Meeting the Challenges of High-Resolution Outdoor Imaging

When I think about **outdoor imaging**, the first challenge that always comes to mind is **lighting**. Harsh sunlight, deep shadows, glare, and sudden changes in weather can all disrupt image consistency in ways that are difficult to predict. But lighting is only one piece of the puzzle. In **high-resolution imaging**, the demands quickly multiply: vibration from airborne platforms, overwhelming data streams from modern sensors, and the struggle to **store or offload that data efficiently** all add layers of complexity. Together, these factors make outdoor imaging one of the most **technically demanding environments** for vision systems.

Key Challenges in Outdoor Imaging

- Handling **extreme and inconsistent lighting conditions**.

- Managing **motion and vibration** that cause image blur or distortion.

- Maintaining **high optical precision** for superior image resolution.

- Capturing and processing **massive high-bandwidth data streams**.

- Delivering **real-time results** without delays.

- Recording for **extended durations** without exhausting storage.

- Staying within **strict SWaP limits** (size, weight, and power).

- Efficiently **offloading and processing** data post-capture.

Each of these hurdles is significant on its own. Combine them, and you get a serious engineering challenge.

Why Standard Solutions Fall Short

Most **off-the-shelf systems**—pairing a high-resolution camera with a standard recorder or PC—work fine in controlled environments. But outdoors, their weaknesses quickly show: **limited bandwidth**, **rigid architectures**, **restricted storage**, and **bulky, power-hungry designs** can't keep up with modern mission demands.

That gap is what motivated us to **rethink how imaging systems can work together more efficiently**.

A Partnership Built for Real-World Demands

illunis and Gidel have partnered to deliver a **cost-effective, high-performance solution** that's flexible, modular, and ready for **high-resolution, high-bandwidth outdoor applications**. The synergy between the two technologies is what makes this collaboration powerful.

illunis contributes decades of expertise in **ultra-high-resolution cameras (51–250 MP)** featuring **global shutter sensors** that eliminate distortion and provide consistent results, even in motion. These cameras are **rugged, lightweight, power-efficient**, and built for customization—perfect for outdoor deployments. illunis also offers a range of **35 mm to large-format lens solutions** and **active Canon EF and RF lens mounts** with electronic **focus**, **aperture**, and **stabilization** control, including **power zoom RF support**.

Gidel provides **FPGA-based imaging platforms** that handle **real-time acquisition, preprocessing, and compression** of massive data streams. With features such as **HDR**, **white balance**, and **AI-assisted image processing**, Gidel's systems manage bandwidth efficiently and can **extend recording capacity by up to 10×**. Compact **edge computers**, like the **FantoVision20**, are engineered for **low-SWaP environments** where efficiency is mission-critical.

Together, this partnership bridges the gap between **raw sensor performance** and **field-deployable imaging systems**.

A Real-World Example: Aerial Infrastructure Monitoring

Imagine an **aerial inspection mission** to monitor power lines using the **illunis EMC2-103MPGlobal Shutter CMOS** camera paired with the **Gidel FantoVision20** edge computer.

FantoVision20 Edge Computer

The Application Demands

- **Resolution & Frame Rate:** The **EMC2-103MP** delivers **103 MP (11,276 × 9,200)** images at **7.0 fps** over **10GigE**, outputting **12-bit precision**. Each frame is approximately **155 MB**, generating a continuous **1.09 GB/s (~8.7 Gb/s)** data stream.

- **Mission Duration:** A **3-hour flight** at 7.0 fps would yield nearly **12 TB** of uncompressed data.

- **Motion Reliability:** The **global shutter** design ensures **distortion-free capture** under UAV vibration or turbulence.

- **SWaP Efficiency:** With a **440 g body** and **~7 W power draw**, the EMC2-103MP is **lightweight and power-efficient**, ideal for airborne payloads.

- **Turnaround Speed:** Post-mission **data offload** must be fast to minimize **downtime** between flights.

How illunis and Gidel Solve It:

The Camera – illunis EMC2-103MP Global Shutter CMOS

- **103 MP global shutter CMOS sensor** for ultra-detailed, distortion-free imaging.

- **3.2 µm pixel pitch** balances resolution and light sensitivity.

- **10GigE interface** for high-speed, long-distance data transmission.

- **440 g weight** and **low power (~7 W)** ensure easy UAV integration.

- **RF Lens Controller** supports **aperture**, **focus**, and **zoom control** for Canon RF lenses.

EMC2 10G Camera

The Processing & Recording – Gidel FantoVision20

- **FPGA-based frame grabber** handles the **1.09 GB/s stream** with zero frame loss.

- **Real-time preprocessing:** HDR, white balance, and filtering on-the-fly.

- **On-the-fly 10× compression** reduces mission data from **~12 TB to ~1.2 TB** while preserving full inspection quality.

- **High-speed NVMe storage** (>1 GB/s sustained) prevents bottlenecks.

- **Compact design** (~750g, ~30 W) ideal for UAV or aircraft integration.

- Optional **Jetson Orin AI module** enables **in-flight defect detection** and **real-time analytics**.

Data Flow in Practice

Parameter	Uncompressed System	With Compression (10×)
Data Rate	~1.09 GB/s	~109 MB/s
3-Hour Mission Data Volume	~12 TB	~1.2 TB
Storage Required	12× NVMe drives	1× NVMe drive
Offload Time (10 GbE link)	~5 hours	~30 minutes

The Outcome:

100MP+ Image Processing in Real-Time
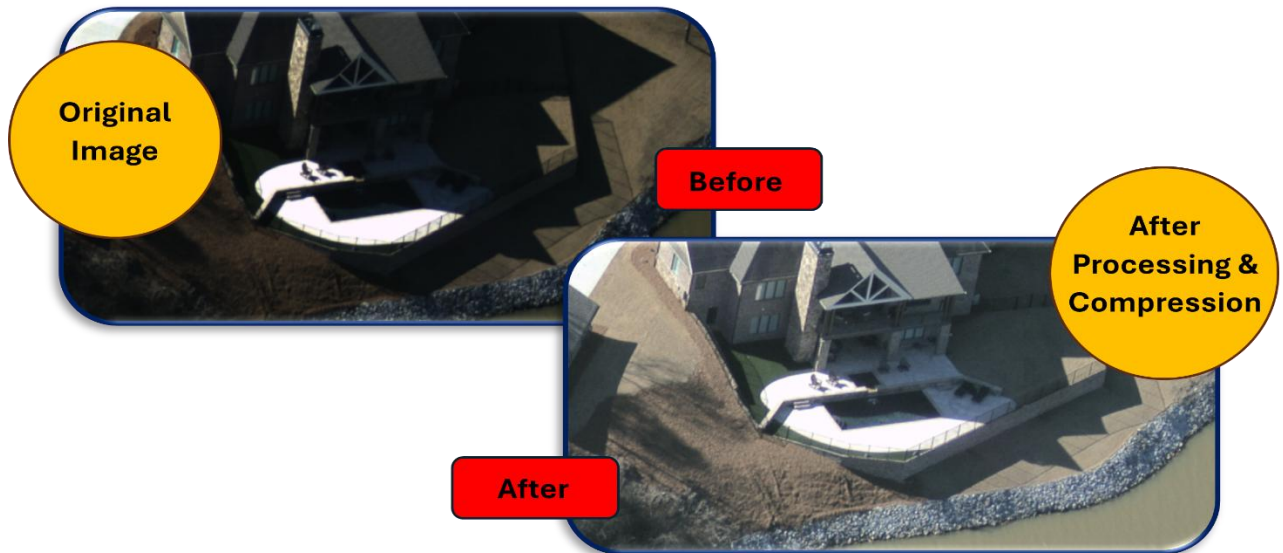
With **illunis** and **Gidel** working together, this system transforms a challenging imaging workflow into a **streamlined, deployable solution**:

- **No dropped frames** or **image distortion**, even under demanding conditions.

- **10× data reduction** enables long-duration missions without constant storage swaps.

- **SWaP goals met**, keeping payloads light and power-efficient.

- **Post-mission turnaround** reduced from hours to **under one hour**.

Instead of wrestling with data overload, teams gain a **refined, ready-to-analyze image stream** that drives faster, smarter decision-making.

Looking Ahead

Outdoor imaging no longer means choosing between **performance, cost, and practicality**. By combining **illunis's** high-resolution sensor and lens-control technology with **Gidel's** FPGA-based real-time processing and compression platforms, integrators and developers now have a **complete toolkit** built for **real-world field operations**.

It's a partnership founded on a shared goal: to make **cutting-edge imaging** both **technically robust and deployable**, turning complex missions into **achievable, efficient solutions**.

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