

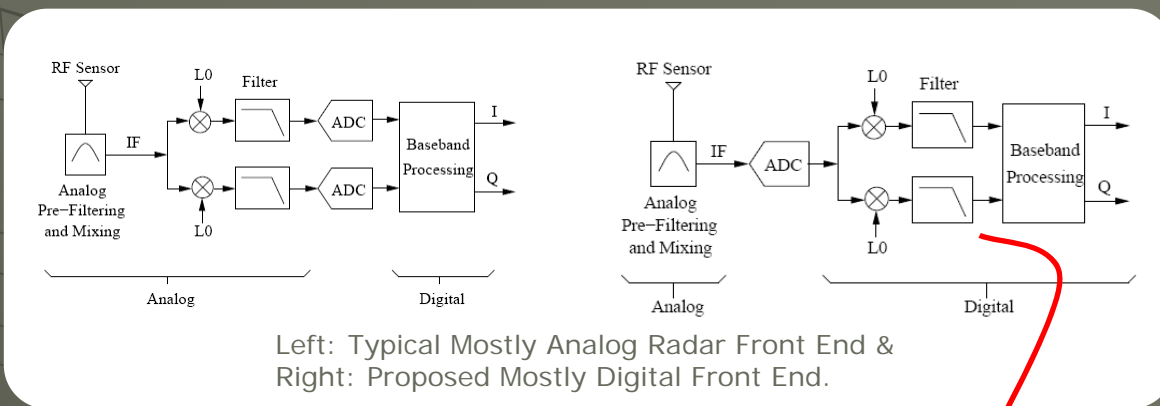
RF-SAMPLE

Radio Frequency – Sensing Atmospheric Module for Platform Leveraged Economy

The goal is to prove how fundamentally new contributions to the area of light-weight, low-power, low-cost radar receiver modules can be made. For the first time, software defined radio techniques will be employed for atmospheric observations. These compact stand-alone units are designed to be the building blocks of a mobile, reconfigurable radar system that is flexible to support many objectives.

Recent Project Activities

1. A Xilinx FPGA has been employed for the digital filtering. It is packaged on a thin quad flat pack (TQFP) for efficient implementation.
2. A 14-bit, 40 MHz analog-to-digital converter has been employed to implement the bandpass filtering operation.
3. A Texas Instruments TMS320f2800 series DSP has been employed. This processor also resides on a TQFP and has flash memory.
4. A few ideas about the general philosophy of the project are shown on the right side of this slide. Future visions are many.



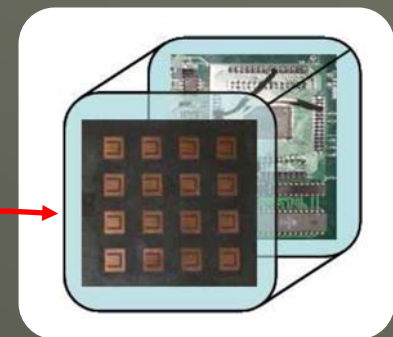
Left: Typical Mostly Analog Radar Front End & Right: Proposed Mostly Digital Front End.

Derive discrete time equations for polyphase filter bank. This filter bank will also include a digital Hilbert transform to replace the LOs.

Store equations on FPGA. Prior FPGA floorplanning results are shown below. Looking ahead, Simultaneous Rational Representations may be used for another level of optimization.

$$I(n) = \sum_{i=0}^{\left\lfloor \frac{N-1}{2} \right\rfloor} (-1)^i h_{2i} x_{nM-2i}$$

$$Q(n) = \sum_{i=0}^{\left\lfloor \frac{N-1}{2} \right\rfloor} (-1)^{i+1} h_{2i+1} x_{nM-2i-1}$$



I&Q samples of one and/or many modules sent to a data fusion center.