Integrating Environment, Chem-Bio Technologies, and A/E at a Package Handling Facility

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Challenge

- Integrate Technologies For Identification Of Chemical And Biological Agent Intrusion
- Protect Of Personnel, Mail Handling And Package Processing Facility, And Ultimately The Public From CB Intrusion
- Approx. 70,000 ft^2 Facility
- Daily Processing Of 8-12 Trailers Of Materials
- Extensive Distribution Network

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Versar's Scope

- Threat Assessment
- Requirements Analysis
- Engineering Assessment of Current Detection Technologies and Practices
- Engineering Design
- Design/Build
- O&M and Support

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Technology Integration Issues

- Environmental:
  - Indoor Air
  - Sampling/Chain of Custody
  - Baseline
    - Chemical Analysis
    - Microbiology
- Chem-Bio
  - Chem/Bio Testing
  - Detection Technologies
  - Decontamination Processes
  - Individual and Collective Protection
- A/E
  - Air Flow/HVAC/Mechanical Engineering
  - Structural and Architectural Design
  - Materials Selection
  - Process Engineering and Process Flow
  - Clean Room Engineering

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The 3 Pillars of Versar's Organization

- ***Environmental Services***
  - **Remediation**
  - **Scientific Services**
- ***National Security***
  - **Homeland Defense**
  - **Military Defense**
- ***Architecture, Engineering and Construction***
  - **Engineering & Design/Build**
  - **Weapons Demilitarization**

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Environmental Services Pillar

- Core Capability of Company
- Services provided include:
  - Remediation
  - Pollution prevention
  - Compliance management
  - Natural Resource Management

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National Security Pillar

- Combines Military Defense and Homeland Defense
- Chemical and Biological Protection
  - Chemical Surety Laboratory
  - BSL-2/3 Biological Warfare Laboratory

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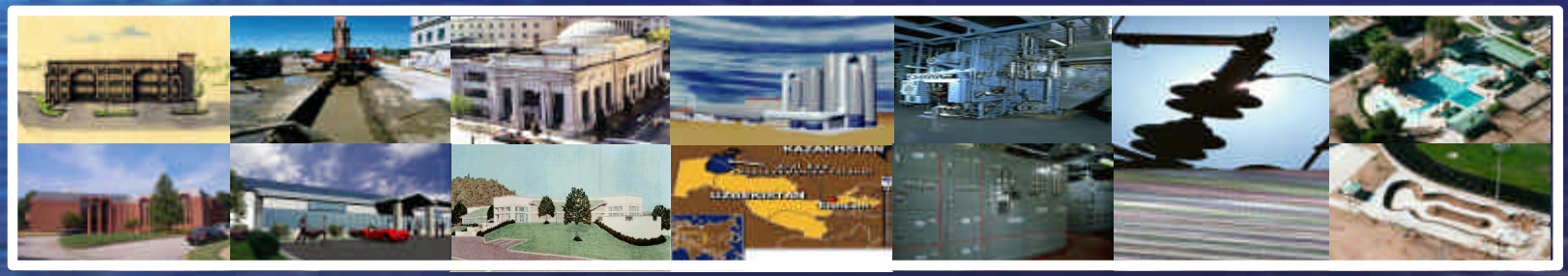
Architecture, Engineering & Construction Pillar

- Design Build and Construction Management
- Civil Engineering
- Infrastructure Management



Design/Build ¦ Construction ¦ Facility Design ¦ Demilitarization ¦ Energy ¦ Infrastructure ¦ Recreation

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Mitigation Technologies

- Will Address Four Threats:
  - Biological
  - Chemical
  - Radiological
  - Explosive

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Concept of Operations

- Contamination Avoidance (Intercept the Threat)
- Individual and Collective Protection (Reduce the Impact)
- Response Scenario (What Happens if…)
- Operational Issues (Day to Day Operations, Training, Maintenance, etc.)

Design Issues

- Biological Detection: Time Delay from 1 hour up to 48 hours (Depends on technology)
- Chemical Detection: Real Time
- Radiological Detection: Real Time
- X-Ray-Explosive Detection: Real Time

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Prior Lessons Learned

- Biological Protection Drives “Retention Time” and therefore design footprint
- No “perfect” system
- Lessons from classic military NBC programs – may not apply in civilian arena due to lack of intel on specific threats

Biological Threats in "Packaged Materials And Mail"

- Primarily *bacillus anthracis* (anthrax)
  - Still "most likely" threat scenario
- Other pathogens of interest
  - Bacteria
    - Anthrax
    - Plague
    - Brucellosis
  - Viruses
    - Smallpox
    - Others
  - Toxins
    - Botox
    - Ricin
- Issue: Can Exterior Sampling/Detection Warn/Intercept unopened packages/mail?
  - Residue
  - "Exfiltration" from letters, etc.

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Real (or Near Real) Time Detection

- **Requirement:**
  - ***Detect and respond to potential biological pathogens in mixed stream of materials in real-time***
- **Solution:**
  - ***Layered Approaches***
    - Particle Size Distribution (gross particle load)
    - Particle Discrimination (bio vs. non-bio, live vs. dead)
    - Layered Detection Systems
      - PCR
      - Flow Cytometry
      - Antigen-antibody reactions
- **Procedure:**
  - Collection (aerosol, spincon, vacuum/HEPA filtration, etc.)
  - Preparation (extraction, preparation, buffering, etc.)
  - Sensing (PCR, fluorescence, culture, etc.)
  - Output (colorimetric, charts, graphs, dials, lights, codes, alarms, etc.)

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Real (or Near Real) Time Detection Operational Issues

- Sampling Process
  - Packages and mail (6 sided, tubs, sweeps, composites, etc.)
  - Envelopes (“poof” in sorting machines)
  - Surfaces (tabletops, bins, sorting machines, etc.)
  - HVAC sampling (HEPA filters)
  - HEPA Vacuum Sampling (aggressive suction)
- Sampling Protocol and Personnel
- Personnel Qualifications and Certification
- Sample Chain of Custody and Records
- Operation and Maintenance of Systems

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Examples – Integrated, Multiple Technology Systems

- Biological Detection System – (Smiths) Northrup/Grumman Team -- 19 USPS Facilities
- Lockheed-Martin Bio
- Biological Aerosol Sentry and Information System (BASIS) – Deployed in Metro, DC area

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Chemical Threats

- Chemical Threats in Packages/Mail Agents
  - Immediate Danger (nerve agents)
  - Short incubation (hours for blister agents)
  - Many Ingestion Pathways (dermal, inhalation, ingestion)
- Threat Scenarios Vary
  - Localized (1-10 ft)
    - Powders
    - Liquids
  - Area Threats (wider areas of concern)
    - Vapor
    - Gas
    - Aerosol

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Chemical Detection

- Problem: Detect and respond to potential chem agents in mixed stream of materials in real-time (“sniffing” exterior vs. interior detection)
- Solutions:
  - X-ray (for “suspicious” configurations)
  - Point detection
  - Area detection
- Based on:
  - Multiple technologies
  - Handheld vs. integrated

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Real Time Detection

- Integrated Systems Now on Market
  - Ex: Smiths Detection Saber Centurion
    - Ties into HVAC
    - Could be modified to sample packages
  - Handheld Systems Available
    - M9 paper
    - M256 kit
    - CAM
    - others

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Commercial Detection and Identification Technologies

- Vapor Analysis
  - FID
  - IMS
  - PID
  - FID/PID
  - GC
  - GC/MS
- Solids/Liquids Analysis
  - IR
  - GC
  - GC/MS

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Operational Issues With Chemical Detection

- Understanding capability
- Training
- Equipment Calibration/Background “Noise”
- O&M requirements
- Response Scenarios
  - Safe area
  - Response planning

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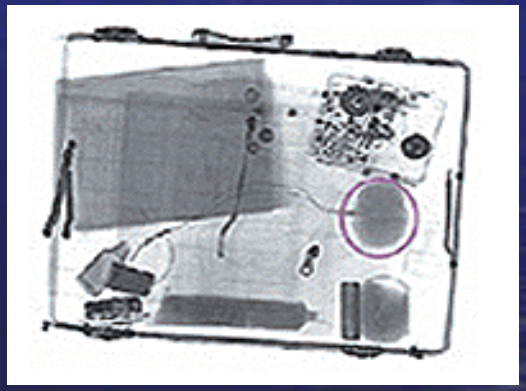
Explosive Detection

- Older “baggage style” x-ray system not effective against today’s threats
- Enhanced Systems
  - Threat Image Projection (TIP)
  - Screener Assist Technology (SAT)
  - Networking
  - Redundancy



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Trace Explosive Detection

- Real Time
- Example: IONSCAN® technology (similar to hand-held trace analyzers) – uses radiological source to ionize then analyze traces
- Detects RDX, PETN, TNT, Semtex, Nitrates, NG, HMX and others
- Side benefit – detects trace drugs

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Explosives Detection Operational Issues

- Training/Certification of Operators
- Response Scenarios
- Explosive-Proof Storage Area
- Throughput
- Redundancy
- Operations and Maintenance

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Radiological Detection

- Problem: Assessing Radiological Threat from Mail
- Radiological “Refresher”
  - Ionizing Radiation - harmful to humans
    - Alpha (largest emitted particles, stopped by paper, ingestion primary risk)
    - Beta (higher energy particles, like electrons, penetrates steel)
    - Gamma (electromagnetic radiation, penetrates concrete and lead, Immediate danger)
  - Health Effects
    - Acute (radiation poisoning)
    - Chronic (mutations, cancer)

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Detection Technologies

- Hand-held Survey Instruments
- Pass-through monitors
- Area Monitors
- Air Sampling Monitors

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Radiological Detection Operational Issues

- Training
- Health Physics Support (also applies to x-ray machine dosimetry)
- Calibration/O&M of Equipment
- May be Immediate Threat to Health and Safety
- Response strategy
  - Isolate/Evacuate Area
  - Contain
  - Remedy

Summary

- Solution Requires Integration Of Chem-Bio, HAZMAT, Environmental and A&E Talents
- Technology Is Available, But...
- There Is No “Silver Bullet”
- Cost Benefit Analysis Vs. Risk Criteria

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