TACTIC Program

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The TACTIC Program focuses on detection and knockdown/neutralization of chemical and biological threat agent clouds produced during military operations either through defensive measures against an adversary or by intentional agent dissemination/release by an adversary.

The TACTIC Program seeks to actively protect the warfighter from such events and to provide a means to maintain critical military operations at the required tempo.

- Develop critical technologies:
  - **TACTIC BEACONS**: standoff technologies that can rapidly detect, discriminate, and identify chemical and biological airborne clouds
  - **TACTIC BULLETS**: Methods to knockdown/neutralize threat agent clouds before they can reach military assets

- Construct and test prototype system

“time is of the essence”
Threat Agent Cloud Tactical Intercept & Countermeasure Program

TACTIC Program: Paradigm Shift

Survive and Respond

- Protective posture
- Decontamination
- Mission tempo lost

Detect and Destroy

- Detection
- Discrimination
- Identification
- Interception
- Defeat
- Continue operations

Development of discrimination/identification technologies (BEACONS) lowers the false-alarm rate, allows specific countermeasure responses (BULLETS), and reduces the number of times the countermeasure technology is deployed.
The Threat

1. DETECTION
   - TICs
     - Chlorine
     - MIC
     - Acrolein
   - Chemical Agents
     - Blood
     - Blisters
     - Choking Agents
     - Nerve Agents
   - Toxins
     - Neurotoxins
     - Cytotoxins
     - Enterotoxins
     - Mycotoxins
   - Virus
     - DNA
     - RNA
   - Bacteria
     - Spores
     - Vegetative Cells

2. COUNTERMEASURE

Vapor and Droplet Clouds

Particle Clouds
Existing Cloud Detection Triggers

**RADAR**
- High-resolution phased-array radars can detect and identify condensed clouds
- Use for early warning, long-range capability as part of a more comprehensive system

**JLSCAD**
- Passive infrared detection system
- Discriminates between the chemical targets and the other non-toxic species in a complex battlefield environment
- Chemical agent cloud detection up to 5 kilometers away

**XM94/Blackhawk**
- Aerosol detection
- Range of 30km

**LR-BSDS**
- Backscatter LIDAR technology will detect and track aerosol clouds at ranges up to 30km
- UV-LIDAR will provide some biological/non-biological discrimination
- Systems will provide information about the cloud configuration and location
Taggant/sensor delivery

Detect a specific visible or fluorescent emission

Sensor communicates presence of chemical or biological agent OR taggant illuminates in the presence of a chemical or biological agent

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**Chemical**
- VX
- GB
- GD

**Biological**
- B. anthracis
- Y. pestis
- Smallpox

Detection within 1 minute
TACTIC BULLETS
Cloud Countermeasure Technologies

Threat cloud

Countermeasure delivery
Chemistries to simultaneously neutralize & precipitate

Charged Particles

Attraction of positive to negative particles can cause coagulation of threat particles to cause them to “rain” out

Polymerizing agents can be used to cause increased size of threat particles to cause them to “rain” out

Military assets protected / no interruption of operational tempo

Catalyst

Military assets
**TACTIC Bullets**

**Countermeasure Goals**

Volume_{cloud} \sim 10^5 m^3

Chemical 10g/m^3

Biological 10^8 particles/m^3

10km

1. **Neutralize**

2. **Knockdown**

Phase I goal:

4-log kill

Countermeasure acts within 5 minutes
TACTIC Technical Challenges

• **TACTIC BEACONS:**
  - Rapidly detect, discriminate, and identify the chemical or biological agent in air
  - Timeframe ~ 1 minute

• **TACTIC BULLETS:**
  - Countermeasure the cloud by a factor of $10^4$
  - Timeframe ~ 5 minutes

If TACTIC is successful, it shifts the battlefield paradigm:

Survive and Respond $\Rightarrow$ Detect and Destroy
Passive Defensive $\Rightarrow$ Force Projection
TACTIC Government Aerosol Test Facility

Toxic Explosive Chamber - JPM for NBC Contamination Avoidance

Chamber Structure - 16,000 cubic ft
32 feet diameter x 20 feet height

Toxic Filtration System

Hazardous Materials Tank Farm Enclosure

GOVERNMENT AEROSOL TESTING CHAMBERS for TACTIC Program Technologies

Building E3570 Edgewood
## TACTIC Program Schedule

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TACTIC Components

High-performance detection
- Taggant based
- Broad spectrum of agents
- Standoff
- Low $P_{fa}$; High $P_d$

High-efficiency countermeasure
- Low regret
- Biological (particle clouds) agent Countermeasure
  - “Sticky”, reactive particles coagulate when they collide with bioparticle causing “rainout” and decontamination
  - Chemically driven sonic agglomeration causes particles to collide and stick
  - Combination provides greatly enhanced collision rate of sticky particles; enhances “kill” and requires less chemical fuel
- Chemical (vapor/droplet clouds) agent Countermeasure
  - Particles break down the chemical agents by oxidation and hydrolysis at surfaces; particles act as catalysis for the oxidative reactions
  - Pyrophoric materials injected into the cloud and ignited to oxidize (burn) the agent
  - With catalytic particles, lower temperatures (smaller amounts) of pyrophoric agent is required
Threat Agent Cloud Tactical Intercept & Countermeasure Program

初始威胁云定义

威胁场景

大气传播的威胁云

触发检测

部署TACTIC BEACONS

部署TACTIC BULLETS

措施的有效性:
- 威胁场景
  - 剂型
  - 质量释放
  - 大气传播
- 保护资产
  - 部队或基地
  - 部署密度
  - 从释放的距离

散射装置
- 压力驱动释放
- 其他？

碰撞TACTIC BEACONS和威胁粒子或分子:
- 压力驱动混合
- 布朗运动扩散
- 涡旋（尺度？）
- 增强机制

反应TACTIC BEACONS和威胁:
- 粘附概率
- 产生“BEACON”属性的生产率常数

远程检测“BEACON”属性

交付系统

分析与建模

S = 系统组件
T = 技术组件

Transparency is ensuring the entire content is translated with no omissions or errors. This may involve interpreting diagrams, tables, and flowcharts. The goal is to present a natural representation of the document's contents. The translation is intended to be as accurate as possible, reflecting the context and intent of the original text.