Wide Area Surveillance in Support of Law Enforcement

Ross T. McNutt
Persistent Surveillance Systems
Jan 2014
We request your help

• PSS is concerned about privacy and the impact of these systems and has draft policies for use of its and similar systems.
• PSS has been working with various police and local communities to develop appropriate policies for use in support of local law enforcement.
• Current PSS systems are currently legal and covered by existing airborne surveillance law and supreme court decisions
• These and similar technologies are coming whether PSS does it or not.
• We (PSS) request your assistance to develop appropriate policies and practices that could be adopted as the standard for us and for others.
  – Resolution Restrictions - Oversight Procedures
  – Investigation Policies - Data Protection Policies
  – Data Retention Policies - Defense Attorney Access
  – Data Access Policies - Analyst Training and Agreements
• We are asking for and would very much like your help
Persistent Surveillance Systems

- Wide Area Airborne Surveillance Introduction
- Sample Coverage Areas
- Example Murder Investigation
- Analysis and Law Enforcement Use
- PSS and Customer Privacy Policies
- Sample City Unmet Needs
- Request to work to develop appropriate privacy policies
Wide Area Surveillance
88 megapixels 1Hz downlinked
Cincinnati  12 Sept 07

Football players practicing
## Samples of Pixels

### Typical Security Camera

<table>
<thead>
<tr>
<th>Type</th>
<th>Resolution</th>
<th>Megapixels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard TV</td>
<td>640 x 480</td>
<td>0.31 MP</td>
</tr>
<tr>
<td>HD TV 720P</td>
<td>1280 x 720</td>
<td>0.92 MP</td>
</tr>
<tr>
<td>HD 1080</td>
<td>1920 x 1080</td>
<td>2.07 MP</td>
</tr>
<tr>
<td>Digital Cinema 2K</td>
<td>2048 x 1080</td>
<td>2.21 MP</td>
</tr>
<tr>
<td>Imax Digital Cinema 4k</td>
<td>4096 x 2160</td>
<td>8.84 MP</td>
</tr>
</tbody>
</table>

### Wide Area Surveillance Systems

<table>
<thead>
<tr>
<th>Type</th>
<th>Megapixels</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSS Hawkeye</td>
<td>99 MP</td>
</tr>
<tr>
<td>PSS Hawkeye II Color</td>
<td>192 MP</td>
</tr>
</tbody>
</table>
Wide Area Surveillance
64 Square Kilometers  192 Megapixel Color Image
½ Meter Resolution      Recorded for analysis
Example Investigation

Murder #2 on
26 Aug 09 at 13:42

Report Number 1126146
Case Number 43132N
PSS Incident Locator

Ingests available police reports and dispatch information

Shows times and locations of flights

Shows summary of reported crimes within the coverage area

Searchable by location, time, crime, flight, and coverage area

Significantly speeds process to identify crimes in coverage area
Persistent Surveillance Systems

Area Coverage (With 3 month murder overlay)

Coverage Area 4 x 4 miles - 600,000 people within covered area
Murders Observed and Investigated in a 2 month Period

- 26 Aug 13:10 - Execution of Police Woman
- **26 Aug 13:45 - Cartel on Cartel Murder**
- 31 Aug 15:15 - Armed Robbery
- 1 Sept 15:20 - Body Dumping by Liberty Bridge
- 9 Sept 14:09 - Attempted Execution
- 9 Sept 14:55 - Execution of City Official
- 20 Sept 13:05 - Murder
- 24 Sept 16:15 - Execution on Street
- 25 Sept 14:22 - Execution on Street
- 29 Sept 14:47 - Murder
- 1 Oct 13:47 - Execution on Street
- 2 Oct 17:15 – Murder
- 10 Oct 14:07 - Murder
- 15 Oct 14:22 - Murder
- 16 Oct 14:48 - Murder
- 21 Oct 11:56 - Double Murder
- 22 Oct 15:22 - Murder in Mall Parking Lot

Many more events in data collected but we have not analyzed
We witnessed many more crimes than could be analyzed with available staff

PSS – Confidential Information
Not for Public Release
Wide Area Surveillance
Murder Examples

Megapixels/sec -- up to 16 square miles coverage

Murder 1 13:10
Murder 2 13:47
Images of the Murder
Images of the Murder
Images of the Murder
3 Cars Directly Involved in Murder

Murder Car 1
Murder Get into this car after murder

Murder Car 2

Murder Car 3

Murder Location and Murderer
Suspect Car 1 Path
Prior to Murder

Car 1 2nd Meeting
Starting Place on Person meeting with Car #1

First Meeting Car to Car

Car 1 3rd Meeting Car to Car 3 min

Car 1 Parking Spot 1 18.46
Suspect 1 look out location 8 minutes 1 20.35
Car 1 parking spot 13 31.14
Car 1 Waiting Location 13 43.26
Car 1 4th car to car meeting 20 seconds
Suspect Murder Car #1

Timeline

13:01:14  Murder Car #1 Start
13:02:51  Car to Car Meeting With Car 3
13:04:20  Car to Multi People Meeting
13:07:32  Car to Car Meeting with Car 3
13:12:40  Car to Car Meeting by Where murder will happen
13:18:48  Person exits Car to observe area where the murder will take place
13:42:11  Car to Car meeting just down the block where the murder will happen
13:44:25  Murder Occurs
13:45:46  Suspect enters Car on passenger side and Suspect Car drives away
13:47:58  1st Person exits Car enters house
13:48:33  Car to Person Meeting
13:53:41  2nd Person exits Car and enters house
13:56:05  Suspect Car Parks - Driver exits Car
14:35:20  Suspect Car stops (37 25.818’N   122 05.36’W) 35 minutes long
14:39:46  Suspect Car parks and Driver exits

......
Post Murder Locations

Suspect Car #2
Returns here after Murder

Suspect Car #1
Returns here after Murder
– Drops off person

Suspects from Car 2
Enter this House after Murder

Suspects from Car 1
Enter this House after Murder
Street View

SUSPECT #1 STARTING AND ENDING LOCATION "B"
Murderer, Accomplices, and Associates

Tracked Activities 45 minutes prior and 3 hours after murder
Suspect Car 1 in Camera 4.12 at 13:15:27
13:47:51: Murder Car 1 returns to location of pre-event meeting, parks briefly. Person exits passenger side (it is possible that this is the murderer) and enters this Blue building (also pictured earlier).

13:48:31: Driver from Murder Car 2 Meets Murder car 1 then enters this building.

13:47:53: Murder Car 2 returns here after murder and parks. Driver appears to exit vehicle.

Corner D.M. Ruiz & Heroes del Carrizal

Corner of Pascual Jaramillo & Heroes del Carrizal
24 Sept Murder
Same Group
Analysts at Work
• **Real-Time Operational Support**
  - Event response and information forwarding
  - Multiple simultaneous location surveillance
  - Cued or tasked support - Dispatch or 911, locations of interest, BOLO

• **Level 1 Analysis - Overnight**
  - Who is directly involved with the crime
  - Where did they come from
  - Where did they go

• **Level 2 Analysis – 1-3 days**
  - Who did the criminals meet with
  - Where did they come from
  - Where did they go

• **Level 3 Network Analysis - 1 week**
  - Over the last week or two who did all of the above meet with
  - Where did they come from and where did they go
Wide Area Surveillance

Other Applications

- **Officer Support**
  - Support for local law enforcement in crime investigations
  - Philadelphia, Baltimore, Dayton, Compton, Nogales, Juarez, Mexicali, Torreon, Indianapolis, Columbus, Cleveland

- **Major Event Security**
  - Security and traffic management support of large events
  - Brickyard 400, Coca Cola 600, Sarah Palin VP announcement, 4th July Fort Leonard Wood, Ohio State Football

- **Emergency Response**
  - Quick response to natural disasters and other events
  - Iowa Floods, Gulf Oil Spill, Hurricane Sandy

- **Border Surveillance**
  - Coverage of large swaths of remote borders
  - Yuma Proving Grounds, Nogales Sector, El Paso Sector

- **Environmental Management**
  - Pipeline surveillance, environmental impact, wild life studies, traffic Studies
User Need Analysis

Dayton Ohio Example
In 2010, Dayton had **28,245 reported crimes**
- 1,509 were violent crimes
- 8,890 major property crimes

**Dayton’s case closure rate is 14% for property crimes**

2010 FBI UCR Crime Data Table 25 Case Clearance Rates
- Similar to U.S. case closure rates for U.S. cities.
- Most cases go unsolved for lack of evidence, leads, or witnesses

**Per capita - Dayton’s crime ranks**
- 39th in violent crime
- 22nd in property crime
- Roughly **1 of 14 citizens or 1 of 4 families** will be a victim of major crime each year.

- **Traditional policing strategies, community based policing, intelligence-driven policing, and community involvement** while having some impact, has **not adequately addressed the problem**.

**The cost of crime to Dayton is significant**
- Dayton’s total cost of crime is **over $480M per year or over $3300 per person per year**.
  Based on the cost of crime from a recent National Institute of Justice - Urban Institute study and the number of FBI reported Dayton crimes
- **Does not include the impact on quality of life, home prices, and economic development in our community.**

**Avoiding even a fraction of this crime would provide significant value to the community.**

**Dayton represents just one of over 200 US cities of similar size and circumstance**
The cost of crime is significant. The national Institute of Justice has sponsored many studies on the cost of crime to a community. Using the results of one of these studies conducted by the Rand Center on Quality Policing the cost of crime in Dayton is calculated to be $480M per year. This is calculated by multiplying the number of crimes in a given category by the cost of crime from the study.

### Cost of Crime Dayton

#### Cost of Dayton Violent Crime

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Cost per crime</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murder</td>
<td>34</td>
<td>$8,649,216</td>
<td>$294,073,344</td>
</tr>
<tr>
<td>Rape</td>
<td>93</td>
<td>$217,866</td>
<td>$20,261,538</td>
</tr>
<tr>
<td>Robbery</td>
<td>782</td>
<td>$67,277</td>
<td>$52,610,614</td>
</tr>
<tr>
<td>Aggravated Assault</td>
<td>602</td>
<td>$87,238</td>
<td>$52,517,276</td>
</tr>
</tbody>
</table>

**Total Violent Crime**

$419,462,772

#### Cost of Dayton Property Crime

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Cost per crime</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burglary</td>
<td>3,390</td>
<td>$13,096</td>
<td>$44,395,440</td>
</tr>
<tr>
<td>Larceny</td>
<td>4,882</td>
<td>$2,139</td>
<td>$10,442,598</td>
</tr>
<tr>
<td>Auto Theft</td>
<td>673</td>
<td>$9,079</td>
<td>$6,110,167</td>
</tr>
</tbody>
</table>

**Total Property Crime**

$60,948,205

**Total Cost of Part 1 Crimes**

$480,410,977

Dayton Population 142,000  Cost per Person  $3383 per year per person
Crimes per Square Mile
Per year

Dayton
172
Robbery Spree Captured
Single Perpetrator - 3 locations
Dayton House Burglary

Officers directed by PSS caught up to suspect before he got out of his car – With stolen goods in it
Review of Other Surveillance Technologies

• **Ground-based Cameras** – Widely Deployed by Police Departments
  – A recent Urban Institute report Baltimore invested over $8M in cameras and operating costs to cover an area of **1.19 sq miles. = $6.7M per square mile**
  – The net return cited in the report, while positive, is also lower than one would hope for.

• **Police Helicopters** - Traditional Airborne Surveillance
  – **Cost of procurement ($4-7M) and operating ($1.25M per year)** is beyond the available resources of the department for the perceived benefit.
  – Small coverage area of the camera systems does not allow it to be effective in investigating most of our targeted crimes.

• **Other Sensors Considered**
  – Departments are considering adding additional sensors such as automatic license plate readers, shot spotter gunshot detection system, red light cameras, and speed cameras
SITUATIONAL AWARENESS AND SURVEILLANCE TECHNOLOGIES

WHAT IS IT? Technologies that allow users to perceive information about environment factors and anticipate their affect in the near future.

MARKET OUTLOOK Growing market with fast growing niches in: surveillance equipment, sensors, and related software.

Surveillance Equipment:
The global market for surveillance equipment was $78 billion in 2009 and is expected to grow at a CAGR of 11.7 percent to reach $139.2 billion in 2015.

Law enforcement is the largest end-user market, worth nearly $50 billion in 2009 and anticipated to reach $94 billion in 2015.

The military and government segment of the market was valued at $10 billion and should reach $16 billion by 2015.

Ohio has several industry participants working on cutting-edge technologies with situational awareness and surveillance applications.

Insights Into Markets That Ohio Can Serve From Industry Forum Discussions
Situational awareness and surveillance technologies are a key growth area in aerospace/defense.
Market Segments

US DoD
International Defense
$10B

US Federal and International Security Organizations
10 US / 50 International
SBP, Sec Service, OGA, Coast Guard, National Guard, CIA

Federal / States Law Enforcement
10 US / 50 State / 100 International
FBI, DEA, SBI, SP, AG
Target price $5-$10M

Large Cities Law Enforcement
20 US / 400 International
LA, NY, Chicago, Phoenix, DC, ...
Target price $5-7M

Medium Cities Law Enforcement
200 US / 2000 International
St Louis, Dayton, Indianapolis, Cincinnati...
Target price $1-3M

Event / Location Security/ Private Security
NASCAR, NFL, Parades, Events Amusement parks, Airports, Critical Infrastructure
Short term Operations some fixed site surveillance

$10B

$50B

$28B
Privacy Policy and Concerns
Regulatory Requirements
PSS Privacy Policy
Draft Local Policy
Regulatory Requirements

• **Use by Law Enforcement**
  – Reviewed by multiple city attorneys
  – Two Directly Related Supreme Court Decisions
    • Allowing Airborne Surveillance for law enforcement
    • Same rules as police helicopters when supporting law enforcement
  – Strict PSS Privacy Policy eases some concerns
    • Used to support police directed crime investigations
    • Cued from police dispatch, crime report, or ongoing investigation.
  – Strictly support local developed and approved privacy policies
    • To be included in support contracts
  – Political concerns remain – Careful, Caution, and Full Open Communication
  – Benefits are significant - Should be considered along with privacy issues
    • 34 murders witnessed -- confessions that account for 75
    • Multiple crimes witnessed per day
PSS Privacy Policies

- Privacy and privacy policies are very important to PSS, our analysts, our customers, and our business.
- Breaches in our privacy policies can and will be dealt with as a management priority.
- PSS has privacy policy training and procedures for its analysts and teaches them to others.
- PSS resolution is limited by technology and design:
  - Objective is 1 pixel per person and to cover as large an area as possible.
  - You cannot tell who a person is, what they are wearing, or most the time what they are doing.
- Investigations are tied directly to a reported crime or ongoing investigation:
  - PSS analysts find a reported crime in the imagery then track cars and people who are involved or are likely witnesses to the crime and can assist in the investigation.
  - Cars and people are only tracked over public roads and sidewalks in areas that have no expectation of privacy.
  - Occasionally during investigations – Additional suspicious acting cars catch the eye of the analyst – Cars going at excessive speeds, making multiple u-turns, not stopping at red lights or stop signs. These cars are followed to determine if they are involved in a larger crime effort. If they are not they are to be deleted.
• PSS analysts have had DHS suitability checks and/or DoD Security clearances to provide some assurance of personal integrity.

• PSS can provide an audit trail of every location and time when an analyst looked at imagery.
  – PSS through its server process can record this information and managers can review this data to ensure that the analyst is looking at appropriate locations and times for the crime they are investigating. This data can show every place and time the analyst looked. Management can pull this data when needed.

• PSS provides secure storage and management of the collected data. Sensitive data analyzed data can be secured in classified storage safes.

• All computers are password protected and firewalled keeping non-authorized users from the data.
Sample Draft Police Department
WIDE AREA AERIAL SURVEILANCE
POLICY STATEMENT

The XXX Police Department utilizes Wide-Area Aerial Surveillance for the purpose of creating a safer environment for all those who live, work and visit the city of XXX. This policy explains the purpose of the use of this technology and provides guidelines for the operation and for the storage of captured images.

DEFINITIONS

**Wide-Area Aerial Surveillance** - Wide-Area Aerial Surveillance Sensors is an optical camera assembly that can provide continuous, second-by-second video monitoring of a city-sized area via a manned small fixed wing aircraft platform.

**Part 1 Crimes** - The Federal Bureau of Investigation (FBI) designates certain crimes as Part I or index offenses because it considers them to be the major crimes plaguing society in the United States: Murder, Rape, Robbery, Aggravated assault, Burglary, Larceny-theft, Motor vehicle theft, and Arson.

**Major Events** – For the purposes of this operating policy, major events will be interpreted as any event where a large gathering of individuals may congregate and there is illegal and/or dangerous activity.

**Weather Emergencies** – Large scale damage or power outages due to weather related events.

**Natural Disaster Response** – Coordination of emergency services to aid the populace in the event of a natural disaster.

**Large Scale Disturbances** – Rioting, civil unrest, violent strikes, etc.

**Tactical Operations** – Tactical operations include SWAT call outs, active shooter situations, Hostage Team call outs, maintenance of order, etc.

**Illegal Dumping** – Large scale disposal of waste in public right–of–way.
Sample Draft Police Department
WIDE AREA AERIAL SURVEILLANCE
POLICY STATEMENT

I. Purpose
Wide-Area Aerial Surveillance (WAAS) can be used for general deterrence of targeted crimes; disrupting identified crime patterns; safeguarding against potential threats to the public; management of emergency response situations during natural and man-made disasters; and for support of tactical operations.

II. Wide-Area Aerial Surveillance

- The use of wide-area aerial surveillance (WAAS) will only be utilized to view areas of public right-of-way or public view.
- The current system has the ability to operate uninterrupted for five hours without having to make a stop for fuel.
- The sensor technology has the capability of viewing up to a 25 square mile area depending upon altitude.
- The images captured by the sensor have the ability to be viewed nearly in real-time utilizing a down-link system.
- While images cannot identify specific persons, they can provide significant leads to investigators (See appendix A).
- Due to the cost to operate WAAS, this technology will only be deployed for the following reasons:
  - To disrupt identified Part I crime patterns.
  - To monitor major events,
  - To assist during weather emergencies or natural disaster response.
  - To monitor large scale disturbances.
  - To support tactical operations.
  - To monitor for illegal dumping.
- During active WAAS operations dispatch information, to include citizen generated calls for service, will be monitored and evaluated to see if the use of this technology would assist in the apprehension or case solvability of an active incident.
III. Training

• Personnel involved directly with the use of WAAS technology shall be appropriately trained and supervised.
• Training shall include the review of this policy.

IV. Prohibited Activity

• The use of WAAS will be conducted in a professional, ethical and legal manner.
• WAAS will not be used to invade the privacy of individuals, to look into private areas or areas where the reasonable expectation of privacy exists.
• All reasonable efforts will be taken to protect these rights.
• WAAS technology shall not be used to track individuals arbitrarily or based on race, gender, ethnicity, sexual orientation, disability or other classifications protected by law.
• Under no circumstances will aerial surveillance be used for the purpose of tracking persons lawfully exercising their rights to protest or assemble.
V. Media Storage

- All media will be stored in a secure area with access restricted to authorized persons.
- Recordings not otherwise needed for criminal evidence or for official reasons shall be retained for a period of 45 days.

VI. Review and Release of Video Images and related Data

- The review or the release of video images and analytical data (to non-law enforcement personnel) shall be done only with the authorization of the Director and Chief of Police or their designee and only with a public records request.
- Any recordings or analytical data needed for a criminal investigation or other official reason shall be collected and stored as noted in General Order 3.02-7 and submitted into evidence as noted in General Order 1.06-1.
- An audit trail shall be maintained to record all access to the video images and analytical data and may be used to detect inappropriate or unauthorized use.

VII. Policy Violations

- Unauthorized access to the WAAS recorded imagery, misuse of the imagery, unauthorized reproduction of the imagery, or unauthorized distribution of imagery will result in an Administrative Investigation.
- The Director and Chief of Police or his designee shall authorize access to the system.
PSS Analysts

- 80 hours of hands on analysis training
- Training Formalized as Community College Courses
- System Introduction
- Privacy Policies and Procedures
- System Uses and Limitations
- Tracking
- Investigation Process
- Intel process
- Criminal TTPs (What they typically do)
- Integration of sources
- Reporting results
- Leading teams
Summary

• New and Unique technology
• Demonstrated impact on various law enforcement operations
• Success in investigation support across a wide array of crimes
  – 34 murders witnessed and investigated – Confessions that account for 75
  – Kidnappings, Robberies, Assaults, burglaries, car theft, car jackings, ...
• Multiple other uses
• Affordable system aimed at Large to mid-level police departments
  – Purchase, lease and service options available
• Want to develop appropriate policies to ensure protection of people and privacy
Good People
Doing Good Things
Wide Area Surveillance
Other Applications

- **Officer Support**
  - Support for local law enforcement in crime investigations
  - Philadelphia, Baltimore, Dayton, Compton, Nogales, Juarez, Mexicali, Torreon, Indianapolis, Columbus, Cleveland

- **Major Event Security**
  - Security and traffic management support of large events
  - Brickyard 400, Coca Cola 600, Sarah Palin VP announcement, 4th July Fort Leonard Wood, Ohio State Football

- **Emergency Response**
  - Quick response to natural disasters and other events
  - Iowa Floods, Gulf Oil Spill, Hurricane Sandy

- **Border Surveillance**
  - Coverage of large swaths of remote borders
  - Yuma Proving Grounds, Nogales Sector, El Paso Sector

- **Environmental Management**
  - Pipeline surveillance, environmental impact, wild life studies, traffic studies
Persistent Surveillance Systems

• **Conducting Live Operations since 2008**
  - NASCAR BrickYard 400 Indianapolis Motor Speedway
  - North Philadelphia Philadelphia Police Department
  - Baltimore Police Department
  - NASCAR Race Cola Cola 600 Charlotte Motor Speedway
  - Iowa Floods
  - Dayton Police Department
  - Sarah Palin VP Candidate Announcement
  - Ft Leonard Wood
  - Juarez Mexico
  - Private Kidnapping
  - El Paso Border Surveillance DEA
  - Gulf Oil Spill
  - Mexicali Mexico
  - Torreon Mexico
  - Compton California – LA Sheriffs Office
  - Nogales Arizona Border Security Operations
  - Dayton Police Department
  - Hurricane Sandy Response NJ/NY Emergency Response
Major Event Security

• Pre-Race Planning
• Minor Incident Response
• Major Incident Response
• Traffic Management
• Business Case
Emergency Support and Disaster Response

Real-Time Major Incident Response:

- Fast wide-area damage assessment
- Coordinate mass-evacuation, perimeter cordon
- Common Operating Picture for Police, FBI, emergency responders, and other event personnel
- Detect movement over broad areas for potential survivors

Rewind imagery to track and backtrack potential suspects and witnesses

Proprietary PSS Information
Staring and Survey Modes

Persistent Stare and Long Range Coverage

Normal Operations:
- Aircraft Orbits Area-of-Interest
- Downlinks Images Live to Mobile Command Center
- Visually track people, animals, watercraft, etc.

Survey Mode Operations:
- 2-mile x 2-mile images
- 60 images per location
- Visually detect people, animals, watercraft, etc.

Persistent Coverage over and Area
-- Used for high activity areas
-- Constant Coverage over large area
-- Detect and Track Movement Within Area
-- Real Time Constant Download

Long Range Periodic Coverage
-- Used for Long areas of interest
-- Multiple real time images allow for image to image change detection to auto detect movement within the area
-- Pass by pass detection can highlight changes that occur between over flights
-- Periodic Downlink when within range
Iowa Floods

Survey Mode Operations

Imaged entire 160 miles of flooded rivers in slightly over an hour (Route shown)

70 to 100 images per location

Circles over locations of particular interest

2 to 3 mile wide images

See individuals, vehicles, boats, and animals

Original images are 88 megapixels each

Images to right are highly subsampled.

Proprietary PSS Information
Persistent Surveillance Systems

Emergency Response

Iowa Floods

>1,000 sq miles surveyed in one flight
Hurricane Sandy Rapid Response

Imaged entire impacted areas in less than 2 hours

Imagery available to emergency support personnel

60 images per location provides moving look at any location