



#### ENERLINKSII DVA SYSTEM AT-A-GLANCE

- Single digital card converts an L-band or S-band analog FM video data link to a high performance digital link without changing UAV RF components
- IP ready — streams output from network cameras, and IP-based sensor data
- Reliable range coverage to the horizon with EnerLinksII receiver
- Bandwidth and spectrum efficiency
- Security

***This digital system upgrade delivers up to 12dB in measurable link margin over an analog link, or equivalently up to 4x range performance.***

The EnerLinksII DVA (Digital Video over Analog) System is an advanced digital signal processing system that transforms any existing L-band or S-band analog FM video communications link into a robust, flexible digital video and IP data link using the installed airframe ISR transmitter, power amplifier, filter and antenna. The system simultaneously transmits high-quality compressed H.264 video and UDP/IP network traffic in the same bandwidth previously required to send only analog video. Use of modern FEC techniques improves link margin by 12 dB over the analog system. All this and more can be achieved without modification of the RF hardware.

The aircraft downlink system supports a wide range of sensor inputs including analog or digital video, IP data, GPS, and other serial data. Integral H.264 or MJPEG compression is included and compressed video, audio, and data are multiplexed together and FEC coded. By means of digital-signal processing techniques, the FEC coded bit stream is used to form an analog pre-modulation signal that feeds the existing analog video FM transmitter.

Because the pre-modulation waveform is designed to have bandwidth and amplitude comparable to an analog video signal, it can be transmitted using the analog video FM modulator without modification. The DVA can be placed anywhere between the onboard sensors and the FM transmitter. Requiring less than 10 watts, weighing under 8 ounces, and occupying less than 16 in<sup>2</sup>, it needs but a 12v supply and a location on the aircraft.

## DIGITAL TRANSFORMATION FOR TUAS ANALOG LINKS



### KEY FEATURES

- User selectable H.264 or MJPEG video compression
- Multiplexes IP data, compressed digital video, and asynchronous data
- Aggregate bit rate up to 5 Mbps with powerful turbo product code FEC at selectable rates: 1/2, 2/3, 4/5 or uncoded
- Receiver threshold of -96 dBm at 5 Mbps, rate 4/5 FEC without diversity
- Optimized for small, lightweight, low-power aircraft platforms
- Ground-based, built-in space diversity receiver mitigates common multipath fades
- Analog bypass modes in both aircraft and ground equipment allow complete backwards compatibility with predecessor systems

Conversion from an analog to a digital ISR data link has always required significant systems re-engineering of the airborne platform. The EnerLinksII DVA system substantially eliminates UAV re-engineering and provides all the benefits of digital processing. It includes IP sensor data, metadata, standardized video compression, extended-range performance, bandwidth and spectrum utilization, and transmission privacy. Analog bypass modes allow complete interoperability with predecessor analog systems enabling a painless, gradually phased upgrade program.

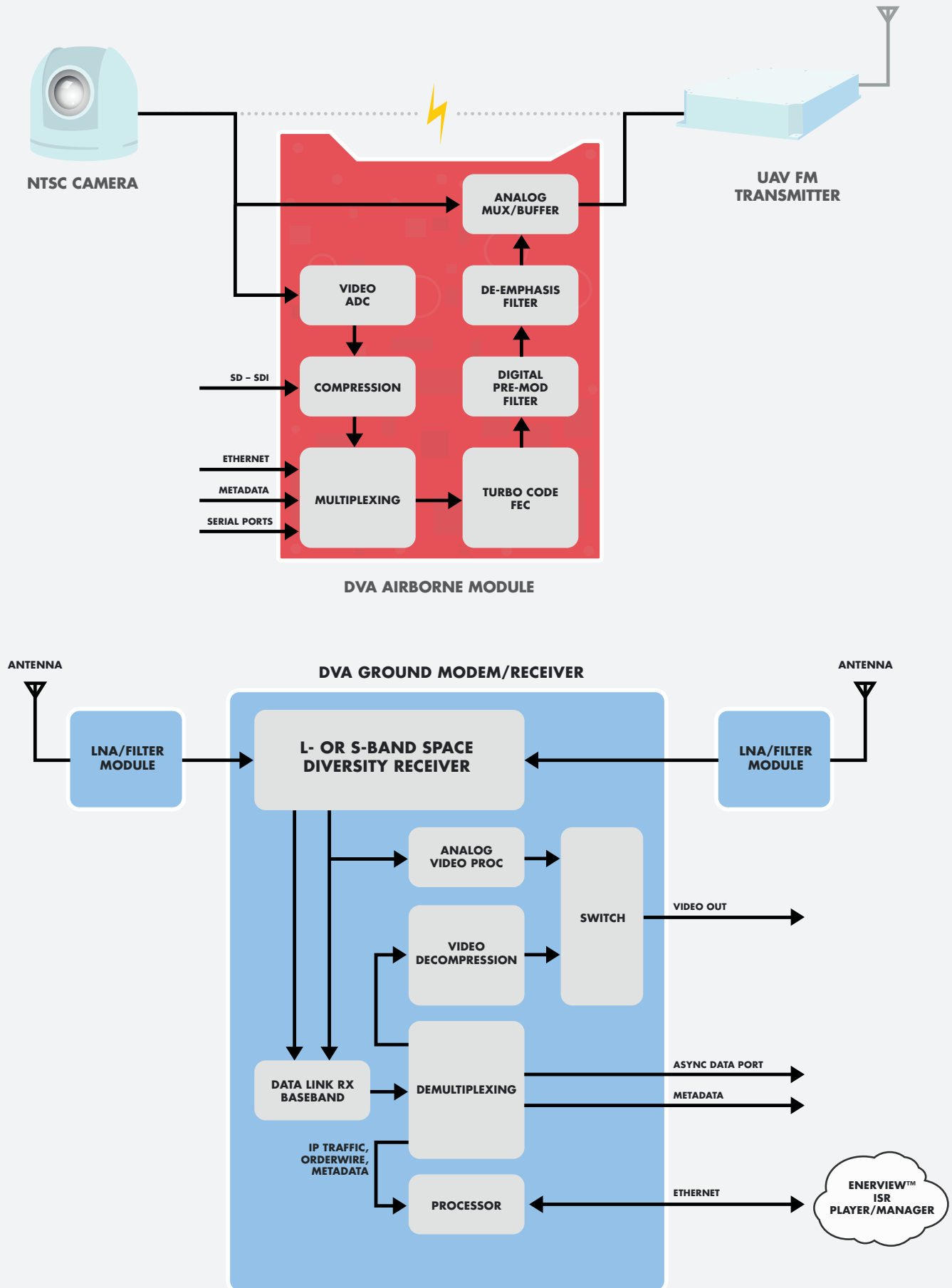
A compatible EnerLinksII Ground Modem/Receiver (GMR) provides the requisite signal processing and I/O to deliver the original sensor and telemetry content for display, exploitation or dissemination. It operates at either L-band (1700-1850 MHz) or S-band (2200-2500 MHz) and has a powerful diversity receiver capability that can operate as either an antenna space diversity or a frequency diversity receiver. Digital video data can be distributed from the GMR via any IP network for display, storage, and retrieval using the Windows-based EnerView™ player/manager application.

Like the EnerLinksII data link system whose protocols and waveforms it shares, the DVA system has unsurpassed RF coverage. The GMR uses a high-performance all-digital bit synchronizer that acquires in milliseconds and reliably maintains lock, even at a signal-to-noise ratio less than 0 dB. The turbo product code FEC provides near error-free performance when the modem produces a BER less than 1%. This yields a receiver threshold of -96 dBm; 12 dB better than most analog FM receivers. When the digital diversity combining feature is used in channels impacted by multipath fading, an additional 6 dB of improvement can often be obtained.



EnerLinksII Ground Modem/Receiver

# EnerLinksII DVA System Block Diagram



## DVA SENSOR INPUTS

### Analog Video:

- NTSC, PAL, CCIR and RS-170
- Adjustments for brightness, contrast, tint, and saturation
- Three selectable composite video inputs or one S-video input

**Digital Video:** BT.656 over SD-SDI

**Network Traffic:** UDP/IP over 10/100BaseT Ethernet

**Metadata:** Via TCP/IP over 10/100BaseT. Can be time associated to video.

**GPS:** 1 PPS used for Metadata timing

**Asynchronous Data:** 1 RS-232 port at rates up to 115 kbaud (or RS-422 up to 460 kbaud)

## INTEGRAL VIDEO COMPRESSION

Frame rate up to 30 FPS (NTSC) or 25 FPS (PAL)

Metadata tagged and time-associated to individual frames

### MJPEG:

Automatically adjusts frame rate to fill available multiplex bandwidth

**Compression Ratio:** User adjustable in 240 steps

**Resolution:** NTSC: 560x480, 560x240, 280x240  
PAL: 560x576, 560x288, 280x288

### H.264:

Baseline Profile Codec (level 3), I and P frames

**Resolutions:** NTSC: 640x480, 640x240, 320x240  
PAL: 720x576, 352x288

Bit rate adjustable from 50 kbps to 3.5 Mbps

## METADATA

KLV format, MISB RP0604 synchronization to H.264 video

GPS tagged to MJPEG video frames using RTC

MJPEG Time stamped via real-time clock

## MULTIPLEXING

Flexible EnerLinksII interoperable multiplexing dynamically allocates bandwidth and transports any combination of:

- 1 compressed video stream
- Network traffic (UDP/IP — max rate of IP traffic is user selectable)
- Asynchronous (serial port) data
- Metadata

Multiplexer aggregate rate from 50 kbps to ~5 Mbps

## DATA LINK

**FEC:** Turbo Product Code with user selectable rates 1/2, 2/3, 4/5 and uncoded (rates are approximate). Soft decision decoding.

**Modulation:** Gaussian-filtered FSK with BT = 0.5

- User selectable modulation rates from 35 kbps to 5 Mbps
- Premodulation signal amplitude is user programmable
- Selectable de-emphasis filter for use with analog video transmitters having pre-emphasis
- Aircraft DVA card operates with most L-band (1700-1850 MHz) or S-band (2200-2500 MHz) FM video transmitters
- Analog video bypass mode for backwards compatibility with legacy analog video systems

## GROUND RECEIVER UNIT

- Diversity receiver: dual antenna space or frequency diversity with options for L- or S-band. Selection diversity algorithm chooses best receiver based on block CRCs each 4096 bit times.
- Analog video bypass mode for backwards compatibility
- All sensor data is streamed out over IP network via multicast or unicast
- Operates with EnerView client viewer package and viewers based on industry standard video over IP transport protocols

## RECEIVER SENSITIVITY (dBm at LNA input)

	>2.5 MBPS	≤2.5 MBPS	<1 MBPS
Rate 1/2	-97	-100	-103
Rate 2/3	-96	-99	-102
Rate 4/5	-95	-98	-101
Uncoded	-85	-88	-91

## CONTROL & CONFIGURATION

GUI via web-based interface over Ethernet, or Command line interface via serial port

## INPUT POWER

### Airborne System

28 VDC MIL-STD-704D

Power consumption < 8 watts

### Ground System

24 VDC ± 4 V

Power consumption < 30 watts

## ENVIRONMENTAL

### Airborne System

**Operating Temp:** -20° to +70°C

**Non-operating Temp:** -40° to +85°C

**Altitude:** 70,000 feet

**Humidity:** to 95% non-condensing

### Ground System

Fan-less chassis

**Operating Ambient Air Temperature:** 0° to +60°C

**Non-operating:** -40° to +85°C

**Vibration:** consistent with section 514.4 category 20 of MILSTD-810F

Procedure 1, Figure 514.5 C-3 (wheeled vehicles)

Submersible in 1 meter water per MIL-STD-810F

## DIMENSIONS

4.75" L x 5.25" W x 1.5" H

## WEIGHT

1.36 lbs

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