



DARPA MTO
AOSP
Analog Optical Signal Processing

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DARPA/MTO
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Program Kickoff

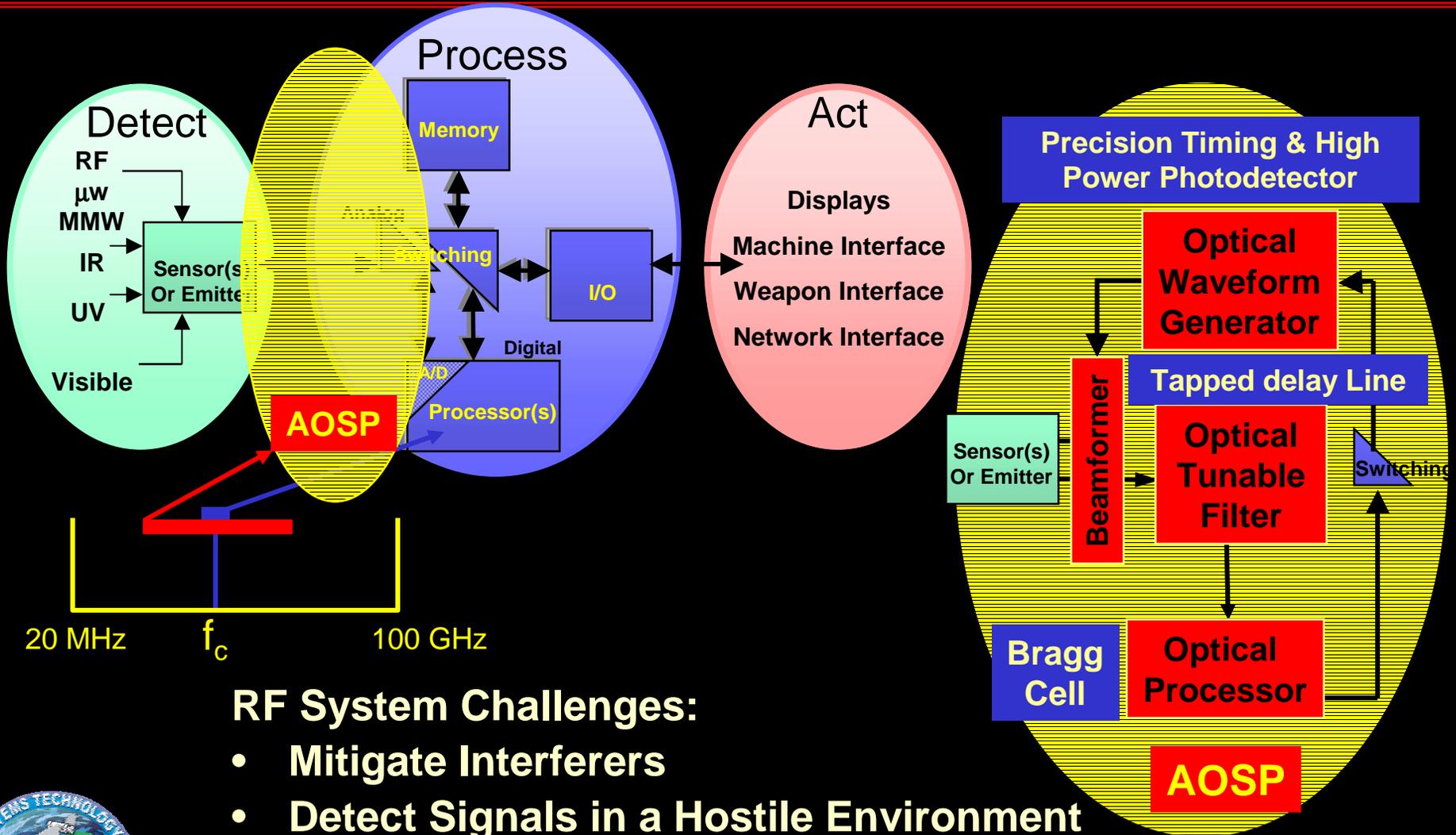


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Program Concept



RF System Challenges:

- Mitigate Interferers
- Detect Signals in a Hostile Environment
- Generate a RF Response



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Program Synergy: Establishing a New Paradigm



Multi-Octave
Multi-Beam
Array Antennas



High Fidelity
Analog Signal
Transport



Broadband:
Signal Generation
Filtering
Processing / Detection
Precision Oscillators



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A New Paradigm for High Performance RF System Design !!



AOSP

Program Participants - Phase 1

SIGNAL PROCESSOR

TRW/UCSD

U of Colorado

HRL

NIST

Essex

Optical Bragg Cell

Coherent Fiber Lens

Matched Detection Matrix

Optical Electric Field

Study – Signal Proc Architec

TAPPED DELAY LINE

TRW/U of AZ

MIT/LL / MIT

HRL

OSU/UCSB

Solgel Active Photonic Crystal

3-D Photonic Crystal

Optical FIR / IIR Filters

Free Space Time Delay

ARBITRARY WAVEFORM GENERATOR

U of Wisconsin

U central Florida

Lucent

Non Linear Transmission Line

Spectral Decomposition

Interferometric

PRECISION OSCILLATOR

JPL / OE Waves

MIT/LL

Microsphere OEO

Dual Line Lasers

TESTBED

NRL

AMRFS, EW



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AOSP Program

PHASE I Decision Criteria
Demonstrate Underlying Technology
Jun 02 – Dec 03

Task 1: Optical Bragg Cell

Demonstrate 4 GHz instantaneous bandwidth @ ≥ 2 usec time aperture.
Identify high performance material for 10 GHz instantaneous bandwidth.

Task 2: True Time Delay

Demonstrate fabrication of at least 15 periods of 3-D photonic crystal structure, including internal electrodes and wiring.
Demonstrate internal defect waveguides with resonant tap structures.

Task 3: Arbitrary Waveform Generator

Demonstrate >4 bits @ 10 GHz (Validate mux/demux architecture).
Demonstrate successful calibration approach – Show how it extrapolates to final architecture (>8 bits resolution @ 10 GHz).
Demonstrate ultra stable local oscillator (performance at least as good as Poseidon Oscillator).



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AOSP Program

**PHASE II Decision Criteria
Prove Device Performance
Jan 04 – Apr 05**

Task 1 : Optical Bragg Cell

Demonstrate ≥ 10 GHz instantaneous BW @ ≥ 20 usec time aperture.
Demonstrate Spur Free Dynamic Range of > 100 dB

Task 2: True Time Delay

Demonstrate loss ≈ 1 dB/usec.
Demonstrate complex taps with at least 8 bits of resolution.
Demonstrate architectures for 1.5 ps – 50 ns delay range and / or 1 usec to 20 msec delay.

Task 3: Arbitrary Waveform Generator

Demonstrate >8 bits @ 10 GHz instantaneous BW (Goal 12 bits).
Demonstrate low phase noise LO (at least 10 dB better than Poseidon across the spectrum)



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Summary / Future Plans

AOSP addresses all three of the major RF system challenges:
Signal Detection (**Signal Storage**)
Signal Generation
Interference Mitigation
With increased *Bandwidth* and *Dynamic Range*

GOMACTECH 03 29 March – 1 April:
First PI Review
Opportunities for Display Booths



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