The Hazardous Gas Detection Lab

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Activities

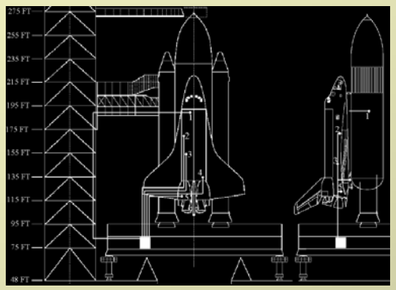
- Quantitation of Hazardous Gases in the Field
- Instrument Development
- Method Development
- Evaluate Commercial Components

Hazardous Gases of Interest

- Explosives & Fuels
  - –Hydrogen & Oxygen
  - –Hydrazines
  - –TNT, RDX, HMX
- Toxins
  - –Hydrazines
  - –Volatile Organic Compounds (VOCs)

Gas Monitoring at KSC

- Shuttle Processing
- International Space Station (ISS) Processing
- ELV Processing
- Environmental Monitoring
- Worker Health

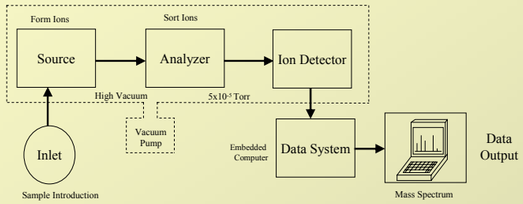


Applications for Gas Analysis Systems

- Air Quality
  - –Environmental
  - –Workplace
- Leak Detection
  - –CRT Industry
  - –Refrigeration Industry
  - –Automotive Industry
  - –Food Industry
- Process Monitoring
  - –Semiconductor
  - –Petrochemical
  - –Cross-Country Pipeline
- Medical Analysis
  - –Blood Analysis
  - –Liver Analysis
- Battlefield Threat
  - –Chemical Weapons
  - –Biological Weapons
  - –Land Mine
- Contraband Detection
  - –Explosives
  - –Drugs
- Geological Prediction
  - –Volcanic Eruption
  - –UV Hazards

What is Mass Spectrometry?

Chemical analysis by transferring a charge to the molecule, separating and detecting

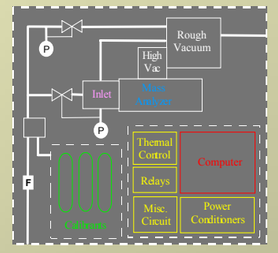


Why Mass Spectrometry?

↑Extremely Specific	↓Power Efficiency
↑Sample Variety	↓Weight
↑Qualitative	↓Size
↑Quantitative	↓Cost
↑Rapid Response	↓Ruggedness
↑Large Dynamic Range	↓Operator Training

Mass Spectrometer System

- Mass Analyzer
- Pumping System
- Power System
- Control System
- Sample Delivery
- Calibration System
- Structural Framework



Parameters of Importance to KSC

- Quantitative Accuracy
- Traceability
- Ruggedness
- Reproducibility
- Ease of Operation
- System Size
- System Weight
- Power Efficiency
- Low Detection Limits
- Low MW Compounds – H_2; He

Current Strengths at KSC (for small & large systems)

- Quantitative Accuracy
- Quantitative Traceability
- Ruggedness
- Reproducibility
- Certified to Save Lives & Equipment
- Ease of Operation
- Autonomous Operation

I-HUMS

- Fixed Sector – 5 Channel
- < 30 s Response Time
- Accuracy – 10%
- LOD < 25 ppm (100 ppm He)
- In-House LabVIEW Control

HUMS

- Fixed Sector – 5 Channel
- < 30 s Response Time
- Accuracy – 10%
- LOD < 25 ppm (100 ppm He)
- In-House C++ Software
- Local & Remote Control

HGDS 2000

- Linear Quadrupole
- < 30 s Response Time
- Accuracy – 10%
- LOD < 25 ppm
- Redundant Systems
- Local & Remote Control
- 1800 lbs (820 kg)

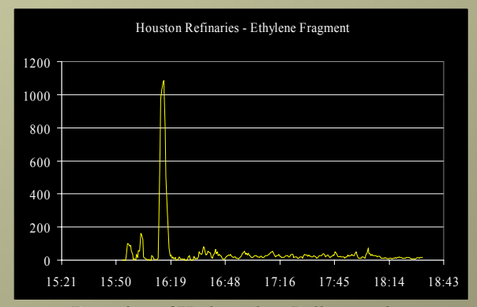
PAMS

- Fixed Sector – Single Channel (2,3 or 4)
- < 30 s Response Time
- Accuracy – 10%
- LOD < 0.1 ppm
- In-house LabVIEW software control
- 346 lbs (157 kg)
- Disassemble to 3 parts

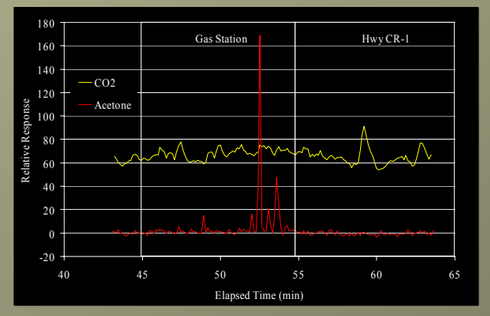
AVEMS

- Linear Quadrupole
- 350 W (steady state)
- 6 s Scan Time
- 30 s Response Time
- Rugged (25 to –60°C; 760 – 50 torr)
- 47 kg (105 lb)
- 90,000 cm^3
- Autonomous
- 20 ppm LOD
- Monitor 16 Gases

AVEMS – Urban Air Quality



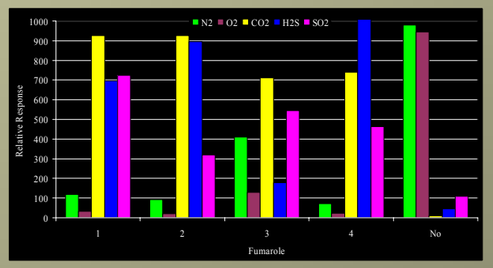
Detection of Hydrocarbon Pollutant when flown over refineries at ~5000 ft.



Monitoring of CO_2 and Acetone. AVEMS installed in SUV and driven around San Jose, Costa Rica.

AVEMS – On-site Volcano Evaluation

In-Situ sampling of several fumaroles in Turrialba Volcano



SAMS – The Next Generation

- Linear Quadrupole
- Weight reduced; < 70 lbs
- Size reduced (Backpack Size)
- Helium LOD < 1 ppm
- Reduced Power Demand by 30%
- Improved Autonomy

Opportunities at HGDL

- Undergraduate Internships
  - Chemical, Mechanical, & Electrical Engineering
  - Chemistry, Physics, Computer Science
- Graduate Fellowships
  - Chemical, Mechanical, & Electrical Engineering
  - Chemistry, Physics, Computer Science
- Post-doctoral Fellowships
  - Mechanical & Electrical Engineering; Chemistry
- Summer Faculty Programs
  - Mechanical Engineering
  - Analytical Instrumentation
- Collaborative & Cooperative Projects
  - Urban & Atmospheric Air Analysis
  - Volcanic Monitoring
  - High-risk (workplace, airport, battlefield) Air Monitoring