
MIGFA

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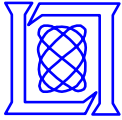
NEXRAD TAC

28 APRIL 2005



Outline

- **Machine Intelligent Gust Front Algorithm (MIGFA)
Product 140 Review**
- **Performance Example**
- **Performance Characterization**
- **Summary**



MIGFA and ORPG Builds

- **Targeted for Build 9 release (Spring 2007 proposed)**
- **Tied to the ROC rollout of the ORPG platform refresh**
- **Intend to maintain through subsequent Builds**



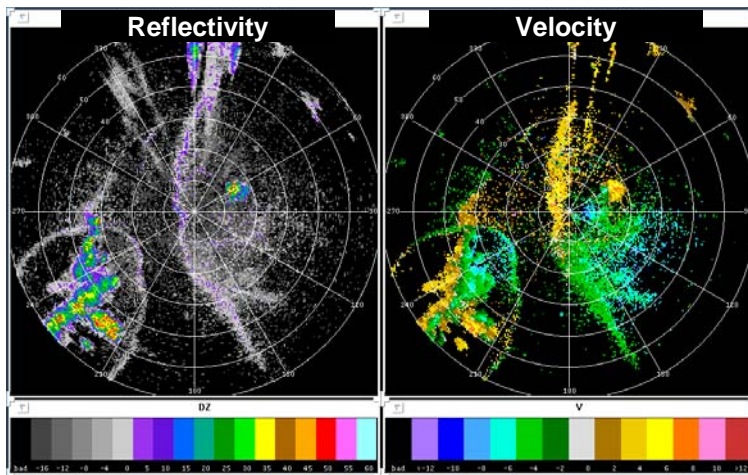
NEXRAD MIGFA

- **Motivation: technology transfer of wind shear hazards algorithm already used in two FAA weather systems**
 - ITWS TDWR MIGFA
 - ASR-9 WSP MIGFA
 - Adds unique, new capability to NEXRAD
- **Methodology**
 - Multi-dimensional image processing approach
 - Fuzzy logic, data fusion, delayed thresholding
- **Provide gust front detections (wind shear hazards) to airports not equipped with ITWS or ASR-9 WSP**
- **Complement at airports with ITWS or ASR-9 WSP MIGFA**
 - Adds redundant capability (safety backup)
 - Different viewing angles
 - Similar FA rates but differing causality

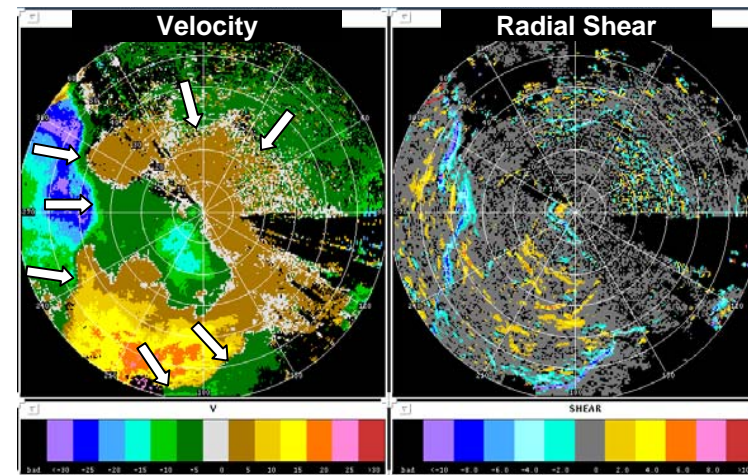


Radar Gust Front Signatures

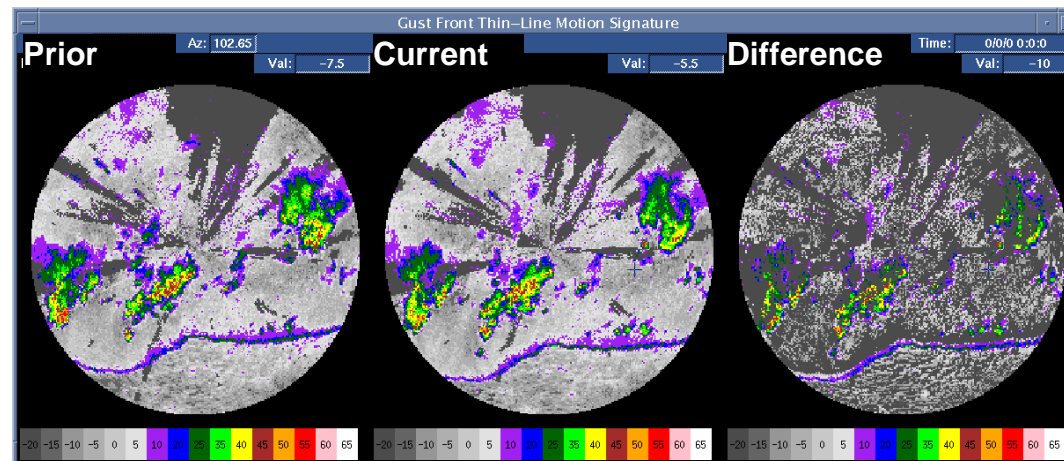
Reflectivity and Velocity Thin Lines



Velocity Convergence

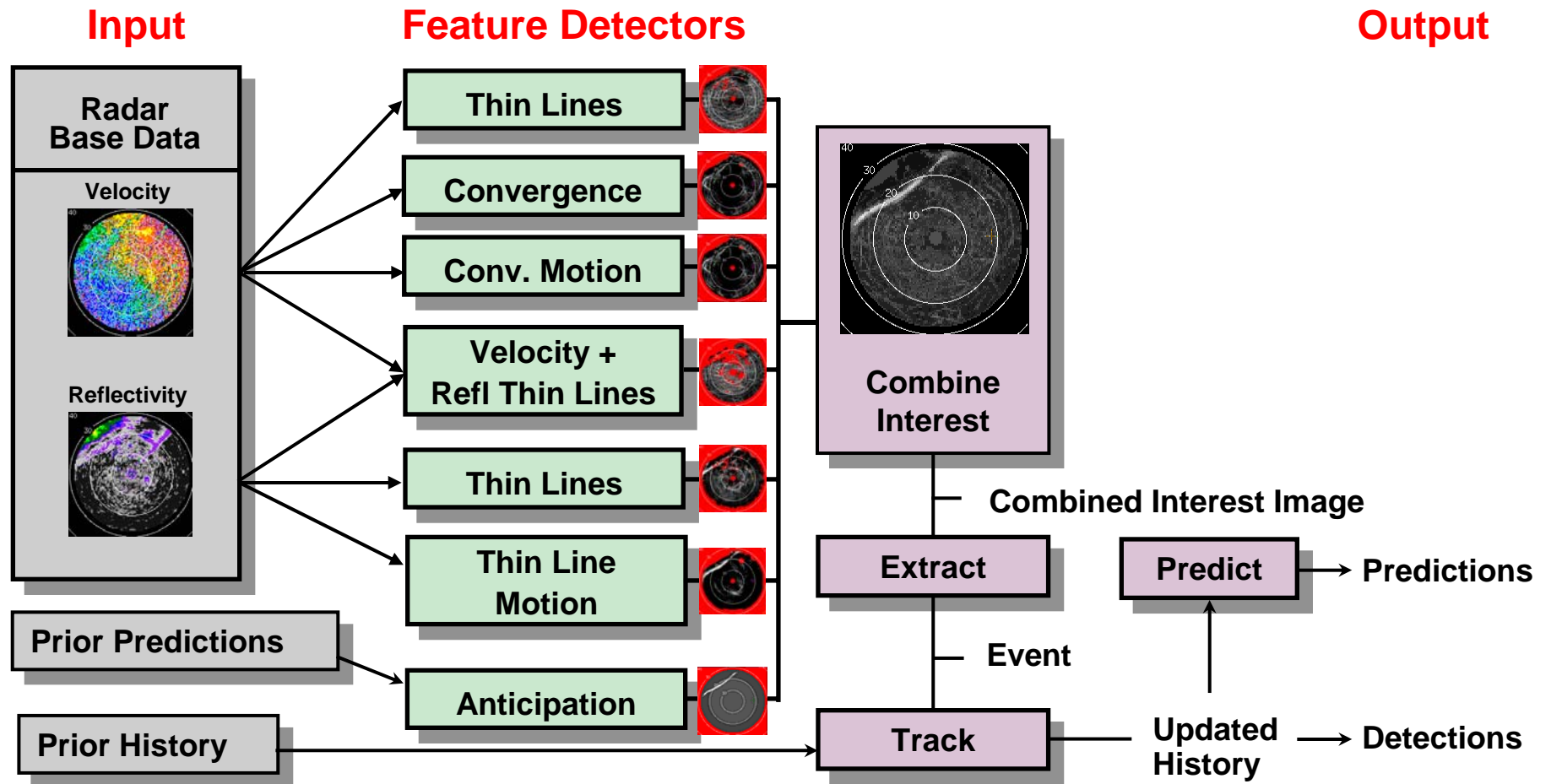


Motion





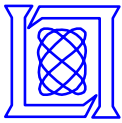
Machine Intelligent Gust Front Algorithm (MIGFA)



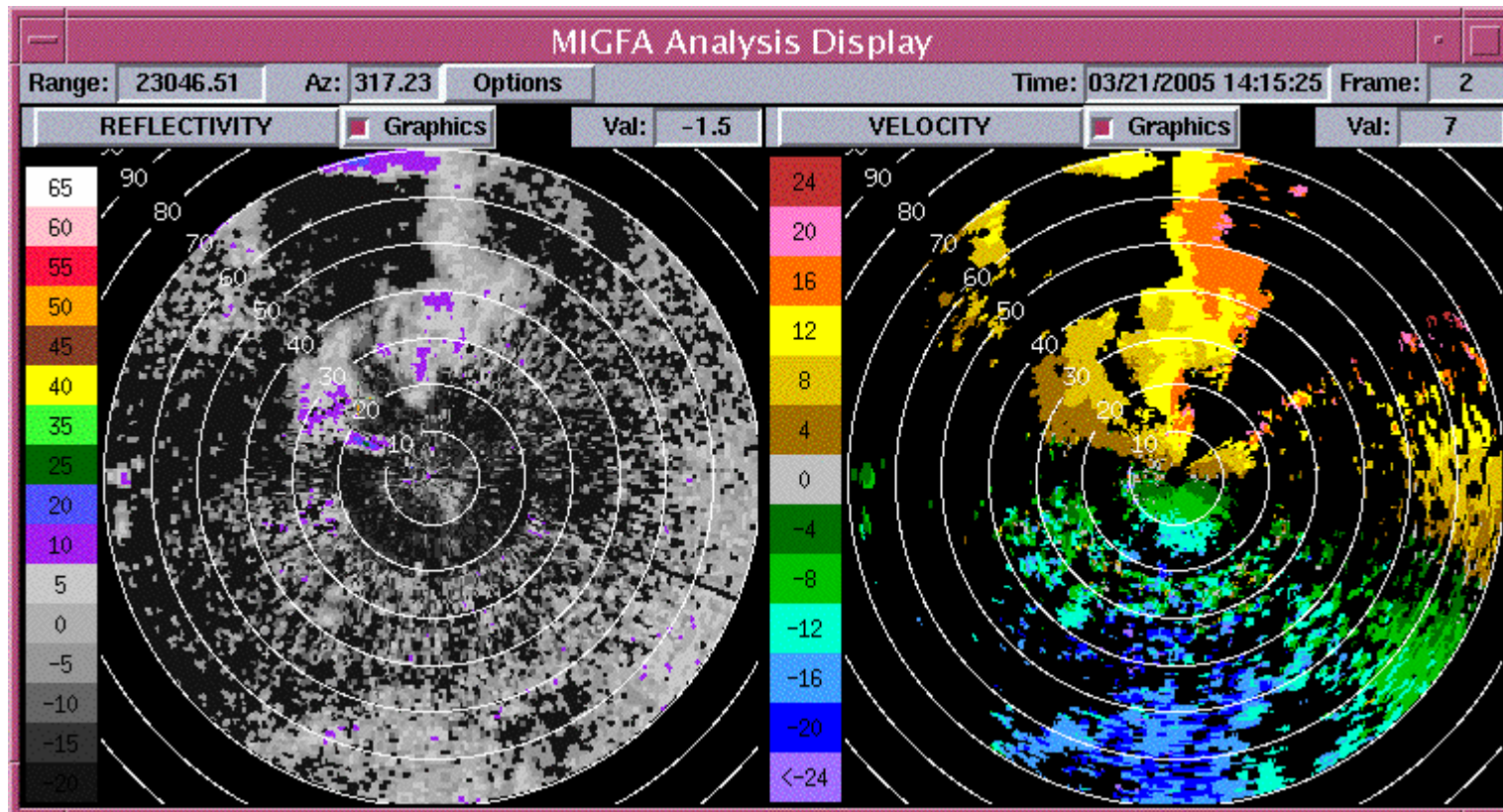


NEXRAD MIGFA Product Specification

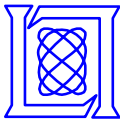
Range Coverage	70 km
Azimuthal Coverage	360 deg
Elevation Coverage	Combined 0.5⁰ through 1.5⁰ tilts
Output	Detection(s) with 10 and 20 minute forecasted position(s) each with descriptive information



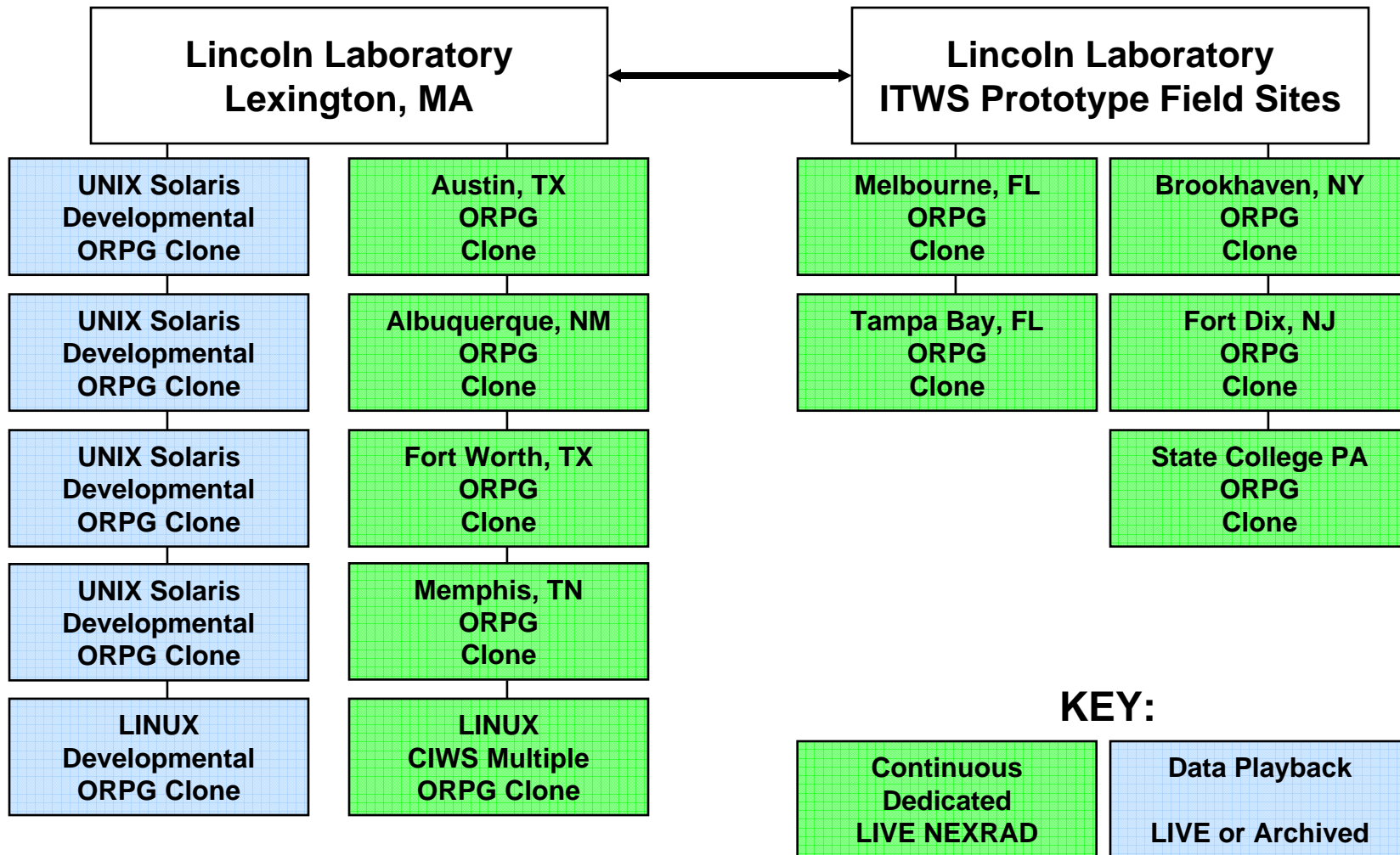
Performance Example



KEWX San Antonio/Austin, TX NEXRAD

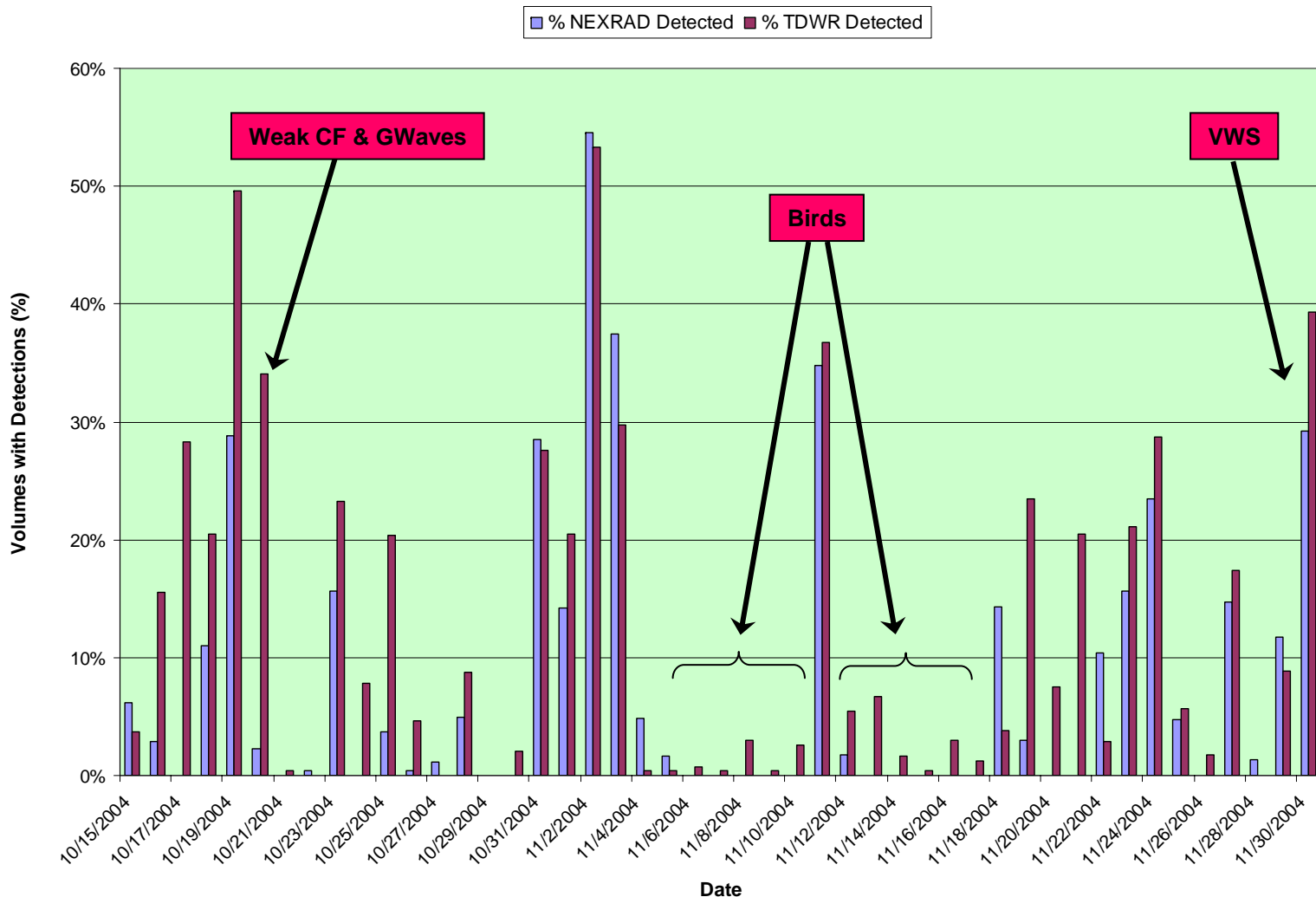


Lincoln Laboratory NEXRAD Algorithm Development Environment

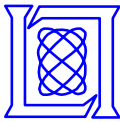




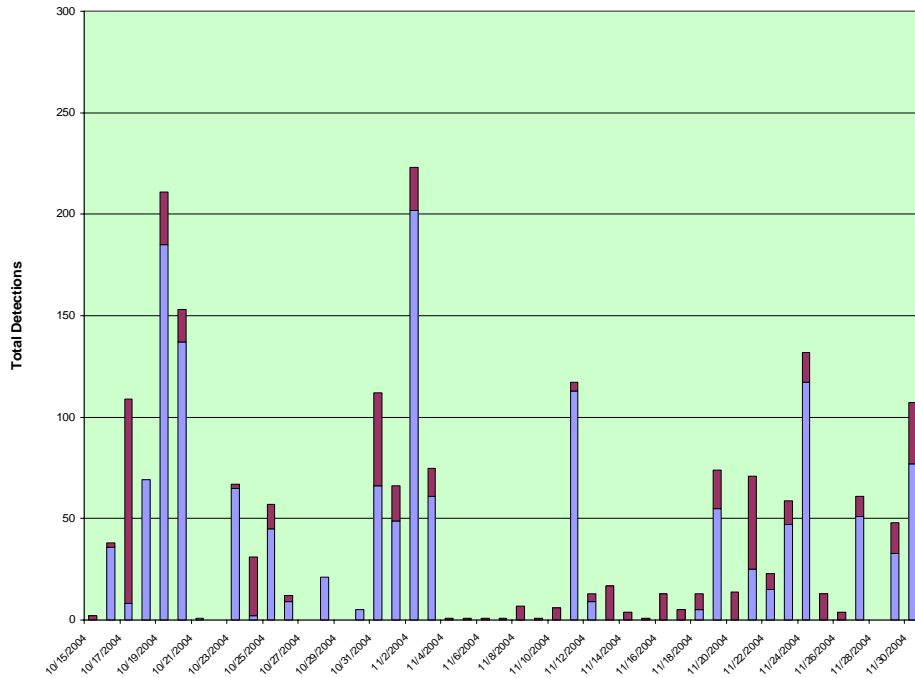
NEXRAD/TDWR MIGFA Detections



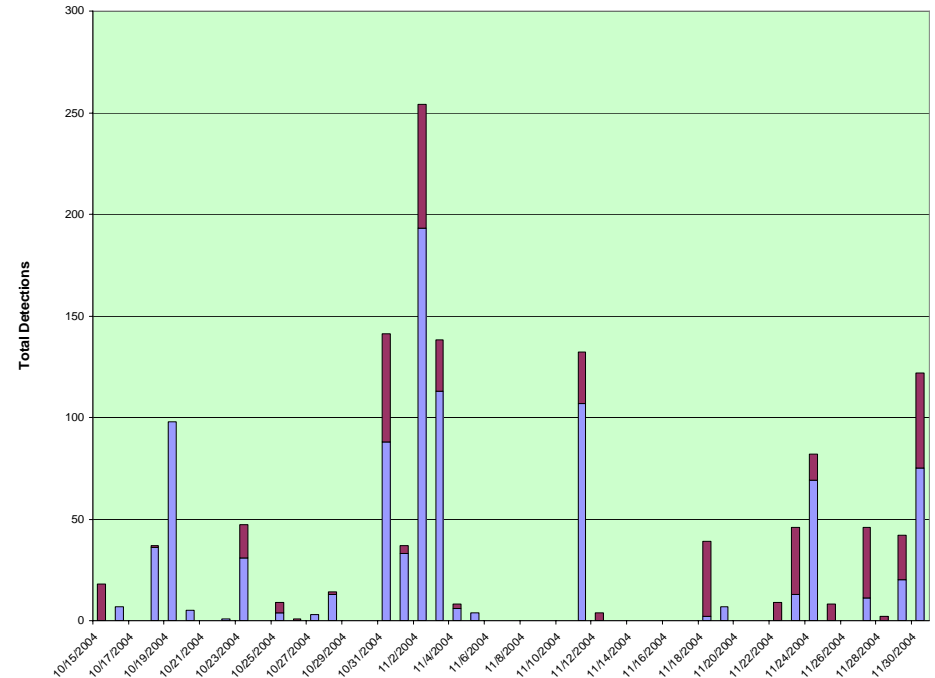
Daily detection percentage of NEXRAD MIGFA is similar to TDWR MIGFA.



NEXRAD/MIGFA “Cool Month” PFA



TDWR Detection Statistics		
TDWR True	TDWR False	PFA
1508	551	27%

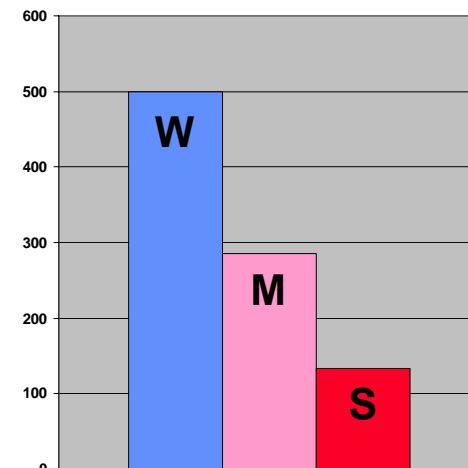


NEXRAD Detection Statistics		
NEXRAD True	NEXRAD False	PFA
939	422	31%

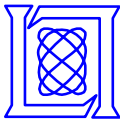


NEXRAD/TDWR MIGFA Data Set

- **Very robust data set (> 50 hours of data from MEM and DFW)**
 - Different times of year
 - Different types of gust front events (airmass, cold fronts, convective outflows)
 - Different strength gust front events (weak, moderate, strong)
 - Data from both radars used to determine truth
- **No false alarm only events included**



Good distribution of gust front intensities



NEXRAD/TDWR MIGFA Performance

Warm Months

Cool Months

DATE	SITE	HOURS	STRENGTH TYPE	NEXRAD		TDWR	
				POD	PFA	POD	PFA
6/27/00	DFW	3	S A	43.4	0.0	79.5	2.9
9/20/00	DFW	3	S CF	90.3	0.0	100.0	2.9
8/16/01	DFW	2	S CO	95.7	0.0	100.0	15.4
3/25/02	DFW	4	M CF	90.9	16.7	100.0	25.0
6/26/02	DFW	4	M A	70.8	1.7	82.9	7.5
7/12/02	DFW	4	S A	67.6	4.2	91.5	8.1
6/12/03	DFW	3.5	M CO	73.2	1.3	95.1	3.3
11/23/03	DFW	3.5	S CF	80.6	22.2	96.2	12.2
12/28/03	DFW	5	M CO	95.3	15.2	91.2	24.0
8/23/04	MEM	4	M CO	74.7	5.2	66.7	2.2
8/28/04	MEM	3.5	M A	69.0	10.2	81.2	7.5
9/3/04	MEM	3	W A	55.0	0.0	85.7	1.9
10/22/04	DFW	3	S CO	97.8	14.8	51.5	0.0
11/11/04	MEM	5	M E	74.6	17.5	81.3	2.6
11/11/04	MEM	3.5	M CF	75.6	12.7	97.2	0.0
TOTAL		57.0		73.5	8.8	85.1	8.0

Overall NEXRAD MIGFA performance is comparable to TDWR MIGFA.
Recall that PFA increases significantly during “cool month” events for both.



Summary

- **NEXRAD MIGFA product will provide significant benefits to existing and planned FAA, NWS, and DOD systems**
 - Especially of value during convective season
 - Fusion with gust front products from other radars
 - Support convective weather forecasting
- **MIGFA has been tuned to optimize performance on NEXRAD**
 - POD and FAR akin to TDWR MIGFA results
- **More computational testing of MIGFA on the official ORPG refresh platform definition needed before hand-off**
- **Finalizing product output (generic format)**