

 digital harmonic™

revealing the **unknown**



Foundational Technologies

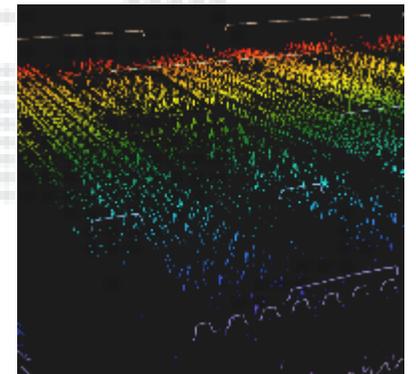
22 issued patents globally



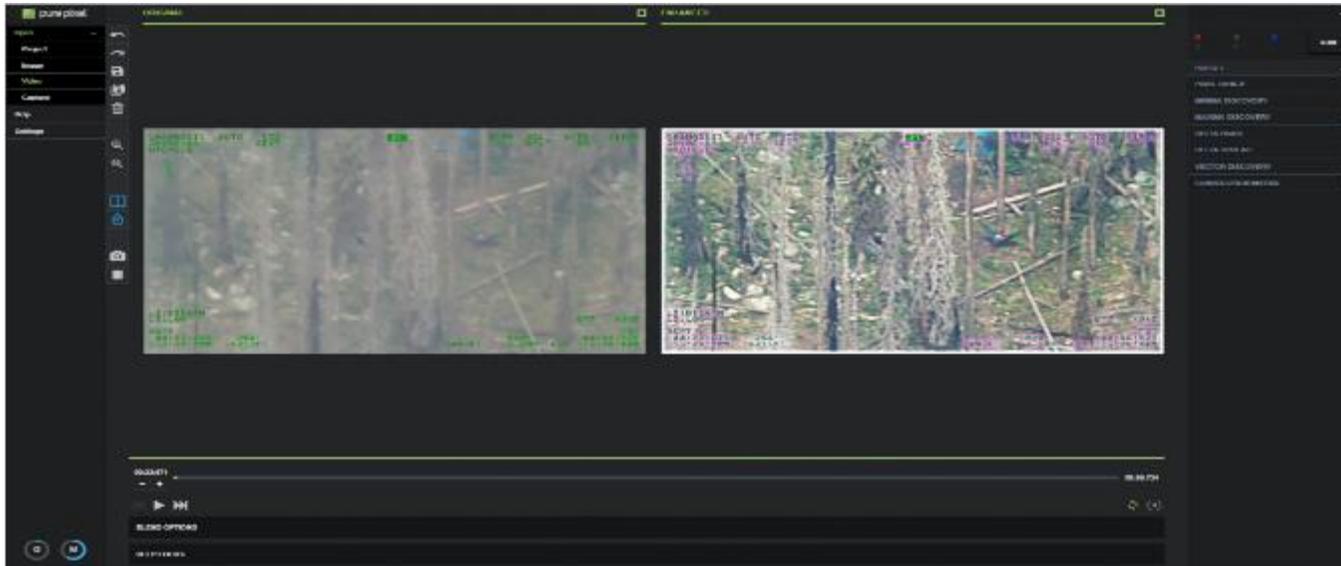
The application of brute force mathematical scoring and adjusting of pixel values based on neighborhood relationships which reveals new data in images



New extraordinary multi-dimensional measurement, analysis and separation of complex compound waveforms



PurePixel (PPxl) is an agnostic imagery improvement tool that discovers unseen data within images, including Full Motion Video (FMV). PPxl can improve the output from Electro-Optic (EO), Infrared (IR), Synthetic Aperture Radar (SAR), Multi- and Hyperspectral imagery (MSI and HSI) Imaging systems.



PurePixel can:

- Process and enhance video in real-time
- Remove effects of adverse weather conditions
- Remove haze from images
- Extract information from under- and over-exposed images
- Algorithmically support target recognition
- Enhance images in forensic applications

Accessing High-Fidelity Information

ORIGINAL ENHANCED

Open Source Machine Learning (YOLO) detection of objects in PurePixel enhanced video



00:42:576 02:44:831

BLEND OPTIONS

YOLO unable to classify anything in the original video on left

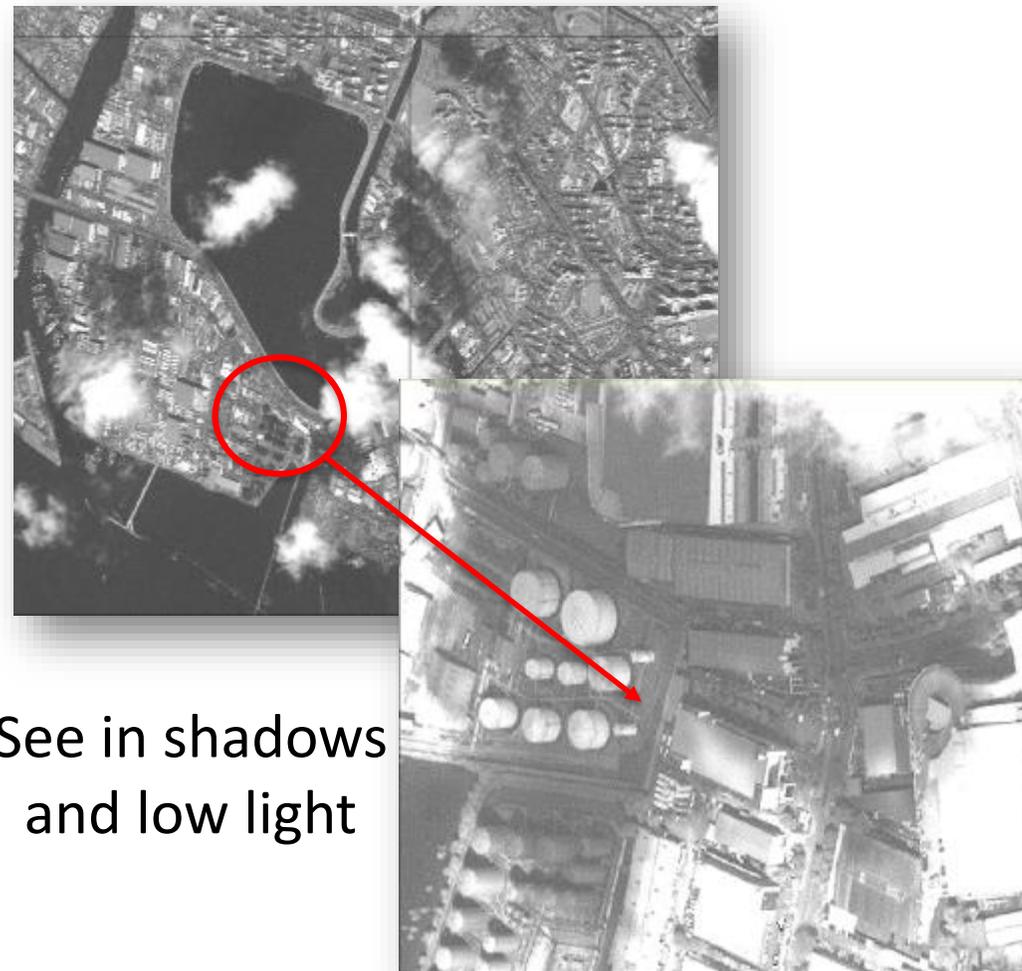


Real-time Video Enhancement <1 frame delay, remove atmospheric interferences

State of the Art



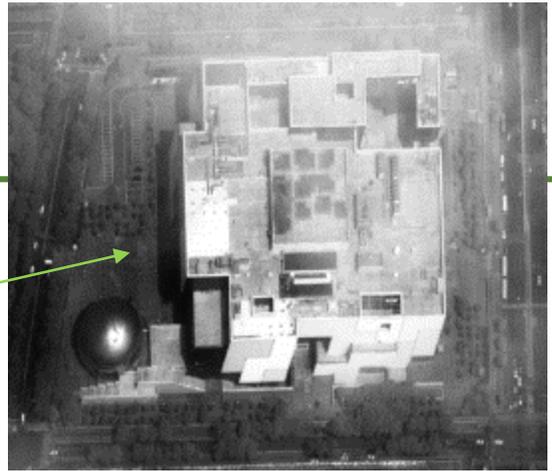
PurePixel Enhanced



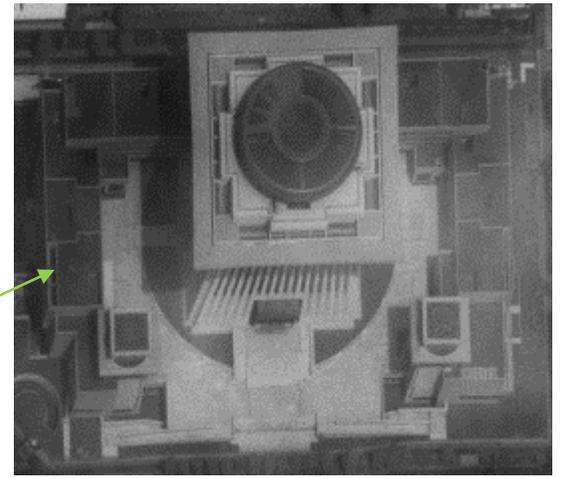
Cloud Cover – Satellite Imagery



Cloud Cover – Zoom



ppxl™



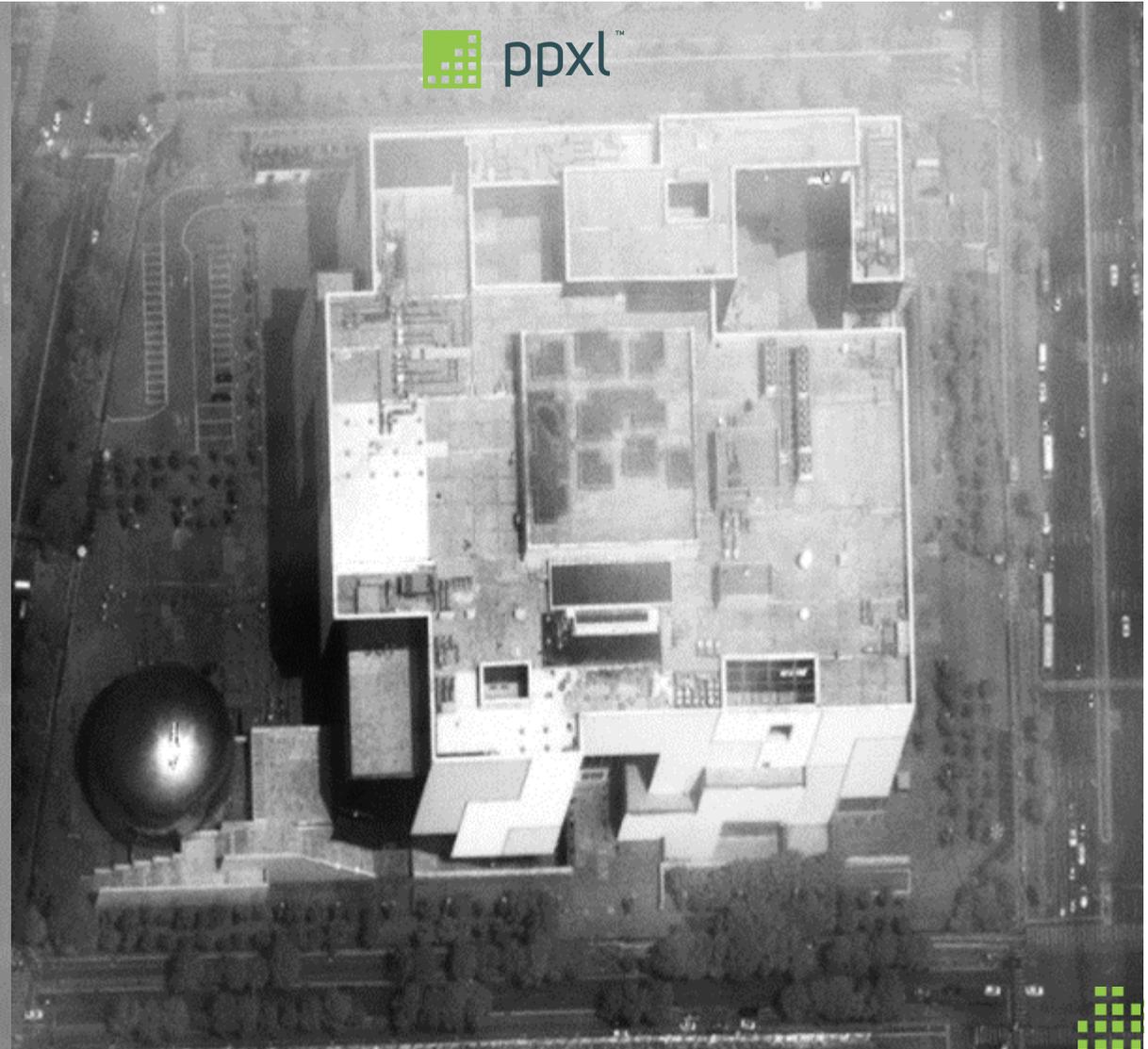
ppxl™



ppxl™



Cloud Cover – Satellite Imagery Zoom



Cloud Cover – Satellite Imagery Zoom

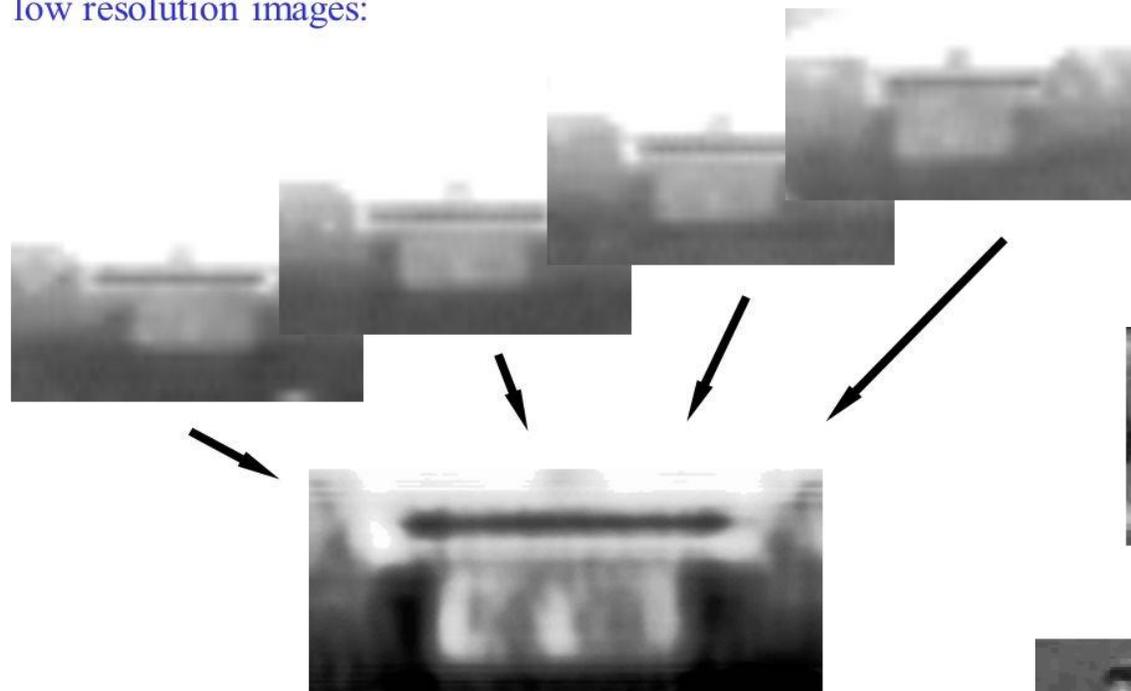


Haze Removal – MX-20 Source

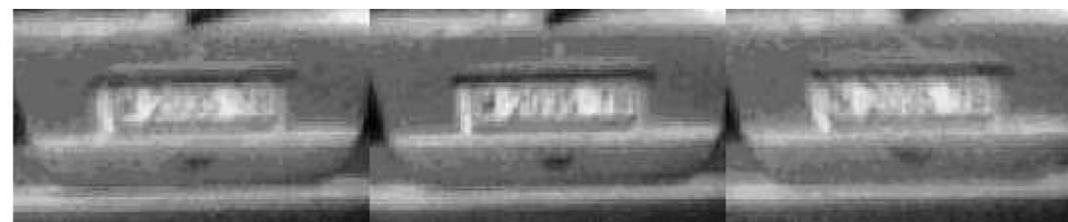


Super Resolution Image Enhancement

Super-resolution from multiple low resolution images:



Number plate reconstruction



(a)



(b)



(c)



(d)



Auto Tune – Programmatic Parameter Optimization of PurePixel



Original



ppxl™





Original



 ppxl™

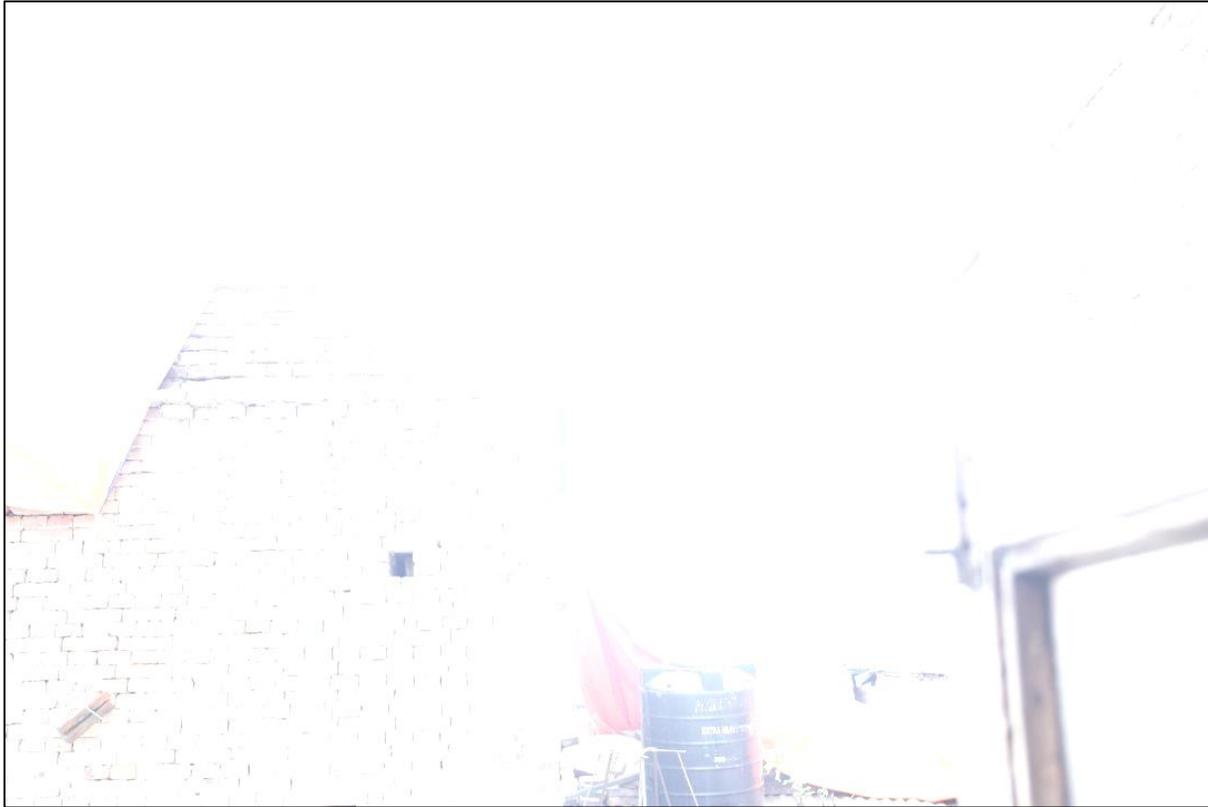


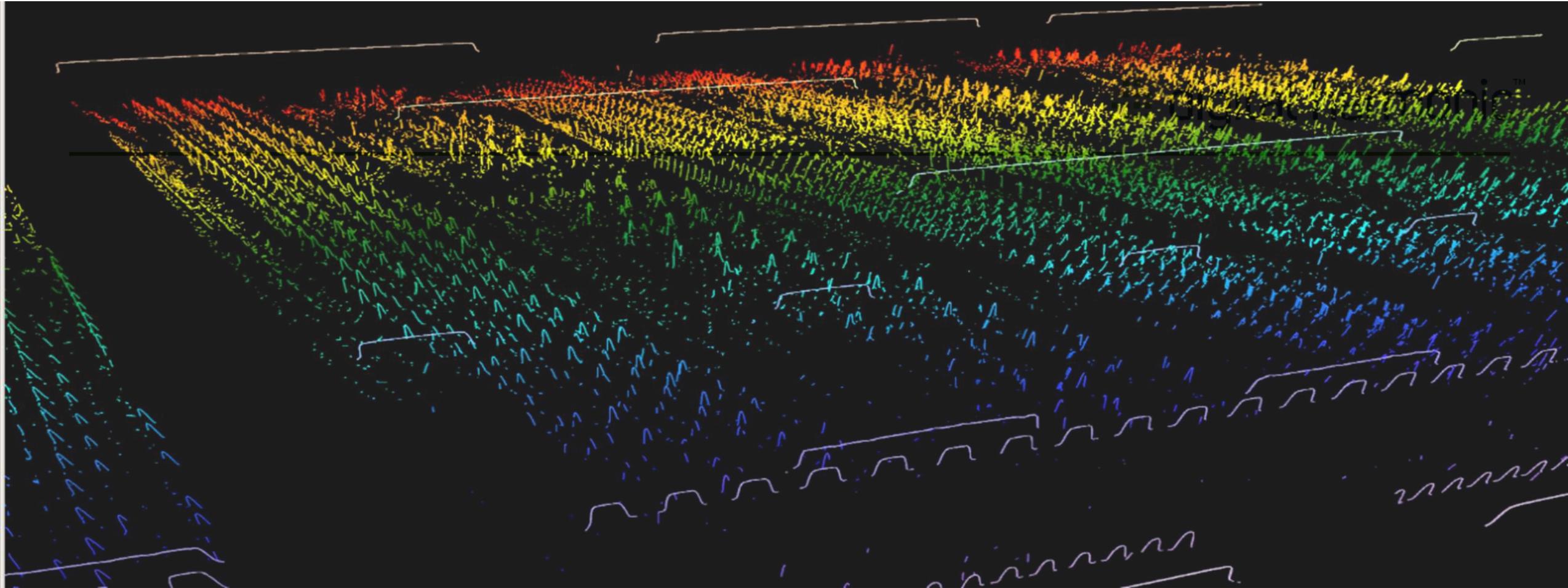
Original



Over Exposed Image

Original

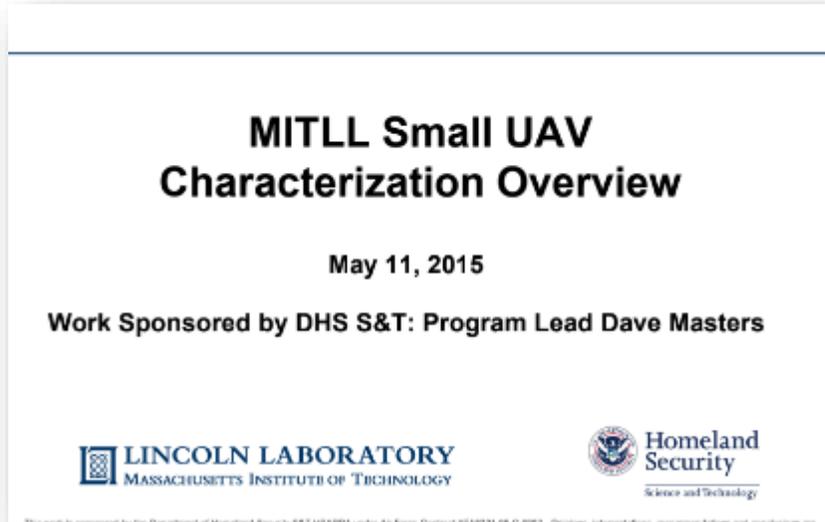




precision™
MEASURING MATRIX

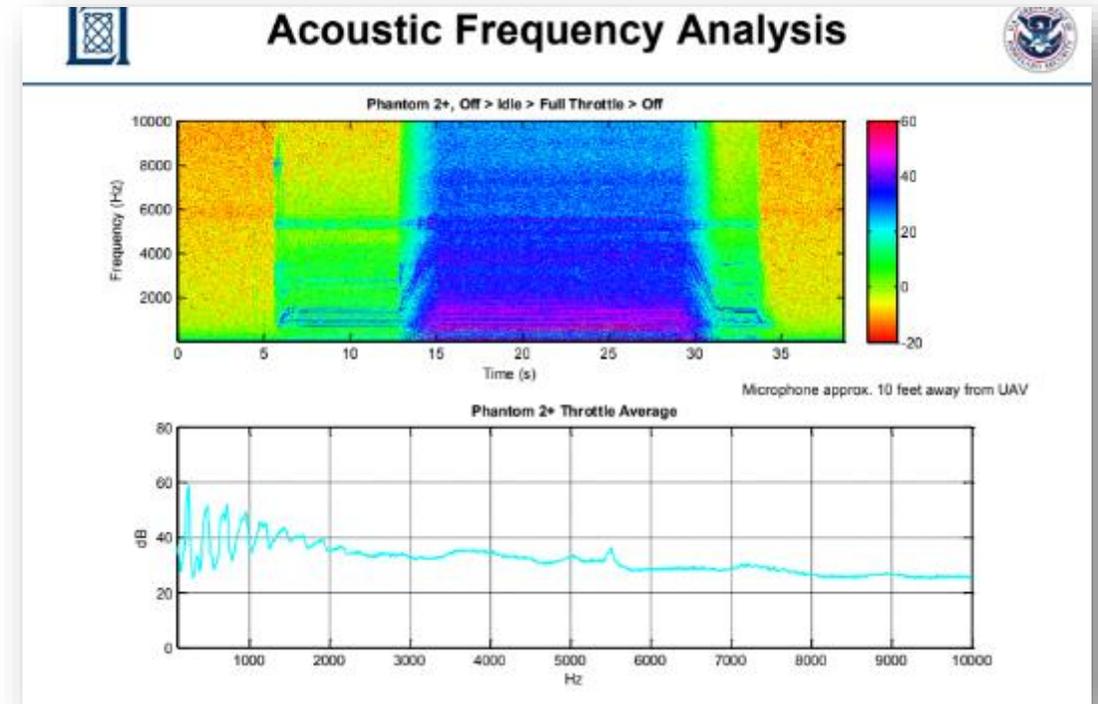


PMM provides deeper insight Drone Signatures

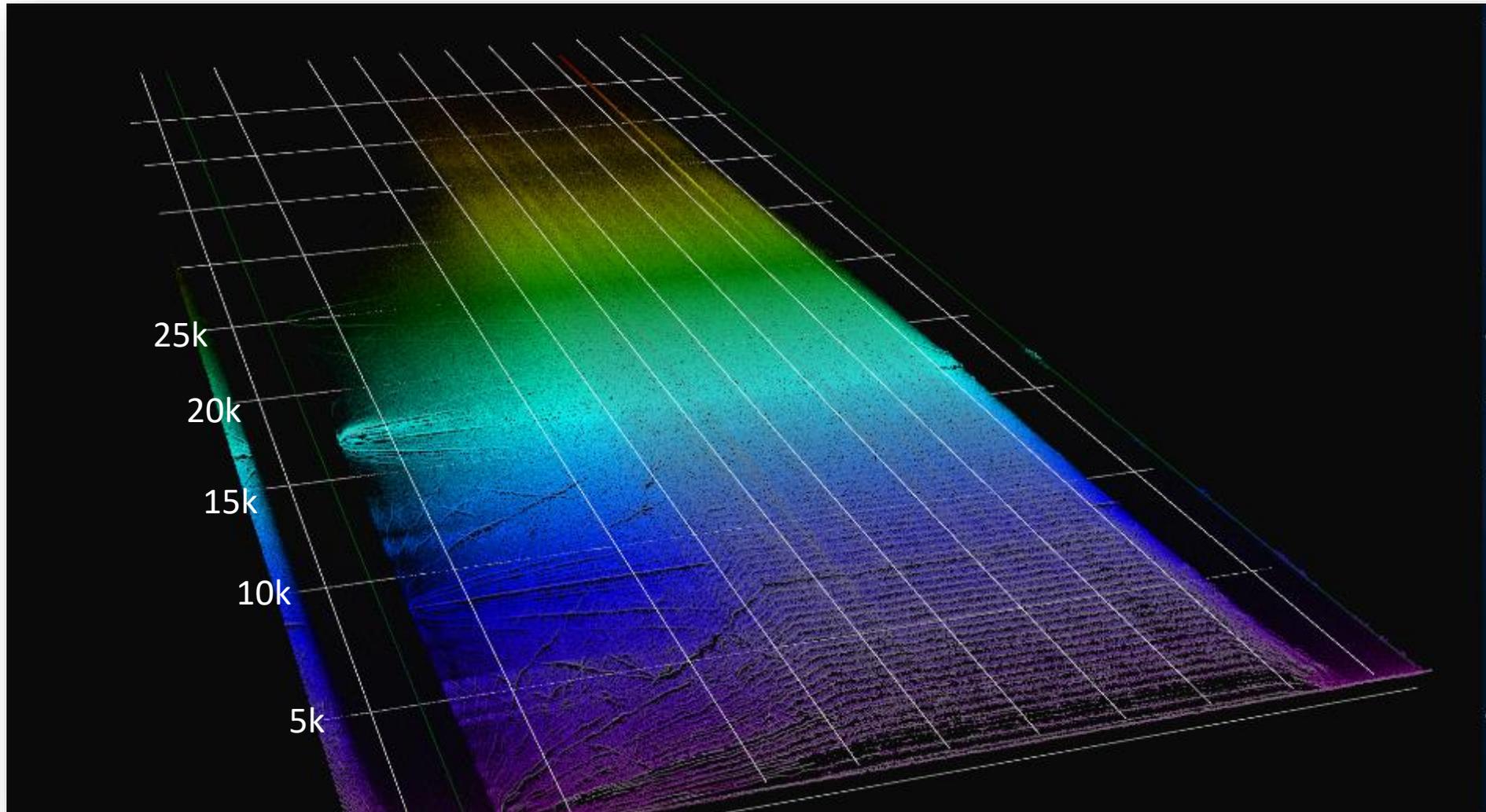


MITLL data:

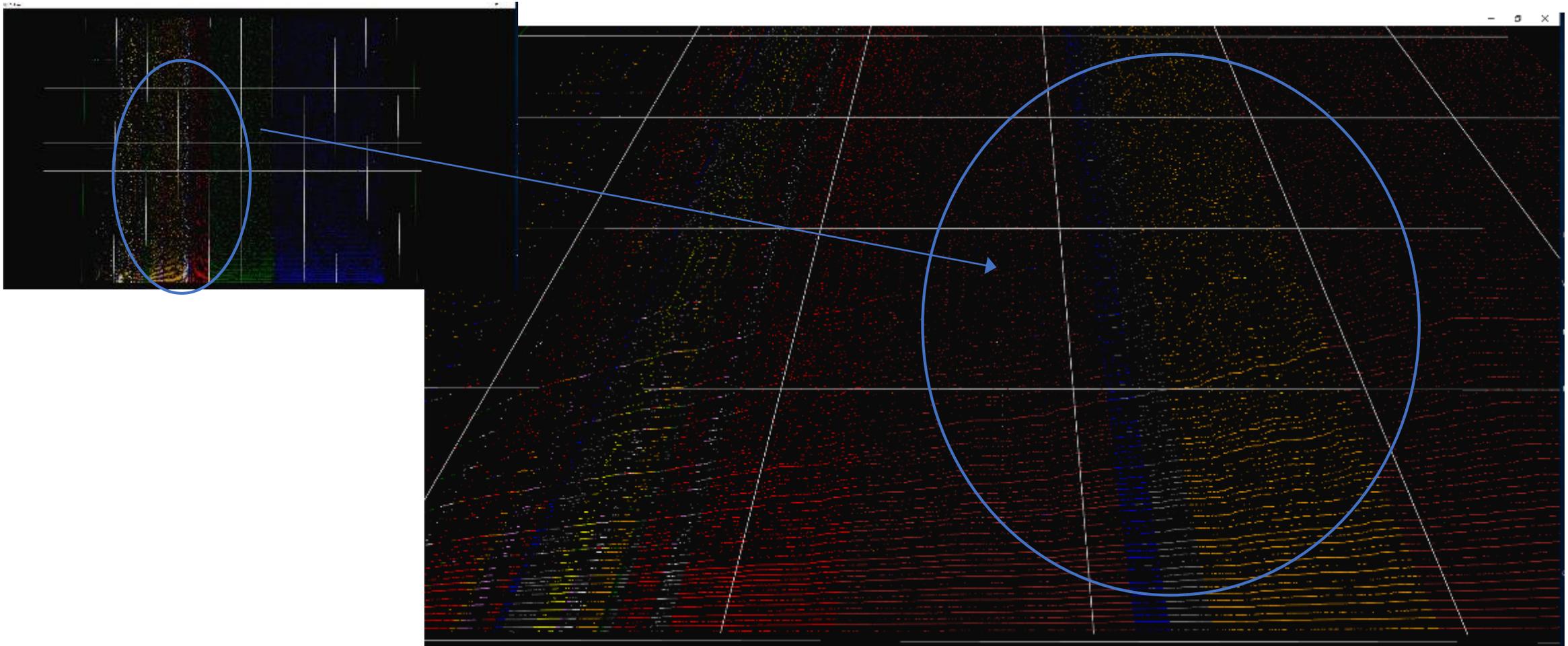
- Information was available in the collected data that was not being used
- The answer to the original question (How to uniquely ID each drone) lay outside the frequency range that had been investigated.
- Current analysis techniques do not allow the identification of simultaneous signal activity with the ease that PMM does.



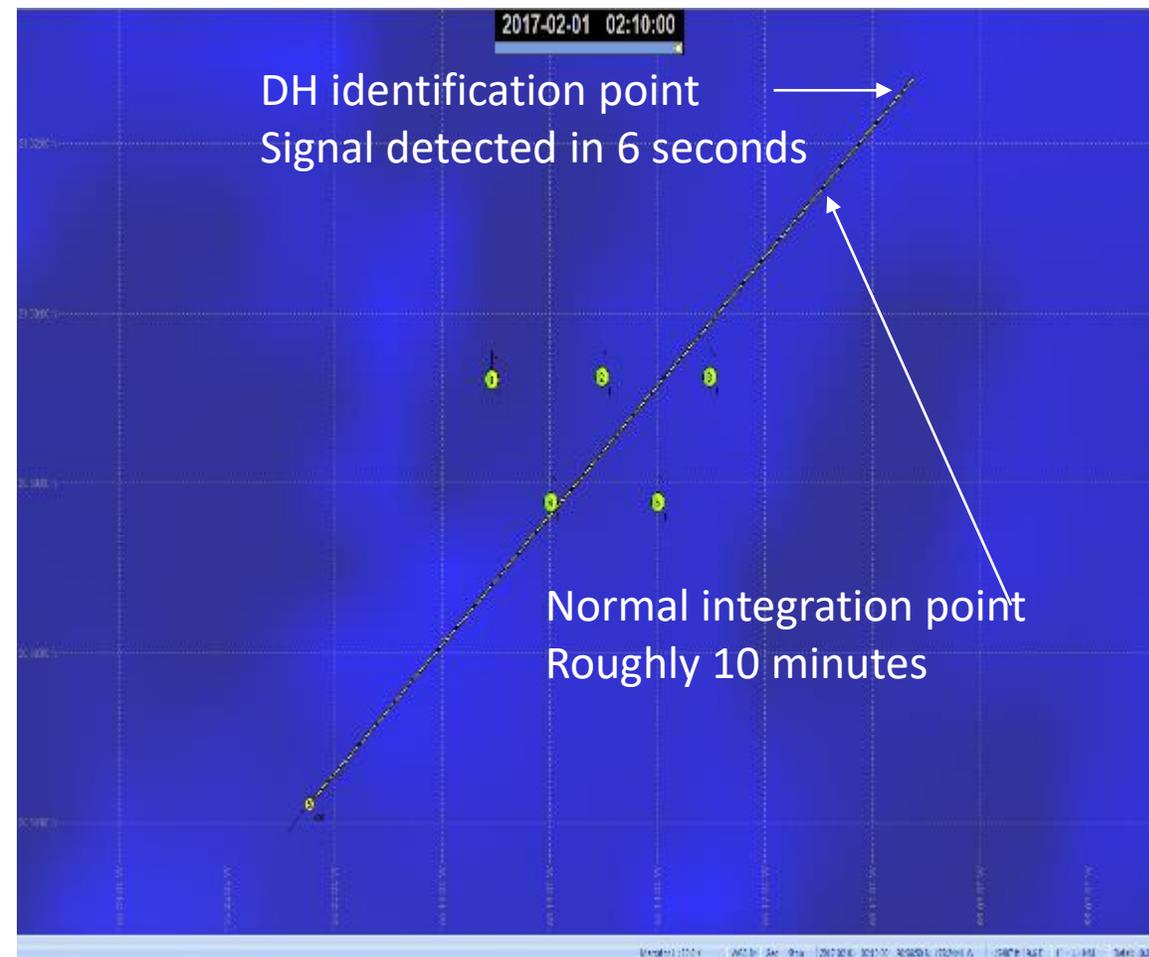
PMM View of Drone Signatures



PMM View of Drone Signatures



- PMM signal discovery started as early as 6 seconds into the 40-minute files
- Clear detection of main XXXHz in all sensors at 2 Sec increments from the start of all files
- Noted Lloyd's Mirror on Sensor 1_03
- Detected multiple signals below the ambient noise floor
- Doppler shift noted on XXXHz and XXHz on Sensor 1_03

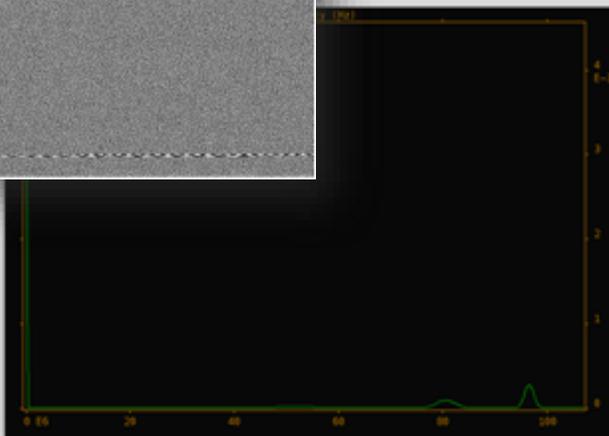
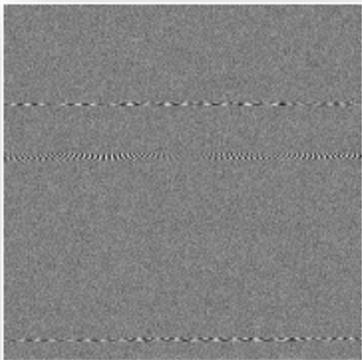
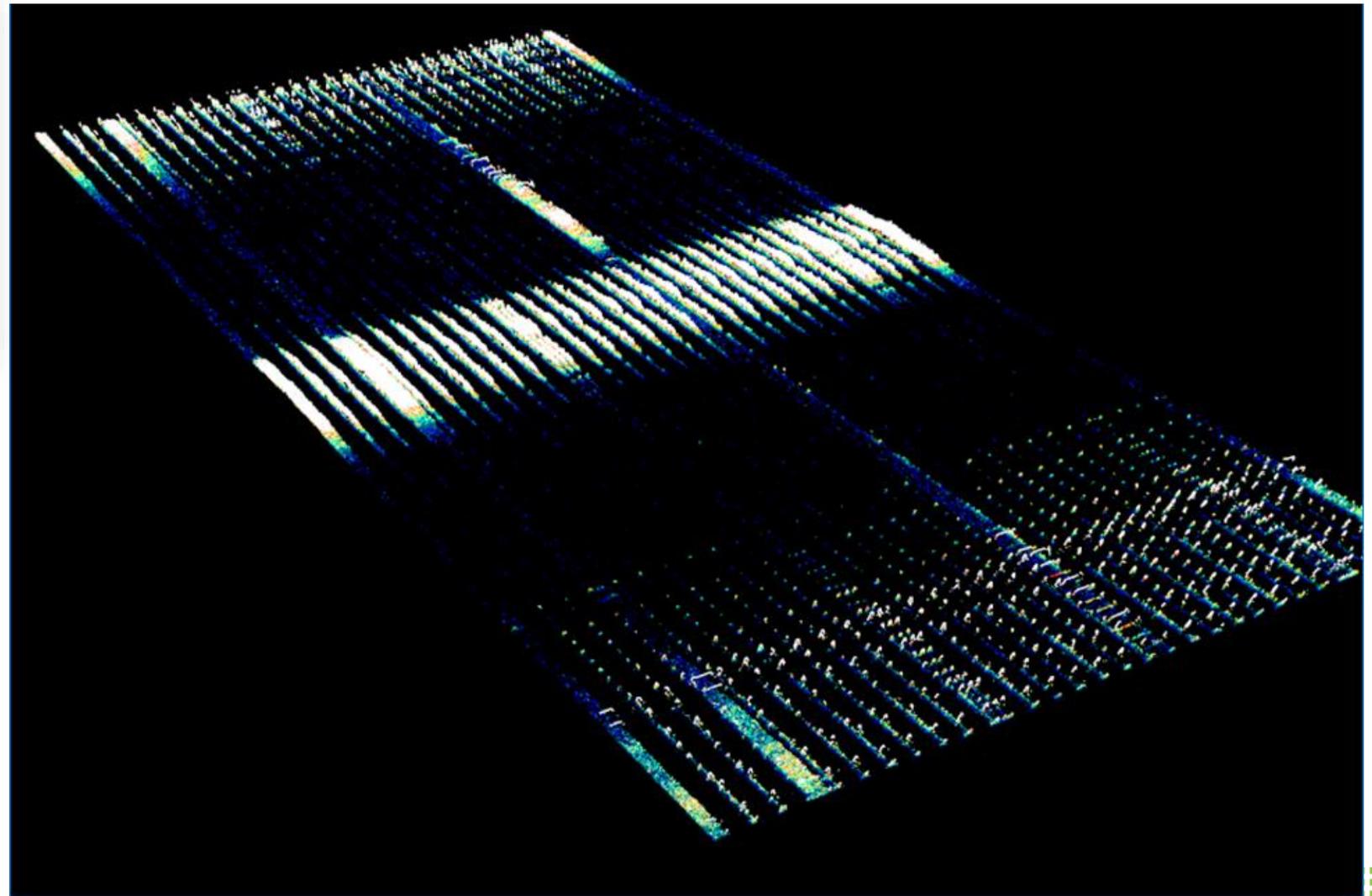


Red line on Sensor layout indicates data end for all Sensor files

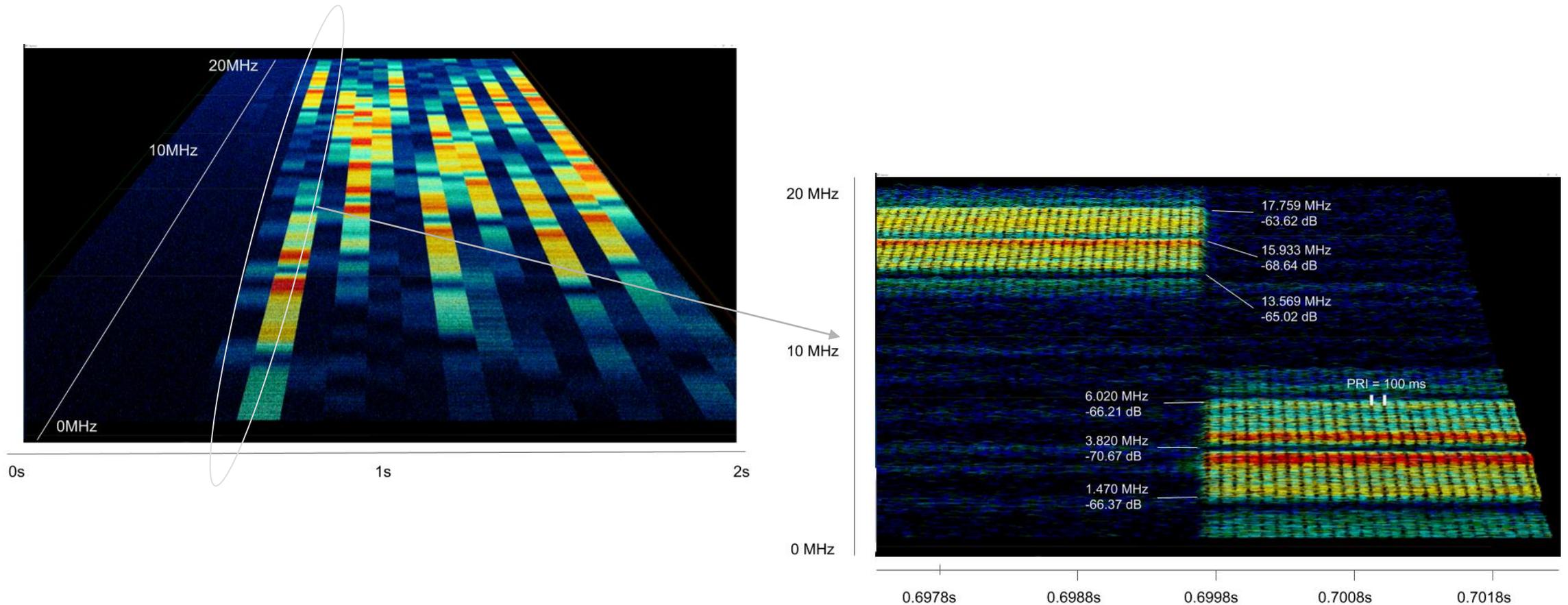
US Navy – Separating Radars by Serial

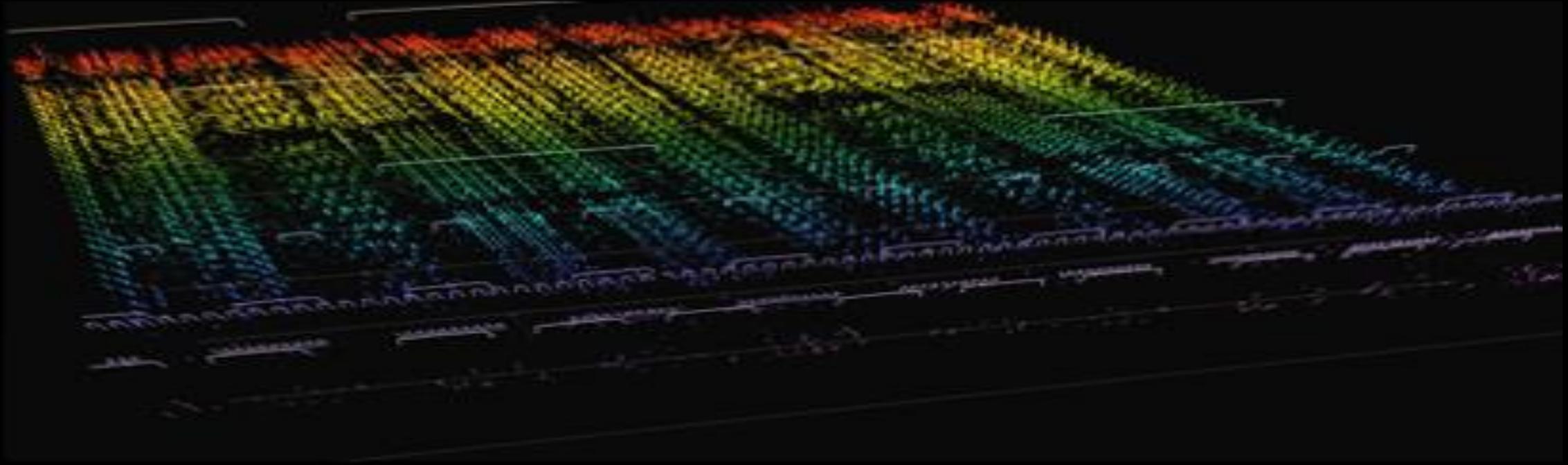


The slide features a blue diagonal banner on the left with the Digital Harmonic logo and the text "THE NEW SPANISH-UNIT PARTNERSHIP OPERATIONAL". The main content includes the "Radiant Dragon Phase II" logo, the title "Technical Exchange Meeting (TIM)", the date "September 15, 2016", and the names and titles of attendees: "Joseph F. Paroulek, Program Manager, Northrop Grumman" and "Shane G. W. Morris, CTO, Digital Harmonic".



Advanced RF Signal Analysis





Identified targets 7-8 minutes ahead of legacy systems

Created unique digital fingerprints of radar emitters and receivers

Located radar signals buried deep in noise

Resynthesized a voice indiscernible from original

Separated voice from noise

Defined drone rotors through acoustic analysis

