S²MARTS

PROJECT TALX

Transparent Accessibility • Live Exchange

FOR

Advanced Integration Interconnect & Fabrication Growth for Domestic

SOTA Radio Frequency Gallium Nitride

"STARRY NITE"

July 1, 2021 • 3:00PM (EST)

About the Q&A

Q&A Review Process

1. Questions can be submitted two ways:
    - By visiting www.slido.com on any device and entering the event code **#StarryNitePJTX**
    - By scanning the QR code shown on any slide
2. Questions will then be captured and shared with the audience in real time

Join via web
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or scan the QR code
using your smartphone

Speaking Today

- **Ms. Brooke Pyne |** Principal of S²MARTS
- **Mr. Tony Kestranek |** Deputy Director of S²MARTS
- **Mr. Jalen Rollins |** S²MARTS Collaboration Coordinator
- **Dr. Joshua Hawke |** Chief Engineer of RF & Optoelectronics, NSWC Crane
- **Dr. Brian Olson |** Chief Engineer of Solid-State Technologies, NSWC Crane

Interested in submitting a question?
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Webinar Agenda

Project 21-12:
Advanced Integration Interconnect & Fabrication Growth for Domestic
SOTA Radio Frequency Gallium Nitride
"STARRY NITE"

Rules of Engagement

Project Discussion

Q&A Open Exchange via Slido.com

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Rules of Engagement

- Remember the intent
- Not intended to vet your specific solution
- Primarily a programmatic/technical conversation
- Any discrepancies? Documentation takes precedence
- Time permitting, all questions will be answered

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Project 21-12:

Advanced Integration Interconnect & Fabrication Growth for Domestic

SOTA Radio Frequency Gallium Nitride "STARRY NITE"

- **Dr. Joshua Hawke |** Chief Engineer of RF & Optoelectronics, NSWC Crane
- **Dr. Brian Olson |** Chief Engineer of Solid State Technologies, NSWC Crane
- **Mr. Shaun Davis |** S2MARTS Program Manager, NSWC Crane
- **Mrs. Anna Gates |** S2MARTS PM Team, NSWC Crane
- **Mr. Eric Hendrix |** S2MARTS PM Team, NSWC Crane
- **Mr. Carson Polley |** Contracting Officer, NSWC Crane
- **Mrs. Suzanne Kixmiller |** Agreements Officer, NSWC Crane
- **Mrs. Rebecca Poplin |** Contracting Specialist, NSWC Crane
- **Mr. Eric Vanwiltenburg |** Legal Counsel, NSWC Crane

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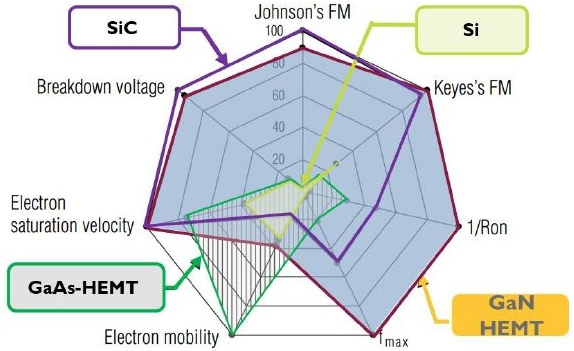
RF GaN Applications



Source: OKI Semiconductors

GaN RF Market: Applications, Players, Technology and Substrates 2021 | Report | www.yole.fr | ©2021

Strengths

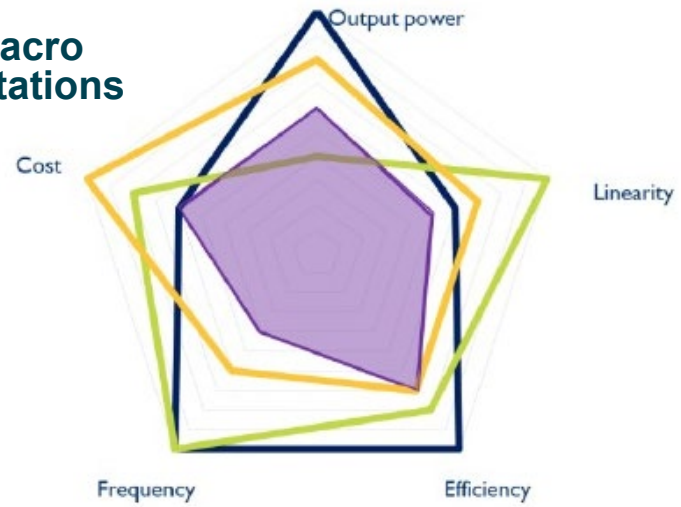
- High PAE (low loss and system cost)
- High Power Out
- High Thermal Conductivity
- Small System size
- Wide Bandwidth (fewer components)
- Ruggedness
- Radiation Hardened

Weaknesses

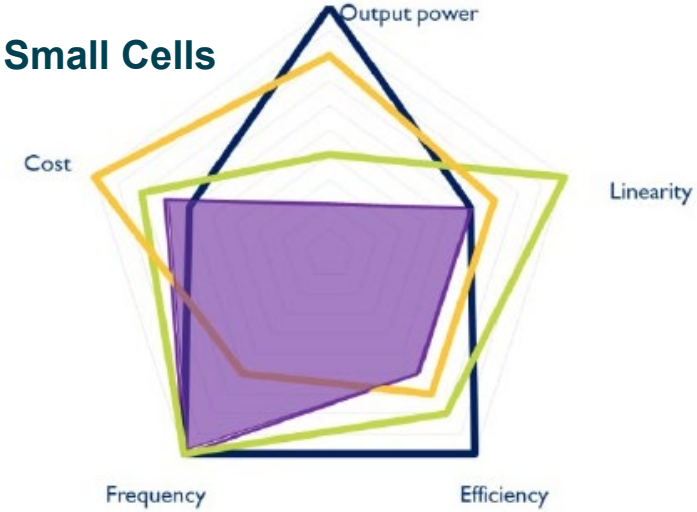
- Limited substrate size
- High Cost
- Limited # of qualified GaN device suppliers
- Need for advanced technology nodes <0.15µm
- Low Maturity
  - Parasitic resistances
  - Short channel effects
  - Thin wafer handling
- Need innovative MMIC & FEM designs

GaN Poised to Satisfy Market Requirements

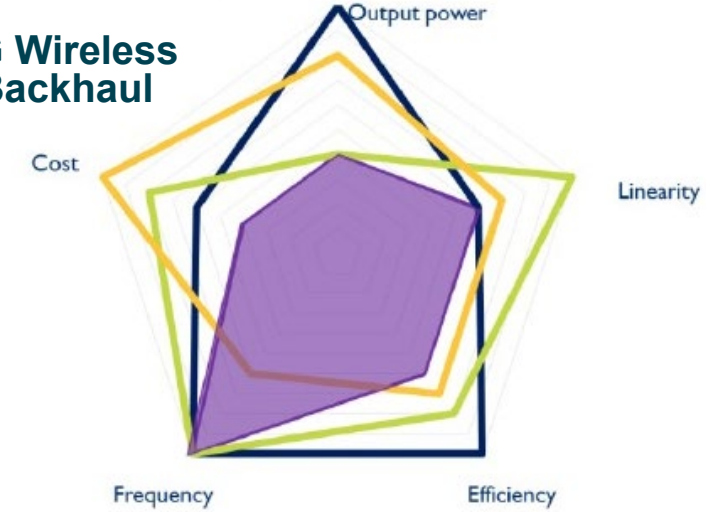
5G Macro Base Stations



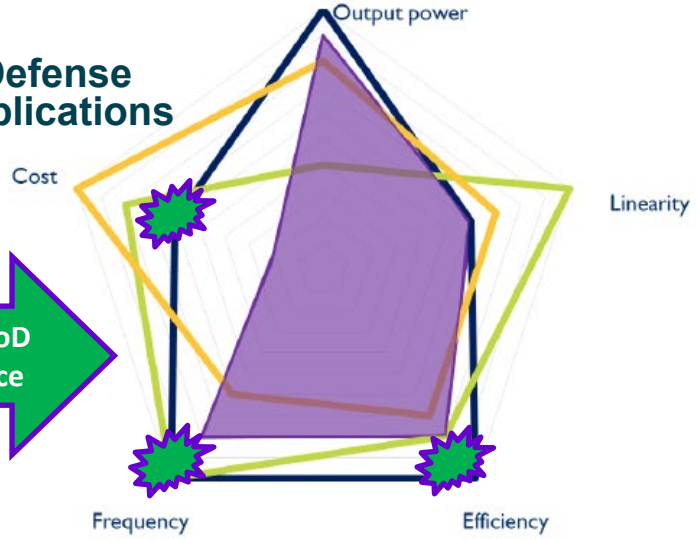
5G Small Cells



5G Wireless Backhaul

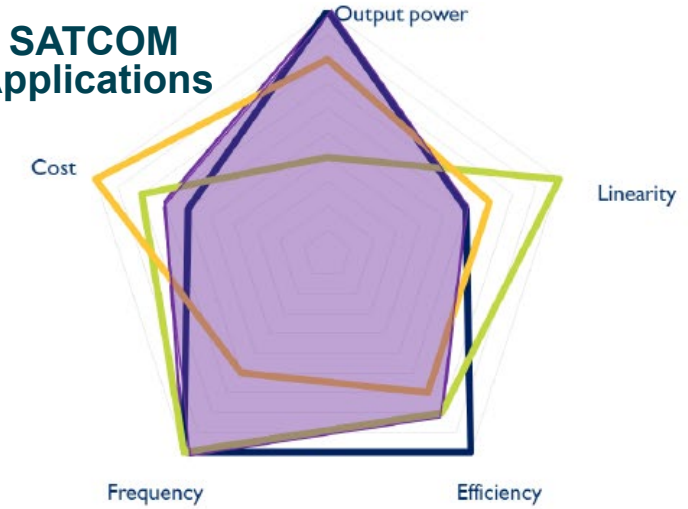


Defense Applications



High frequency apps driving **new DoD requirements** in **Cost & Performance**

SATCOM Applications



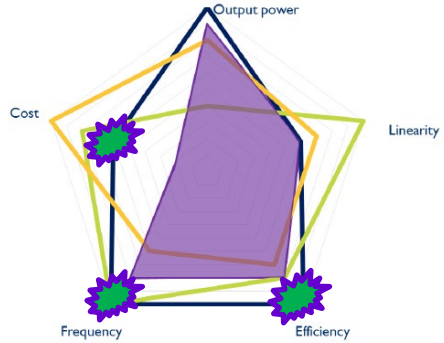
GaN RF Market: Applications, Players, Technology and Substrates 2021 | Report | www.yole.fr | ©2021

RF GaN in Defense

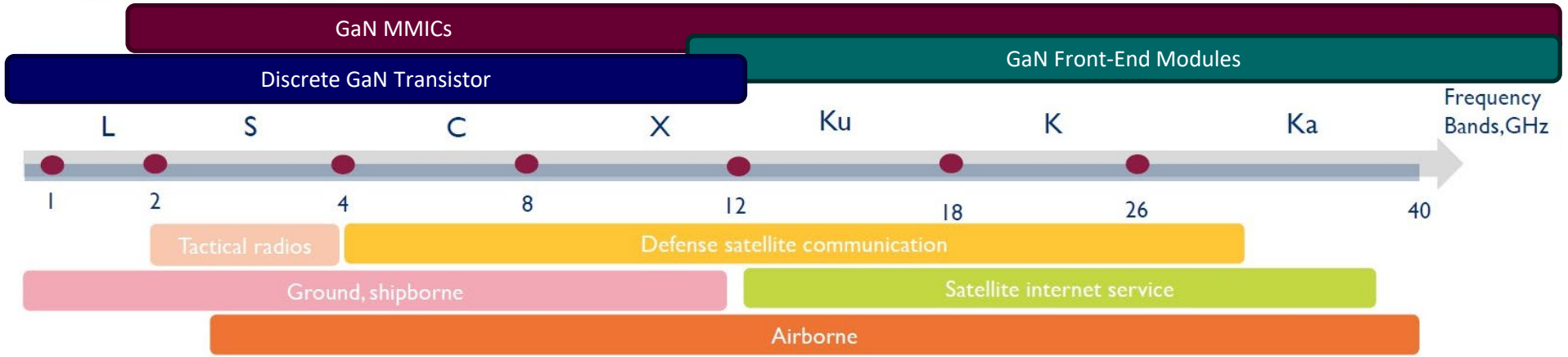
Can we afford more platforms?

Can we cover wideband threats?

Can we extend mission time?

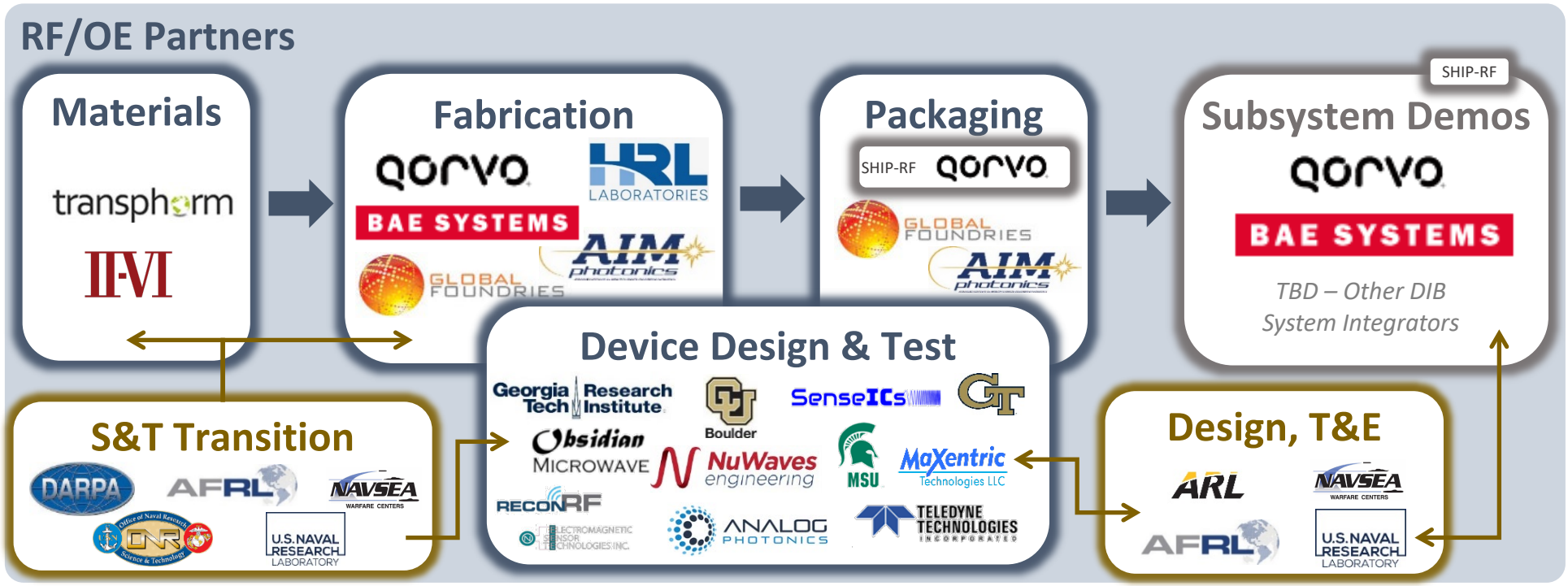


Defense Requirements



OUSD(R&E) Trusted & Assured Microelectronics

RF/OE & SHIP-RF Ecosystem Concept



RF/OE Goals

- Develop domestic access to mature SOTA RF/OE materials, foundries, and packaging, which enables next generation sensors and communications
- Demonstrate ecosystem alignment via SOTA RF/OE devices and subsystems, which transition USG S&T to the Defense Industrial Base and Programs of Record.

USG | RF/OE | SHIP-RF

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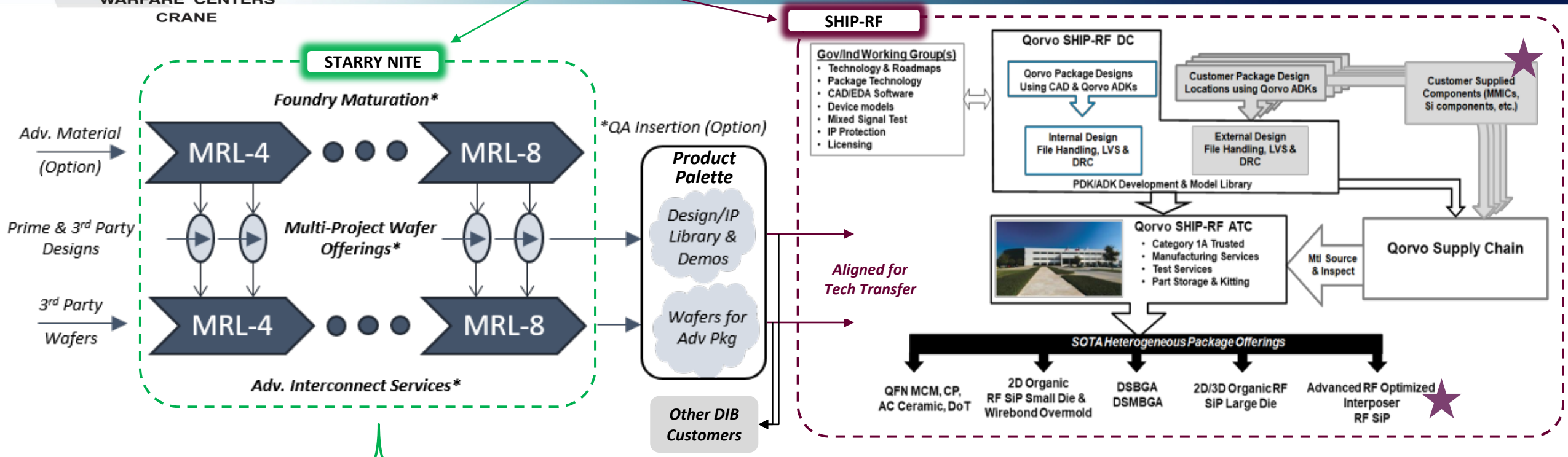
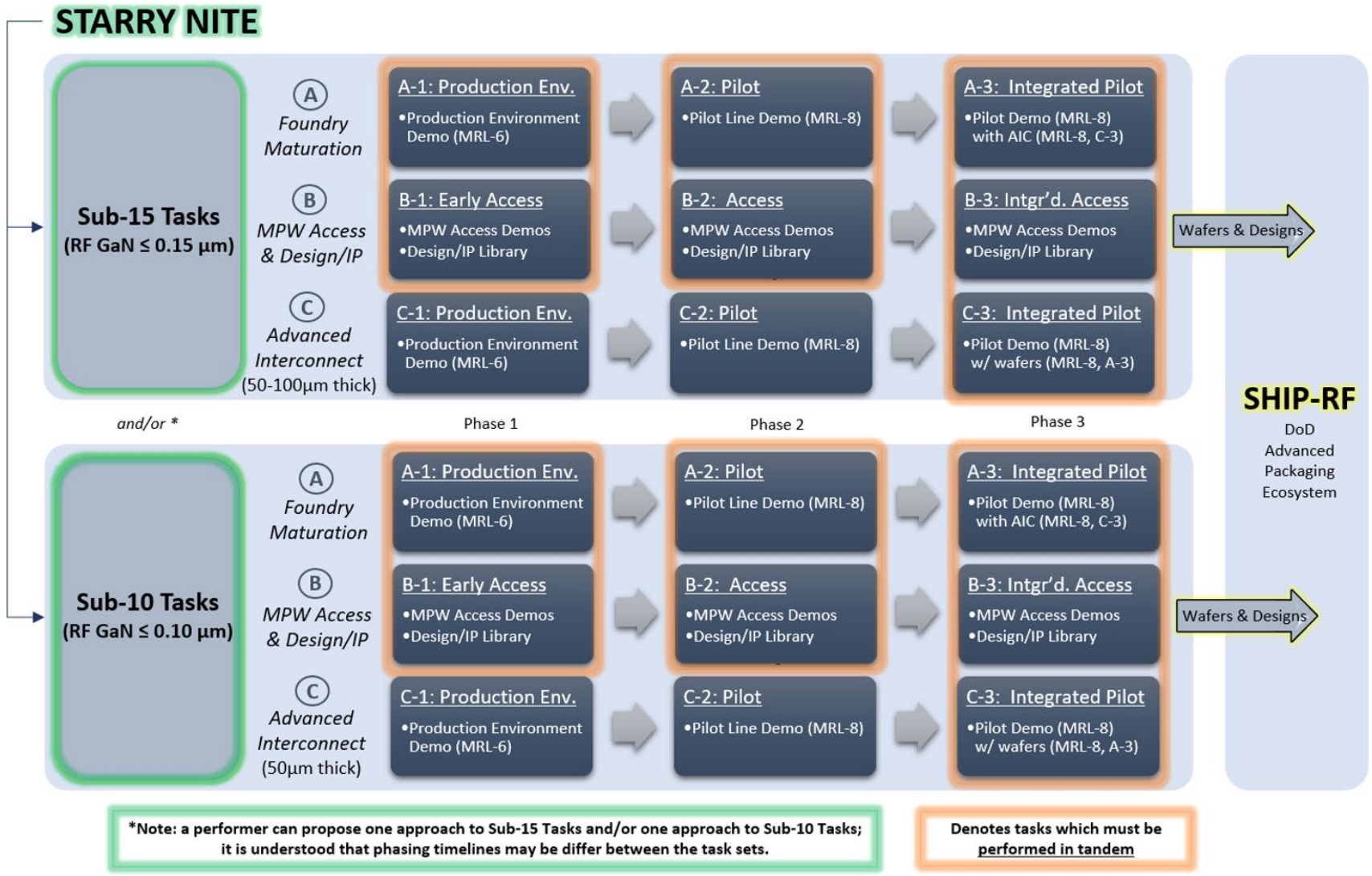
Material → Fabrication → Packaging → Device Demo → Subsystem Demo

STARRY NITE Ecosystem & Goals



- **Invest in US-based RF GaN foundries**
- **Target high-frequency nodes**
  - **"Sub-15" → gate length < 0.15µm**
  - **"Sub-10" → gate length < 0.10µm**
- **Demonstrate "pure-play" business model**
  - **Recurrent open-foundry MPW access**
  - **Secure design/IP capture**
- **Offer advanced interconnect**
  - **Compatible with DoD Packaging Ecosystem**
  - **Service "prime" and "third-party" wafers**
- **Accelerate maturation at production volume**
  - **Start: MRL-4 "R&D Environment"**
  - **Finish: MRL-8 "Pilot Line"**
- **Transition Designs, IP, and Wafers into DIB**

STARRY NITE's RFS Structure



- One performer can submit one proposal per node
  - I.e., 2 proposals max
    - 1 proposal for Sub-15
    - 1 proposal for Sub-10
  - Each proposal should stand alone
- Entry Criteria
  - A-1 & B-1: MRL-4 RF GaN process
  - C-1: MRL-6 RF GaN process and MRL-4 AIC process
- The proposal "node" is determined by the end-state node of Phase 3
  - E.g., a Sub-10 proposal may require maturing AIC technology from a Sub-15 node in Phase 1 and then transferring it to a Sub-10 node in Phase 2 for integrated demonstration in Phase 3 on a Sub-10 node
- "Second Fiddle" proposals accepted
  - It is acceptable to submit a proposal addressing only Task Lanes A&B with a path towards partnering with a "third-party" AIC servicer provider in Phase 3.
  - Note: although multiple awards are a possibility, the government cannot guarantee multiple awards.

Questions & Answers

- Today's topics will be captured in the Q&A posting on S2MARTS.org
- Reminder: Any changes will be publicized via RFS modification
- Slido Event Code: **#StarryNitePJTX**

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QUESTION 1

Is there a requirement or preference for all AIC steps to be physically performed by the RF GaN foundry performer, as opposed to outsourcing

There is no requirement prohibiting an RF GaN foundry performer from outsourcing advanced interconnect processes. However, please keep in mind that one of the primary objectives of the effort is to establish domestic capabilities.

QUESTION 2

Is there a targeted project kickoff date? For example, would proposing a 2023 kickoff for a given task set put an offeror at disadvantage?

Kickoffs will be held immediately after project award. Proposals can be held "on-the-shelf" at NSTXL for up to three years and could therefore potentially be considered for future years' funding. However, said theoretical award, could not be considered/made until said future years' budget has become available.

QUESTION 3

For the purpose of this solicitation, can an RF GaN process with a key process step being done externally, e.g. outsourced or with development partner, qualify for MRL-4?

The MRL-4 entry criterion will be evaluated in accordance to the DoD MRL Deskbook (http://www.dodmrl.com/MRL%20Deskbook%20V2020.pdf).
If partnering/outsourcing, please note that some of the primary goals of the program are investing in domestic foundries and reaching an end state of MRL-8.

QUESTION 4

May a small business submit a proposal to develop 1 step of the foundry process or is it better to team with the large GaN foundries?

A key entrance criterion for the program is having demonstrated an existing GaN fabrication process at MRL-4. If this is not the case, a support role is most likely appropriate.

QUESTION 5

Entry criteria for Phase C-1 is a pre-established R&D process (MRL-4) for AIC and a pre-established RF GaN foundry with production environment demonstration (MRL-6). " - Are teaming arrangements allowed in order to meet these two requirements?

Yes. Teaming arrangements are acceptable.

S²MARTS Open Exchange

Join via web or scan the QR code using your smartphone

StarryNitePJTX

Closing Reminders

- All Q&A's are publicly available – visit S2MARTS.org
- Proposals are due on **July 26 at 12:00pm EST.**
- Follow the instructions within the Request for Solutions (RFS)
- Ensure your membership is active
- Engage with other potential partners using NSTXL Community

S²MARTS

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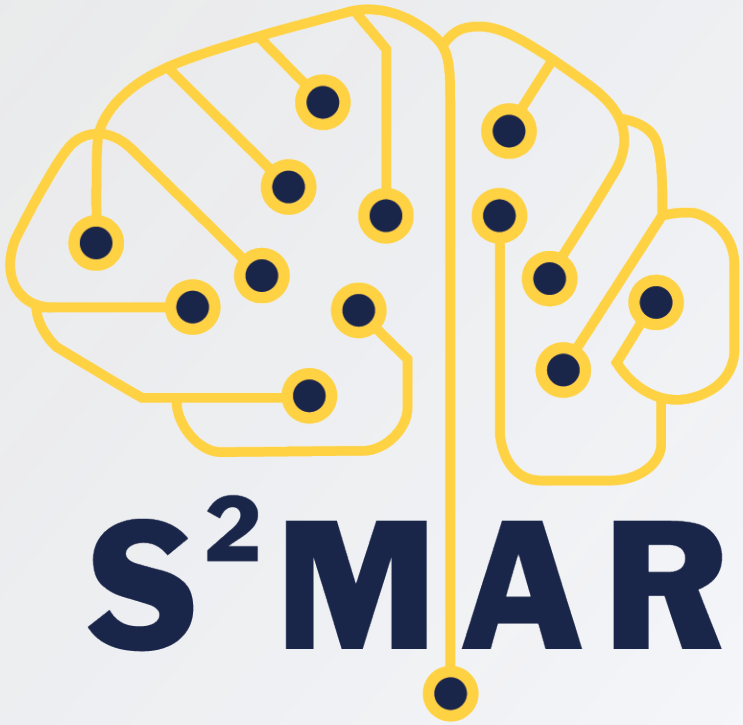

Thank you for joining!