BLACKWIRE

FLEX

BW-FLEX-001 · Software tactical video encoder

Clear video under jamming, at range, and on thin links.

FLEX is a software AV1 video system for UAS, UGV and USV operators, platform integrators and GCS vendors. It runs on the Pi-class compute already on the platform and keeps full-motion video up over links that used to carry voice only.

COMPRESSION PERFORMANCE

FLEX operating points beside the published minimum bitrates for live H.265 and H.264 streaming at the same resolution.

Operating point	FLEX (AV1)	H.265 minimum	H.264 minimum
1080p30	250–500 kbps	4,000 kbps	5,000 kbps
720p30	100–250 kbps	2,000 kbps	3,000 kbps
480p	50–100 kbps	300 kbps	400 kbps
480p5 floor	~10 kbps	—	—

FLEX figures are recommended operating points. H.265 and H.264 figures are YouTube's published live-encoder minimums at 30 fps, not a matched-quality test.

HEADLINE OPERATING POINT

Full HD@500

1080p30 at 500 kbps, as low as 350 kbps

80–90% less bandwidth than H.264 and 3–4× more streams on the same link.

LOW-LATENCY MODE

25–50 ms glass-to-glass, excluding network transit.

EW RESISTANCE AND LINK RESILIENCE

FLEX is built for links that are jammed, contested or stretched to the edge of range. AV1 error-resilient coding with golden-frame anchoring on a one-second cadence means lost packets cost picture quality for a moment. The stream does not freeze waiting for a keyframe.

- Recover from a dropout in under a second, no stream restart
- Picture quality drops before the video does
- Retune bitrate, frame rate and resolution mid-stream
- Keeps streaming down to ~10 kbps at 480p5

COMBAT TESTED

Link drops. Video stays up. No matter what.

Ukraine MoD field tests, Nov 2026. Raspberry Pi 5 host, Starlink under active enemy jamming, with link dropping below 100 kbps during the mission. Documentation available upon request.

Actual performance depends on the waveform, the interference and the scene.

API AND LIVE CONTROL

Everything in the FLEX Manager web UI is also in the REST API, so a radio, autopilot or GCS can run FLEX with no operator in the loop.

- Change bitrate, frame rate and resolution on a live stream
- Create, start, stop and edit pipelines
- Discover USB, MIPI and ONVIF cameras, with hot-plug events
- Live stream status, event webhooks and license state

Link-driven control Your radio, autopilot or link monitor calls the API and FLEX retunes the encode in about 100 ms.

MultiView Up to four cameras composited at the source into one stream. Spotlight or hide any input live.

FlexMux Video, Codec2 voice and KLV metadata in one stream, built for ultra-low-bandwidth links such as HF.

Endpoint reference is available to customers and integration partners.

INTEGRATIONS

Radios and bearers

MANET: Silvus, Persistent Systems, TrellisWare, L3Harris, Thales
HF: AN/PRC-160 3G IP
SATCOM: MUOS, UHF TACSAT, Ku/Ka, Starlink/Starshield, Iridium Certus 100+

GCS and players

TAK 5.5+ and TAK Server
Anduril Lattice
Vidterra Compass
ArduPilot ecosystem
GStreamer and FFmpeg pipelines

Output protocols

RTSP and RTSPS
SRT with AES encryption
UDP unicast and multicast
WebRTC web viewer, WHIP push
IPv4 and IPv6

AI Tap

Feeds raw frames to your on-board model through a local pipe. No extra video stream off the platform. Detections can be drawn back into the video.

FIELD PROVEN

Combat proven

TRL 9. In service with active customers in the Ukrainian Armed Forces.

HF VTC

Nov 2026 AN/PRC-160 tests carried VTC over HF from L3Harris HQ, Rochester, NY to JBLM, WA, and St. Louis, MO to L3Harris on 150 W.

Joint force

Validated by USASOC and AFSOC-GSU. CRADA with USASOC via USSOCOM SOF AT&L. HF groundwave at Cosmic Storm.

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VALIDATED HARDWARE

Platform	Status
Raspberry Pi 5	Validated
Raspberry Pi CM5	Validated
Rockchip RK3588, NVIDIA Jetson Orin	Validated
Qualcomm Snapdragon and Dragonwing	Validated
Blackwire IVPM inline module	Dev kits available

Minimum: 64-bit ARM or x86 Linux, multiple modern cores, 1 GB RAM, 20 GB storage, Docker. Encoding runs on the CPU; no GPU or encode hardware required.

Load: on a Pi 5, roughly one core and under 1 GB RAM per 1080p30 stream from a raw camera source, with no transcode.

SECURITY AND OPSEC

- Runs fully offline. Licenses validate on the device: no call home, no telemetry, no revalidation traffic.
- Per-device licenses, bound to the hardware ID and cryptographically signed.
- Encrypted transport: SRT with AES-128/192/256, and RTSPS over TLS.
- HTTPS on every management port, stored credentials AES-256 encrypted, hardened non-root containers.
- Air-gapped install from a single Cosign-signed offline installer.

EXPORT

EAR99 under BIS commodity classification Z1901344.

TECHNICAL SPECIFICATIONS

Parameter	Specification
Codecs	AV1 (primary)
Operating points	1080p30 at 250–500 kbps · 720p30 at 100–250 kbps · 480p at 50–100 kbps
Bitrate and frame rate	10 kbps to 1 Mbps, 1–60 fps, both adjustable on a live stream. Floor ~10 kbps at 480p5
Latency	25–50 ms glass-to-glass in low-latency mode, excluding network transit
Loss recovery	Sub-second, no stream restart. Golden-frame anchoring on a one-second cadence
Inputs	USB, MIPI CSI, HDMI/SDI, ONVIF, GoPro, RTSP, RTMP, SRT, UDP, RTP/SDP, TAK and Lattice feeds
Outputs	RTSP, RTSPS, SRT (AES), UDP unicast and multicast, WebRTC web viewer (WHEP), WHIP push
Audio and metadata	Codec2 (1.2–3.2 kbps) or Opus voice. KLV passthrough and HUD, CoT to TAK, Lattice entities
Mesh	Flex units find each other and relay AV1 video over SRT; a hub can transcode or build a multiview
Deployment	Docker, by offline installer or Compose template. Debian 12, Ubuntu 22.04+, Raspberry Pi OS 64-bit, OpenWrt
Management	FLEX Manager web UI (English and Ukrainian) and REST API over HTTPS. IPv4 and IPv6

DEPLOYMENT IN FOUR STEPS

1 Flash
Write Raspberry Pi OS 64-bit or the Blackwire OpenWrt image to the device.

2 Install
Run the offline installer. FLEX services start in Docker.

3 License
Send the device serial, paste the key back. No network needed after that.

4 Stream
Pick a camera and an operating point, then start the pipeline.

Installers: **flex.blackwire-ts.com/downloads** · Install guides: **flex.blackwire-ts.com/install-guide**

LICENSING

License	Terms
Lifetime	Perpetual. One license, one device, never expires.
Attritable	90-day term for expendable platforms. Clock starts on first use.
Fleet	License at deploy time from system configuration or a Compose template.
Field	Keys issued and apportioned in the field for deployed customers.

Pricing on request. Every license is tied to one device and runs offline.

Put FLEX on your platform.

Talk to us about licensing

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