



KT-Tech Incorporated

www.kttech.com

Delivering

Actionable Visual Intelligence

in Operational Time

for Enhanced Situational Awareness

Over Extreme Narrow-bandwidth

Communication Links

Robert Lerner, Vice President

[rlerner @ kttech.com](mailto:rlerner@kttech.com)

15480 Annapolis Road, Suite 202, Bowie, MD 20715

(o) (301) 262-0081 (fax) (866) 862-2666

DOD CHALLENGE

Delivery of “Actionable Intelligence” contained in video/imagery

- Over Narrow-bandwidths
- In Operational(‘*Reactionable*’)Time
- To and from the Tactical Edge
- While minimizing SWaP-C
(**S**ize, **W**eight, **P**ower, and **C**ost)
- Enhancing Situational Awareness

DOD CHALLENGES

To send/receive “Actionable Intelligence” contained in video/imagery over narrow-bandwidths in Operational Time while minimizing SWaP-C
(Size, Weight, Power, and Cost)

- DOD seeks situational-awareness intelligence capability for small units on the leading edge of battle
- Warfighters are too often SURPRISED in tactical situations.
- Soldiers in Small Units lack sufficient timely MISSION COMMAND & TACTICAL INTELLIGENCE to understand:
 - ❖ where their assets are
 - ❖ who and where the enemy is
 - ❖ who and where non-combatants are /to document and communicate this information to each other and higher echelons

The KT-Tech Solution

Video Compression Software for Narrow-bandwidth COMMs to the Tactical Edge

- Optimized for Low Latency (*Super Fast*)
Less than 250 milliseconds
- Ultra-Narrow-bandwidth Delivery
Less than 64 kbps COMM Links
- ❖ *As Low as 1 kilobit per second - Scalable to Broadband*
- Computationally Efficient :
- ❖ works on low-powered processors (e.g. 200 MHz)
- Small Footprint (*Super Small*) : less than 500 KB on Windows Platforms

KT-Tech Video Compression Software Solution

Benefits/ Strengths and Advantages

Implemented in Power-Efficient, Portable Software for greatly reduced **S**ize, **W**eight, **P**ower, and **C**ost (**SWaP-C**)

- **Super Small** – Video Compression Encoder/Decoder Software less than 500 KB in size for maximum portability and easy download deployment
- **Power Efficient** – proven capability on low-power 200 MHZ ARM Processor

Example: Minimal power drain allows for continuous video streaming for over one-hour on a COTS Smartphone

- **Low Cost** - resides solely on the edge device and works on currently deployed man-portable devices (laptops, netbooks, smartphones)
 - ❖ No requirement to purchase additional infrastructure/network hardware



KT-Tech Video Compression Software Solution

Benefits/ Strengths and Advantages

Superior Ultra-Narrowbandwidth Performance

- Delivers the World's First Actionable Quality Video over SOCOM's Iridium satellite network at an unprecedented 1 kilobit per second bandwidth with less than 0.01 second processing time
 - ❖ (Demonstrated at SOCOM SORDAC Tampa)
- Dynamically adjusts to varying available bandwidth caused by high RF noise levels and conditions of network congestion
- Automatically Scalable from Ultra-Narrowbandwidth to Broadband

Low Latency Performance - Less than 250 milliseconds

- High Speed Access to Actionable Intelligence in Operational Time
- Fully Symmetric Video CODEC (same short time to encode/decode video frames) facilitates high speed sensor-to-display
- Current Encode Speed =
 - 3,000 Full Color Pixels per Second per MHZ of CPU
 - ❖ Fast encode/display on handheld devices

Example: a QVGA Frame (320 X 240 pixels) encodes on a low powered 500 MHZ ARM Processor in less than 0.06 Seconds (60 milliseconds)



KT-Tech Video Compression Software Solution

Benefits/ Strengths and Advantages

Delivers Superior Actionable Visual Intelligence

- **Improved video analytics - continuous imagery lines kept intact**
- **NO blocking artifacts introduced**
- **Built-in dynamic Scene Detection feature**
- **Superior performance on videos with many scene changes (Example: Surveillance Video)**
- **Retains details of unexpected events such as explosions**
- **Distortion-free as demonstrated by ability to accurately make biometric matches from compressed video frames**

Superior Performance in Denied/Degraded Environments

- **Demonstrated Robustness in the presence of Jamming, Noise and Network Congestion (SOCOM TNT 12-1, Camp Roberts)**
- **Demonstrated Robustness over Congested Cellular Networks (both CDMA and GSM), CTIA Convention Center San Francisco**



KT-Tech Video Compression Software Solution

Benefits/ Strengths and Advantages

Net-Centric Enterprise System (NCES) - Interoperability

KT-Tech's video compression software is:

- Immediately adaptable to all communication networks (e.g., cellular, landlines, satellite, Wi-Fi or any combination).
- Network agnostic—optimized for devices at the network edge
- Operates on existing equipment – NO new acquisition of infrastructure hardware required

Multi-Level Security/Cross Domain Security

KT-Tech's video compression software provides:

- Increased security of communication – proprietary encoding and no requirement for a central server
- Additional protection with TCP/IP protocol against data interception, alteration or deletion
- Demonstrated compatibility with encryption

KT²

**DOD/OSD Awarded a Contract to KT-Tech:
Conduct Experiments with KT-Tech's Video
Compression Technology at SOCOM TNT 12-1
Camp Roberts, November 2011**

**SOCOM TNT Camp Roberts, November 2011 :
Demonstrated KT-Tech's Video Compression
Software: **to 64 kbps****

The following slides show KT-Tech Examples:

- **RAVEN UAV**
- **CROWS Daylight Camera**
- **DOD "Multi-Spectral Infrared Skin Detection"**
- **Demonstrated robustness in the presence of jamming, noise, and network congestion**



KT-Tech Video Compression: 64 kbps Video at 1 FPS

SOCOM TNT 12-1 Camp Roberts Nov 2011

RAVEN UAV (Man - launched)

Retain All Significant Video and Metadata Information

RAVEN UAV Video

Original Uncompressed
File Size = 1.56 GB

RAVEN UAV Video

KT-Tech Compressed

File Size = 2.5 MB

less than 0.15 % of original

ALT 18:48:38 11-05-11 4+
10SFE99276037 935 HSL
26 KTS 0.1 KH
304°H 32°
23.4U
10f1t

10SFE99106024 249m 3KTS
227° 29°

ALT 18:48:38 11-05-11 4+
10SFE99276037 935 HSL
26 KTS 0.1 KH
304°H 32°
23.4U
10f1t

10SFE99106024 249m 3KTS
227° 29°



KT² KT-Tech Video Compression: 64 kbps Video at 1 FPS
SOCOM TNT 12-1 Camp Roberts Nov 2011

CROWS Daylight Camera

Distinguish: Man Carrying Weapon versus Farm Equipment

CROWS Video
Original Uncompressed
File size = 398 MB

CROWS Video
KT-Tech Compressed
File Size = 472 KB

less than 0.12% of original size



KT-Tech Video Compression: 5 kbps and 9 kbps Video at 1 FPS

SOCOM TNT 12-1 Camp Roberts Nov 2011

CROWS Daylight Camera

Distinguish: Man Carrying Weapon versus Farm Equipment

CROWS Video

Original Uncompressed / File size = 398 MB

CROWS Video

KT-Tech Compressed

File Size = **25 KB**

less than **.006 %** of original size



5 kbps at 1 FPS

CROWS Video

KT-Tech Compressed

File Size = **77 KB**

less than **.02 %** of original size



9 kbps at 1 FPS

SOCOM TNT 12-1 Camp Roberts Nov 2011

DOD “Multi-Spectral Infrared Skin Detection”:
Detect Concealed Sniper

DOD “IR Skin Detection” Video
Original Uncompressed
File Size= 1.46 GB

DOD “IR Skin Detection” Video
KT-Tech Compressed
File Size =177 KB
less than 0.01 % of original size



KT²

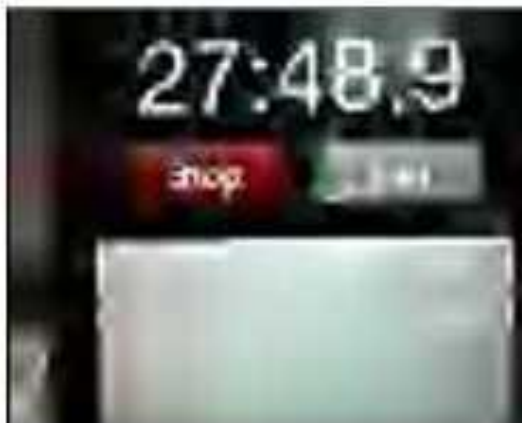
SOCOM Invited KT-Tech to Tampa UTB: **Challenge: Provide Usable/Actionable Video** **Over the Ultra-Narrowband (less than 2 kbps)** **Iridium Satellite Network**

Breakthrough Results:

KT-Tech Video Software successfully demonstrated the
World's First Usable Live Video Feed over
SOCOM's Single Iridium Satellite Channel at:

- **1 Frame Per Second (FPS) at Iridium Bandwidth of 1 kbps**

Examples of still images from the Iridium video experiment
(all video transmitted at 1 FPS at 1 kbps):



iPhone stopwatch



Man walking



Car (sedan) moving



KT-Tech Compressed FLIR Infrared (IR) Video

➤ KT-Tech compressed Live Video from a DOD IR camera.

Below are two images captured from highly compressed video streams using KT-Tech's Software Video Compression CODEC running on a low-power Netbook.



6 Kbps 1 FPS at 15 Meters.



128 Kbps 7FPS at 84 Meters

The DoD camera used for input was attached to an ASUS Eee PC Netbook with an Intel Atom N270 1.6 GHz CPU & 1 GB RAM running Windows XP(Service Pack 3). On this net-book KT-Tech's Video symmetric CODEC encodes or decodes, in software, at the rate of 4.8 full-color Mega-Pixels per Second. That is a QQVGA frame(160 pixels x 120 pixels) is encoded or decoded in 4 milliseconds

**KT-Tech's Video/Audio Compression Software
Provides the Solution to the DOD Challenge of
Delivering "Actionable Visual Intelligence"
over Narrow-bandwidths in Operational Time**

Technical Readiness Level TRL 6+

Super Small/Super Fast Video/Audio Compression Software

- True Real-Time Performance [Low Latency]
- **Scalable (Narrowband to Broadband)**
- High Visual Quality over Extreme Narrowbandwidth
Communication Links
- **Proven Performance on Mobile Low Power Military Equipment**
- Network Agnostic
- **Retains Details of Unexpected Events such as Explosions**
- Demonstrated Robustness in the Presence of Jamming,
Noise and Network Congestion
- **Minimal SWaP-C**



KT-Tech History

- ◆ **KT-Tech, Inc. founded in 1991 by Dr. Bao Ting Lerner**

(First woman to achieve status of tenured Full Professor in Science at U.S. Naval Academy, Mathematics Department, 1979-1991)

- ◆ **KT-Tech : R&D ‘Think-Tank’ for NASA Goddard Space Flight Center**

- Created at request of NASA, 1991-2000
- Robotics Laboratory : sensor fusion, computer vision, mission testbed for astronauts (Hubble Missions, Flight Telerobotic Servicer Missions)
- Earth Sciences Directorate: image processing, understanding, and storage of remotely sensed images; Mission to Planet Earth program; developed first semi-autonomous Image Registration Software Toolkit
- Space Sciences Directorate: satellite sensor data analysis, Mars Rover Prototype



- ◆ **KT-Tech’s Mission: 2000 – Present**

- Creating leading-edge technology to enable next-generation multimedia and wireless applications(2000-present, independently funded)