## **Action Items.**

The current assumption is that we will have one aircraft for 45 days. As soon as this is confirmed, or if it changes, the group will be informed by email. – Alex – TBD

Work up a back-up plan for aircraft (such as Baylor) in case plans to work with TCEQ do not work out. – Alex, April 1, 2005

Develop a timeline for what is needed when. – Alex, April 15, 2005.

Ensure that hangar space and other space needed for offices, tetrooms, etc. is taken care of. DFW – Doug/Noor, Houston – Alex/Carl, April 30, 2005.

Check into other scheduled and/or potential flights in East Texas (Environ/Baylor), Longview/Tyler and San Antonio. Determine if some coordination is possible/helpful. – Alex, April 1, 2005.

Doug will let us know when we can talk about the aircraft carrier which has been chosen as the contractor. – Doug, April 7, 2005.

Doug/(HARC) needs to identify the cost of an incremental 45 hours. – Doug, March 25, 2005.

Notify team as soon as information is available about the negotiations between TCEQ and the aircraft carrier. – Doug, April 1, 2005.

Identify minimum flight speed and send to Alex for distribution. – Doug, April 15, 2005.

Identify the exact number of canisters per flight, and total canisters for the summer. – Doug, April 15, 2005.

Identify what compounds are measured in a canister, what the detection limits are, and what the turnaround time is. – Doug, April 30, 2005.

Need gridded met and AQ model. Daewon needs to have sample data so that we can build software. NCAR aircraft data format works. – Doug, April 15, 2005.

Write-up flight plans for everyone. – Carl, Noor, April 30, 2005.

Verify that the tetron aircraft study can take place July 15-July 31. – Carl, March 25, 2005. (Noor will plan on working Aug. 1- Aug. 31, and will be available sooner if the tetron project finishes early).

Does the power from the PTRMS have to be clean? Inform Doug of the specs. – Renyi/Ed, April 1, 2005

Provide John Nielsen-Gammon with specifications on desired wind/met conditions for the aircraft projects. (NG will use this to run sample models to test out plans.) – Noor/Carl, April 1, 2005

Provide Daewon Byun with number of layers and desired species for aircraft support predictive information so he can adjust software now. – Carl/Noor, April 1, 2005.

Provide sample model run output to Noor/Carl. – John, May 1, 2005

Develop detailed plan for installing the PTRMS on the aircraft, including calibration of the instrument and the impact of the instrument on other on-board instruments. (note: if two different planes are used, additional work needs to be done). – Renyi/Ed, May 31, 2005.

Develop alternate locations for tetron releases, east and west of Houston, in case desired wind patterns do not appear. – Carl, May 1, 2005.

Develop plans to have aircraft fly over the ship channel immediately preceding the tetron chase. – Carl, May 1, 2005.

Send met data/model output web site/url to Alex when it is up and running. Alex will distribute it to the group. – John, May 1, 2005.

Need to talk about extending the contracts beyond August 31, 2005 with Katherine Marvin at TCEQ. – Doug/Pete, May 1, 2005.

Renyi Zhang to send a list of compounds to Carl/Noor that are suitable for PTRMS measurements. – Renyi, April 1, 2005

Carl, Noor to send Renyi selected compounds from list. – Carl/Noor, April 15, 2005.

Provide Renyi the species measured by the auto-GC's. – Doug, April 1, 2005.

Determine where to store tetron equipment. – Alex, April 30, 2005

Ship tetron equipment to Alex. – Carl, July 1, 2005

Send information to the team about the formaldehyde analysis. – Bernhard, April 15, 2005.

#### Comments from Pete

SIP modeling meteorology has been a problem, and we're hoping this summer's work will fix that.

Tetroon – interested in Houston's plume on the impact on the rest of Texas. Need to mark the air parcel.

The average ozone in Dallas is higher than Houston. Houston's air gets flushed out. Dallas always gets pollution blowing in from someone. Knowing the plumes around Dallas is important.

Houston industrial VOC's are problematic so the SOF study and PTRMS study will help fix that for us.

Each project sets us up for test cases for the more extensive study in 2006. These will be proof of concept.

TCEQ has decided on who they will go with on the aircraft. TCEQ will support NET Plume Study only with \$419K. TCEQ will work with HARC to set up the aircraft, so HARC won't have to go through another RFP process.

Daewon can do a tracer from the emission inventory to model/forecast the plume direction. No chemistry. Carl will let Daewon what specifics he knows. – Carl, April 15, 2005.

#### Comments from Noor

Need to address the emissions of sources upwind of DFW, which are mostly power plants.

Areas are VOC limited, transition, and NOx limited – we should aim to make plume measurements in all three cases.

Need to add existing profilers to Noor's list, and then identify what other locations need profilers.

Limestone and Big Brown are target sources which impact DFW. We plan to begin making detailed measurements at 9:00 am. (start flight at 8:00 am) and zig zag through the plume, urban areas and downwind. Fly until about 16:00. This will take up 10 hours of aircraft time per mission.

I have estimated that, on average, we may use up 6-12 hours of flight time per mission depending on whether the mission is focused on Zone A, B or C (less for zone A and longer for Zones B and C). Assuming an average of about 10 hours per mission, we can have only about six missions with 60 hours, and that is about one mission of each of the six categories I had identified. That is the bare minimum. It may be possible to do the six missions in 15 days or more. We will need 30 days if we have more flight time than 60 hours, and more missions. Ideally, 12 missions (two of each kind) would be great if we can come up with 60 more hours, in which case, we would have a busy NETPS lasting a full month.

Comments from Carl/Paul/Rahul

Need information on the following:

- Model forecasts
- Real-time access to profiler winds in Houston area?
- Pilots and flight crew duty day?
- Aircraft endurance? FAA approval of our tentative plans?
- Aircraft instrument suite?
- Will there be an onboard scientist?
- Ground to air communication?
- Hanger space contract.
- Aircraft pilot will have a map that shows aircraft tracks as well as tetron path.

John Nielsen-Gammon

Model runs once/day. Spans 48 hours. Supplies data to UH, TCEQ and UAH.

Daewon

Forecasting target is 2 days.

Dick McNider

We may need 2 tetroons to track a plume due to differences between the direction and travel of the top and bottom of the plume.

Stagnant days may be important because they have defined the ozone design value. Should we consider an aircraft study for stagnant days? (If money/aircraft time becomes available this will be considered).

Comments from Doug

TCEQ has chosen the aircraft supplier.

TCEQ will provide \$419K in July/August timeframe. Expect approximately for 45 days of availability.

We may have to deal with winds not being what we want.

TCEQ is looking into doing options with a joint grant with HARC.

The aircraft carrier will have a pilot plus one technician aboard.

Data will be available in delimited text files with raw data plus various levels of QA's data.

(Noor/Carl need to know if researchers will be able to review data quickly and have a debriefing after each mission.)

Tetroon researchers need to determine how long is too long for a plane to follow the tetron? Travel time may exceed available time if long distances are required. If there is a next day balloon reading/plume is too far, then there will not be another flight.

The aircraft carrier is bringing 2 pilots. Typical flight day may be 12 hours long according to the contract.

Pilots need to show up 2 hours before flight.

Cost includes:  
Instrument rental  
Flight time  
Duty days  
Aircraft Rental  
Fuel

There is no cost per hour, only a cost to do the project. Doug needs to identify the cost of an incremental 45 hours.

Majority of costs is due to labor rather than aircraft.

Question from Pete: Both teams want same air currents. Do we want to use two aircraft? Noor would want 30 days to run 10 missions which would take 60 hours of aircraft time.

Other comments

Winds may be more favorable in July.

Ozone peak is about 2 weeks earlier in Dallas than it is in Houston.

If project scientists can state what winds they need, NG can run sample models so we can test out. Provide specs to NG. Noor and Carl will provide that to info to NG.

Aircraft could measure ship channel prior to going after the tetroons.

Renyi

PTRMS can be available from July 15-Aug. 31 for aircraft measurements to support the tetron project and the NETPS. The PTRMS should be automatic – and can be used without having someone on board the aircraft.

Satellite modems may be able to use for gathering data or even controlling the PTRMS directly. Renyi may contact Paul for future, but not likely for this project.

John Nielsen-Gammon

Surface met equipment that will be available...

Balloon - radiosonde

Sodar

Radar

Profilers

ACARS

Access to Radar and wind profilers will come from Sonoma Tech in real time.

Radar (wind profiles most interesting) info will be available in real time

Info will be on a common web site at TAMU.

Also John will generate model forecasts in same format as observations (so they can be compared).

ASCII files will be available. NG will be archiving data themselves since it is needed for validation.

Need to check suppliers wrt data, and will share what we can.

Met data/model output should be available in the next couple of months and will be available for the following 18 months.

NG will send website to Alex to distribute when we get it.

Citing of C-Band needs to be placed on land, needs electricity, can be mobile.

NEXrad radar and C-Band radar

Operate on different wavelengths.

We have control of scanning on C-Band radar, but NEXrad has fixed scanning.

Both are measuring microwave return power, both are dopplers so you can measure velocity.

You can get to horizontal wind components, to get better picture of the wind.

Special soundings can be made to aid the aircraft flights in Dallas.

Profilers – give hourly averages. (Consensus number is chosen).

C-band radars give output every five minutes – much better than standard profilers.

Profilers and radars are subject to errors due to migrating birds.

Sodar quality varies with manufacturer.

Comments from Jim

Surface monitoring

Surface monitoring system was supposed to be installed by May 1, but that doesn't look like that will happen. Cost is about \$2 million.

Types of monitors:

Ozone and met

Ozone chemistry sites – highly equipped sites. O<sub>x</sub>, NO<sub>x</sub>, speciated FRM, SO<sub>2</sub>, VOC, formaldehyde, TEOM, NO<sub>y</sub>, visibility, CO and Met.

Met (profiler and rawinsonde) system. NOAA is bringing one more.

PM and Haze

Biggest issue is funding and timing thereof, and access agreement. Cost of buying all material at one time is much better than buying equipment piecemeal.

All sites will feed in real time LEEDS system. Much more data will be behind the firewall. Data outside of the firewall will be available near real time.

Emissions inventories

What surface information is available to help map out expected plumes? After the study it would be useful for modeling. SAPRC emission inventory – for 2000 is ready, but it will be awhile before 2005 is ready. CBIV 2007 and 2000 inventories are available. For Noor's work the CBIV 2007 should be the best choice. After the field study SAPRC 2005 should be ready, but we can't guarantee that.

UH/A&M will have data and will cross reference each other.  
TCEQ will also have a website  
Others (UT, Baylor, NOAA) will have results.

Dick McNider

Marginal cost of flight hours.  
Maximums/stationary fronts define ozone emission design days.  
Stationary fronts prevent dilution, so that even modest sources create pollution problems.  
Ozone sites that fill in empty spots in east Texas will tell us how big these events are.

Hypothesis: Most ozone seen is produced locally, even from modest emission sources due to stagnation.

A cyclone will give a mixed period.

Is free troposphere above this is fairly enriched with ozone – which would mean if there is mixing with the boundary layer, then we are not doing any good because we're mixing bad air with more bad air.

Since these situations (static days) have been so important in the design days, then we could set aside at least one day to do a study on it.

Some of the same mechanisms that create dead zone are related to developing before the sea breeze.

This would not require a highly instrumented aircraft. Met and ozone is what is needed, not additional chemistry.

Need to get SAC to weigh in on. Jim is concerned that we don't have enough funds for enough hours for the aircraft.

Aircraft operations have been identified as the highest priority.  
Need a sounding program to look at ozone above and below the front.

Need a back-up plan for HARC money support such as with the Baylor aircraft.

Could send ozone sondes in Dallas area during stagnant time, but that has limits. Aircraft could follow that.

Contracts issues.

No cost extension – wait until May?

Aircraft – negotiation.

TCEQ to talk with Katherine Marvin about extension issues.

#### Timelines

SETBS – July 15 – July 31.

NETPS – Aug. 1 – Aug. 30

Ed will be around to run the PTRMS. May be able to do calibrations on some test flights. Probably need about 6 hours, 3 flights to do test. Maybe you can use the PTRMS for testing on the tetraon study.

If we have both Baylor plane and the TVA plane available – Renyi says he thinks we can transfer it okay. Need to verify that the Baylor plane can hold it. It will take some time to move from one plane to another.

Changing instruments out may involve another test flight. It isn't the best thing, because we need to test the whole system.

Species to measure for PTRMS – will try formaldehyde and propylene are difficult but we'll try. 1,3 butadiene is going to be very important. Butenes are also very important. Alkanes of more than 6 carbons. Benzene, xylene, trimethyl benzene, MVK (isoprene degradation products), glycol, mesoglycol.

Renyi will send an email to Carl/Noor with a list of compounds.

For tetraon study it should make a pass over the ship channel before chasing the tetraons.

Aircraft speed is 50-100 meters per second. Most PTRMS have a 5 second resolution time per compound. There is a trade-off between speed or results and accuracy.

For close to the plume, identify your top 4 compounds with 1-2 second resolution, then increase resolution as the flight plans.

Doug will get the minimum flight speed.

Doug will provide species to Renyi from the auto-GC's.

Can use SO<sub>2</sub> as the tracer compound for the ship channel.

Canisters have 30-50 cans for 60 hours of flight. Doug will get the exact number. Typically you could get 6-10.

Doug will get what will measure components, detection limits, and a lab that can turn around data in a reasonable amount of time.

VOC data will not be available for a few months. Sometimes it takes 2-3 weeks, but no promises. They do GC-MS. Typically they use EPA standard which has about 55 compounds.

Planes can go to a specific spot using GPS.

Instrumentation does not necessarily come across a single lap top.

Formaldehyde is not measured. Carbonyls will be measured (to capture a degradation product).

Daewon had some concerns. He would need to start over to figure out how to incorporate the Dallas work.

Noor says the hind cast is more important. Met forecast will be more critical. 4 km model forecasting is not needed for Dallas. 12 km forecast will be good enough.

Daewon already has the Houston 4 km modeling hindcast/forecast.

How many layers do you want to have and what species do you want to look at? Noor will tell Daewon. Noor has to look at it and pass it on to Daewon.

Need same info from Carl. Carl will provide information to Daewon.

UH/A&M will have separate web sites and have links to each other.

If wind is only blowing south all the time, what does the tetron study to? They will have to develop Plan B. e.g. if there was easterly flow. If there is a persistent flow, that it is good. They can drive to other sites to release. A bigger issue is for the pilot to work with FAA. Would like 72 hour MM5 forecast – to be provided by NG.

Daewon can do a tracer from the emission inventory to model/forecast the plume direction. No chemistry. Carl will let Daewon what specifics he knows.

Tetron – how close can we get to the ship channel – northerly flows may work out.

Carl will ship tetron equipment to Alex. Alex will figure out will decide where it goes.

Noor will work with Doug/aircraft carrier to identify the operations center in the Dallas area.

Operations for a Dallas is part of the TCEQ/aircraft carrier contract. Aircraft carrier will take care of that.

Renyi does not have an issue wrt to basing operations.

Pre-mission briefings. – Noor will work it out off line. Tetron – they will work it off-line.

Staffing of the aircraft campaign...

Tetron study will have 6 people here.

NETPS - Noor and one other.

Two people for PTRMS

Forecasting – John NG will be onsite as needed.

Data Management

Noor – most important info is to have access to aircraft data as soon as possible. How will it be stored.

Doug – will convert it to the desired file.

The data schema of measurements. What format and what timescale.

Post processing data needs to be provided ASAP.

Generally you look at all measurements and then look at them all to do QA/QC. Will have a screen level data available at first.

Need gridded met and AQ model. Daewon needs to have sample data so that we can build software. Doug will develop. NCAR aircraft data format works.

Balloon will provide data in spreadsheet format.

Things to be resolved:

Open negotiations

Notify team as soon as that is settled or HARC can participate.

Who's gonna sign for the hanger space? Anything beyond the hangar space is responsible by the project.

Carl/Noor – write up flight plans for everyone.

Ed/Renyi – check on the quality of the power for the PTRMS – to Doug. Does it have to be clean?

\$183K will include operations center at Dallas.

Noor – needs office space, etc. Could it be done at the hotel rather than the hanger.

Need to nail down Montgomery airport reservations/contract.

C-band radar – some funding is almost in place from TCEQ for the first part of the summer. Plan was for HARC to supplement it for aircraft study. TCEQ may want to move time in the field towards when the aircraft is. Need drop dead date.

Timeline for what is needed when.

Daewon/NG need data format/wind speed/data etc. from Noor and Carl.

Audits for profilers – does this need to be addressed? Probably not going to happen this year – due to lack of funding. A system audit is \$10-15K per site (9 sites).

### Looking Ahead

NETPS – confirms the impact of various sources, and the interactions of those source emissions with other chemicals and impact on Dallas plume. Assess impact of NO<sub>x</sub> reductions that have been done. There could be some interest in assessing PM 2.5.

Post facto analysis – would be nice to have emissions (CEMS) from power plants.

Balloon Study – can provide transport issues, particularly at night, can get compound ratios (NO<sub>x</sub>/VOC) correct, are we getting the ozone right? All can support/challenge the model in transport and chemistry issues. Specific to trajectories. Demonstrate that we can follow these air masses and evaluate them as time. Need to demonstrate capability to say we have a tool to evaluate.

Bernhard will send data on formaldehyde analysis to be used on an airplane.

SOF will be important to SIPs.