

Taking Multiple PCIe SSDs and NVMe to Performance Extremes

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Samsung's 950 PRO Series

- First consumer PCIe (Gen 3 x4) /NVMe SSD using 32L V-NAND technology in M.2 FF
- Designed for intensive workloads, such as computer-aided design, data analysis and engineering simulations
- Outperforms SATA SSDs by over 4.5 times in sequential read (2,500MB/s) and by over 2.5 times in sequential write (1,500MB/s)



- Puget Systems is based in the Seattle suburb of Auburn, WA, and specializes in high performance custom built computers
- Designs and manufactures high quality custom pc's including quiet gaming computers, desktops, workstations, laptops and servers
- Jon Bach, President and Founder of Puget, and a member of Intel's Technology Provider Board of Advisors



Award Winning System Integration Services

We design and manufacture workstations for:



Content Creation

Photography, Digital Audio Workstations (DAW), Post-Production, Visual Effects (VFX)



Engineering

CAD, Modeling, Simulations, Rendering



Scientific

Finite Element Analysis, Molecular Dynamics, Machine Learning



More

Gaming, Specialty Applications, and More

Case Study - LIDAR Terrain Mapping

BUCKEYE

Color Imagery and LIDAR Elevation Data
Collection, Processing, Dissemination

US Army Geospatial Center

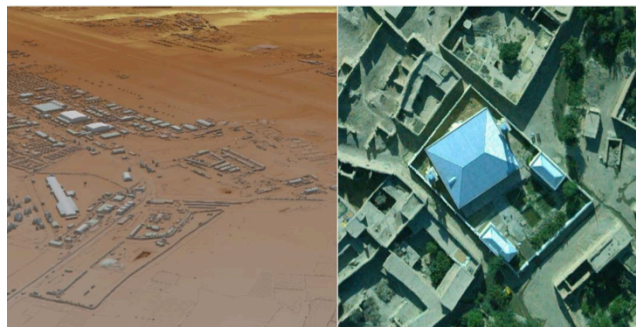


US Army Corps of Engineers
BUILDING STRONG



- Rapidly Collect, Process and Distribute **Unclassified** High Resolution and High Accuracy Color Imagery and Elevation Data for:

- Change Detection
- Intelligence, Surveillance, and Reconnaissance (ISR)
- Urban Mapping



Case Study - LIDAR Terrain Mapping

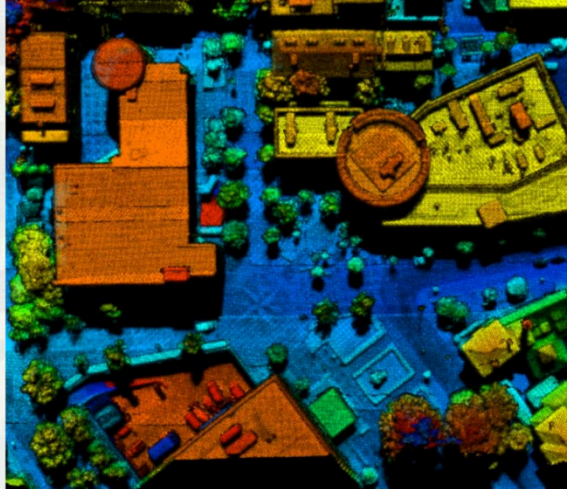
HALOE High Altitude LIDAR Collector

Capable of collecting LIDAR at 300 sq km / hour



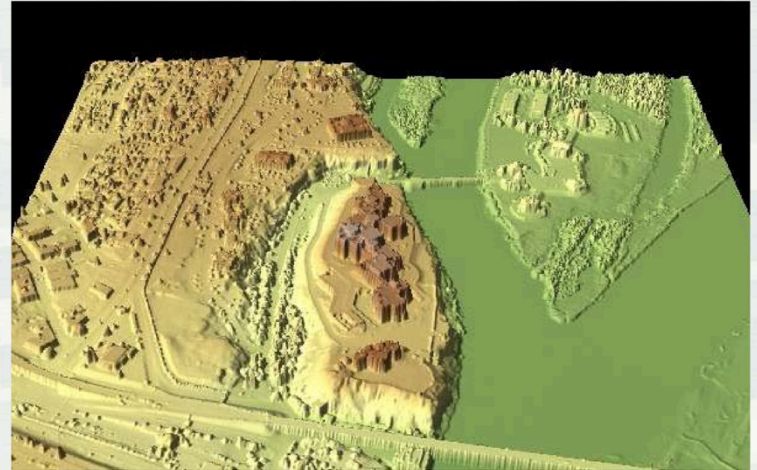
HALOE High Altitude LIDAR (49,000 ft)

Richmond (20 cm)

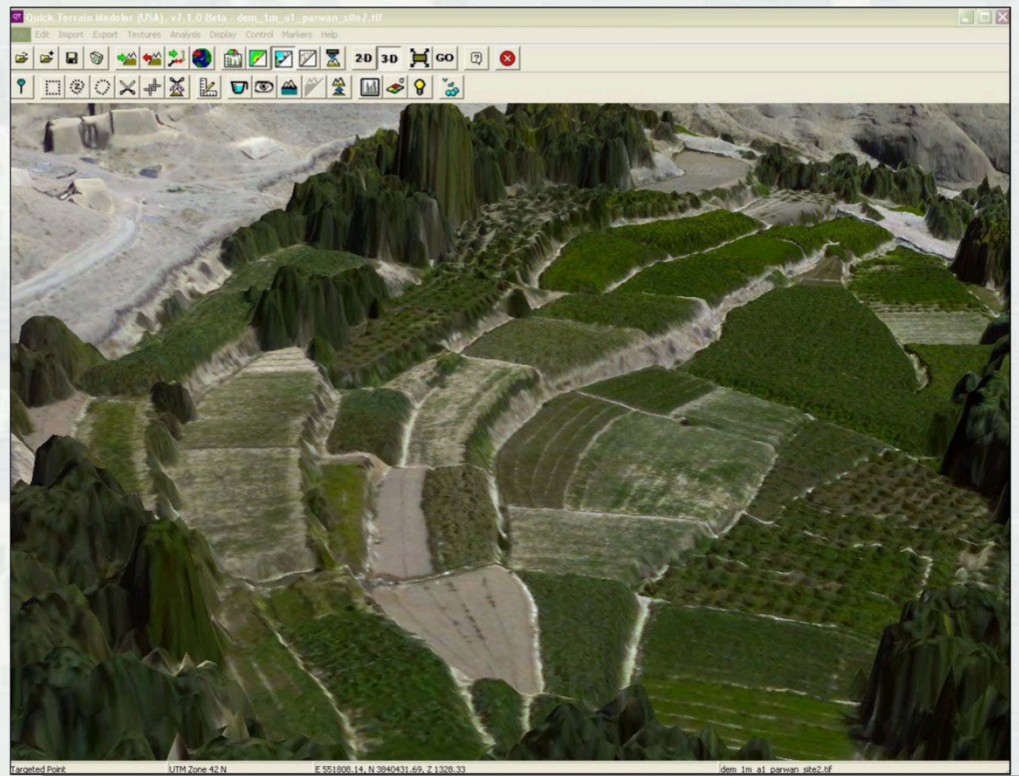


LIDAR Elevation Data

3D Shaded Relief of Tikrit, Iraq



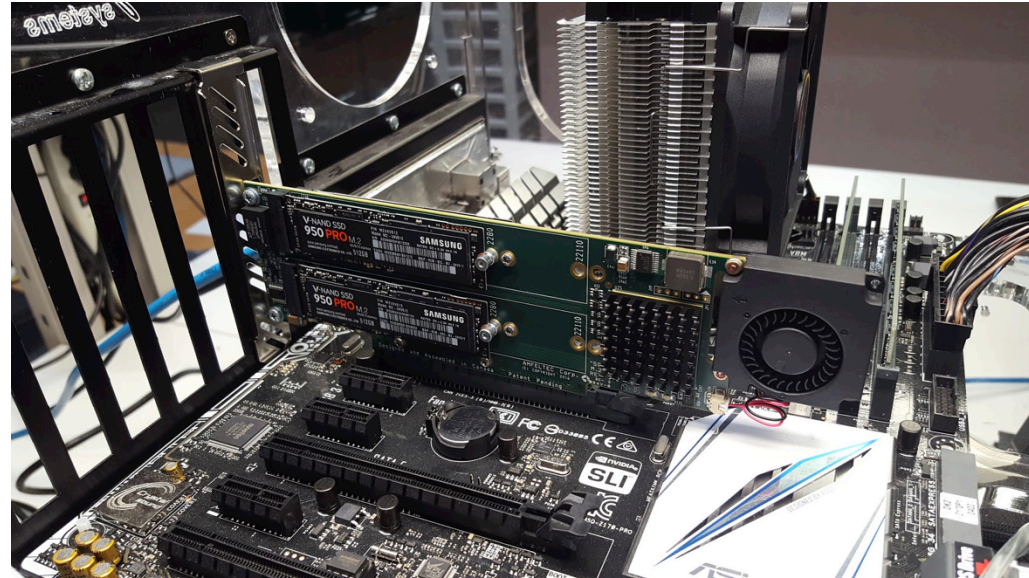
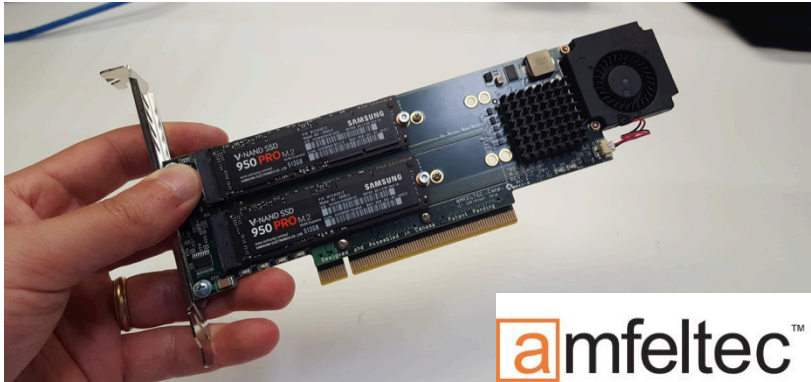
Case Study - LIDAR Terrain Mapping



- 3D Visualization
- Imagery over LIDAR in QR Modeler Software

Hardware Solution - Multiple NVM-E SSDs

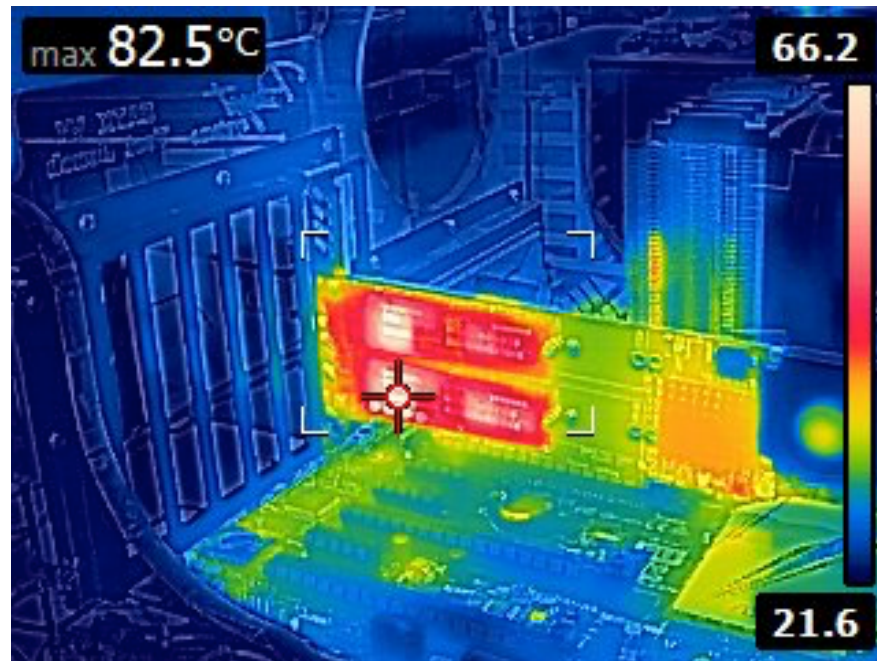
- PCIe 3.0 M.2 Carrier
- 4x 950 PROs [2 front/2 back]



Hardware Solution - Multiple NVM-E SSDs

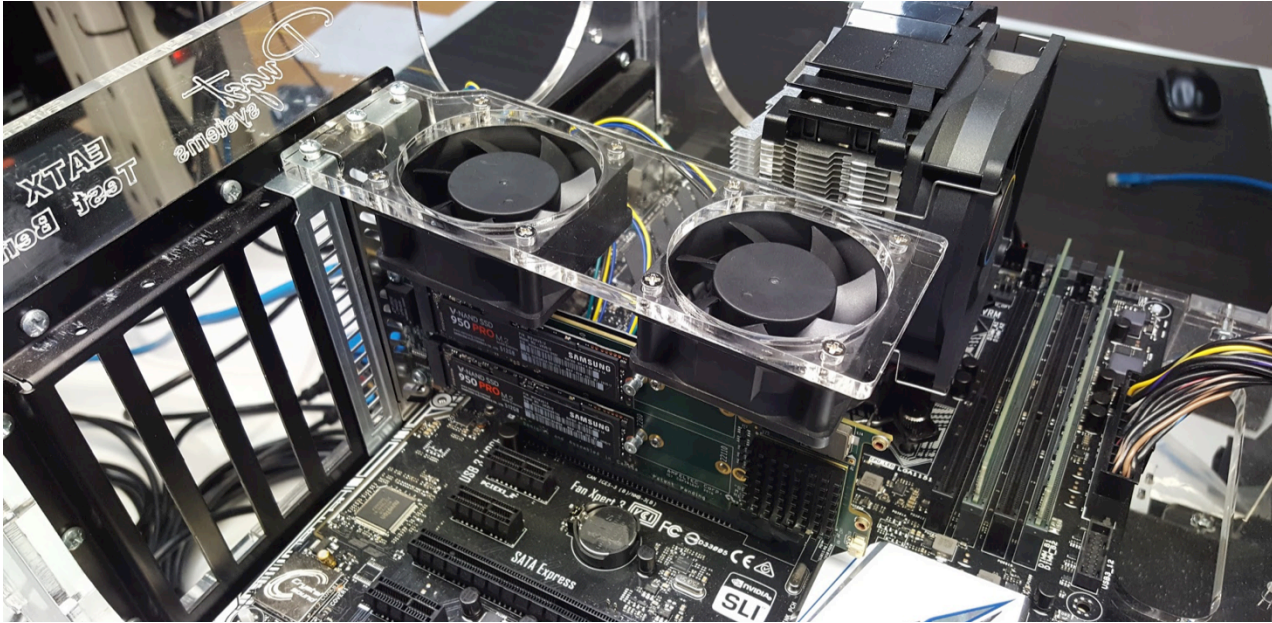


IDLE: M.2 drives at 45C, SLED at 45C



LOAD: M.2 drives at 80C, SLED at 45C

Hardware Solution - Multiple NVM-E SSDs



- Low Profile Hardware
- Custom Cooling Bracket

Hardware Solution - Multiple NVM-E SSDs



IDLE: M.2 drives at 35C, SLED at 45C

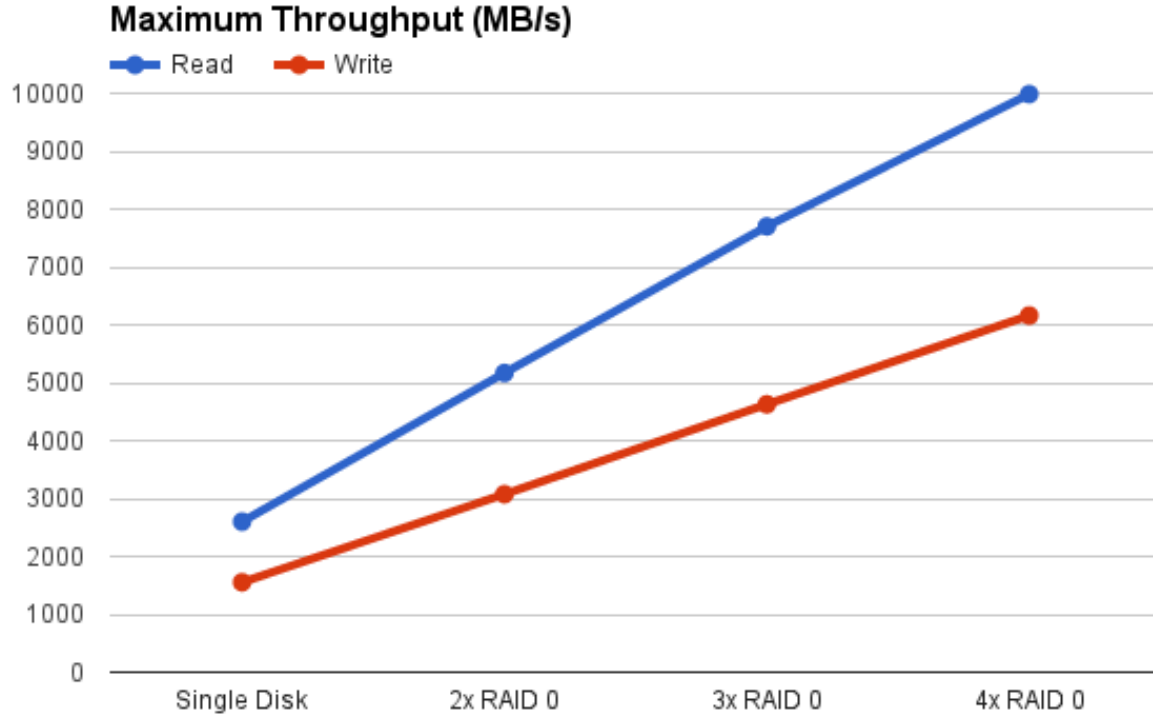


LOAD: M.2 drives at 50C, SLED at 45C

Hardware Solution - Multiple NVMe SSDs

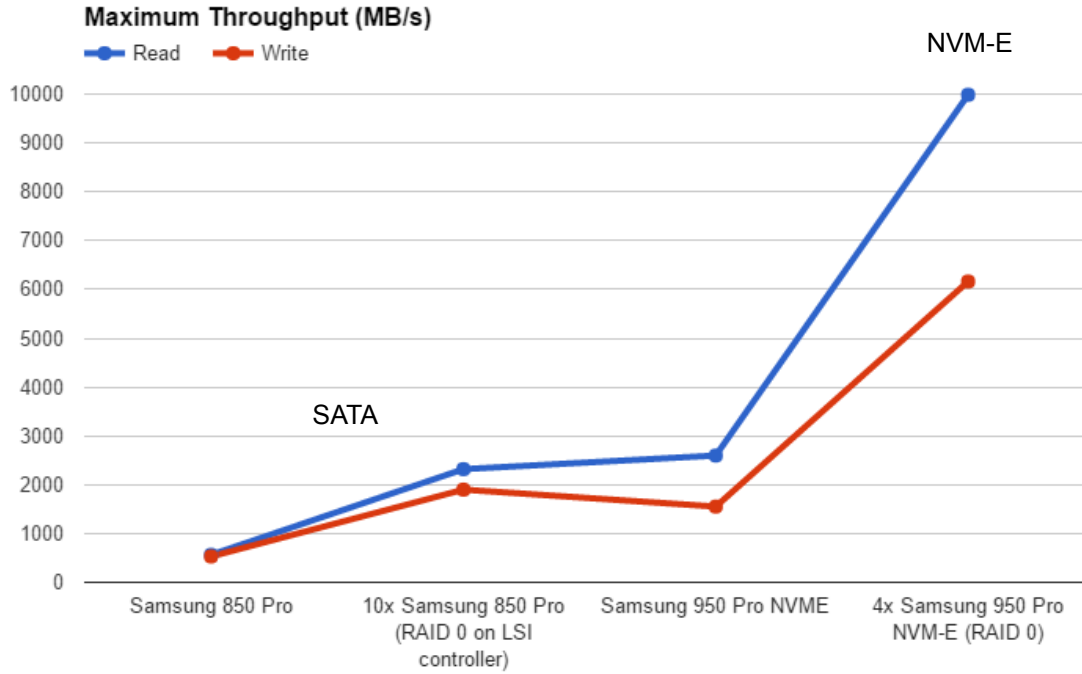


Hardware Solution - Multiple NVMe SSDs



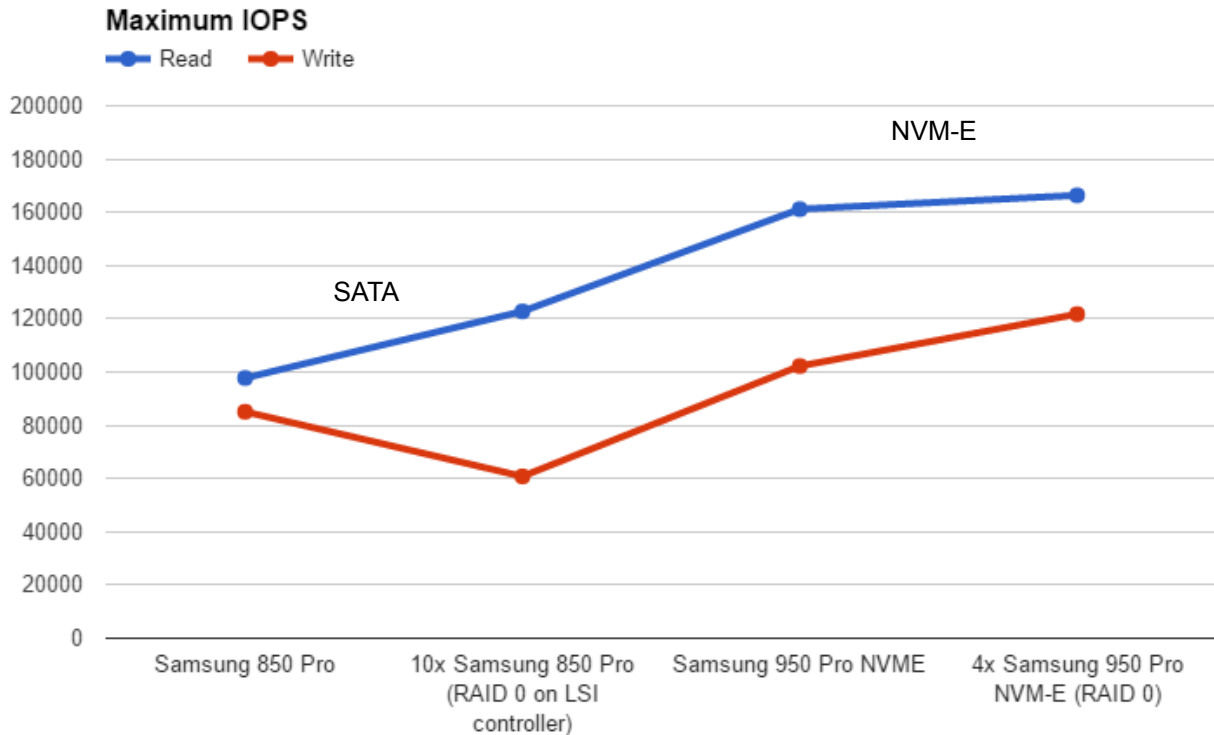


Hardware Solution - Multiple NVM-E SSDs



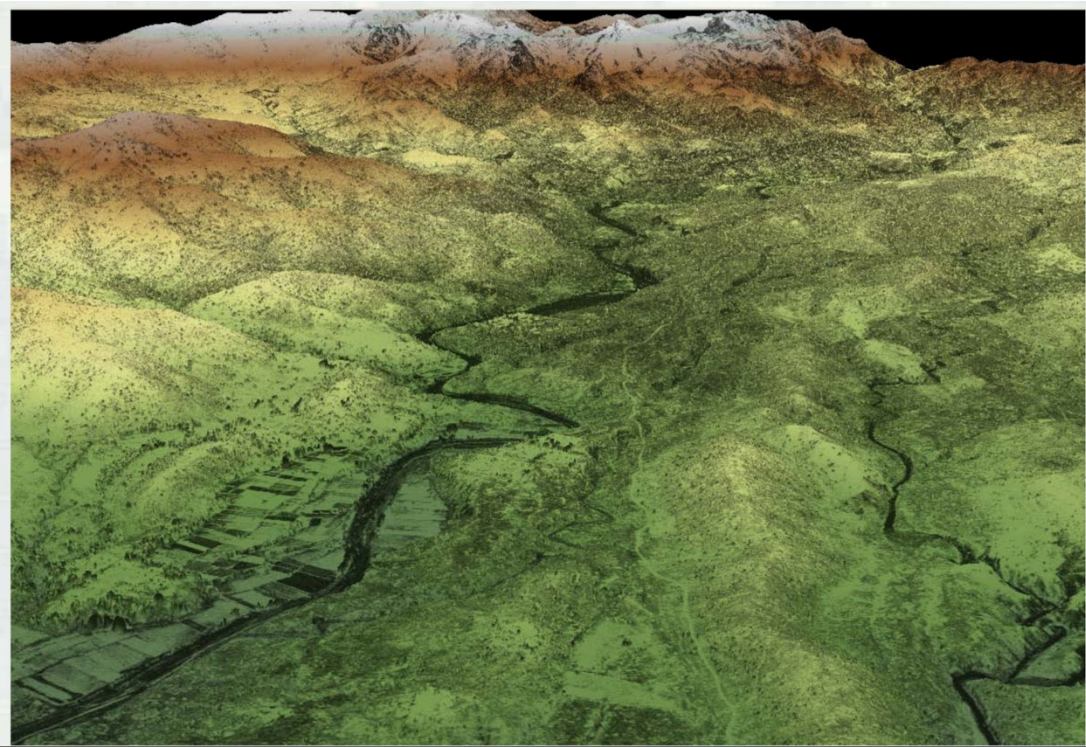


Hardware Solution - Multiple NVM-E SSDs



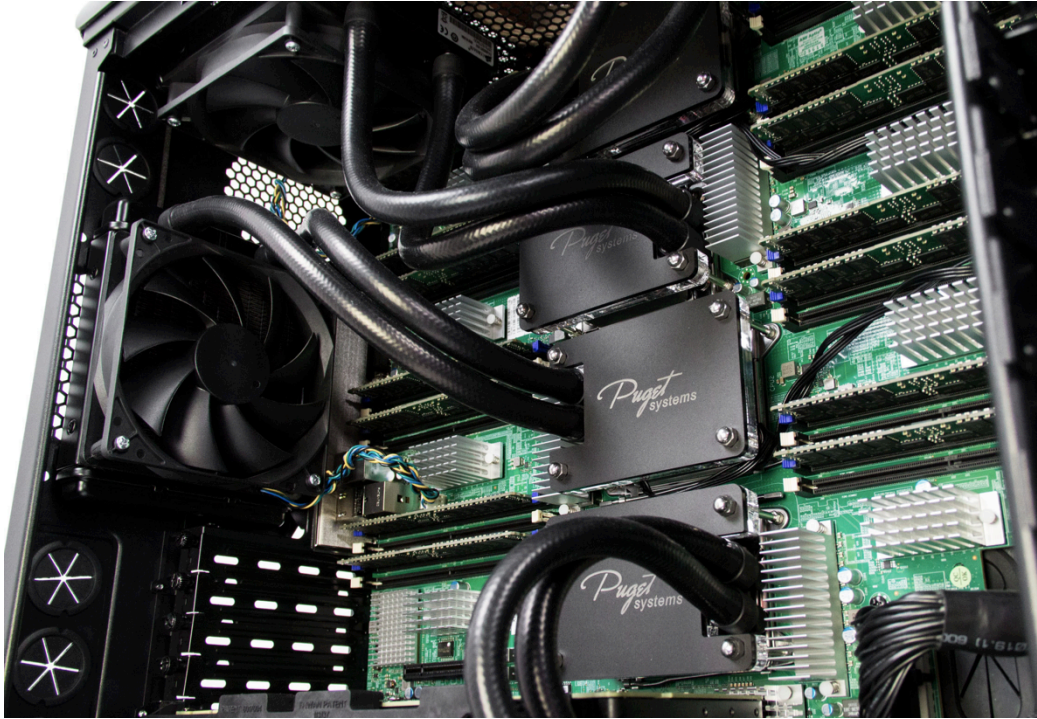


Hardware Solution - Multiple NVM-E SSDs



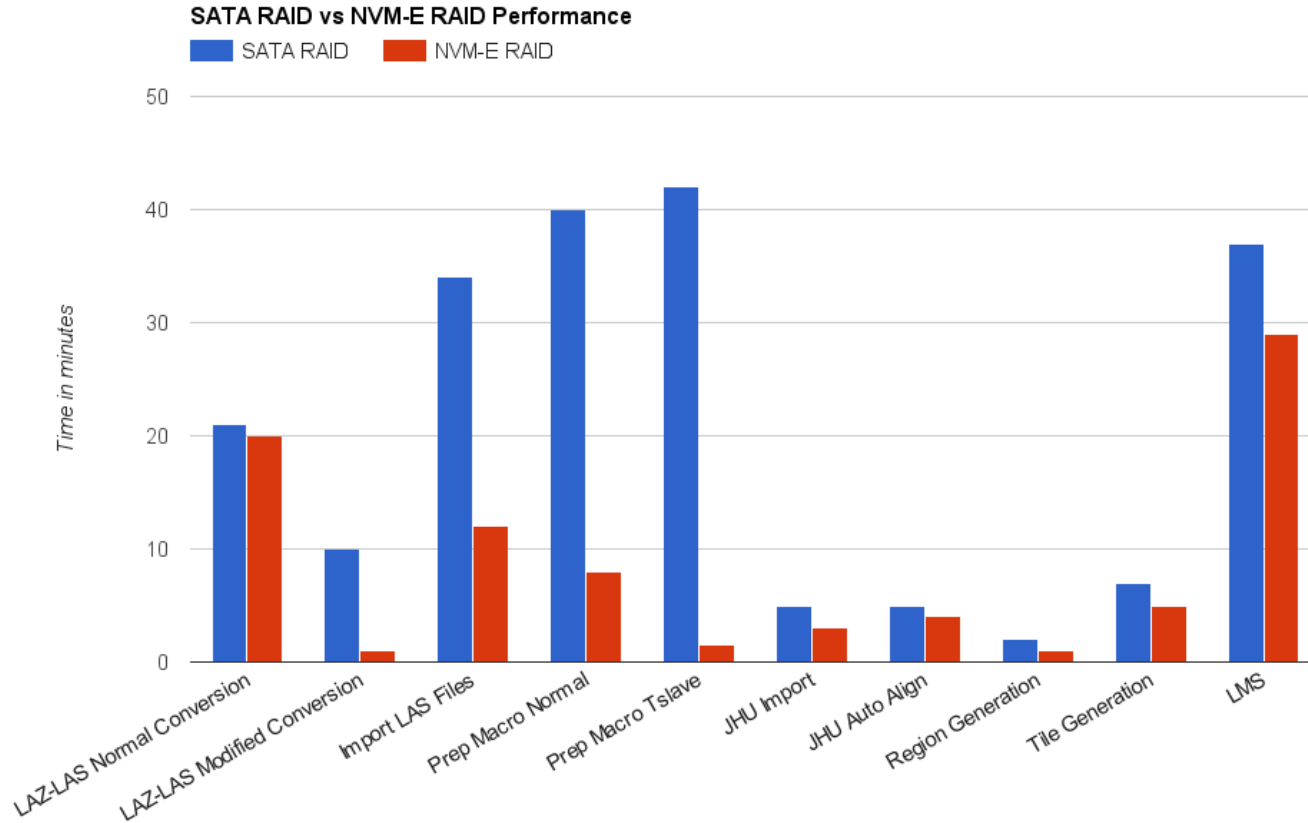
- LIDAR Elevation Data
- 3D Shaded Relief of DEM with Intensity Image (Khowst, Afghanistan)
- 200GB~2TB Data Sets per mission flight

Hardware Solution - Multiple NVMe SSDs



- Huge IO and CPU power requirements
- NVMe removes bottleneck

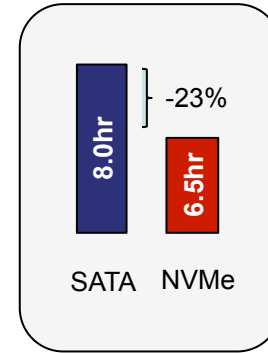
End User Application Speedup



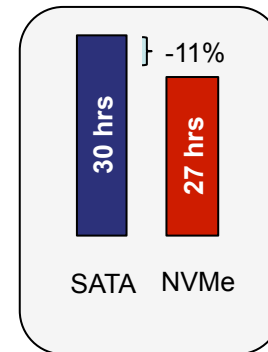
End User Comments

- A normal project covers an area of 50 square kilometers
- Processing the LiDAR data takes approximately:
 - 8 hours on SATA SSD array
 - 6.5 hours on NVM-E SSD array

- Processing the Electro-Optical data takes approximately:
 - 30 hours on SATA SSD array
 - 27 hours on NVM-E SSD array



LiDAR
23% Time
Improvement



Elec. Optic
11% Time
Improvement



End User Comments

- Attributed to gains:
 - Reading in data was considerably faster
 - Writing out processed data was considerably faster
 - Data manipulation was more fluid
 - Transferring large files to the PCI SSD was faster

“We are sold on this technology and would like to purchase a few systems built with these drives . The only question is how much storage can you squeeze into a system? ... How soon can we get them??”

- Remaining challenges -- disk size!