T-MUSIC Proposer’s Day

William Chappell, Office Director MTO

Briefing prepared for T-MUSIC proposer’s day

January 8, 2019

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Generalization + Abstraction

A More Specialized, Secure, and Heavily Automated Electronics Industry

Moore’s Inflection

THE ELECTRONICS RESURGENCE INITIATIVE

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Materials & Integration Thrust

Image: Stanford, MIT

Image: GLOBALFOUNDRIES

Image: DARPA POEM

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University Research

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Materials & Integration Thrust

CNFET
RRAM
SiGe
MTJ

PI PES
Low-loss optical MEMS

CHIPS
T-MUSIC

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A More Specialized, Secure, and Heavily Automated Electronics Industry
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A More Specialized, Secure, and Heavily Automated Electronics Industry
Technologies for Mixed-mode Ultra Scaled Integrated Circuits (T-MUSIC)

HR001119S0016 T-MUSIC Proposers Day

T-MUSIC will improve the bandwidth, dynamic range and operational frequencies of RF analog electronics by >10x each, enabling disruptive DoD systems.

Dr. Young-Kai Chen
Program Manager
Microsystems Technology Office
January 8, 2019
T-MUSIC Program Overview
Performance Wall of Today’s CMOS

Problem:

Scaling digital CMOS does not support the growth of analog information.

Moore’s Law has multiplied digital CMOS with high density and low power … but hits the performance wall to increase fidelity, sensitivity and bandwidth for next generation mixed-mode electronics.
Transistor Speed And Density In Today’s RF Mixed-Mode SoC Technologies

Today –
- Current Moore’s law scaling not able to increase transistor speed
- Continual investment in SiGe BiCMOS by off-shore consortia but not in US.
Invigorate **On-Shore Foundry Capability**

1. **Advance On-Shore Foundry Platform**
   - TA-1A: Ultra-broadband Foundry Platform
   - TA-1B: Ultra-broadband Mixed-Mode Building Blocks

2. **Research Next Generation THz Devices**
   - TA-2: Advanced THz RF Mixed-Mode Devices

T-MUSIC leverages Moore’s Law to scale **on-shore** mixed-mode semiconductors to THz while integrating advanced digital digital CMOS.
Remove Analog Performance Bottlenecks

**Broadband RF Frontend**

- RF frontends require transistors 10x faster than the operating frequency.
- High DC to RF efficiency.

**High Resolution Converters**

- Fast matched transistors to digitize fast signals.
- Low transistor noise enables high resolution and precision.

**Precision Oscillators**

- Fast transistors enable high frequency sensing.
- Low close-in and broadband noises to capture faint signal.

**State of the Art**

- Fast transistors require transistors 10x faster than the operating frequency.
- High DC to RF efficiency.

**T-MUSIC**

- High Resolution: 32 levels (5 effective bits) over 20 GHz @ 64 GSps
- High Resolution: 256 levels (8 effective bits) over 50 GHz @ 100 GSps

**T-MUSIC**

- Phase Noise @ 30 GHz:
  - State of the Art: < -97 dBc/Hz @ 1 MHz offset
  - T-MUSIC: < -120 dBc/Hz @ 1 MHz offset

T-MUSIC will develop key mixed-mode IP blocks in foundries for HF to 100+GHz operating frequency span with 10x bandwidth, 10x finer resolution and 100x lower oscillator noises.
T-MUSIC will multiply DoD capabilities in sensing, EW and communications.

**Broadband RF Frontend**
- Millimeter wave digital arrays

**High Resolution Converters**
- Direct-sample digital arrays
  - System Impacts
    - 2X wider span: HF to 100+GHz
    - 2X energy efficient

**T-MUSIC Transistors**
- 2X Faster, 2x Higher Gain

**T-MUSIC Converters**
- 10X Lower Uncorrelated Noises
  - System Impacts
    - 10X higher resolution
    - 10X fewer number of elements

**Precision Oscillators**
- 100X Lower Phase Noise
  - System Impacts
    - 10X slower moving Doppler targets
    - 10X energy efficiency

T-MUSIC will develop key mixed-mode IP blocks in foundries for HF to 100 GHz operating frequency span with 10x bandwidth, 10x finer resolution and 100x lower oscillator noises.
Unceasing Demands Of Wireless Broadband Services

Commercial Wireless Applications Drive High Volume RF SOCs for mobile units and infrastructures.

Commercial wireless data capacity grows at 10x per decade

- **1G (AMPS)**: Voice (1980)
  - 64 kbps

- **2G GSM CDMA**: (1990)
  - 2 Mbps

- **3G (WCDMA)**: (2000)
  - 2 Mbps
  - 300 Mbps

- **4G (LTE)**: (2010)
  - 2.5 Gbps
  - 10 Gbps

- **5G**: (2020)
  - 1 Gbps
  - 10 Gbps

- **6G**: (2030)
  - 100 Gbps

- **Today**
  - 100 Mbps
  - 10 Gbps

Data Rate Per Channel (Mb/s)

Year


Back Haul Links

Mobiles

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T-MUSIC Program Structure
(48 Months over three phases 18/18/12)

TA-1: Ultra-broadband Mixed-Mode Foundry Platform
(6.3 $55M)

TA-1A: Ultra-broadband On-Shore Foundry Platform
TA-1B: Ultra-broadband Mixed-Mode Building Blocks

TA-2: Research For Advanced THz Devices
(6.2 $15M)
Objective
• Develop on-shore wafer-scale ultra broadband mixed-mode technologies based on digital CMOS foundry platform

Key Metrics and Deliverables
• Analog transistor cut-off frequency $\geq 600$ GHz
• Embedded $\leq 22$ nm digital CMOS logic

Key Challenges
• Ultra vertical and lateral scaling of both HBT and CMOS for high speed and low noises
• Wafer-scale integration in foundry processes

Key Innovations
• Novel scaled device topologies and materials
• Innovative fabrication processes leveraging digital CMOS foundry platform

Ultra Scaled Devices

Vertical HBT

Large Topology
Transistor $f_T/f_{max} \leq 300/360$GHz

mm-wave HBT-SOI
Metrics:
• $f_T/f_{max} \geq 600/700$ GHz
• $1/f$ noise corner $\leq 10$ kHz

RF CMOS-SOI
Metrics:
• $f_T/f_{max} \geq 350$ GHz
• $Lg$ (gate length) $\geq 90$nm

Lateral CMOS

Bulk CMOS
$f_T/f_{max} \leq 280$ GHz;
$Lg$ (gate length) $\geq 90$nm

Establish on-shore semiconductor technology to provide ultra broadband RF mixed-mode SoCs for DoD applications and world-leading commercial suppliers.
**Objective**
- Innovate critical mixed-mode function blocks via joint device development with on-shore foundries

**Key Metrics and Deliverables**
- Novel mixed-mode building blocks with 10x bandwidth, 10x resolution and 100x lower noises
- Support Process Design Kits (PDKs) and test cells
- Implement DoD relevant mixed-mode blocks and DoD IP repository for future IC designs

**Key Challenges**
- Develop mixed-mode PDKs capable of re-using legacy digital CMOS IP library
- Innovative circuit architectures to capitalize advanced devices for >10x performance gain

**Key Innovations**
- Novel low noise, high resolution analog/digital circuit topologies to maximize system performance
- Optimal combination of HBT and CMOS devices to maximize circuit performance and energy saving

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**Innovative Mixed-Mode Cells**

**Low Noise mm-wave Oscillators**
- Metrics:
  - Low noise phase-locked oscillators:
    - $\leq -120$ dBc/Hz at 30GHz @1MHz offset

**Precision Ultra Wideband Converters**
- Metrics:
  - High resolution converters:
    - 256 resolution levels (8 effective bits) over 50 GHz bandwidth @ 100GSp/s sampling rate

**Embedded Ultrafast Digital Cells**
- Metrics:
  - High speed digital building blocks:
    - Frequency divider up to 200 GHz input signals

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T-MUSIC technology development will develop critical mixed-mode building blocks for shared DoD-wide use.
### TA-1: Ultra-broadband Mixed-Mode Foundry Platform

<table>
<thead>
<tr>
<th>TA-1A Technology</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transistor $f_T/f_{max}$</td>
<td>$\geq 350/500$ GHz</td>
<td>$\geq 400/600$ GHz</td>
<td>$\geq 600/700$ GHz</td>
</tr>
<tr>
<td>Embedded Digital CMOS</td>
<td>$\leq 90$nm node</td>
<td>$\leq 45$nm node</td>
<td>$\leq 22$ nm node</td>
</tr>
<tr>
<td></td>
<td>$\geq 200$ mm wafer</td>
<td>$\geq 200$ mm wafer</td>
<td>$\geq 200$ mm wafer</td>
</tr>
<tr>
<td>PCM Yield Per Wafer</td>
<td>50%</td>
<td>70%</td>
<td>90%</td>
</tr>
</tbody>
</table>

### TA-1B Building Blocks

<table>
<thead>
<tr>
<th>Demo Circuit #1: PLL</th>
<th>Phase Noise @ 30GHz</th>
<th>Phase Noise @ 30GHz</th>
<th>Phase Noise @ 30GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$&lt; -90$ dBc/Hz @ 100kHz offset</td>
<td>$&lt; -110$ dBc/Hz @ 1MHz offset</td>
<td>$&lt; -100$ dBc/Hz @ 100kHz offset</td>
</tr>
<tr>
<td></td>
<td>(Measurement)</td>
<td>(Measurement)</td>
<td>(Measurement)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demo Circuit #2: ADC</th>
<th>Architecture simulation and building block demo</th>
<th>$\geq 256$ levels (8 ENOBs) @50 GSp, 25 GHz IBW</th>
<th>$\geq 256$ levels (8 ENOBs) @100GSp, 50 GHz IBW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Demo 16ENOB 1GSp ADC)</td>
<td>(Demo: THA(\textsuperscript{d}), ADC)</td>
<td>(Measurement)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demo Circuit #3: Frequency Divider</th>
<th>100 GHz</th>
<th>150 GHz</th>
<th>200 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Measurement)</td>
<td>(Measurement)</td>
<td>(Measurement)</td>
</tr>
</tbody>
</table>

| Circuit Yield Per Wafer | 50% (of divider) | 70% (of PLL) | 90% (of ADC) |

---

(a) Proposal must define the test structure for extrinsic $f_T$ and $f_{max}$ to include practical parasitics of the gate and interconnect. $f_T$ and $f_{max}$ will be extracted from >20 GHz measurement.

(b) The advanced CMOS node requirement for embedded digital circuits.

(c) PCM: foundry-defined Process-Control Monitor (i.e. testers, transistors, 59-stage ring-oscillators).

(d) PLL: Phase-Locked Loop; ENOBs: Effective Number of bits; IBW: Instantaneous Bandwidth; ADC: Analog-to-Digital Converter; THA: Track-and-Hold Amplifier.

(e) Within-wafer yield with more than 10 demo circuits per wafer.
**Objective**

- Develop next generation THz transistors beyond today’s Moore’s Law scaling

**Key Metrics and Deliverables**

- Transistor cut-off frequency $\geq 1,000$ GHz
- Fast frequency divider circuit $\geq 400$ GHz

**Key Challenges**

- Aggressive scaling, new materials and fabrications needed to attain THz performance
- Leveraging highly scaled digital CMOS fabrication infrastructure (e.g. FinFETs)

**Key Innovations**

- Novel device topologies and new materials
- Convert vertical devices into scalable lateral devices

Explore novel silicon-based ultra-fast device topologies for next generation wafer-scale THz SoCs beyond current progressive Moore’s Law scaling.

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**Ferro-electric MOSFETs**

Reduced (negative) gate capacitance
[University of California, Berkeley]


**Lateral SiGe HBT on SOI**

Lateral HBT utilizing scaled CMOS-SOI topology
[IBM, IEDM 2011; RPI 2015]

## TA-2 Metrics

<table>
<thead>
<tr>
<th></th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(18 months)</td>
<td>(18 months)</td>
<td>(12 months)</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>• Develop new device structure</td>
<td>• Scale device and materials</td>
<td>• Increase integration level</td>
</tr>
<tr>
<td><strong>TA-2: Fundamental: Advanced THz RF Mixed-Mode Devices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transistor $f_T/f_{max}^{(a)}$</td>
<td>$\geq 600/600$ GHz</td>
<td>$\geq 800/800$ GHz</td>
<td>$\geq 1000/1000$ GHz</td>
</tr>
<tr>
<td>Demo Circuit: 1/4 prescaler</td>
<td>$\geq 100$ GHz</td>
<td>$\geq 200$ GHz</td>
<td>$\geq 400$ GHz</td>
</tr>
</tbody>
</table>

(a) Proposal must define the test structure for extrinsic $f_T$ and $f_{max}$ to include practical parasitics of the transistor and interconnect. $f_T$ and $f_{max}$ will be extracted from $>20$ GHz measurement.
T-MUSIC Program Schedule

TA-1: Ultra-broadband Mixed-Mode Foundry Platform

TA-1A: Ultra-broadband On-Shore Foundry Platform

**Device**

- **Phase 1 (18 mo)**
  - Goals - Metrics:
    - 600/600 GHz
    - 100 GHz prescaler

- **Phase 2 (18 mo)**
  - Goals - Metrics:
    - 800/800 GHz
    - 200 GHz prescaler

- **Phase 3 (12 mo)**
  - Goals - Metrics:
    - 1000/1000 GHz
    - 400 GHz prescaler

**Advanced Devices**

- **Phase 1 (18 mo)**
  - Design-1
    - 100 GHz Frequency divider
    - AFRL test and evaluation

- **Phase 2 (18 mo)**
  - Design-2
    - 30 GHz PLL < -110 dBc/Hz
    - AFRL test and evaluation

- **Phase 3 (12 mo)**
  - Design-3
    - 50 GHz IBW ADC, 8 ENOBs
    - AFRL test and evaluation

**Pre-qualified foundry technology**

- 350/500 GHz + 90nm CMOS
- 400/600 GHz + 45nm CMOS
- 600/700 GHz + 22nm CMOS

TA-1B: Ultra-broadband Mixed-Mode Building Blocks

TA-2: Fundamental: Advanced THz Mixed-Mode Devices

**Device**

- **Phase 1 (18 mo)**
  - Goals - Metrics:
    - 600/600 GHz
    - 100 GHz prescaler

- **Phase 2 (18 mo)**
  - Goals - Metrics:
    - 800/800 GHz
    - 200 GHz prescaler

- **Phase 3 (12 mo)**
  - Goals - Metrics:
    - 1000/1000 GHz
    - 400 GHz prescaler

**Distribution A. Approved for public release: distribution unlimited.**
## Schedule, milestones and deliverables for Phase 1 and 2

<table>
<thead>
<tr>
<th>Phase</th>
<th>TA-1</th>
<th>TA-1B</th>
<th>TA-2</th>
</tr>
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<tbody>
<tr>
<td>1, 2</td>
<td>TA-1A Foundry Technology</td>
<td>TA-1A Foundry MPW</td>
<td>TA-1B Building Blocks</td>
</tr>
<tr>
<td></td>
<td>TA-1B THz Devices</td>
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<td></td>
</tr>
<tr>
<td>Month</td>
<td>Task</td>
<td>Deliverables</td>
<td>Task</td>
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<td>Kickoff</td>
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<td>Deliverables</td>
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<td>1</td>
<td>NDAs/DKLAs in place</td>
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</tr>
<tr>
<td>2</td>
<td>Draft PDK.+1</td>
<td>PDK.0 ready</td>
<td>Draft PDK.+1</td>
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<tr>
<td>3</td>
<td>PDR: fab plan</td>
<td>PDK.0 Release</td>
<td>PDR: fab plan</td>
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<tr>
<td>4</td>
<td>Short Loops</td>
<td>MPW PDR</td>
<td>Simulation</td>
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<td>SL Plan, PDR</td>
<td>MPW PDR</td>
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<tr>
<td>6</td>
<td>SL CDR</td>
<td>MPW CDR</td>
<td>Layout; Simul.</td>
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<tr>
<td>7</td>
<td>SL Test Report</td>
<td>MPW Tape-in</td>
<td>SL CDR</td>
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<tr>
<td>8</td>
<td>MPW start</td>
<td>Report</td>
<td>Test plan; Doc</td>
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<td>MPW CDR</td>
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<td>SL Test Report</td>
<td>PDK.+1 CDR</td>
<td>Comments</td>
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<tr>
<td>11</td>
<td>SL CDR</td>
<td>SL Test Report</td>
<td>SL CDR</td>
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<tr>
<td>12</td>
<td>SL Test Report</td>
<td>PDK.+1 CDR</td>
<td>SL Test Report</td>
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<td>13</td>
<td>MPW Out</td>
<td>MPW Test start</td>
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<td>SL CDR</td>
<td>SL Test Report</td>
<td>SL CDR</td>
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<tr>
<td>15</td>
<td>SL Complete</td>
<td>PCM Test</td>
<td>SL CDR</td>
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<td>16</td>
<td>PDK.+1 Update</td>
<td>MPW CDR</td>
<td>Test result</td>
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<td>PDK.+1 Release</td>
<td>PDK.0 Update</td>
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<td>18</td>
<td>Phase Review</td>
<td>Test report</td>
<td>PDK.+1 Update</td>
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*DISTRIBUTION A. Approved for public release: distribution unlimited.*
# Schedule, milestones and deliverables for Phase 3

<table>
<thead>
<tr>
<th>Phase</th>
<th>TA-1</th>
<th>TA-1A Foundry Technology</th>
<th>TA-1A Foundry MPW</th>
<th>TA-1B Building Blocks</th>
<th>TA-2 THz Devices</th>
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<td>0</td>
<td>Task</td>
<td>Deliverables</td>
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<td>Deliverables</td>
<td>Task</td>
</tr>
<tr>
<td>1</td>
<td>Draft PDK.+1</td>
<td><strong>Draft PDK.+1</strong></td>
<td>PDK.0 ready</td>
<td>PDK. Release</td>
<td>Design starts</td>
</tr>
<tr>
<td>2</td>
<td>PDR: fab plan</td>
<td>PCM, Test cell</td>
<td>MPW PDR</td>
<td>PCM Test cells</td>
<td></td>
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<td><strong>Short Loops</strong></td>
<td><strong>SL Plan, PDR</strong></td>
<td>MPW CDR</td>
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<td><strong>MPW start</strong></td>
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<td>SL Test Report</td>
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<td><strong>PDK.0 Update</strong></td>
<td><strong>PDK. Release</strong></td>
<td>MPW CDR</td>
</tr>
<tr>
<td>12</td>
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</table>

End of Program Review
Proposal Evaluation Criteria

In Order of Importance:

1. Overall Scientific and Technical Merit

2. Potential Contribution and Relevance to the DARPA Mission
   • The proposer clearly demonstrates its plans and capabilities to contribute to U.S. national security and U.S. technological capabilities. The evaluation will consider the proposer’s plans and capabilities to transition proposed technologies to U.S. national security applications and to U.S. industry. The evaluation may consider the proposer’s history of transitioning or plans to transition technologies to foreign governments or to companies that are foreign owned, controlled, or influenced. The evaluation will also consider the proposer’s plans and capabilities to assist its employees and agents to be eligible to participate in the U.S. national security environment.
   • In addition, the evaluation will take into consideration the proposed technology transition strategy and the extent to which the proposed intellectual property (IP) rights will potentially impact the Government’s ability to transition the technology, as applicable.

3. Cost and Schedule Realism
   • Specifically for this program, for which simultaneous impacts to the commercial sector and DoD are expected, the level of performer cost share will be considered as a significant element of the Cost Realism evaluation. DARPA recognizes that undue emphasis on cost may motivate proposers to offer low-risk ideas with minimum uncertainty and to staff the effort with junior personnel in order to be in a more competitive posture. DARPA discourages such cost strategies. It is expected that the effort will leverage all available relevant prior research in order to obtain the maximum benefit from the available funding.
• Please follow the BAA requirements
  • TA-1A, TA-1B, and TA-2 are three stand-alone Technical Areas
  • Submit a proposal to only one Technical Area
  • Abstract is limited to 5-page maximum
  • Technical volume of the proposal is limited to 20-page maximum

• Teaming agreement in proposal between TA-1A and TA1B
  • Associate Contractor Agreement

• Abstracts are strongly encouraged

• Don’t be late for your proposals

• Please send technical questions to HR001119S0016@darpa.mil
Important BAA Dates

- Abstract Due Date: *January 25, 2019 - 1 PM EST*
- FAQ Submission Deadline: *February 18, 2019*
- Proposal Due Date: *March 12, 2019*
- Estimated period of performance start: *August 2019*

BAA Coordinator: [HR001119S0016@darpa.mil](mailto:HR001119S0016@darpa.mil)
Frequently Asked Questions (FAQ) Reminder

- Read the BAA
  - FedBizOpps
    https://www.fbo.gov/index?s=opportunity&mode=form&id=d9dcf5f58978dd3aea11e4d0cb5d1e9e&tab=core&_cview=1

- Please send questions to the BAA email address:
  - HR001119S0016@darpa.mil

- FAQ Submission Deadline
  - February 18, 2019 – 1:00 PM EST

- DARPA will post the FAQ on the Opportunities Website
  - Please check frequently at http://www.darpa.mil/work-with-us/opportunities
T-MUSIC
HR001119S0016
(ERI Phase II)

Proposers Day

January 8, 2019

Michael Blackstone
Contracting Officer
DARPA Contracts Management Office

Distribution Statement A. Approved for Public Release; Distribution Unlimited.
Plenty of good information is made available to potential proposers to help clarify program goals/objectives and proposal preparation instructions - those things that are stipulated in the BAA

However:

- Only the information/instructions in the BAA counts
- Proposals will only be evaluated in accordance with the instructions provided in the BAA
- Any response provided by the Government in the FAQ that’s different than what is provided in the BAA will be made formal by an amendment to the BAA
  - Such responses will make note of an impending BAA amendment

- Only a duly authorized Contracting Officer may obligate the Government
BAA Overview

- BAA allows for a variety of technical solutions and award instrument types
  - The BAA defines the problem set, the proposer defines the solution (and SOW)
  - Allows for multiple award instrument types:
    - TA-1A and TA-1B: Procurement Contract or Other Transaction (OT) - - 6.3 Funding
    - TA-2: Procurement Contract, OT, Grant or Cooperative Agreement - - 6.2 Funding

- DARPA Scientific Review Process
  - Proposals are evaluated on individual merit and relevance as it relates to the stated research goals/objectives rather than against one another (there is no common statement of work)
  - Selections will be made to proposers whose proposals are determined to be most advantageous to the Government, all factors considered, including potential contributions to research program and availability of funding

- Government may select for negotiation all, some, or none of the proposals received
- Government may accept proposals in their entirety or select only portions thereof
- Government may elect to establish portions of proposal as options

Distribution Statement A. Approved for Public Release; Distribution Unlimited.
1. Proposers Day is conducted (7 January 2019)

2. BAA is released (4 January 2019)  
   - 21 days

3. Abstracts are due (25 January 2019)  
   - 17 days

   - ~29 days

5. Proposals are due/submitted (12 March 2019)  
   - BAA closes on 8 April 2019
   - ~29 days

6. Proposals are reviewed for BAA compliance  
   - Noncompliant proposals are not reviewed (and cannot be selected)
   - ~45 days

7. Government conducts Scientific Review Process  
   - Clarification requests may be sent to various proposers
   - ~100 days

8. Government sends out select/non-select letters (~ 26 April 2019)  
   - All proposers who submit a compliant proposal may request an Informal Feedback Session
   - ~100 days

9. Contracts negotiated & awarded (awards by ~ 4 August 2019)
Eligibility Issues

- All interested/qualified sources may respond subject to the parameters outlined in BAA (such as accepting use of 6.3 funding for TA1-1A & TA-1B)

- Foreign participants/resources may participate to the extent allowed by applicable Security Regulations, Export Control Laws, Non-Disclosure Agreements, etc. (No classified proposals anticipated)

- FFRDCs and Government entities:
  - Are not prohibited by the BAA from proposing
  - Are, however, subject to applicable direct competition limitations
  - Are, however, required to demonstrate eligibility (sponsor letter)

  ➢ The burden to prove eligibility for all such team members rests with the proposer

  ➢ All elements of a proposal (tech and cost, prime and subs – even FFRDC team members) must be included in the prime’s submission

- Real and/or Perceived Conflicts of Interest:
  - Identify any conflict/s
  - If any are identified, a mitigation plan must be included
Proposal Abstracts

Abstracts are highly encouraged:
1. The abstract provides a synopsis (5 pages) of the proposed project
2. They minimize unnecessary effort in proposal preparation and review
3. They reduce the potential expense of preparing an out of scope proposal

Submit ONLY to DARPA BAA Website: https://baa.darpa.mil

Government will reply by letter with one of two possible responses:
1. Encourage full proposal, and may provide feedback
2. Discourage full proposal, and will provide rationale (may provide feedback)

- DARPA will not communicate further (verbally or in writing)

Regardless of DARPA’s response to an abstract, proposers may submit a full proposal

- DARPA will review all full proposals submitted without regard to abstract recommendation/feedback
Full Proposal Ground Rules

Proposals can address:

- A proposal can **ONLY** address a single Technical Area
  - TA-1A, TA-1B, or TA-2

- A proposer can submit proposals to multiple Technical Areas

- A proposer can be selected for multiple technical areas

Seeking Contract or OT: Submit **ONLY** to https://baa.darpa.mil

Seeking Grant or Cooperative Agreement: Submit **ONLY** to Grants.gov or Mail (Hard Copy)

TIP 1: Propose to the program (goals, objectives, schedule, deliverables, etc.) the BAA has defined, not to the program you desire.

TIP 2: Stay in your swim lane (TA).
Volume 1: Technical/Management Proposal

- Be mindful of the page limitations
- Be mindful of preparation instructions in the “Funding Opportunity Description”
- Be sure to respond to all of the required “Detailed Proposal Information” items

E. National Security Impact Statement

- This proposal topic is relatively new to MTO BAAs (See Evaluation Criterion #2)
- How the proposed work contributes to U.S. national security and U.S. technological capabilities. The proposer may also summarize previous work that contributed to U.S. national security and U.S. technological capabilities.
- Plans and capabilities to transition technologies developed under this effort to U.S. national security applications and/or to U.S. industry. The proposer may also discuss previous technology transitions to the benefit of U.S. interests.
- Any plans to transition technologies developed under this effort to foreign governments or to companies that are foreign owned, controlled or influenced. The proposer may also discuss previous technology transition to these groups.
- How the proposer will assist its employees and agents performing work under this effort to be eligible to participate in the U.S. national security environment.

Volume 2: Cost Proposal

- No page limitations
- Be sure to include full subcontract proposals (no ROMs)
Associate Contractor Agreement (ACA)

- TA-1A and TA-1B performers will be required to establish ACAs with each other per BAA and the resulting contract clause – **must be in place prior to contract award**

- The performers (associate contractors) will have no contractual prime/sub relationship

- Each performer (associate contractor) operates under a separate (Prime) contract

- The ACA sets the basic collaboration relationship ground-rules to ensure both parties agree to work together (share data) to meet the defined project goals and objectives
  - It is common (although not specifically required per the clause) that the ACA also include standard Non-Disclosure Agreement (NDA) type language (data marking, data control, IP ownership, etc.)

- The Government is **not** a party to the ACA (does not sign it – only the performers sign it)
  - Contracting Officer gets a copy for the file as verification purposes only

NDAs, Design Kit License Agreements, etc.

- Each performer is responsible for putting these in place with the TA-1A foundry/ies for access to PDKs or similar (**post award**)

Proposal Preparation

- Be sure to include required coordination plan (see BAA page 12)
Data Rights

If asserting less than Unlimited Rights (e.g., Restrictions):
- Provide and justify basis of assertions using the prescribed format
- Explain how each item will be used to support the proposed research project
- Explain how the Government will be able to reach its program goals (including technology transition)

- The above Data Rights Cert includes prime and sub info, as applicable
- Provide even if you are proposing other than a contract (see OT backup slides)

- This information is assessed during evaluations (barriers to transition)

T-MUSIC Specifics:
- TA-1A: Government shall have no less than Limited/Restricted Rights (or similar if an Other Transaction)
- TA-1B: Government shall have no less than Government Purpose Rights (or similar if an Other Transaction)
- TA-2: Government shall have no less than Government Purpose Rights (or similar if an Other Transaction)
Pitfalls That Delay (or prevent) Proposal Review

- **Failure to submit proposal on time**
  - There is a small safety net built in for this BAA (rolling submissions after the initial due date through 8 April 2019 – a few weeks). However, it is not a guarantee as funding may be exhausted during the initial round of selections.
    - *PIs must keep an eye on this if somebody else in your organization is submitting*

- **Failure to submit using the correct mechanism (noncompliant!)**
  - DARPA BAA site only (Procurement Contracts & OTs Only)
  - Click “Finalize Full Proposal” button or it does not get submitted
    - *PIs must keep an eye on this if somebody else in your organization is submitting*

- **Failure to submit both proposal volumes (noncompliant!)**
  - Volume 1, Technical/Management
  - Volume 2, Cost

- **Pages beyond the page limitation (tech prop) – pages will not be reviewed**

- **ROM/s instead of full subcontract cost proposal/s (noncompliant!)**
  - “I didn’t have time to get the subcontract proposal/s” will not change the outcome
    - *This is a competition – we won’t select what we don’t understand*
Communications

- **Prior to Receipt of Proposals (Solicitation Phase):** No restrictions, however Gov’t (PM/PCO) shall not dictate solutions or transfer technology
  - Typically handled through the FAQ

- **After Receipt of Proposals/Prior to Selections (Scientific Review Phase):** Limited to Contracting Officer or BAA Coordinator (with approval) to address clarifications requested by the review team
  - Proposal cannot be changed in response to clarification requests

- **After Selection/Prior to Award (Negotiation Phase):** Negotiations are conducted by the Contracting Officer
  - PM and/or COR typically tasked with finalizing the SOW (with PI)
  - PM and/or COR typically involved in any technical discussions (i.e., partial selection discussions)
  - Pre-award costs will not be reimbursed unless a pre-award cost agreement is negotiated prior to award

- **Informal Feedback Sessions (Post Selection):** May be requested/provided once the selection(s) are made
  - If made on a timely basis (~2 wks after letter), all requests will be accepted
Further Info Regarding OTs

- The following slides are provided for new Non-Traditional DoD performers.
  - They will not be presented during the T-MUSIC Proposers Day.

- Additional information is also available on the ERI Webpage (DARPA Website - “Work With Us” / “Electronics Resurgence Initiative”).
  - Agreement Template (“ERI TIA Model”)
  - Companion Guide
  - Maybe an excerpt of the Page 3/FRANC Proposers Day video where I present the following OT slides

- Additional information is also available on the Contract Management Webpage (DARPA Website - “Work With Us” / “Contract Management”).

- I am available to discuss (I will not discuss the BAA itself).
Other Transactions

Technology Investment Agreements (ERI Fits Best Here)

- DoD-created term that encompasses OTs for Research under 10 U.S.C. 2371 and flexible cooperative agreements under 10 U.S.C. 2358
- To engage nonfederal entities in working collaboratively with the Government on basic, applied, or advanced research projects
- These instruments are premised on the resulting technology being dual-use
- Considered an assistance arrangement
- Presently covered in Part 37 of the DoDGARs (Department of Defense Grant and Agreement Regulations)

OTs for Prototypes (purely military needs)

- Allows DoD to enter into OT agreements to carry out “prototype projects that are directly relevant to enhancing the mission effectiveness of military personnel and the supporting platforms, systems, components, or materials proposed to be acquired or developed by the Department of Defense, or to improvement of platforms, systems, components, or materials in use by the armed forces.”
- 10 U.S.C. 2371b
- Considered an acquisition arrangement (supplies or services for the direct benefit or use of the Federal Government)
- DoD has issued an OT for Prototype Guide (Jan 2017) – available on the web.
Other Transactions

No matter the type of OT – most of the acquisition statutes don’t apply, and none of the acquisition regulations apply:

- Competition in Contracting Act (CICA)
- Truth in Negotiations Act (Truthful Cost and Pricing)
- Cost Accounting Standards
- Contract Disputes Act
- Procurement Protest Process
- P.L. 85-804 and indemnification
- Cost plus a percentage of cost prohibition
- Buy American Act (in part)
- Bayh-Dole Act (patents)
- FAR/DFARS/Agency specific acquisition regulations
  - Termination for Convenience or Default
  - Changes Clause
  - Mandatory flowdowns to subcontractors

But! Some laws (not considered acquisition regs) still do apply:

- Criminal Laws (false claims/statements)
- Laws of general applicability (Civil Rights Act)
- Laws that would apply to anyone doing business in the U.S. (e.g. environmental laws, import/export control)
Other Transactions

Why use an OT?
- Attractive to contractors looking for elasticity in their agreements
- Attracts companies that would normally avoid DoD business
- Any apparent risk allows parties to change the terms to be more suitable to the party absorbing most of the risk
- Invokes commercial practices, such as negotiating terms and conditions
- Removes rigidity of traditional Government procurement
- Promotes trust and a spirit of cooperation with industry

➢ OTs involving non-federal (performer) cost share form a partnership between the Government and the Performer (not just the usual Customer-Performer relationship)

➢ The usual Government procurement safeguards are removed, and risks to the Government increased, which is why the associated statutes involve cost share in most cases.

➢ TIA = 50/50 share to the maximum extent practicable. Sets the expectation (dual-use), but not a firm requirement – it’s negotiable.

➢ OT for Prototypes:
  ➢ 1/3 Performer cost share required (except for small business and non-traditionals)

➢ The inclusion of cost share does influence the terms and conditions negotiation.
Factors to consider (TIAs)

– The Nature of the Project
  • Does it involve the support or stimulation of research?
  • Is it relevant to integrating the technology into the commercial industrial base?

– The Type of Recipient
  • Is a for-profit performer involved in the research?
  • Will the program be more successful with a team approach or a single performer?
    – These efforts often work well with consortia or teams to facilitate collaboration
    – Single firms are permissible, especially when there will be collaboration between their government and commercial divisions

– The Recipient’s Commitment
  • Is there evidence of commitment to incorporate the technology into future products?
  • Are they prepared to cost-share and is the cost-share high quality?

– The Degree of Government Involvement
  • Is the expectation that the Government will be part of the team with insight into progress?
  • Is the recipient or team prepared to self-police and take a leadership role in managing the program?

But keep in mind – OTs can take longer to negotiate than a standard procurement (FAR/DFARS) contract.
Other Transactions (TIAs)

- There is a ERI “Model” TIA available on the ERI webpage.
  - This “Model” is unique even to DARPA (i.e., IP terms and conditions).
  - See also the companion document – it helps you get into the Contracting Officer’s head.

- If you have little to no experience contracting with the federal government, but really want to be an ERI performer, don’t let the unknown (or misinformation) prevent you from submitting a proposal!
  - The Government is not out to steal a performers IP.
    - The Performer owns the IP that is created (all award instruments).
    - The Government seeks only a license to use the IP that is created (Patent and Data Rights).
    - The extent of the Government use rights (data) is negotiable and depends on such factors as program goals and objectives, non-federal (performer) cost share, the nature of each specific data/software deliverable, etc.
    - Yes – the Government typically seeks/prefers Unlimited Rights (no use restrictions at all – but,, as noted, it negotiable).

- The Performer owns all pre-existing IP.
- Any rights the Government has to use pre-existing IP (typically data/software) is negotiable.
**Other Transactions (TIAs)**

**How do we negotiate OTs?**

1. It starts with the Statement of Work (referred to as a Task Description Document/TDD for OTs.
   - Well defined tasks that map to the a well defined program plan/schedule (prime and subs)

2. It also starts with clearly defined deliverables (data, software, material items).
   - What are they?
   - What is the Government going to do with them once delivered (think program goals and objectives) and how does this relate to data rights for each deliverable?

3. Taking the time immediately after selection to ensure each party fully understands the technical goals and objectives, and expectations specific to the proposed/selected project.
   - Work to quickly resolve any misunderstandings and fine-tune the TDD (deliverables).

4. Then – when the above has been accomplished, we work to fine-tune the agreement terms and conditions to ensure it fits the above.

5. Cost is negotiated along the way – the extent is at least somewhat related to the amount of non-federal (Performer) cost share involved.

- Negotiation can take as little as 90 days or as long as 180+ days (each OT is unique)