

Premise

Subsequent to a fact finding meeting between PNNL/Battelle and IntelliScience Corporation, a test was devised by PNNL to better understand the capabilities and possibilities of the IntelliScience technologies.

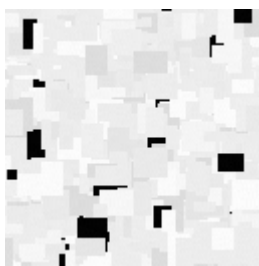
Scenario

- PNNL created a data cube from a PNNL proprietary system.
- Data cube is 128x128x128 representing 128 bands of simulated imagery of a single time slice.
- Cube consists of a background, noise and the PNNL user determined elements implanted within the cube.
- Implanted elements and frequencies where detection should be expected are not disclosed to IntelliScience.
- BSQ (band sequential) files sent to IntelliScience with header description, excluding materials, locations or example image.
- PNNL states that a plume of an undisclosed and location gas is within the cube and requests IntelliScience attempt to “see” the plume.
 - 2 bsq files sent, one with a more obvious plume and one where the plume should be more difficult to detect.

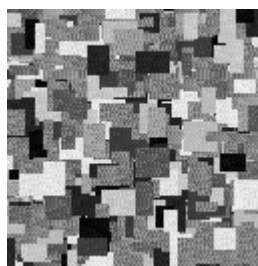
IntelliScience Actions

- Initial action was to open, segment and create a visualization of the BSQ file set.
 - 3 different visualizations created by 3 independently working IntelliScience software engineers.
 - Total time required 4 hours.
 - Results (see figure 1)

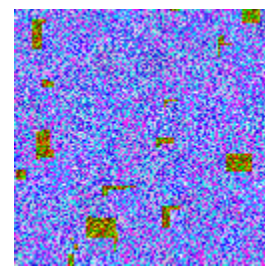
Figure 1



Original Visualization
 Consistent with PNNL
 Orientation Upside Down



Adjusted Visualization
 Providing More Differentiation

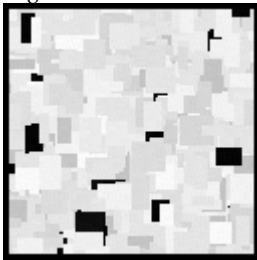


Color Visualization
 Providing Greater Data Depth
 PNNL Provided Floating Point
 4000 values

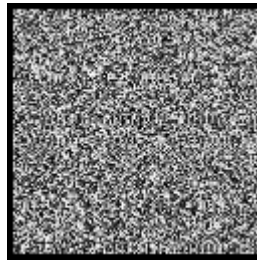
IntelliScience correctly visualized the PNNL data with the exception that it oriented the imagery upside down. Following the creation of the 3 visualizations, the visualization containing the broadest available data was opened within the IntelliScience data analysis application. A group of nearly 60 of the more than 600 algorithms were used to transform the slices of the cube to “see what we could see”.

The IntelliScience transformations yielded positive results in the majority of the bands of both cubes. The results in the strongest band are presented below in figures 2-7. Of significant importance is that the IntelliScience transformations were performed on a laptop computer at an average speed of approximately 25 milliseconds per algorithm. Unexpected and beneficial results found are presented in figures 9-11.

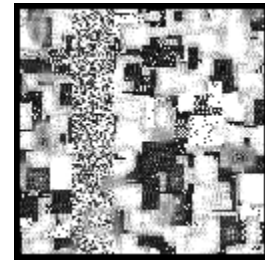
Figures 2-8



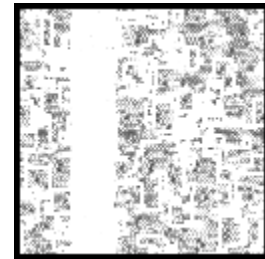
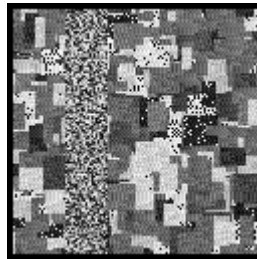
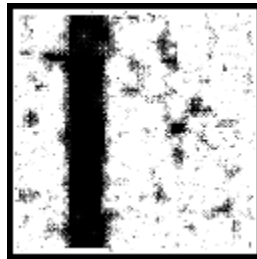
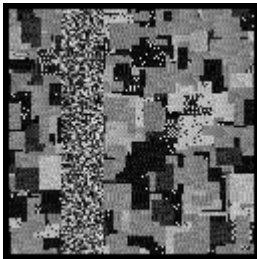
Alg – reveals background



Alg reveals noise

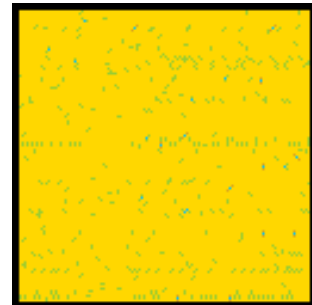
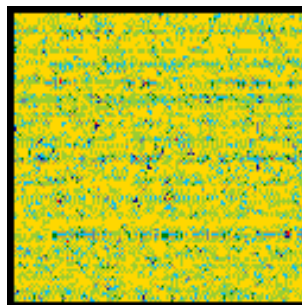
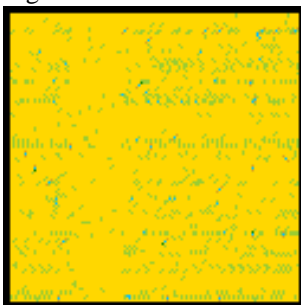


Alg reveals implanted elements



Numerous Algorithms revealed the plume of gas (the band extending vertically in the left half of the image) 4 of the many positive detections shown here.

Figures 9-11



Evident in these three algorithm transformations are horizontal lines of varying size vertical marks. When presented to PNNL, it was determined that the IntelliScience technology found and presented here sets of system artifacts generated unintentionally by the custom software used by PNNL.

Conclusion

Based on the findings above and the speed in which the demonstrated technologies were able to handle, analyze and present the imagery and results, we believe that further refinement of the application, with the assistance of domain experts at PNNL, will produce a robust yet nimble application that can provide accurate, fast and revolutionary analysis and visualization in a system that can easily and naturally evolve as political, physical, technical and threat environments evolve.