Recent advances in infrared focal plane fabrication have allowed for the production of sensors with small detector size (small pitch) and long integration time (deep electron wells) in large-format arrays. Individually, these are all welcome developments, but we raise the question of whether it is possible to utilize all of these technologies in concert to optimize performance. If so, a key part of such a system is digital boost and restoration filtering, to recover the performance loss due to diffraction blur. We describe a system design concept called PWP (Pitch-Well-Processing) that uses each of these features along with Wiener filtering to optimize range performance.

Current targeting performance models, chiefly the Targeting Task Performance (TTP) metric, predict a significant increase in range performance due to boost and restoration filtering. We present this approach and compare the results to observer perception experiments conducted on simulated target imagery (formed from close-range thermal signatures artificially degraded by blur and noise). Initially, we used Triangle Orientation Discrimination (TOD) targets for basic experiments, followed by experiments using a set of 12 military vehicles. In both experiments, the range at which observers could reliably identify the target was measured with and without digital filtering.

This dissertation is focused on the following problems: integrating boost filtering into a system design, measuring the effect of boost filtering through perception experiments, and modeling the same experiments using the TTP metric.

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The public is welcome to attend.