

Synthetic Aperture Radar (SAR) Experiment using the MIT IAP 2011 Laptop Based Radar*

Presented at the 2011 MIT Independent Activities Period (IAP)

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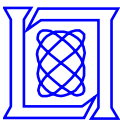
24 January 2011

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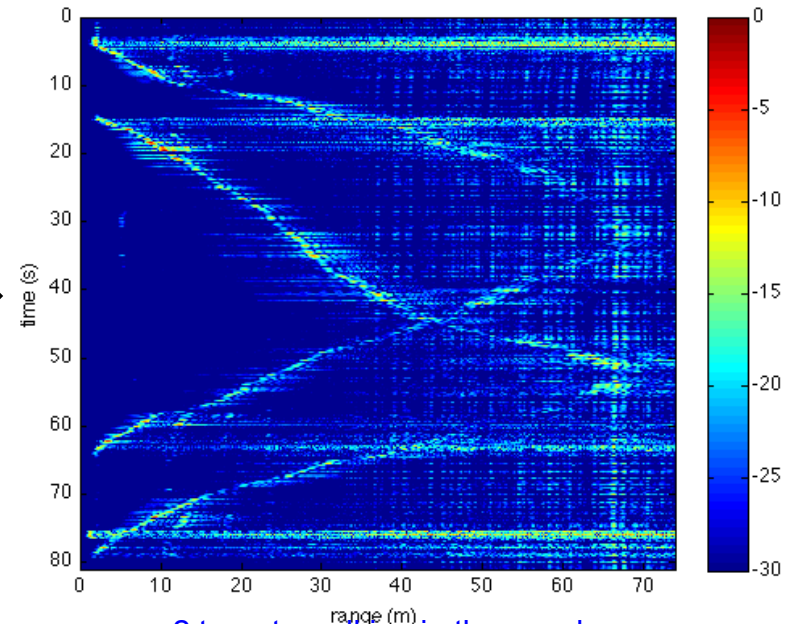
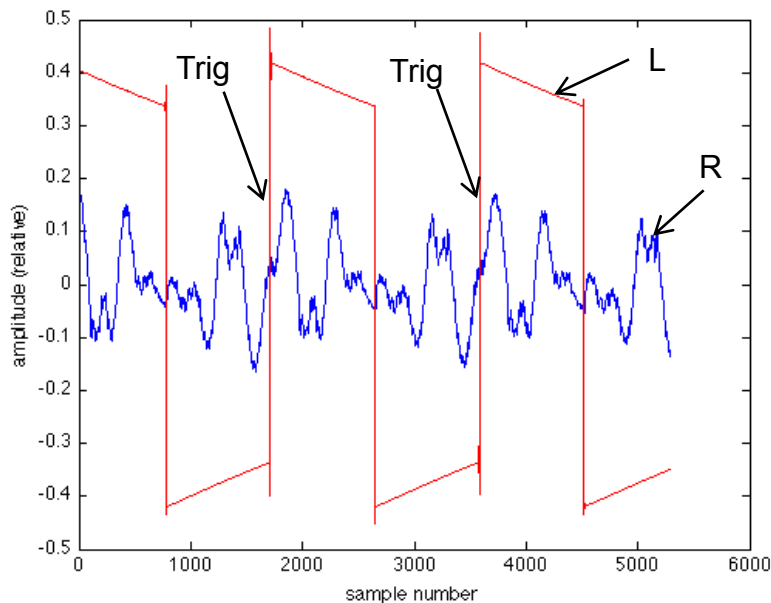
How to

- **Find a location with a straight rail approximately 10' long**
- **Record the R channel using the a .wav recording program**
- **Toggle sync line on and off for each range profile at 2" increments**
- **Pre-process then feed into SAR algorithm from Greg's dissertation**
- **E-mail results to us**

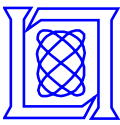


Radar Kit: Ranging vs. Time

1. Re-connect Vtune to modulator output.
2. Set up-ramp duration to 20 ms, adjust magnitude to span desired transmit bandwidth.
3. Deploy radar
4. Record a .wav file.
5. Process .wav using read_data_RTI.m
 - Looks for rising edges of sync pulse on Left channel
 - Saves 20 ms of Right channel data from rising edge, puts into array of de-chirped range profiles
 - Coherently subtracts the last range profile from the current one (2-pulse canceller)
 - Displays the log magnitude of the IDFT of the result as a range-time-indicator (RTI) plot

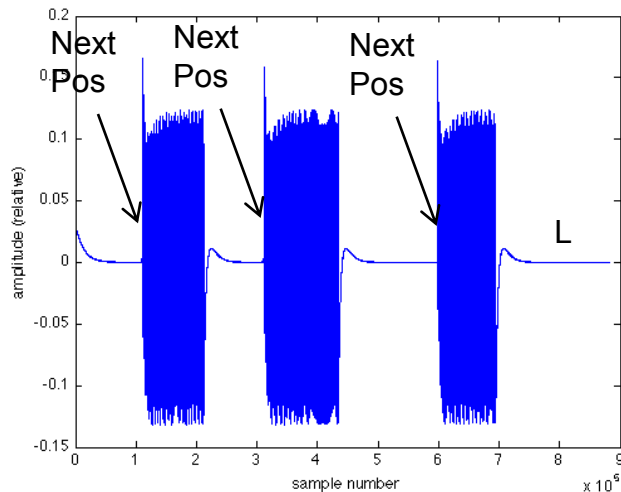
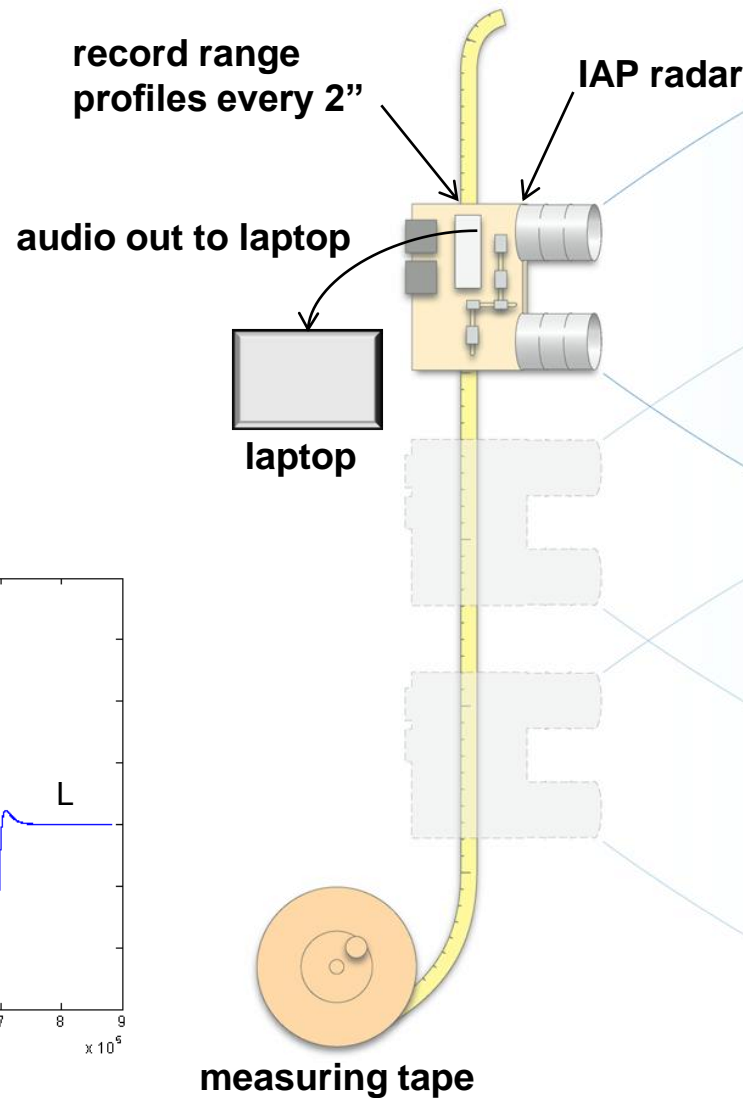


2 targets walking in the woods



Radar Kit: SAR Imaging

- Record .wav continuously
- Acquire range profiles at 2" increments over 8-10' of aperture length
- Use toggle switch to blank L sync channel, indicating change in radar position
- SBAND_RMA_opendata.m to process .wav file into SAR image, looking for gaps in sync pulses indicating new radar position



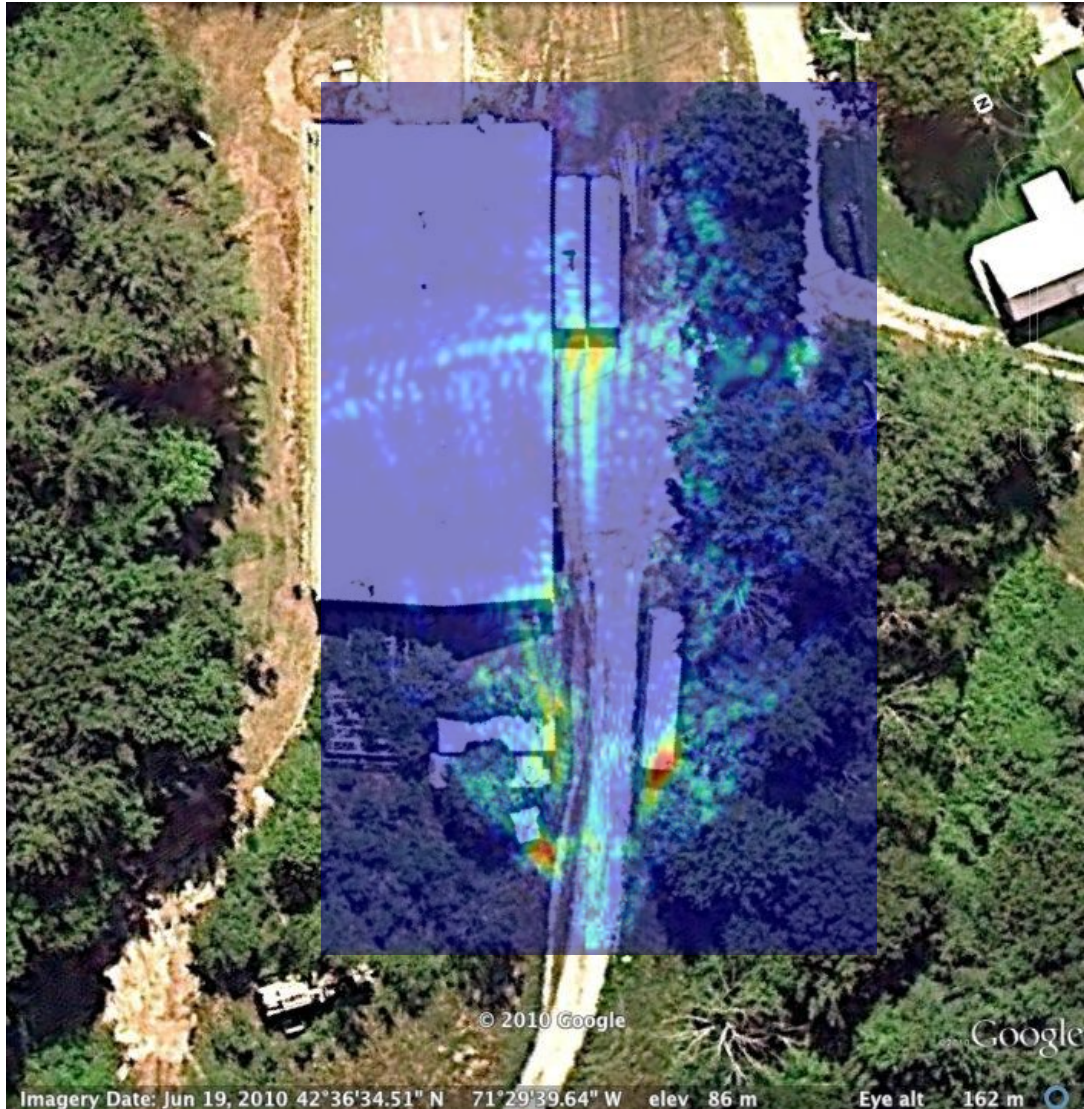


Example: Side of Warehouse



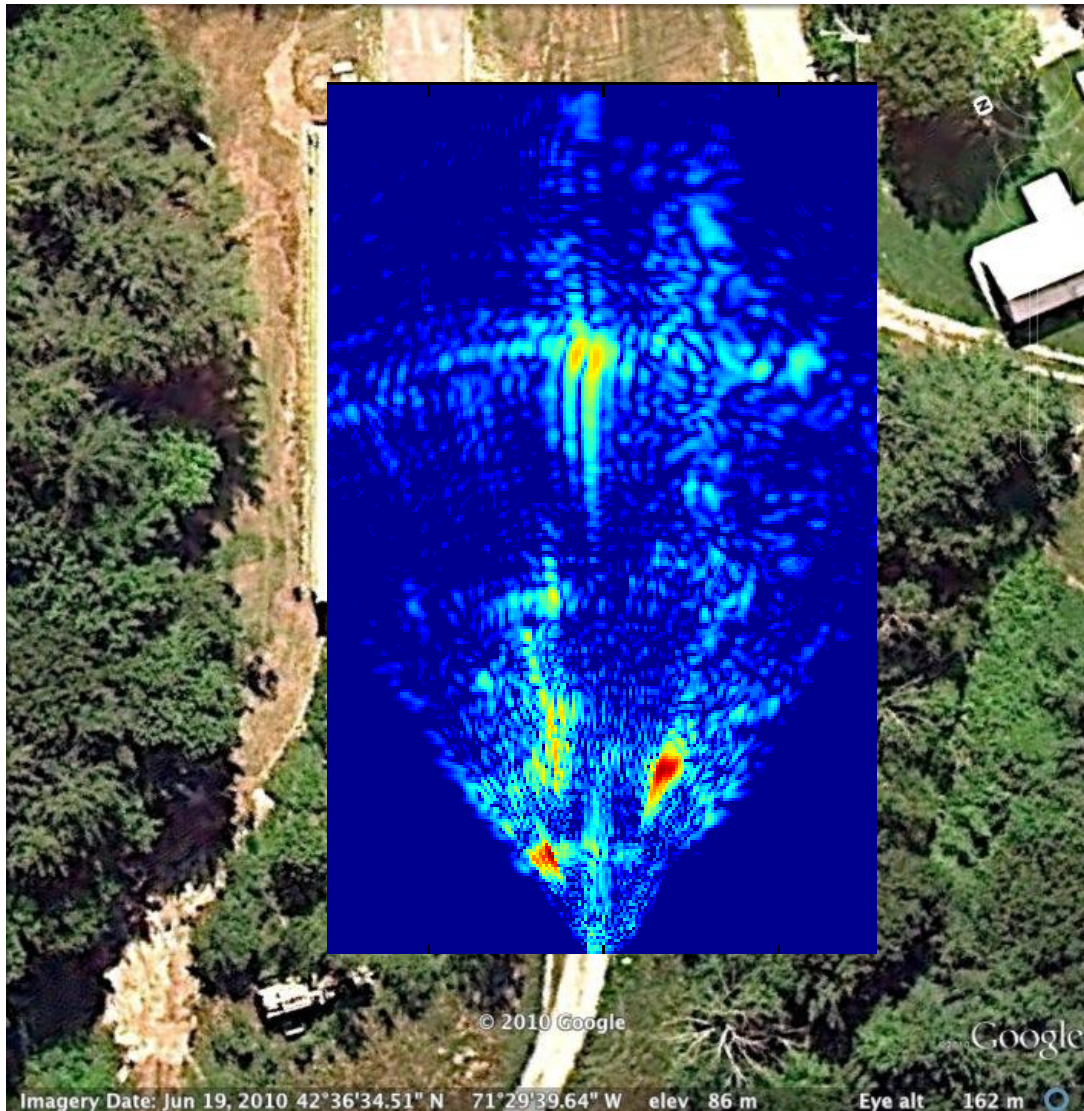


Example: Side of Warehouse



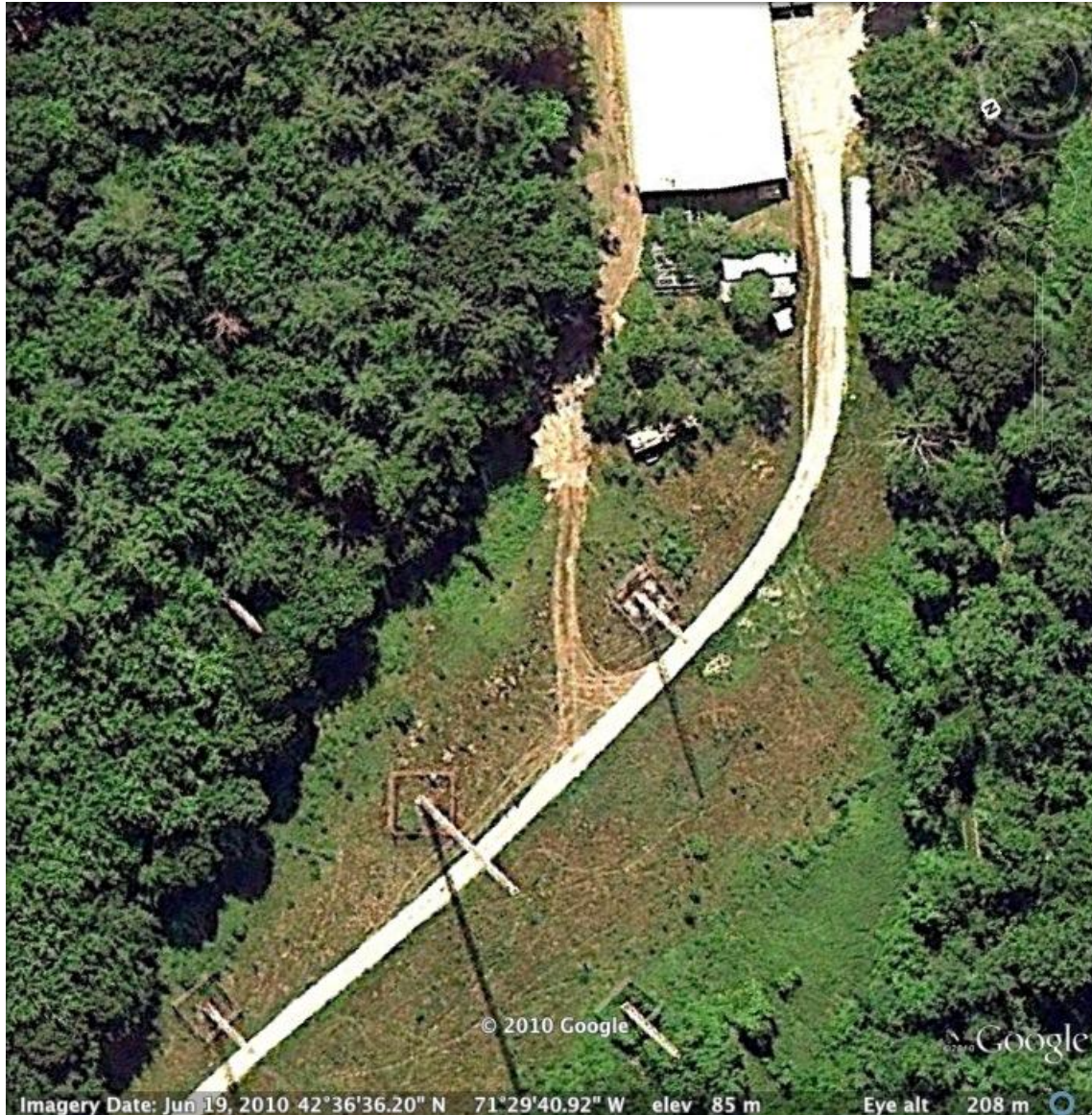


Example: Side of Warehouse



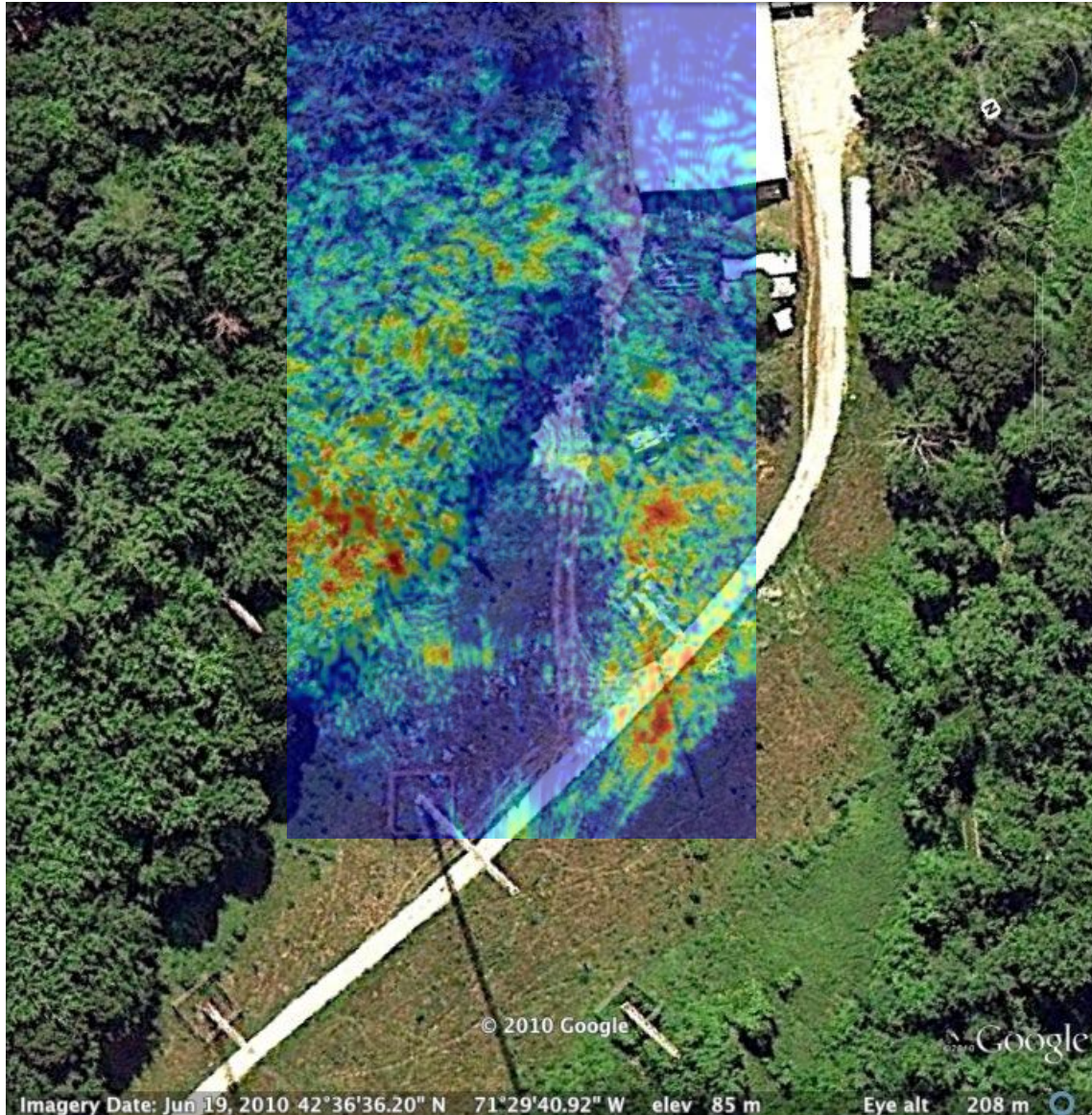


Example: Back of Warehouse



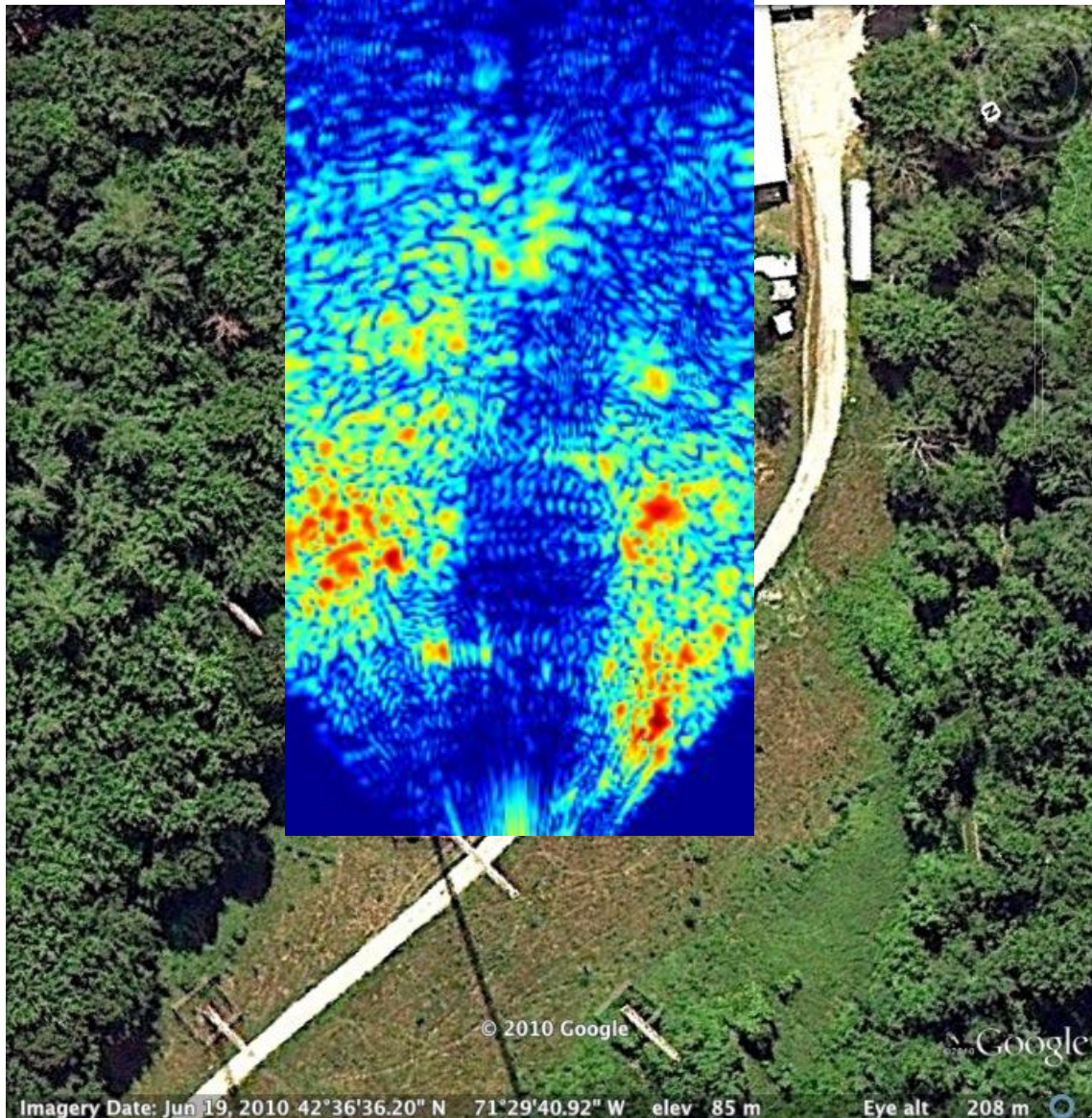


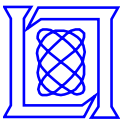
Example: Back of Warehouse





Example: Back of Warehouse





Example: Behind Warehouse



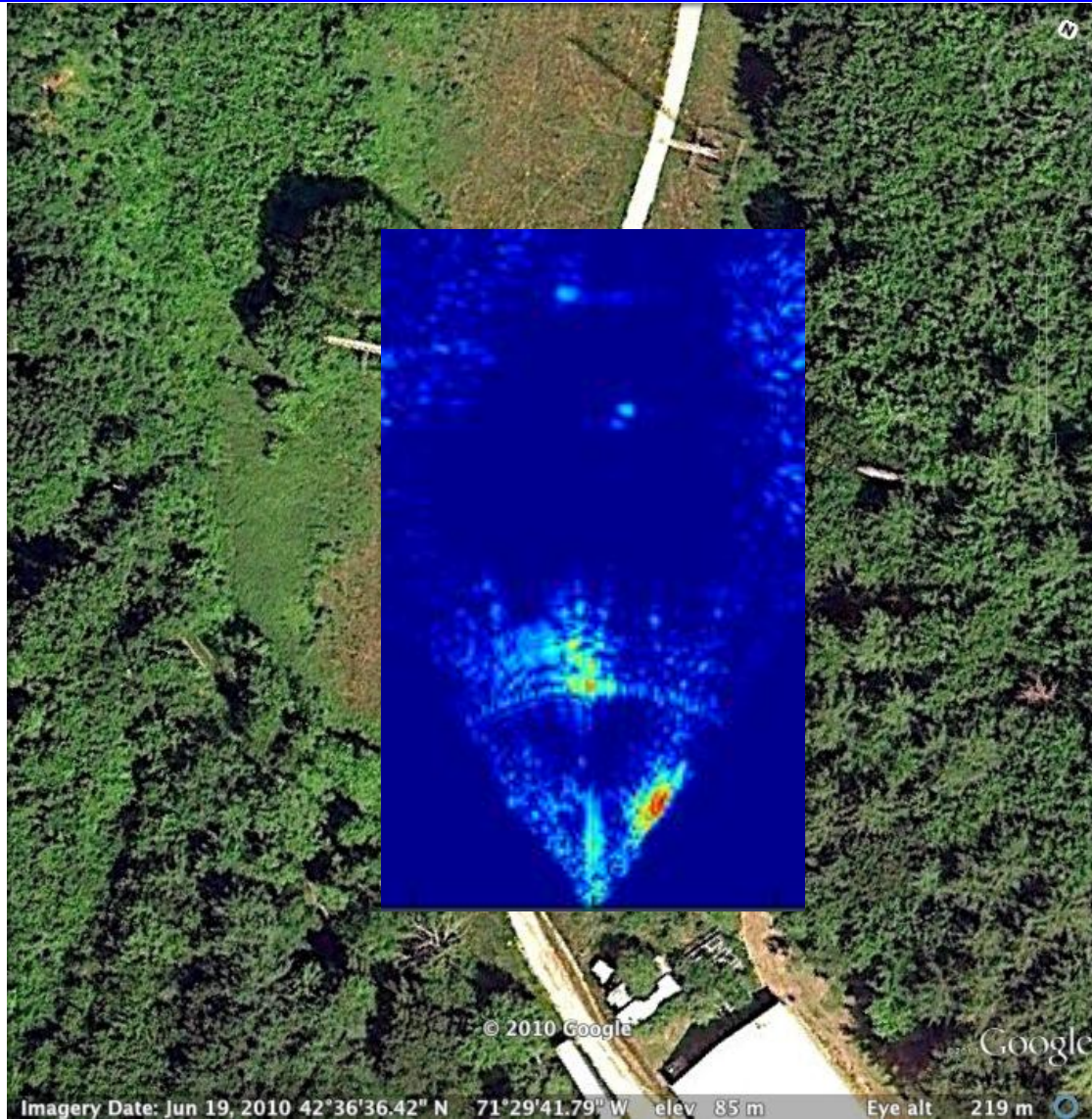


Example: Behind Warehouse





Example: Behind Warehouse



MIT OpenCourseWare
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Resource: Build a Small Radar System Capable of Sensing Range, Doppler, and Synthetic Aperture Radar Imaging
Dr. Gregory L. Charvat, Mr. Jonathan H. Williams, Dr. Alan J. Fenn, Dr. Steve Kogon, Dr. Jeffrey S. Herd

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