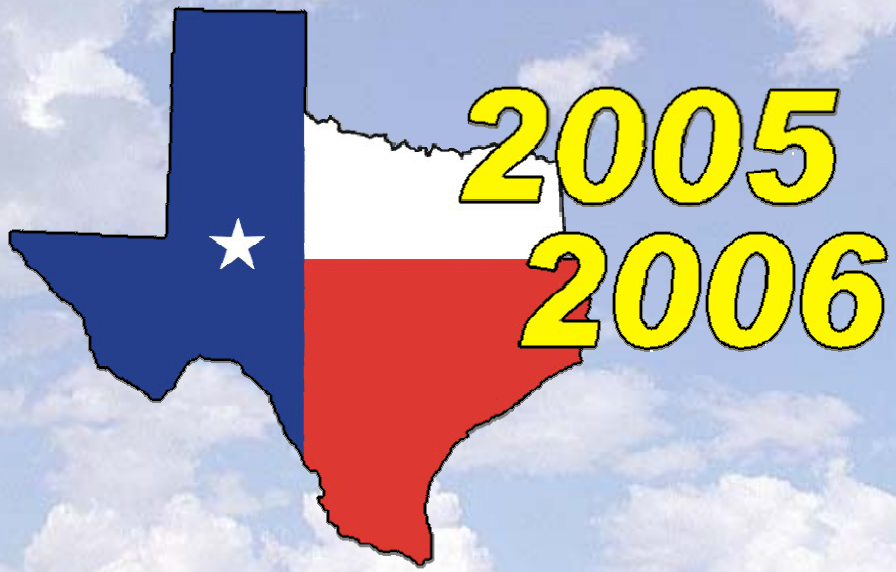
TexAQS II Field Study UPDATE July 19, 2006



The Texas Air Quality Study II

TexAQS II Field Study Status

- Study Overview
  - Purpose and Benefits
  - Research Areas
  - Time Line for Results
  - Participants
- Science Questions
- Ground Monitoring Network
- Time Table for Planned Deployments
- Study Platforms
- Daily Briefings

Study Overview

Purpose and Benefits

- Better understanding of the importance of different emissions sources in the formation of ozone and particulate matter
- Document and understand transport of pollutants into and within Texas
- Acquire more accurate estimates of VOC and NO_X emissions
- Improve photochemical models through measurement of pollutants over East Texas
- Direct understanding of how and why pollution is forming without resorting to photochemical grid modeling
- Independent, objective verification of modeling results
- Acquire data to support a new photochemical modeling episode

Study Overview

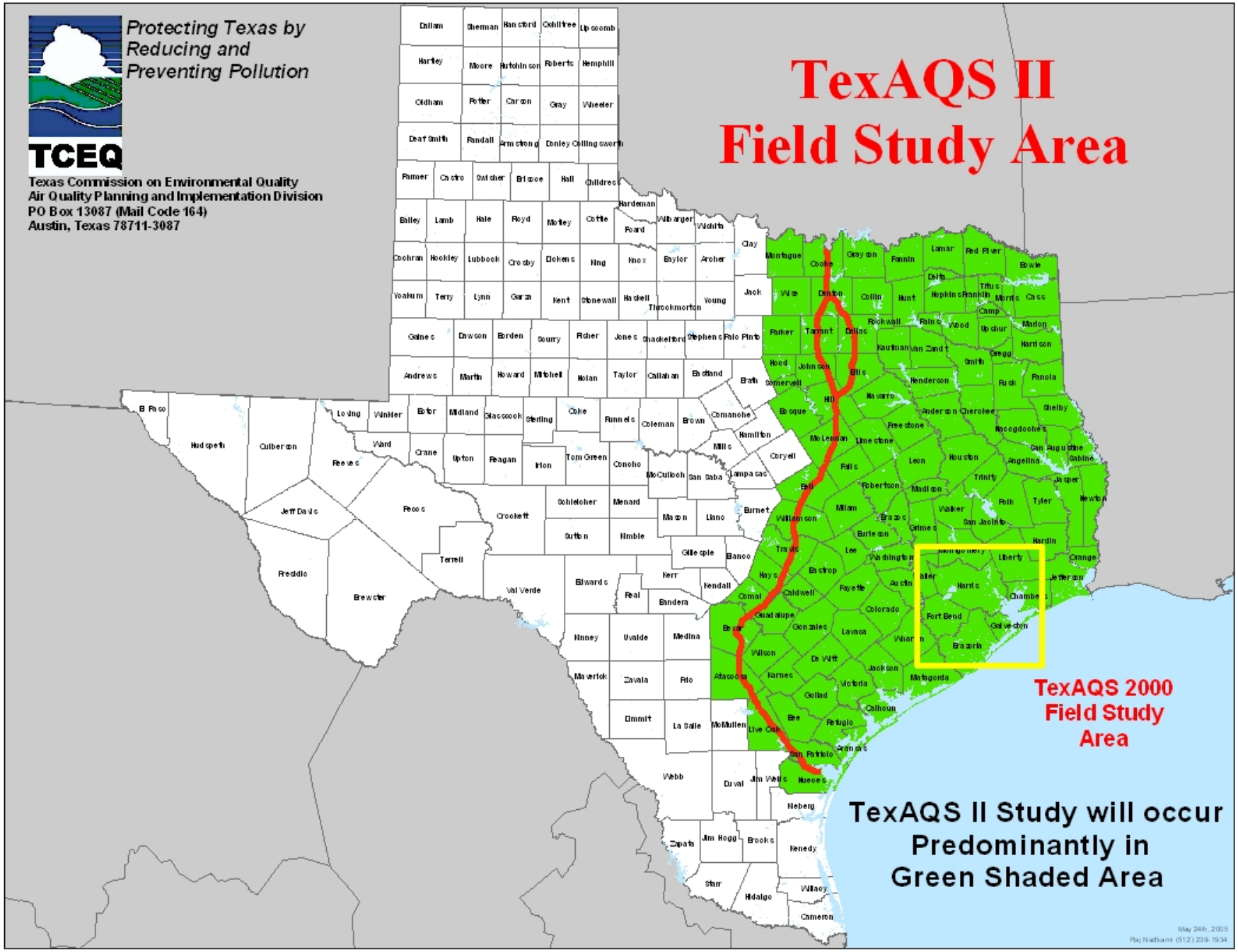
Research Areas

- Emissions Verification and assessment
- Transport and Mixing
- Chemical Transformation
- Aerosol properties and radiative effects
- Forecast Models

Study Overview

Time Line for Results

- Houston/Galveston/Brazoria and Dallas/Fort Worth SIP revisions must be submitted to EPA by June 15, 2007
- For inclusion into SIPs technical results must be to TCEQ by late winter 2007 (February/early March 2007)
- TCEQ is funding a Rapid Synthesis Report to fast-track important study results into SIPs


Protecting Texas by Reducing and Preventing Pollution
TCEQ
Texas Commission on Environmental Quality
Air Quality Planning and Implementation Division
PO Box 13087 (Mail Code 164)
Austin, Texas 78711-3087
TexAQS II
Field Study Area
TexAQS 2000
Field Study
Area
TexAQS II Study will occur
Predominantly in
Green Shaded Area

Study Participants

•Governmental Agencies

- NOAA
  - OAR(ESRL,PMEL,AOML,ARL)
  - NWS
  - NESDIS
  - OMAO
- National Center for Atmospheric Research
- Environmental Protection Agency
- Dept. of Energy
  - PNNL
  - Argonne National Lab
  - Los Alamos National Lab
- Dept. of the Interior
  - Mineral Management Service
- NASA
  - Jet Propulsion Lab
- National Science Foundation
- Dept. of Defense (Navy)
- Tennessee Valley Authority

Texas Government Entity

- AACOG
- CAPCOG
- City of Corpus Christi
- City of Victoria

Study Participants

Institutes of Higher Education

- University of Texas - Austin
- University of Houston
- Texas A&M University
- Texas Tech University
- Rice University
- Lamar University
- Baylor University
- North Carolina State University
- University of Miami
- University of Colorado (CIRES)
- University of Washington (JISAO)
- Georgia Tech University
- California Institute of Technology
- Valparaiso University
- University of North Carolina CH
- University of New Hampshire
- University of Alabama-Huntsville
- Fort Hayes State University
- Pennsylvania State University
- University of California LA
- University of California SC
- Portland State University
- Washington State University
- University of Massachusetts
- University of Rhode Island
- University of Iowa
- Howard University
- University of Manchester, UK
- Chambers University of Technology (Sweden)
- Scripps Institute of Oceanography

Study Participants

- Meteorological Service of Canada
- Environment Canada
- California Air Resources Board
- URS
- Shell Oil Corp.
- ExxonMobile Corp.
- Aerodyne Research Inc.
- SensorSense, (Netherlands)
- Science Systems and Applications, Inc.
- Science Systems and Applications, Inc.
- Texas Environmental Research Consortium (TERC)
- Houston Advanced Research Center (HARC)
- Texas Air Research Center (TARC)
- Houston Regional Monitoring (HRM) Network
- Environ Corp.
- Sonoma Technology Inc.

SIP-Relevant Science Questions

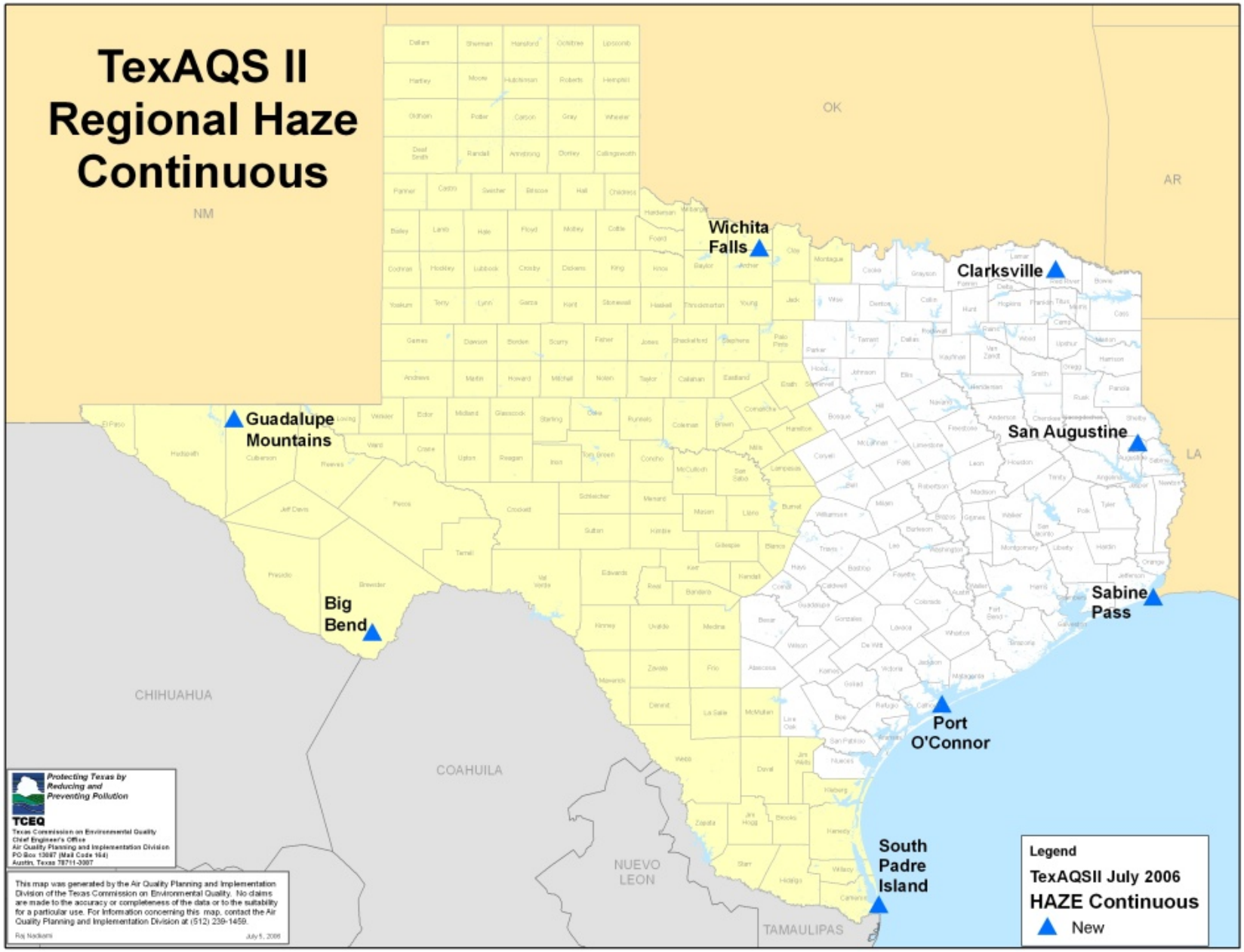
- Rapid Synthesis Report (NCSU – Ellis Cowling)
  - Developed 12 primary questions to be answered by the field study
  - Interim Progress Report - May 31, 2006
  - First Science Synthesis Report – July 30, 2006
  - **Preliminary Rapid Science Synthesis Raw Data Results – October 31, 2006**
  - Final Rapid Synthesis Report - August 31, 2007

SIP-Relevant Science Questions Participants

- Dave Allen, University of Texas
- Wayne Angevine, NOAA ESRL
- Bob Banta, NOAA ESRL
- Carl Berkowitz, DOE PNWL
- Chuck Brock, NOAA ESRL
- Daewon Byun, University of Houston
- Greg Carmichael, University of Iowa
- Bill Carter, U. California Riverside
- Ellis Cowling, NCSU
- Lisa Darby, NOAA ESRL
- Basil Dimitriades, NCSU
- Mark Estes, TCEQ
- Joost deGouw, NOAA ESRL
- Cari Furiness, NCSU
- Mike Hardesty, NOAA ESRL
- Harvey Jeffries, UNC at Chapel Hill
- John Jolly, TCEQ
- Bryan Lambeth, TCEQ
- Stu McKeen, NOAA ESRL
- John Nielsen-Gammon, Texas A&M
- David Parrish, NOAA ESRL
- Tom Ryerson, NOAA ESRL
- Ted Russell, Georgia Tech
- Ken Schere, US EPA
- Christoph Senff, NOAA ESRL
- Dave Sullivan, U of Texas
- Will Vizuete, UNC Chapel Hill
- Allen White, NOAA ESRL
- Jim Wilczak, NOAA ESRL
- Yulong Xie, DOE PNWL
- Greg Yarwood, Environ Corp

TexAQS II Field Office

"Atlas": 16821 Buccaneer Ln., 77058


TexAQS II
Regional Haze
Continuous
NM
OK
AR
LA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
Wichita Falls
Clarksville
Guadalupe Mountains
San Augustine
Big Bend
Sabine Pass
Port O'Connor
South Padre Island
Legend
TexAQSII July 2006
HAZE Continuous
New
Protecting Texas by Reducing and Preventing Pollution
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Texas Commission on Environmental Quality
Chief Engineer's Office
Air Quality Planning and Implementation Division
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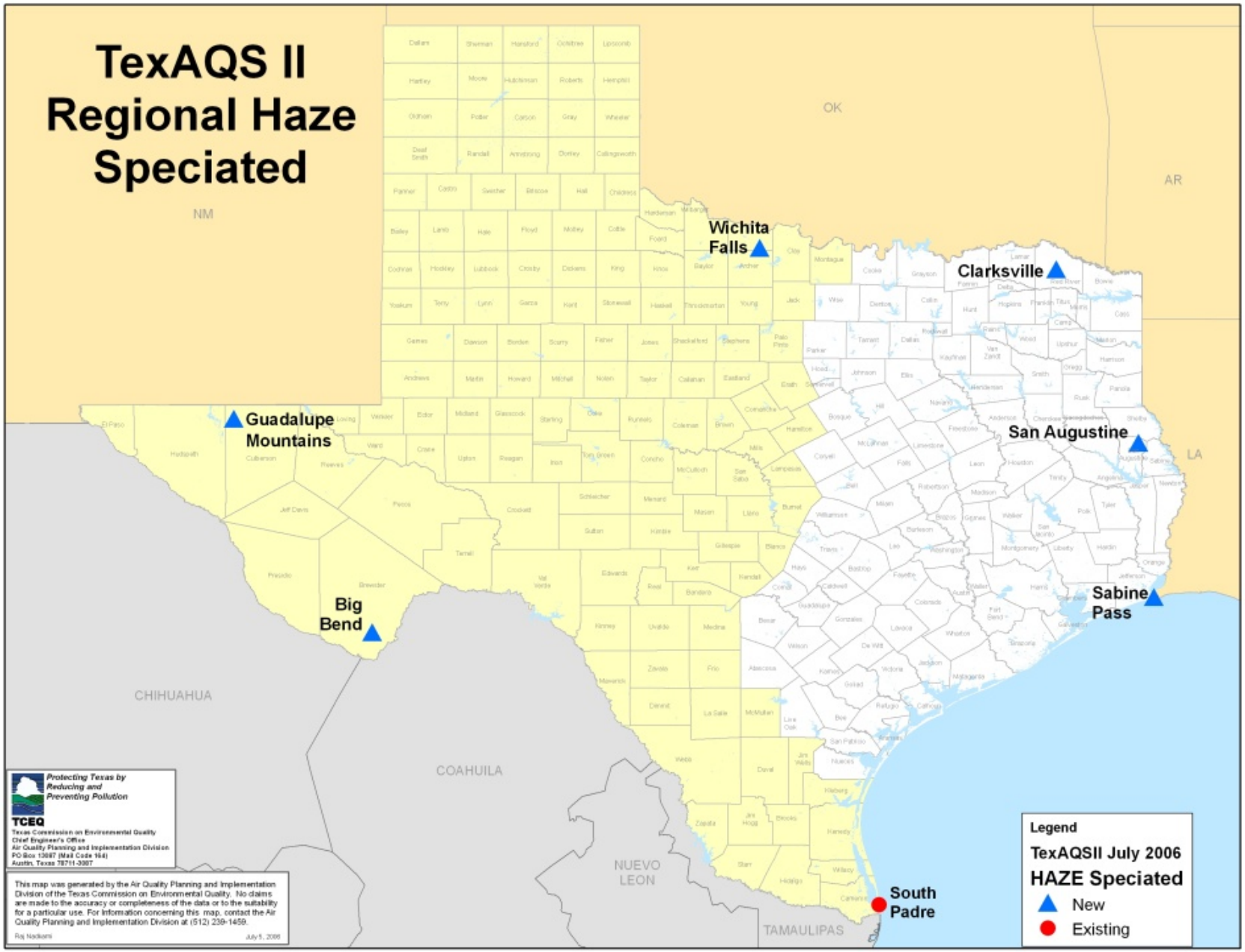
Raj Nadkarni
July 5, 2006


TexAQS II
Regional Haze
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CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
Wichita Falls
Clarksville
Guadalupe Mountains
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Sabine Pass
South Padre
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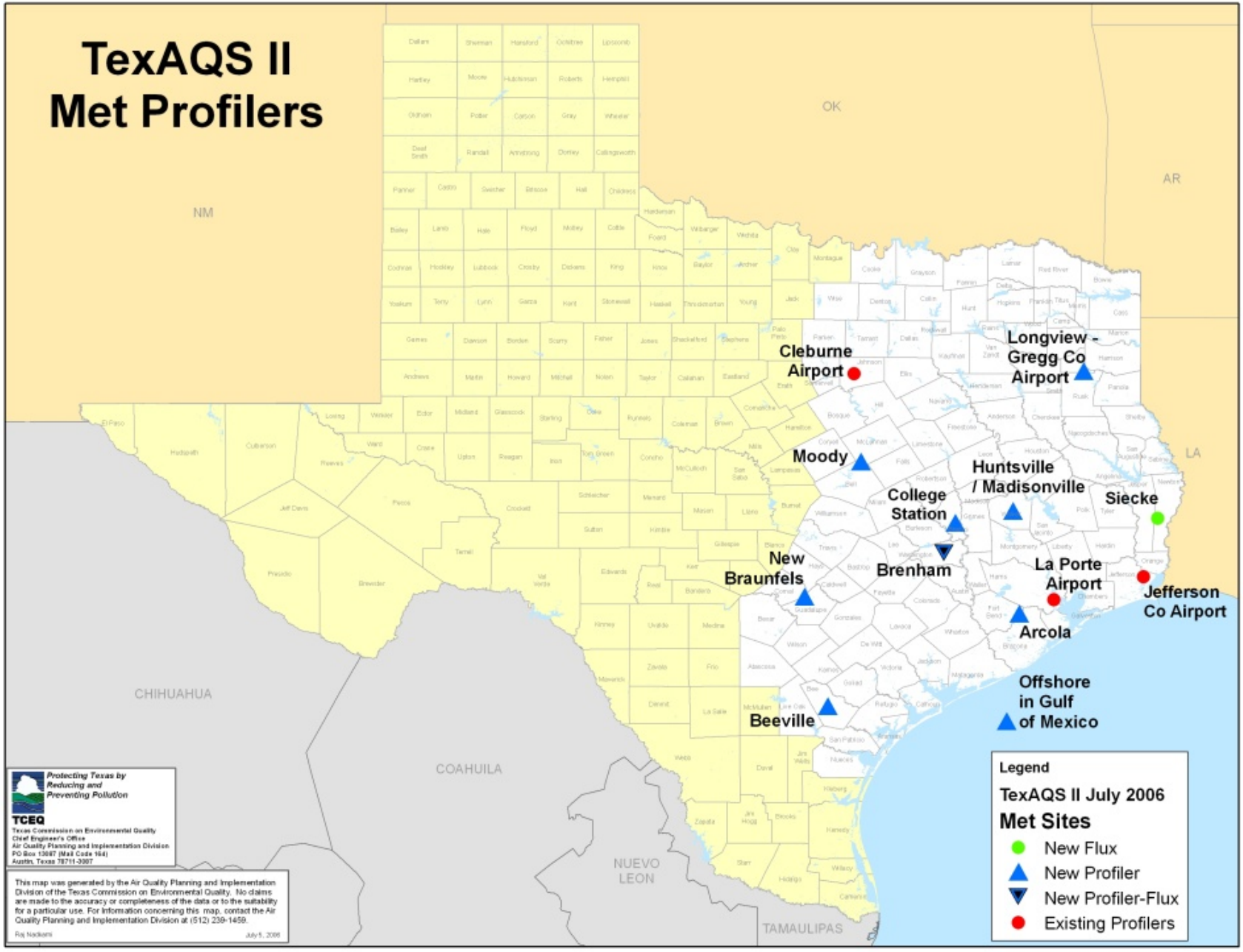
Legend
TexAQSII July 2006
HAZE Speciated
New
Existing


TexAQS II
Met Profilers
OK
AR
NM
LA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
Cleburne Airport
Longview - Gregg Co Airport
Moody
Huntsville / Madisonville
College Station
Siecke
New Braunfels
Brenham
La Porte Airport
Jefferson Co Airport
Arcola
Beeville
Offshore in Gulf of Mexico
Legend
TexAQS II July 2006
Met Sites
New Flux
New Profiler
New Profiler-Flux
Existing Profilers
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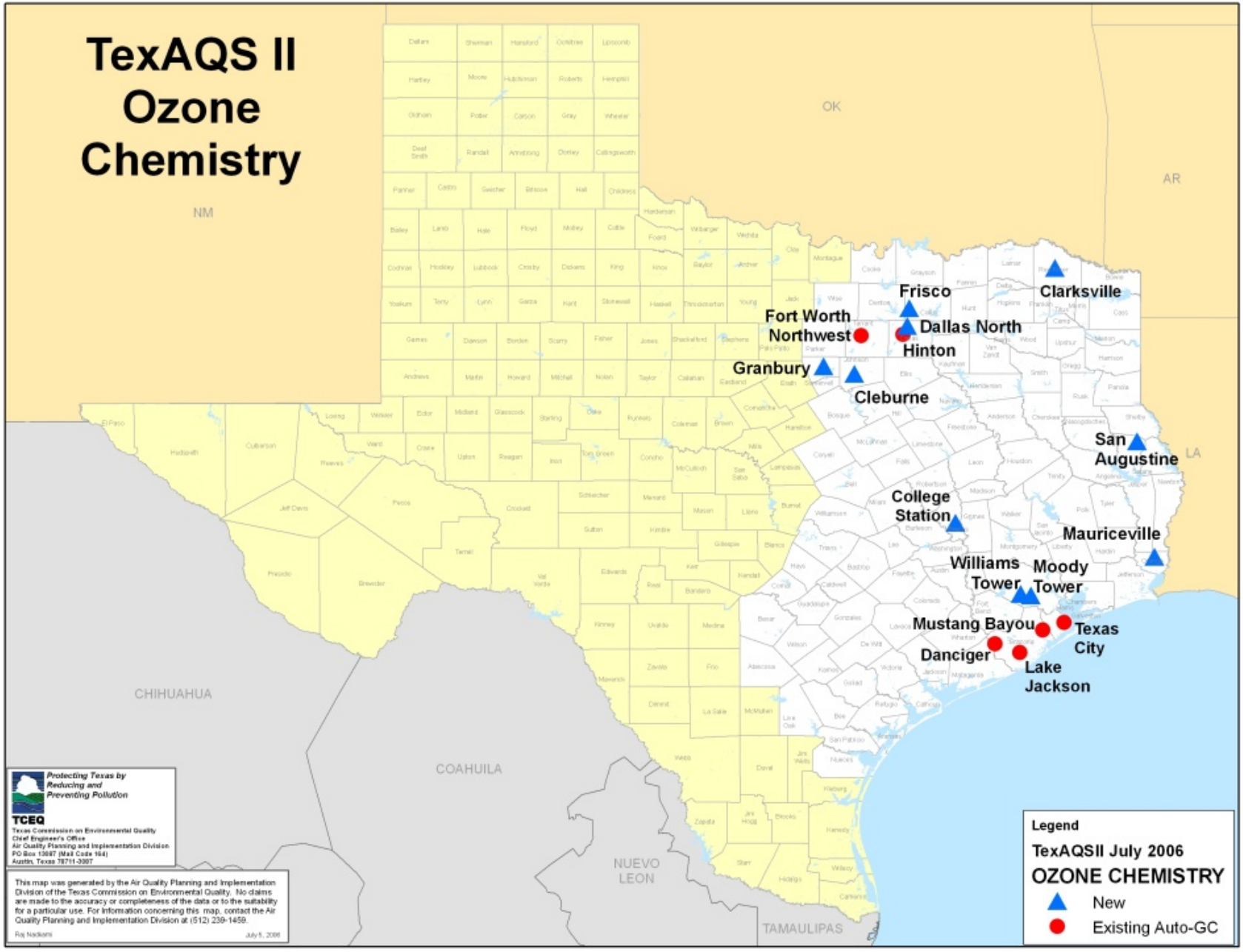
TexAQS II
Ozone
Chemistry
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COAHUILA
NUEVO LEON
TAMAULIPAS
Frisco
Clarksville
Fort Worth Northwest
Dallas North
Hinton
Granbury
Cleburne
San Augustine
College Station
Mauriceville
Williams Tower
Moody Tower
Mustang Bayou
Texas City
Danciger
Lake Jackson
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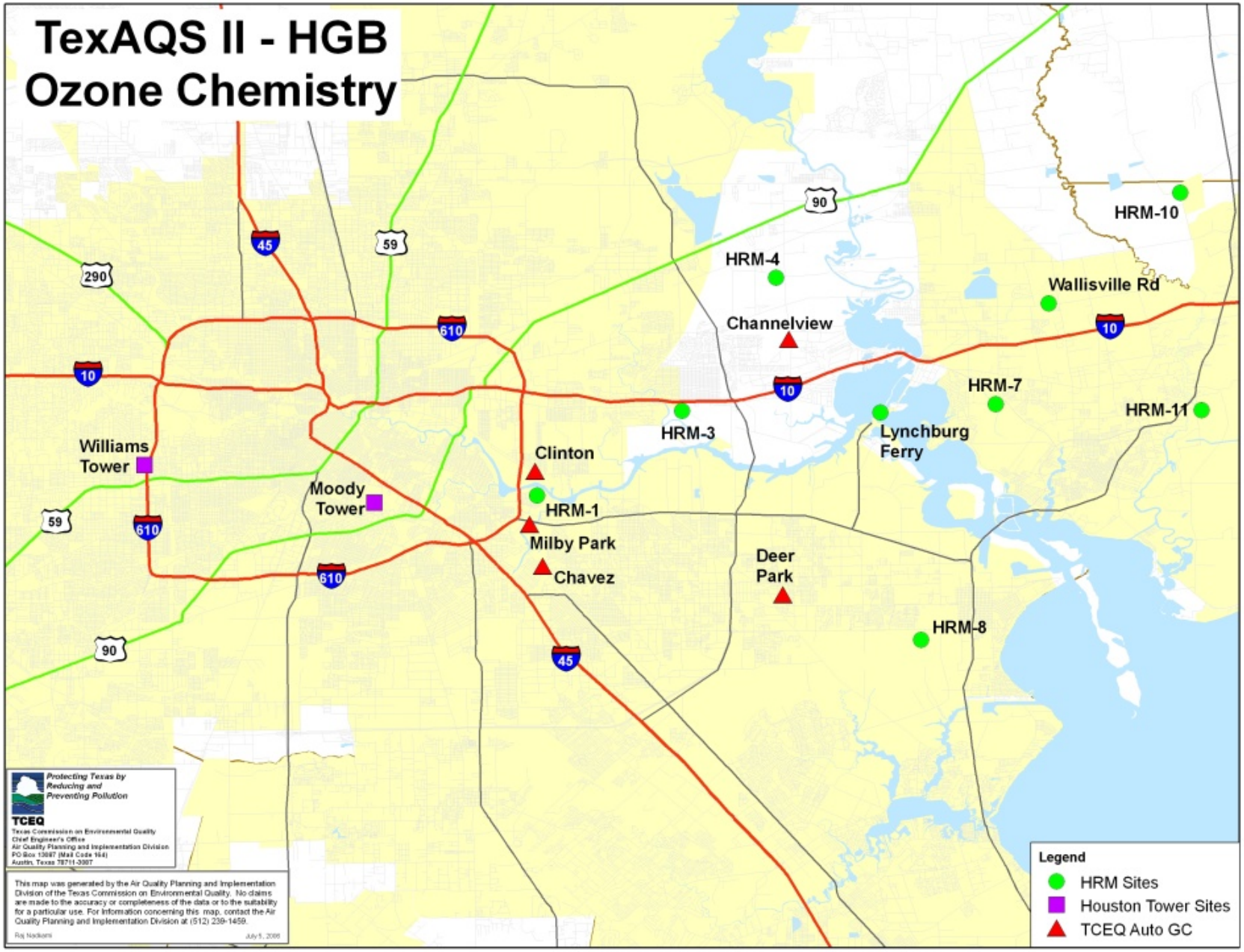
July 5, 2006
Legend
TexAQSII July 2006
OZONE CHEMISTRY
New
Existing Auto-GC


TexAQS II - HGB
Ozone Chemistry
HRM-10
HRM-4
Wallisville Rd
Channelview
HRM-7
HRM-11
HRM-3
Lynchburg
Ferry
Williams
Tower
Clinton
Moody
Tower
HRM-1
Milby Park
Chavez
Deer
Park
HRM-8
290
45
59
610
10
90
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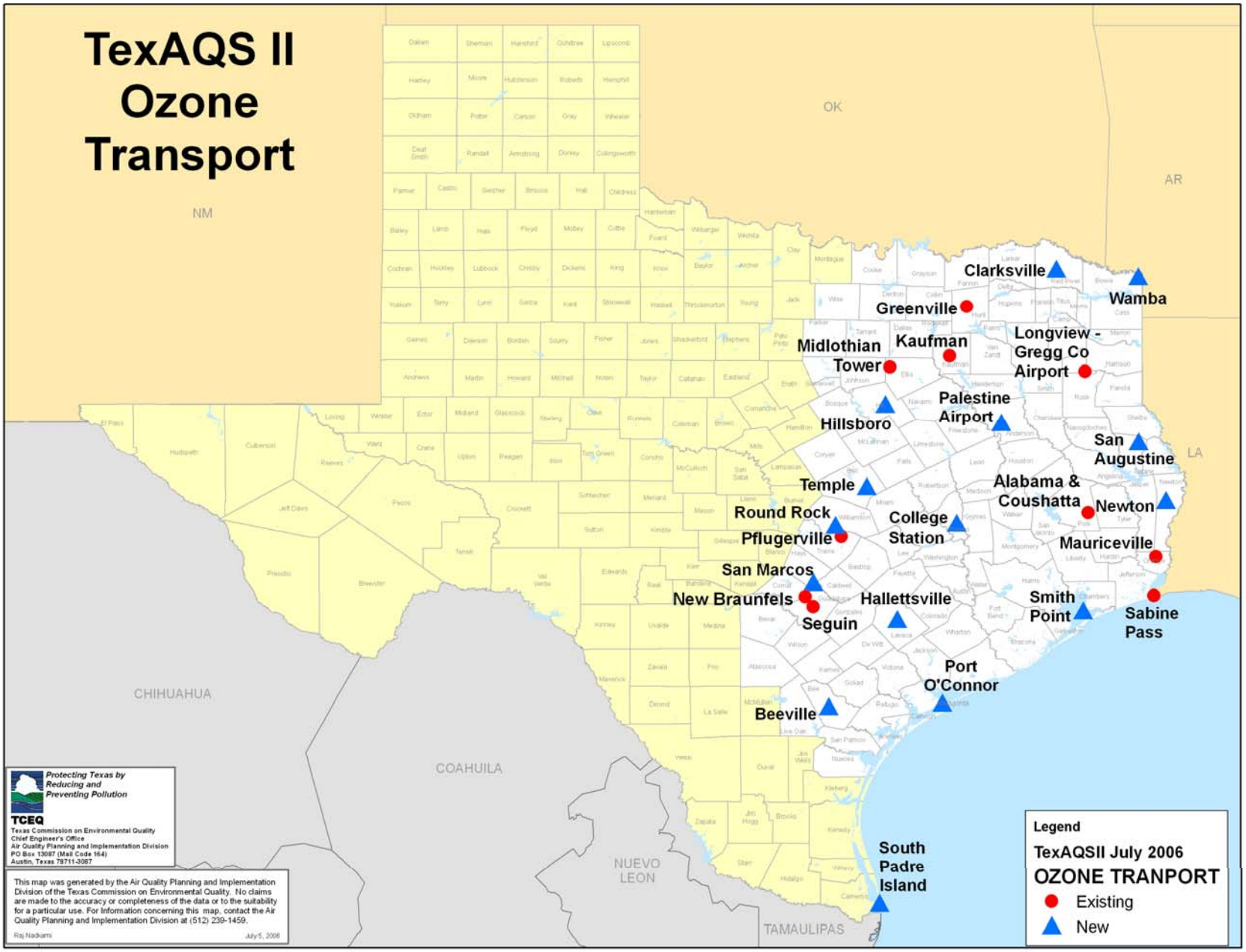
Raj Nadkarni
July 5, 2006
Legend
HRM Sites
Houston Tower Sites
TCEQ Auto GC


TexAQS II
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NUEVO LEON
TAMAULIPAS
Clarksville
Wamba
Greenville
Longview - Gregg Co Airport
Midlothian Tower
Kaufman
Palestine Airport
Hillsboro
San Augustine
Temple
Alabama & Coushatta
Newton
Round Rock
College Station
Pflugerville
Mauriceville
San Marcos
New Braunfels
Hallettsville
Smith Point
Sabine Pass
Seguin
Port O'Connor
Beeville
South Padre Island
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Raj Nadkarni
July 5, 2006
Legend
TexAQSII July 2006
OZONE TRANPORT
Existing
New

Planned Intensive Deployments as of July 12

- NOAA Ronald H Brown Aug. 1 - Sept 12
  - 2 Deployments into the Ship Channel
- NOAA Twin Otter LiDAR Aircraft Aug. 2 – Sept. 15
- NOAA WP-3D Orion Aircraft Aug. 29 – Sept. 30
- CIRPAS Twin Otter Aug. 18 – Sept. 15
- NASA King Air Aug. 15 – Sept. 15
- Baylor Aztec Aircraft Aug. 1 – Aug. 31

Planned Intensive Deployments as of July 12 (contd.)

- Ozone Sondes (balloons)

  beginning July 23 for 3 weeks
- Tethersonde/Radio Sondes July 15 – Sept. 30
- Solar Occultation Flux Aug. 15 – Sept. 30
- Williams Tower Aug. 21 – Sept. 21
- Moody Tower Aug. 14 – Sept. 29

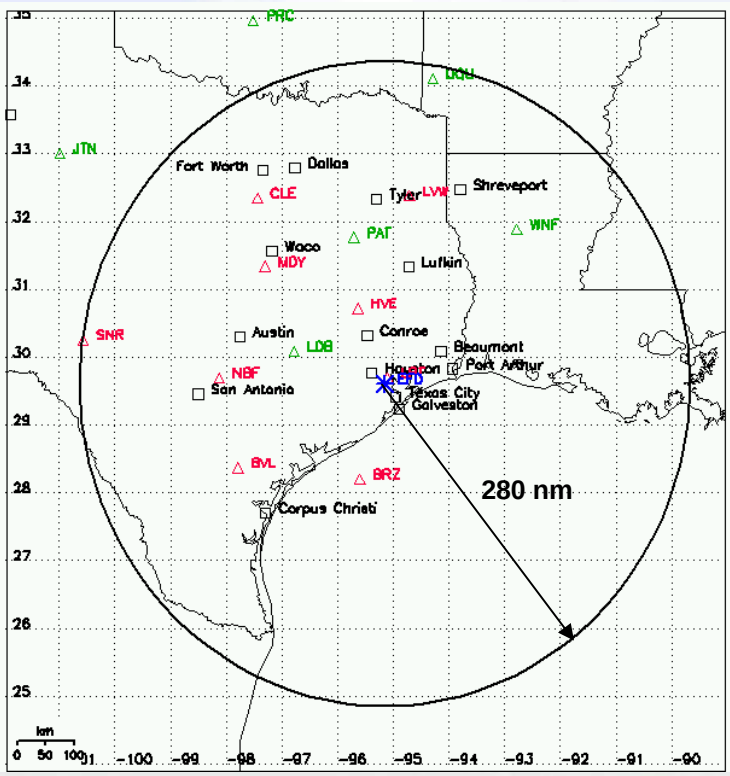
NOAA AOC Twin Otter N46RF

Aircraft specs (without auxiliary fuel tank):

- **Airspeed: 130 kts**
- **Endurance: 4.5 h**
- **Range: 560 nm**
- **Ceiling: 12,500 feet; 25,000 feet (w/O2)**
- **Useful load (personnel, cargo): 1900 lbs**
- **Overwater capability**

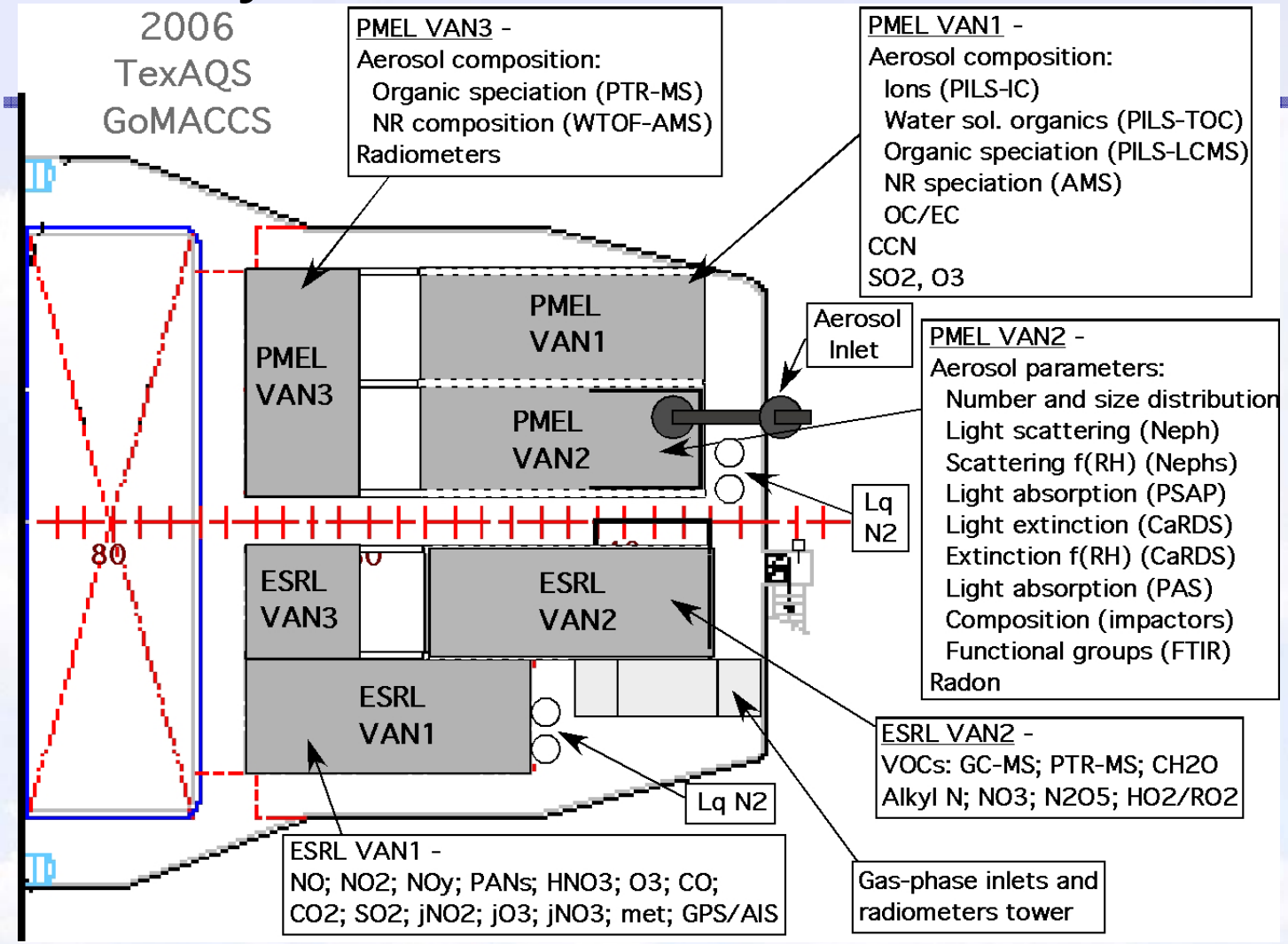
TexAQS 2006 deployment

- **130 flight hours**
- **1 Aug – 15 Sep**
- **Max crew duty: 16 h / day**
- **Max flight time: 12 h / day**
- **Rest period between flight days: 12 h**

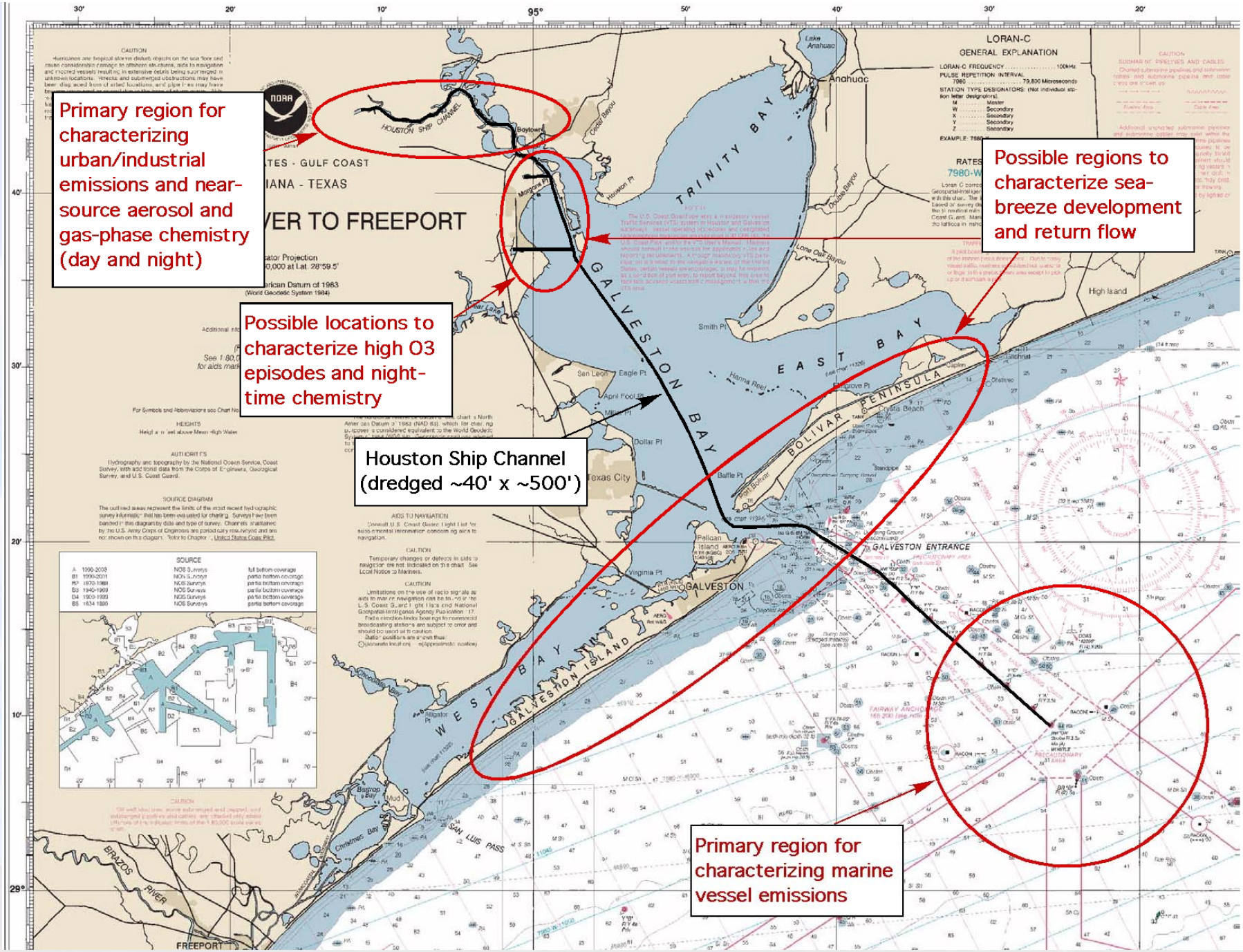


Deployment of Ronald H. Brown

Summary of Measurements on R/V Brown



Fantail: **OPAL (O3/aerosol LiDAR), HRDL (Doppler LiDAR)**
Bow: **Turbulent Fluxes - heat; water; momentum: O3**
Lab: **seawater DMS, pCO2**
03 deck: **AOD, Wind profiler, Sondes, Ceilometer, Mini-sodar, C-Band radar**


Primary region for characterizing urban/industrial emissions and near-source aerosol and gas-phase chemistry (day and night)
Possible locations to characterize high O3 episodes and night-time chemistry
Houston Ship Channel (dredged ~40' x ~500')
Possible regions to characterize sea-breeze development and return flow
Primary region for characterizing marine vessel emissions
LORAN-C
GENERAL EXPLANATION
TRINITY BAY
EAST BAY
GALVESTON BAY
WEST BAY
GALVESTON ISLAND
BOLIVAR PENINSULA
GALVESTON ENTRANCE
GALVESTON
Texas City
Anahuac
High Island
FREEPORT
BRAZOS RIVER
SAN LUIS PASS
HOUSTON SHIP CHANNEL
VER TO FREEPORT

NOAA WP-3D Aircraft: Instrumentation and Capabilities

Approximate Specifications
Length: 30 m
Wing Span: 35.6m
Ceiling: 6-8 km
Air speed: 100 m/s
Payload: 2400 kg + 5 scientists
Range / Duration: 3000 km / 8 hr

Goal : 1 second average measurements with high precision and accuracy

In-situ gases: O_3, CO, CO_2, SO_2, H_2SO_4, NH_3, H_2O vapor, OH, RO_2 NO, NO_2, PANs, $RONO_2$, NO_3, N_2O_5, HNO_3, NO_y, H_2CO, VOCs (canister and PTR/MS).

Planned: Continuous ethylene by photo-acoustic spectroscopy

In-situ aerosols:

Chemical: PILS-IC, PILS-OC, Aerosol mass spectrometer (AMS), soot fraction

Physical: Number size distributions - Low turbulence inlet, CN, CCN, cloud particle size, cloud particle light scattering

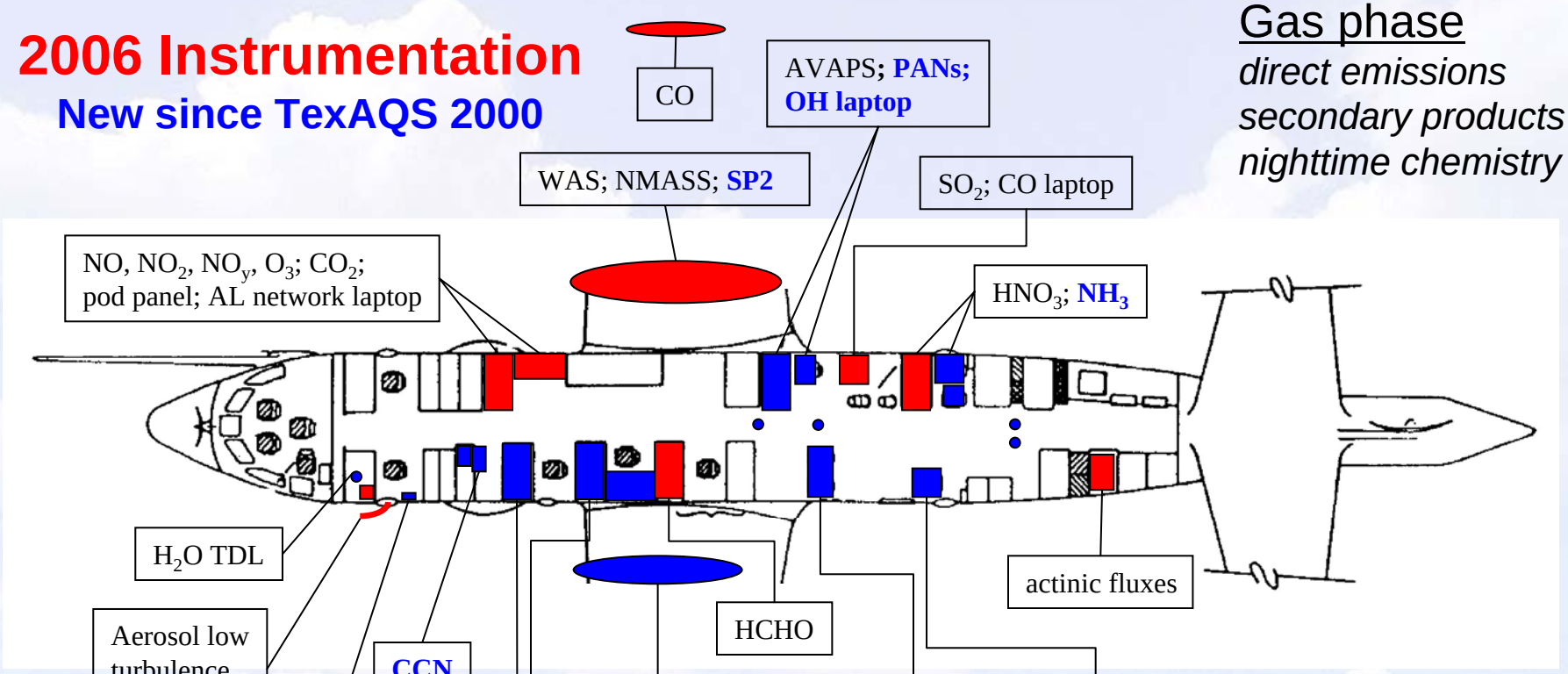
Planned: Aerosol light absorption and extinction (CARDS and PSAP)

Other: Photolysis rates, meteorological parameters

NOAA WP-3D aircraft – status report

2006 Instrumentation

New since TexAQS 2000



Gas phase

direct emissions
secondary products
nighttime chemistry

Aerosol phase

direct emissions
chemical composition
optical properties

Planned schedule for GPS sonde launch from UH main campus

- Twice daily soundings from July through September (184 sondes)

- Four additional soundings on forecasted ozone episode days (assuming 15 episodes, 60 additional sondes)

Tethered-balloon ozone profiles

On selected ozone episode days, tethered balloon will be used as a tower to 500 ft with ozone monitors (from Robert Taylor, UNH) at two levels. This effort will be coordinated with: UNH Smart Balloon and Ozonesonde Launches (Gary Morris, Valparaiso)

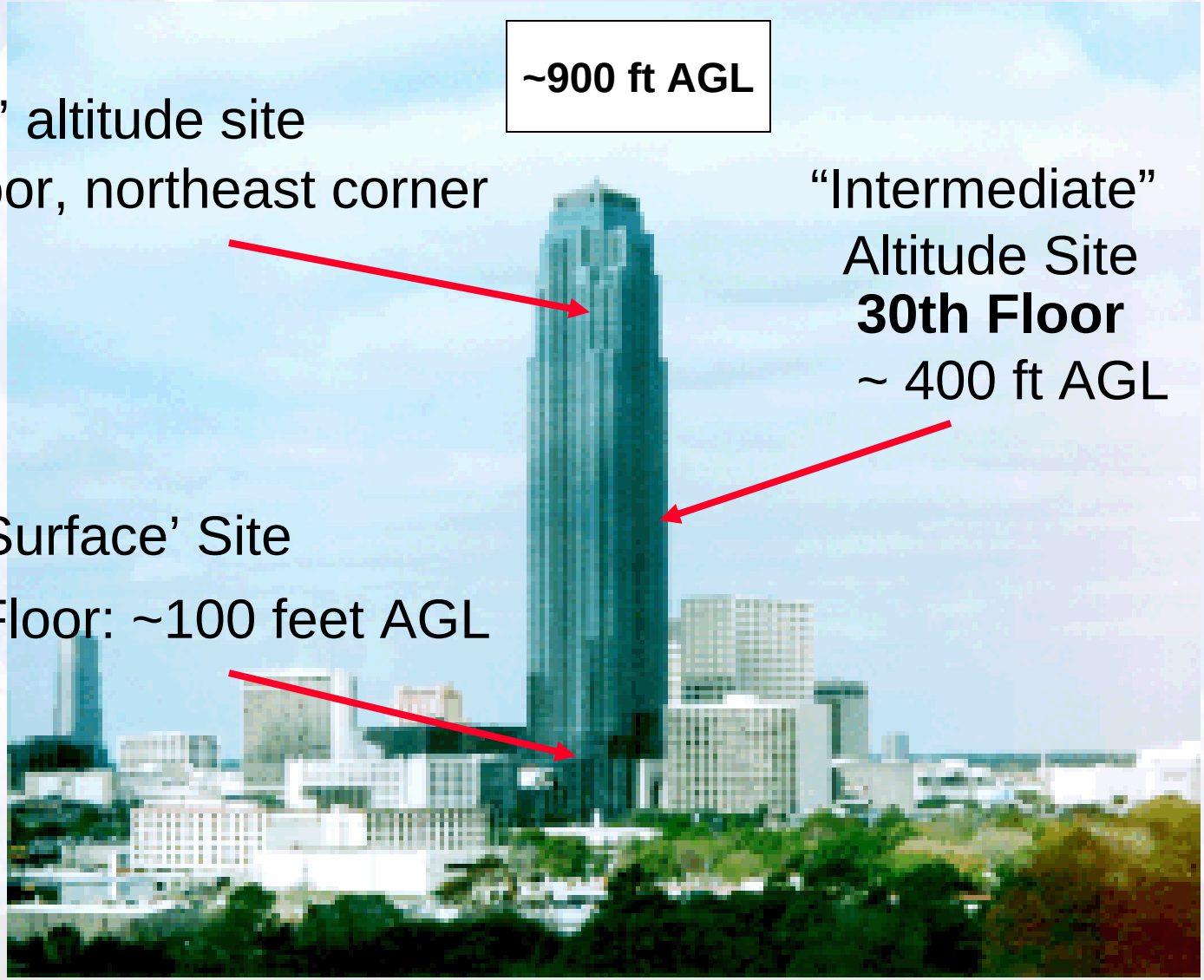
UH Moody Tower

- 18 story tall building (200 ft tall)
- 30 ft Met Tower
- representative site with no direct surface emission impacts

Moody Tower Measurements

- O_3,CO, NO, NO_2, PAN, PPN, MPAN, online VOC, offline VOC (UH)
- photolysis of O_3, NO_2, HONO, HCHO and 20 other important photolysis reactions (UH)
- Meteorological parameters (UH)
- AOD at UV/VIS/IR wavelengths, Overhead O_3 Column (UH)
- Cloud Camera (UH)
- H_2O_2 and Methylhydroperoxide (UH)
- Aerosol size distribution, Aerosol Mass Spectrometer, EC/OC (R. Griffin, UNH)
- HNO_3, HONO, HCOOH, CH_3COOH (J. Dibb, UNH)
- DOAS, vertical gradient measurements O_3, NO_2, NO_3, N_2O_5, HONO, HCHO (J. Stutz, UCLA)
- OH, HO_2, RO_2 (W. Brune, PSU)
- PTr-MS oxy-VOC incl. C_2-C_6 carbonyls, MVK, MACR, methanol, ethanol (R. Zhang, TAMU)
- HNO_3, NO_3, N_2O_5 ID-CIMS (R. Zhang, TAMU)
- HCHO, NO_Y, SO_2, elemental, particle bond and reactive gaseous Hg (W. Luke, NOAA)
- Aerosol size distribution, Cloud Condensation Nuclei (P. Chuang, UC-Santa Cruz)
- Aerosol Scattering and Extinction (D. Atkinson, Portland State)
- Other measurements

Williams Tower



'High' altitude site

- 62nd floor, northeast corner

"Intermediate" Altitude Site
30th Floor
~ 400 ft AGL

- 'Surface' Site
- 6th Floor: ~100 feet AGL

Daily Briefing

- Current Status
  - Daily Briefing 11:00 AM (7 Days a week)

  Wayne Angevine – Forecast Coordinator
  - Met Forecast – John Nielsen-Gammon & Grad. Student
  - Chemistry Synthesis Forecast – Stu McKeen

    Daewon Byun et al.
  - Satellite Synthesis Forecast – Graham Feingold
  - Ozone Forecast – Bryan Lambeth
- Flight Missions / Planning
  - Flight Plans will be posted to the web a day prior to the mission and will be updated post mission by the next day.

Questions???

- TCEQ Web Site
  - http://www.tceq.state.tx.us/implementation/air/airmod/texaqs-files/TexAQS_II.html
- NOAA Web Site
  - http://www.etl.noaa.gov/programs/2006/texaqs/
- University of Texas Web Site
  - http://www.utexas.edu/research/ceer/texaqsII/
- University of Houston Web Site
  - http://www.imaqs.uh.edu/

Media Day is scheduled for Tuesday August 21, 2006 in Galveston

TexAQS II 12 Days and Counting

Special Thanks to the following individuals:

Darrell, Powell, Blake Kidd, Clint Harper, Doug Boyer, Mark Estes, Jim Price, Jim Smith, Erik Gribbin, Dick Karp, Danielle Nesvacil, Russ Nettles, Ken Rozacky, Bryan Lambeth, John Jolly, Pete Breitenbach, Weining Zhao, Leslie Schmidt, Scott Kentros, Sharon Gwinn, Shannon Herriott, Rhonda Scott, John Ribbeck, Greg Dickenson, Sherry Jaecks, Rebecca Rentz, Zhaohua Fang, Brian Foster, Zarena Post, Kevin Cauble, Steven Davis, Susana Hildebrand, Minor Hibbs, David Schanbacher from TCEQ

Thanks also to Jim Meagher, Fred Fehsenfeld, David Parrish, Allen White, Michael Trainer, Mike Hardesty, Tim Bates, NOAA; Karen Olson, Zephyr; Jim Thomas, TexAQS Coordinator; Dr. Dave Allen, Vince Torres, University of Texas; Ellis Cowling, University of North Carolina; Dr. John Nielsen-Gammon, Texas A&M; Dr. Daewon Byun, Barry Lefer, Bernhard Rappengluck, University of Houston; Carl Berkowitz, Pacific Northwest Nation Laboratory; Robert Cameron, Mineral Management Services; Ronald Barnard, City of Corpus Christi; Jerry James City of Victoria; Bill Gill, Capital Area Council of Governments; Peter Bella, Alamo Area Council of Governments; Jay Olaguer, Alex Cuclis, Houston Advanced Research Center; Walt Crow, URS Corp.; Steve Smith, Houston Regional Monitoring

And the many others…

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(512) 239-1934