

Boundless Security Systems, Inc.

sharper images with better access and easier installation



**Woman-Owned
Small Business**

Boundless Solves Fundamental Problems in Video Surveillance

Boundless makes city-scale Wi-Fi wireless video surveillance with large numbers of cameras practical

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Executive Summary

- There is a growing need for video surveillance to combat criminals and terrorists
 - Outdoor surveillance is effective at reducing crime and terrorists, but its high price, difficult installation, and monitoring have limited its use
 - Inexpensive, wide area communications networks have not been able to carry the vast amount of video data required by each camera
 - Video surveillance is no longer a few isolated cameras and a recorder, and its integration with communications networks is complex
- **Boundless Security Systems, Inc., has the broad knowledge required to understand the problems**
- **Boundless Security Systems, Inc., has developed and manufactures ultra low bandwidth, multi-stream products that solve these problems**

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Key Technical Problems with Digital Video Surveillance Systems

- Sharp, high resolution digital video images with smooth motion from a single video camera, flood both wired and wireless networks with video data, even when highly compressed with advanced technology such as MPEG-4, requiring bandwidth equal to *48 x 64 Kbps voice channels*
- The higher the communications speed required to move the video, the more expensive it is and the fewer people who have the required communications infrastructure to easily view and search the live and recorded video images
- Merely switching from analog to digital technology doesn't automatically solve the problems and can make them worse
- It is much more expensive to install permanent and temporary video surveillance outdoors than indoors
- City-wide Wi-Fi wireless networks are being installed everywhere but conventional video surveillance floods them
- Humans monitoring vast numbers of cameras is impractical

Video Surveillance is Now a Complex, System-Level Problem That Requires a System-Level Solution

Many inter-related factors affect the performance of today's digital video surveillance systems, including

- Optics (lenses, filters, focusing and illumination)
- Type of camera (analog CCTV vs. digital / IP-based)
- Image sensor technology (CCD vs. CMOS)
- Type of video scanning (interlaced vs. progressive)
- Type (JPEG, MJPEG, MPEG-x) and amount of compression
- Image quality depends on many factors (not just resolution)
- Communication protocols used to move compressed video between video encoders, recorders and users
- Image and audio “understanding” / automated interpretation
- Distributed vs. centralized system architectures
- Local and wide area communication networks
- Video distribution and presentation systems
- Encryption and Cyber security

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Corporate Overview

In-depth knowledge of computer systems, imaging, digital signal processing, video compression, telecommunications, computer networks, and Cyber security

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Boundless' Corporate Profile

- **Software developer and manufacturer of ultra low bandwidth, digital video surveillance systems**
- **Principals' extensive systems-level expertise**
 - Distributed, real-time operating systems
 - Networked, Cyber-secure, digital video surveillance systems
 - Construction and telemetry of U.S. Air Force communications spacecraft
 - Large-scale, central office telephone switching systems
 - Analyze and understand basic underlying principles in depth
- **Steve Morton, CEO and CTO, MIT '71 BSEE / MSEE, widely known for a child-safety device that uses biometrics and digital imaging**
- **Located in Newtown, CT**
- **Privately held, woman-owned, Delaware C corporation**

Boundless Has Broad Expertise

- **Biometrics**
- **Camera Technology**
- **Chip Design (ASIC's)**
- **Communications**
- **Cyber Security**
- **Design for Test**
- **Digital Signal Processors**
- **Hardware Design**
- **Human Factors**
- **Image Processing**
- **Image Sensors**
- **Internet Protocols (IP)**
- **LAN, WAN, Wireless LAN**
- **Mass-Storage**
- **Operating Systems**
- **Optics**
- **Parallel Processing**
- **Reliability / Fault-Tolerance**
- **Software Design**
- **Software Tools**
- **System Architecture**
- **Video Compression**

Boundless' Products and Services

- **Products**

- ***Boundless Security System™*** -- an open platform, inherently networked, fully scalable, ultra low bandwidth, digital video surveillance system with attention-grabbing ***Live Alerts***
 - Ultra low bandwidth, Linux-based, multi-function, ***Multi-Stream Video Servers*** are sold turn-key, using standard x86 computer hardware with Boundless' proprietary software pre-installed and configured, or software-only to OEM's
 - Boundless' ***Control Panel / Video Player*** client viewing and search software runs under Microsoft Windows

- **Services**

- System-level contract engineering to analyze capability and limitations of existing and proposed video surveillance systems
- System-level contract engineering to design large-scale, very low bandwidth, fault-tolerant, digital video surveillance systems
- Analysis of operational capabilities enabled by low bandwidth

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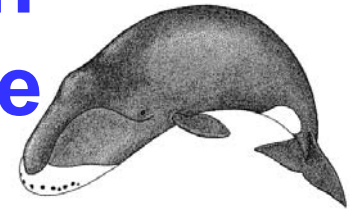
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→ 3. **WHALE Communications
Problem with Video**

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The WHALE Communications Problem in Conventional Outdoor Video Surveillance



- Each video camera requires a WHALE of digital data transmission, about 24 x speed of inexpensive broadband Internet uplinks, even with high (40:1) video compression, but this is many vendors' idea of "low bandwidth"
- Very high speed communications networks are expensive
- Need for very high speed limits remote viewing of live video, and searching and reviewing of recorded video
- The speed an Internet Service Provider sends (uplink) information from a site to the Internet is much slower than the speed a user receives (downlink) information from the Internet, making it quick for a user to browse the Internet, but slow for a video surveillance system to send images
- Conventional outdoor surveillance systems send video continually for each camera regardless of what it's to be used for, and regardless of whether it's needed or not, to a central location for recording, viewing and searching

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Boundless' Unique *Multi-Stream Technology* Solves the WHALE Communications Problem (1)

Boundless' unique, secure, ultra low bandwidth, multi-function, *Outdoor Multi-Stream Video Server...*



- avoids need to continuously send huge amounts of video data, multiplying the number of simultaneous wireless video surveillance channels 100-fold compared to conventional analog and digital video transmission devices
- is far more efficient than conventional systems because it simultaneously and continuously forms, internally records, and prepares for later searching, multiple different, *task-optimized*, digital video streams for each camera
- converts a WHALE of video from each camera into a MINNOW that is securely sent only when requested to an authorized user via the Internet
- sends live video, at 10 frames/s/camera with sufficient resolution for remote situation assessment, using only 2% of the bandwidth (equal to one, 64 Kbps voice channel) of conventional systems
- enables hours of video to be remotely searched and reviewed in minutes
- provides attention-grabbing **Live Alerts** for deterrence and intervention
- provides a cluster of four video cameras for omni-directional viewing, reducing the risk that a decoy distracts attention from the real action
- provides interoperable video and supports virtually unlimited storage using Boundless' **Storage Operating System™**

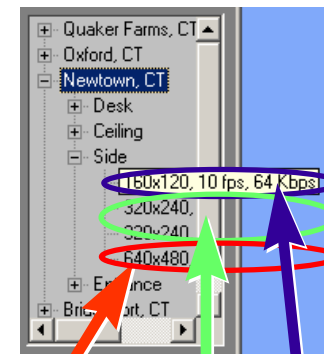
Boundless' Unique *Multi-Stream Technology* Solves the WHALE Communications Problem (2)

The multiple different digital video streams per camera produced by Boundless' ultra low bandwidth, multi-function, *Outdoor Multi-Stream Video Server* are individually optimized for the three most common tasks.

The multiple digital video streams per camera uniquely satisfy the competing tasks of:

- **INVESTIGATIONS** - sharpest images with highest resolution, clarity (fewest compression artifacts) and data rate, remotely view recorded video for faces, license plates, objects...
- **MONITORING** - images with smoothest motion and medium resolution, clarity and data rate; remotely view multiple recorded cameras simultaneously, or one camera per site live
- **SITUATION ASSESSMENT** - images are communicated most-easily, with medium frame rate, and lowest resolution and data rate; remotely view live and recorded; remotely view multiple live cameras per site simultaneously; best for rapid remote review of recorded video, and PTZ control

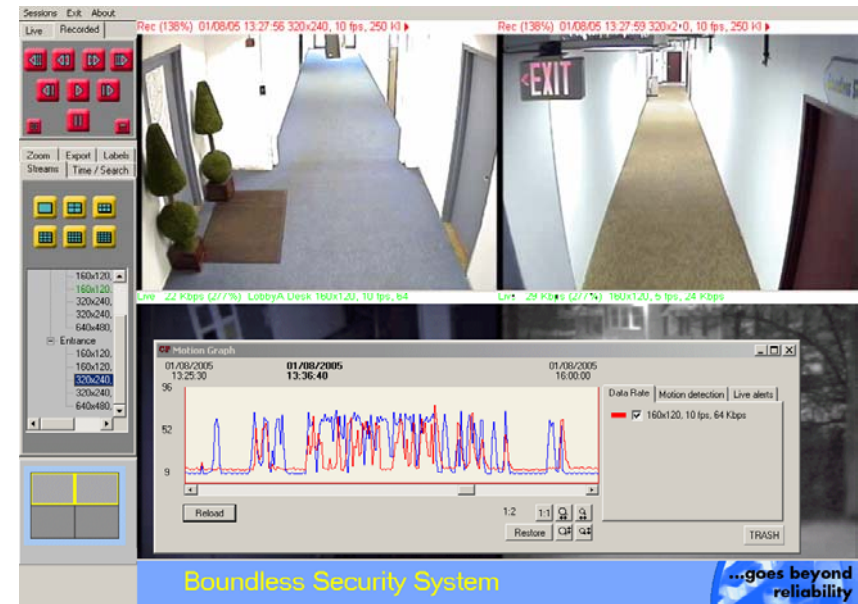
Streams window from Boundless' *Control Panel* client software, showing multiple sites, multiple cameras per site, and multiple video streams per camera.



Boundless' Unique *Multi-Stream Technology* Solves the WHALE Communications Problem (3)

Boundless' *Control Panel* client software runs on Windows PC's and enables users to remotely:

- easily select and seamlessly view live and recorded video from up to 63 cameras on each computer screen at the same time,
- select Investigations, Monitoring, or Situation Assessment video stream for each camera,
- view any combination of live and recorded video on each screen at the same time,
- perform motion searches with 128 zones per camera on recorded video, quickly searching only the areas where trouble was found,
- quickly review recorded Situation Assessment video streams then click over to recorded Investigations streams for details, and
- create and share *Session* files with full screen formatting for cloning of viewing screens,
- from Boundless' ultra low bandwidth, indoor and outdoor, *Multi-Stream Video Servers*



Screen capture shot from Boundless' *Control Panel* client viewing software, showing multiple sites, multiple cameras per site, multiple video streams per camera, live and recorded video, and a Motion Search Graph. Live video has a green header. Recorded video has a red header. Motion Graph shows relative amounts of motion. The exact screen configuration, including the specific recorded frames shown on the screen, can be captured in a *Session* file, shared with others and recalled later for further investigation.

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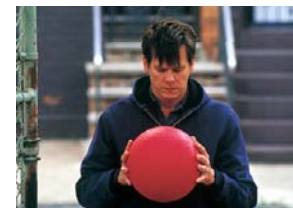
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