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DARPA Phase II SBIR "Highly Integrated Silicon (Si)-based RF Electronics" for Emerging MIMO Radar

Contract: W91CRB-10-C-0078

Small Business Prime Contractor

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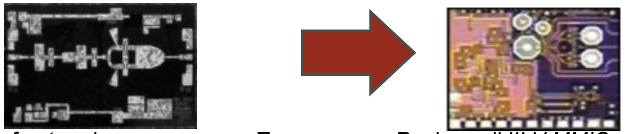
"Highly Integrated Silicon Based RF Electronics for Emerging MIMO Radar" SBIR

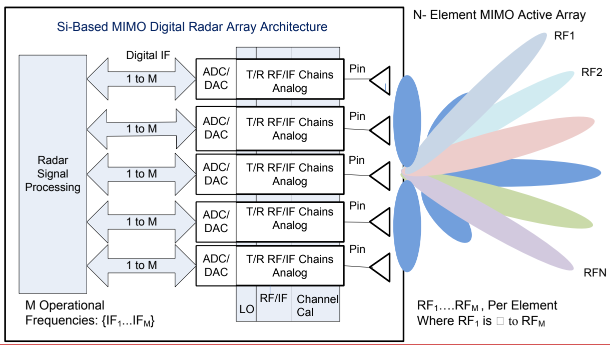
Objective

The overarching technical objective of the Phase II effort performed by Advanced Tech Engineering, Inc. (ATEI) is to develop disruptive and transformative MIMO techniques and silicon based technologies that results in new or advanced capabilities, enhanced performance, and at least an order of magnitude reduction in cost, size, weight, and power (CSWaP) of RF electronic over contemporary type III-V MMIC technologies for emerging MIMO radar, Wideband AESA radars and other new or emerging RF sensors and applications.



- *Radar front-ends use numerous Type III-V MMICs as discrete components.*
- *Trends → higher power PAs , temperature, SW&P and Cost*
- *Employs traditional Radar techniques*

- *Replace all III-V MMICs with single Si-based RF front-end chip*
- *SWaP & Cost > 10X Reduction*
- *New Techniques developed which increases capability/performance at reduced power levels*

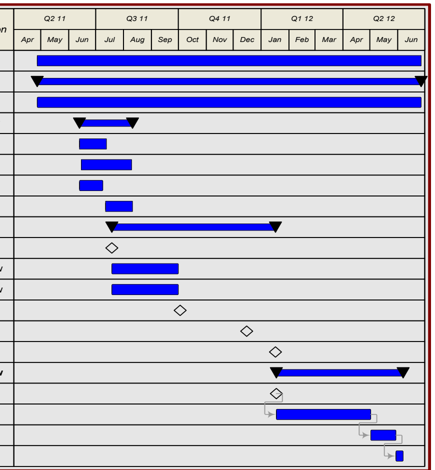


Approach

- Design a scalable, T/R module-on-a-chip for future generation MIMO radar, wideband AESA radar, all digital radar, RF sensors and current generation high performance LPD/LPI communications.
- Inherently resistant to jamming (multi-mode, multi-frequency - through and including 30 GHz)
- Delivers greater capability and performance over current systems at a fraction of the cost, size, weight and power.
- Ideal for missile applications, UAV/UAS, & SWaP constrained systems

Key Milestones – Year 2

ID	Task Name	Start	Finish	Duration
1	Phase II Year 2 Contract	4/27/2011	6/26/2012	61w
2	**System Design/Study Update**	**4/27/2011**	**6/26/2012**	**61w**
3	MIMO Radar Analysis Update	4/27/2011	6/26/2012	61w
4	**System Arch Update**	**6/13/2011**	**8/10/2011**	**8.6w**
5	Receive RF Chain	6/13/2011	7/12/2011	4.4w
6	Transmit RF Chain	6/15/2011	8/9/2011	8w
7	Review/update SystemVue Arch Model	6/13/2011	7/8/2011	4w
8	Update ckt block and specifications	7/12/2011	8/10/2011	4.4w
9	**RFIC Circuit Design Update**	**7/19/2011**	**1/17/2012**	**26w**
10	SSR /Circuit Design Update Kickoff	7/19/2011	7/19/2011	0w
11	Rx Ckt Design Update & Layout	7/19/2011	9/30/2011	10.8w
12	TX Ckt Design Update & layout (IRaD)	7/19/2011	9/30/2011	10.8w
13	PDR	10/3/2011	10/3/2011	0w
14	CDR/ TestChip Kick-Off	12/16/2011	12/16/2011	0w
15	TestChip FDR	1/17/2012	1/17/2012	0w
16	**RFIC Fabrication**	**1/18/2012**	**6/6/2012**	**20.2w**
17	TestChip Tapeout	1/18/2012	1/18/2012	0w
18	TestChip Fabrication Duration	1/18/2012	5/1/2012	15w
19	TestChip Testing	5/2/2012	5/29/2012	4w
20	TestChip Bench Validation Review & Report	5/30/2012	6/6/2012	1.2w



ATEI's advancements are leading to a realizable low-cost AESA Radar

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Phase II Operational View Scenario 3a: Short Range RF Seeker/Fuse or UAS Payload/Sensor

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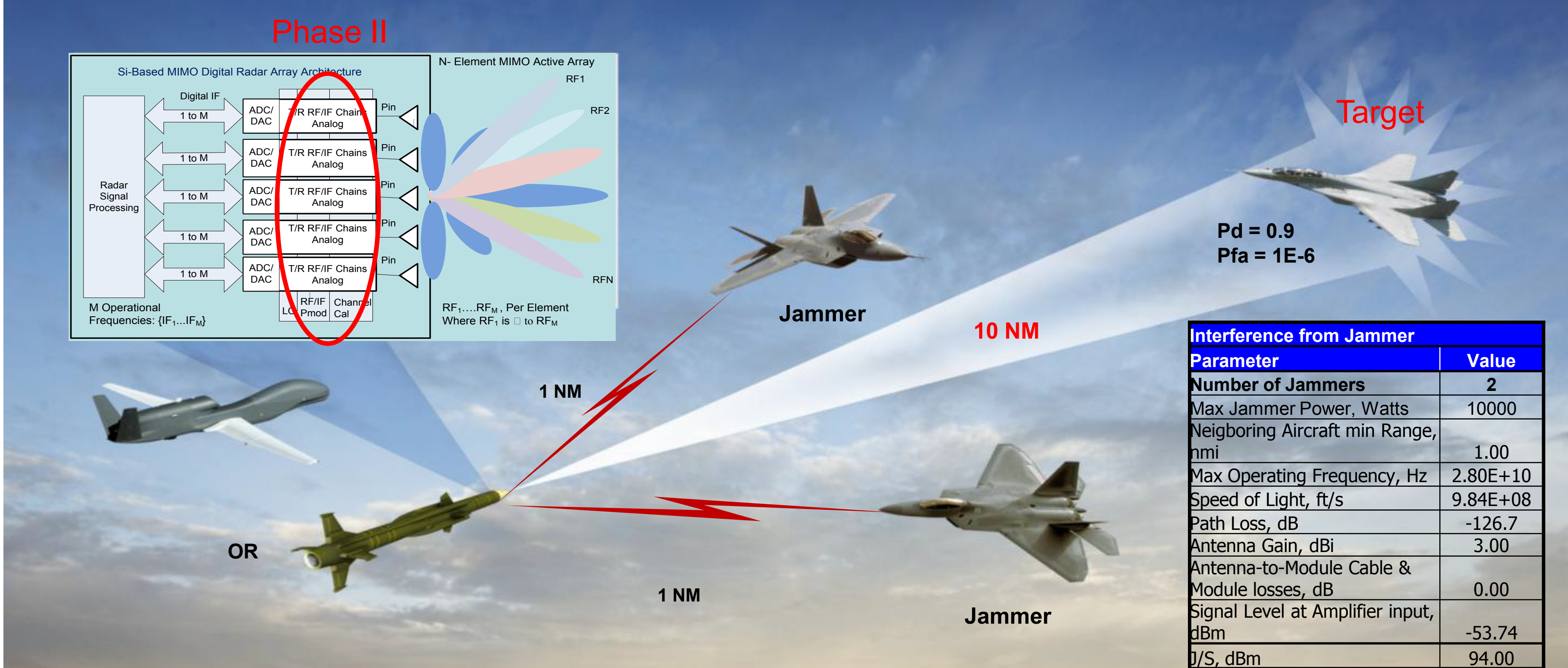
Phase II SBIR Focus → Scenario 3a

Phase II Focus → (Scenario 3a/b)

Scenario	Application	Config	Band	Frequency (GHz)	Range (nmi)	Target
1	Airborne RADAR	mono-static or bi-static	Lower X-band	8	100	Aircraft
2	Airborne RADAR	Mono-static or bi-static	Ku-band	15	100	Aircraft
3a/b	**Airborne Missile Seeker & UAV Sense and Avoid**	**mono-static**	**Lower Ka-Band**	**28-30**	**10/100**	**Aircraft / Missiles**
4	Airborne Missile Seeker	Bi-static	Upper X-band	10	125	Aircraft / Missiles



Interference from Jammer	
Parameter	**Value**
Number of Jammers	**2**
Max Jammer Power, Watts	10000
Neigboring Aircraft min Range, nmi	1.00
Max Operating Frequency, Hz	2.80E+10
Speed of Light, ft/s	9.84E+08
Path Loss, dB	-126.7
Antenna Gain, dBi	3.00
Antenna-to-Module Cable & Module losses, dB	0.00
Signal Level at Amplifier input, dBm	-53.74
J/S, dBm	94.00

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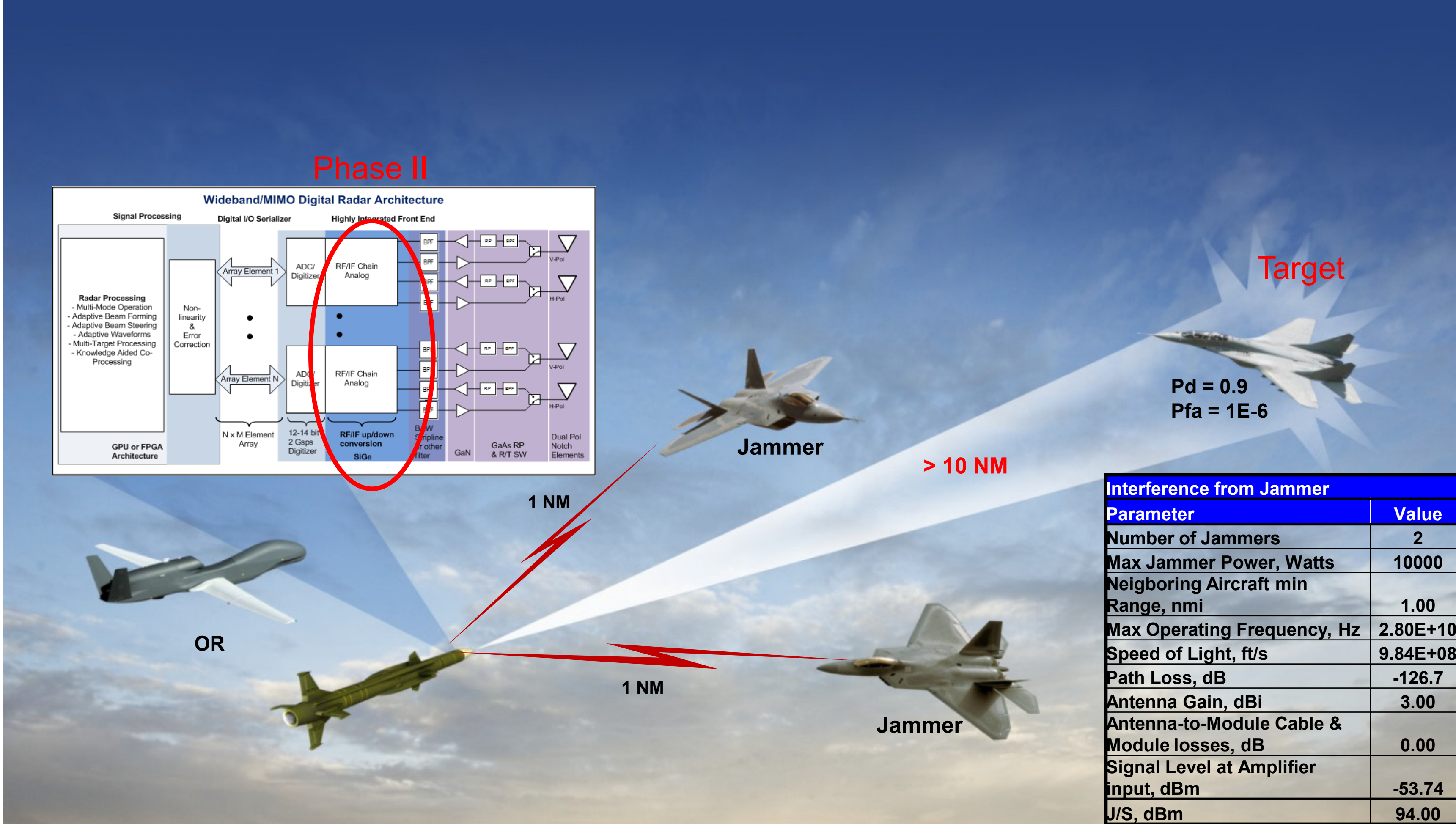
Phase II Operational View Scenario 3 b: Medium to Long Range RF Radar/Seeker or UAS Payload/Sensor

Beyond Phase II SBIR Focus → Scenario 3b

Scenario 3b – Operational View (OV)
Long Range RF Seeker/UAS Payload



Interference from Jammer	
Parameter	**Value**
Number of Jammers	2
Max Jammer Power, Watts	10000
Neigboring Aircraft min Range, nmi	1.00
Max Operating Frequency, Hz	2.80E+10
Speed of Light, ft/s	9.84E+08
Path Loss, dB	-126.7
Antenna Gain, dBi	3.00
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Signal Level at Amplifier input, dBm	-53.74
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