PAWR Project Office

Platforms for Advanced Wireless Research (PAWR) Proposers' Day

April 27, 2017

Today's Agenda

Morning

- **10:00** – Welcome & Agenda Overview
- **10:30** – Significance of PAWR Program
- **11:00** – RFP Walk-through
  - Guiding principles/Research vision
  - Platform vision
  - RFP requirements
  - Spectrum requirements
- **12:30** – Lunch and "Lightning Talks"

Afternoon

- **2:30** – Technical Discussion
  - Architecture framework
  - Services framework
- **3:00** – PPO Role & Organization
- **3:30** – Q & A
- **4:00** – "Office Hours"
- **5:00** – Networking and Team-building Break

Tweet your questions to: @US_Ignite and use the hashtag #PAWRQA

Meet the PAWR Project Office

Strong Project Management

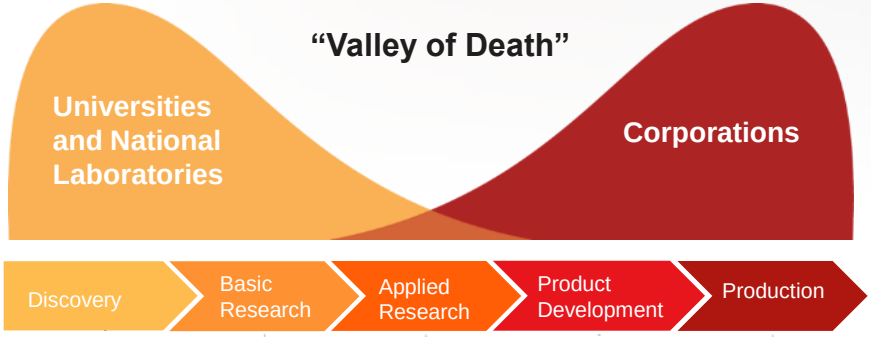
Strong Expertise in Wireless Networking

Level-Setting: PAWR Approach

Attribute	Approach
Problem Definition	Enhanced efforts of ~400 university researchers who need mid-scale testing capabilities to ensure success
Early Industry Involvement	Multi-use research platforms with “pre-competitive” research topic areas selected bottom-up by university PIs, with industry input
Research Scope	Mid-sized areas within cities, experimental platforms, 10-20 antenna sites, backhaul, SDRs
Flexibility and Speed	1 - 2 platforms per year in years 1 and 2, followed by a 4th in year 3
Streamlined governance, deployment, and operation	One governance consortium focused on upfront research and policy; city/university teams propose how to streamline deployment and ops

Problem Statement: Bridging the “Valley of Death”

- NSF historically funds over $50M annually in fundamental, pre-competitive wireless research
- This research could be greatly strengthened if:
  - Researchers had access to mid-scale, end-to-end research platforms
  - Industry collaborated earlier in helping to define and focus research areas



GUIDING PRINCIPLES/ RESEARCH VISION

PAWR Vision

What is the PPO trying to do?

Large gap between basic research and industry

Too often research results don't make it out of the lab

Challenges

Experimental Research in Wireless: Small scale, ad hoc and disconnected platforms, lack of rigor, **results not reproducible**

PAWR is an unprecedented opportunity to change this state of affairs!

Create evidence-driven community of wireless experimenters with shared culture and high standards

Bridge gap between academic research community and industry

OBJECTIVES

Foster innovation through involvement of local communities

PAWR Guiding Principles

Sustainability

A community that facilitates ***low-cost access to wireless infrastructure*** such as ***low-cost real estate and backhaul while streamlining permitting processes*** will make available additional funds for the purchase of advanced wireless equipment

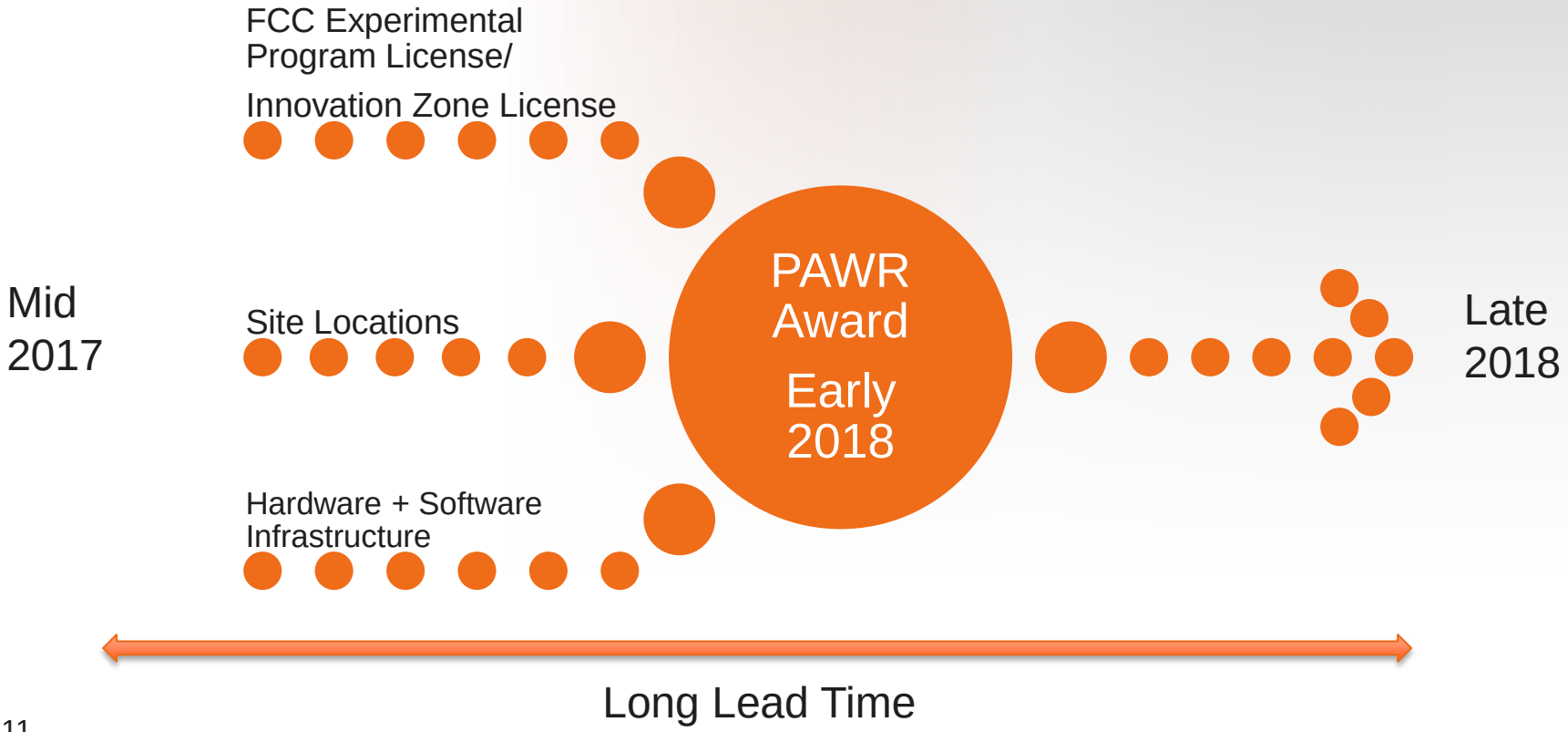
Platforms need to be based on sound operational/financial models that will guarantee sustainability beyond 5 years of initial funding

Modular, extensible, platforms that can be upgraded over the years

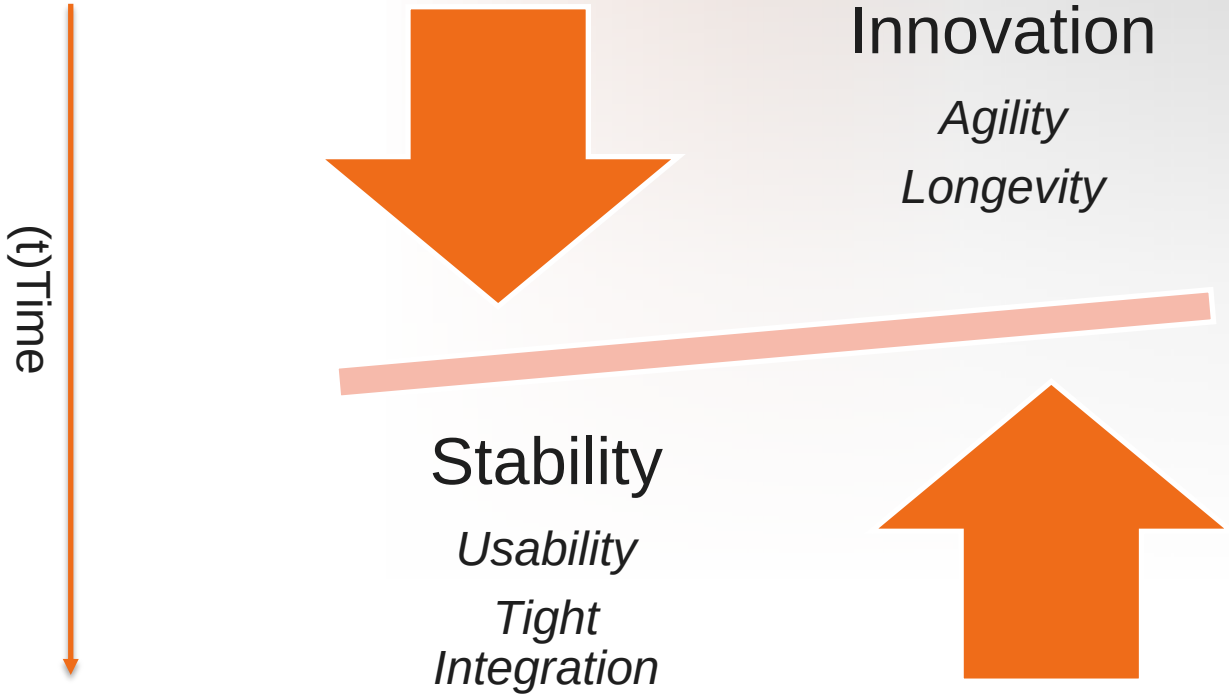
Long-lasting Platforms with Strong Research Impact

PLATFORM VISION

Platform Development Timeline



Platform Development Trade-Off



Role of Key Personnel

Operational Staff

Day-to-Day Operations
Maintenance
Experimenter Support
Management

Research Staff

Innovation
Research
S/W Development
H/W Development

RFP REQUIREMENTS

Key Dates

- Expression of Intent to Submit proposal (optional)
  - May 8, 2017
  - Please submit your team's intent to submit: http://bit.ly/Intenttosubmitproposal
- Preliminary Proposal (required)
  - June 1, 2017, 6pm Eastern Time
- Full Proposal (required)
  - July 31, 2017, 6pm Eastern Time
- Finalists announced
  - No later than October 2017
  - Site visits to be completed by the end of 2017
- Winner(s) announced during the first quarter of 2018

Eligibility

- Proposals may only be submitted by the following:
  - Universities and Colleges
  - Non-profit, non-academic organizations
- Limit on Number of Proposals per Organization: 1
- Who May Serve as Project Director and/or Principal Investigator (PI)?
  - Project Directors/Principal Investigators may be affiliated with universities/colleges or with non-profit, non-academic organizations
  - PI on one proposal may not participate in this role on any other proposal, but may participate in other proposals in another role
  - These eligibility constraints will be strictly enforced

Program Description - Overview

- Joint effort by NSF and a wireless Industry Consortium to create at-scale research platforms to accelerate fundamental research
- Enables experimental exploration of robust new wireless devices, communication techniques, networks, systems, and services
- Constitutes an unprecedented opportunity to create and grow an evidence-driven community of wireless networking experimenters with a shared culture and high standards

Program Description - Design

- Support a diverse community of researchers across the country, in both academia and industry
- Free to focus on just one wireless technology area, but could be flexible enough to support multiple research areas
- Demonstrate overall community commitment and the level of community facilities, resources and services made available for the project
- Define users and usage scenarios as well
- Provide Institutional Review Board (IRB) approval if the experiment is using resources other than just PAWR-provided infrastructure
- Enable creation of novel applications and distributed systems
- Demonstrate how such application areas and services are expected to benefit citizens in the community and overall economic development

Program Description - Deployment

The deployment project plan will not be required for preliminary proposals, but must be submitted as part of the full proposal

- Required to develop a detailed deployment project plan as part of an overall platform development plan or “PDP” that will clearly lay out timelines and costs associated with:
  - Location and site plans and costs
  - Permitting, licensing, and other permissions necessary for deployment
  - Partners/vendors responsible for deployment, keeping in mind any federal or local requirements for open bidding and competition
  - Any risks and contingencies that might delay or alter the PDP in any way
- Must include detailed dates, resources needed, partners secured, and tasks associated with the deployment of the platforms
- Encouraged to optimize end-to-end value by identifying available resources and facilities and services at the time of the submission of the full proposal
  - The PPO, in consultation with the proposers, will incorporate in-kind contributions from the PAWR Industry Consortium after potential finalists are selected based on the review process
  - In addition, the PPO team expects to hold a technical negotiation with platform finalists in partnership with members of the PAWR Industry Consortium to identify feasible technology contributions

Program Description - Operations

The Platform Operations Plan (POP) will not be required for preliminary or full proposals, but must be submitted prior to final award

- Ensure sustainability of the platforms for the duration of the program and beyond
- Secure local corporate, municipal, or non-profit partners who can provide additional operational support that will increase the likelihood of long-term success
- Discuss in both preliminary proposal and full proposal how institutions and local community could support longer-term operation of the platform
  - Proposals that describe a plausible plan for sustainability (and usefulness) beyond NSF funding are strongly encouraged
  - Financial support for the operation of the platform must be included in the overall budget submitted in the platform proposal
- Provide a detailed Platform Operations Plan (“POP”) that will outline the management and financial needs to ensure that the platform remains operational through and beyond the program duration

Award Information

Over the next three years, additional platforms for advanced wireless research are anticipated, for a total of up to four such platforms. Subject to the availability of funds and quality of proposals received, NSF anticipates contributing $50 million in cash and the corporate members of the Industry Consortium anticipate contributing in-kind support of approximately $50 million

- **Anticipated Type of Award**: Subaward Agreement
- **Estimated # of Awards**: Up to 2
- **Anticipated Funding Amount**: Approximately $20,000,000 in cash and in-kind contributions per platform over five years for this RFP, subject to the availability of funds/contributions

Proposal Requirements

Preliminary Proposal (due June 1, 2017)

Project Description (max 8 pages)

- Vision and Technical Merit (max 2 pages)
- Research Community (max 2 pages)
- Community Engagement (up to 2 pages)
- Alignment with PAWR Vision (up to 1/2 page)
- Preliminary Implementation Plan (up to 1 page)
- Preliminary Sustainability Plan (up to 1/2 page)

Team Qualifications

- 2-pages per PI and co-PI/senior personnel – three co-PIs/senior personnel maximum

Full Proposal (due July 31, 2017)

Project Description (max 30 pgs)

- Platform vision (max 3 pgs)
- Platform Technical Architecture Design (max 4 pgs)
- Description of research community support and new research to be uniquely enabled by the platform (max 3 pgs)
- Description of engagement among academic researchers, industry, and the local community (max 3 pgs)
- Alignment with the PAWR vision (max 3 pgs)
- Platform Development Plan (max 6 pgs)
- Sustainability Plan (max 2 pgs)
- Risk Mitigation Plan (max 1 pgs)
- Management Plan, Organizational Structure, and Project Staffing (max 3 pgs)
- Contributions of Key Personnel in the Past Five Years (max 2 pgs)

Supplemental and Other Information

- Biographical Sketches (max 2 pgs per individual)
- Budget Form
- Budget Justification (max 5 pgs)
- Facilities, Equipment and Other Resources Section (max 10 pgs)
- Data Management Plan (up to 3 pages)
- Letters of Support (up to 2 pages each)
- List of Project Personnel and Partner Institutions
- Current and Pending Support Form

1 RFP Information

Platforms for Advanced Wireless Research (PAWR) Request for Proposals (RFP): Seeking Teams to design, deploy, and operate advanced wireless research platforms

Click here to download the RFP Reference Guide: Before you begin responding to this RFP, please download and read the RFP Reference Guide.

Click here to download Other Information supporting the RFP.

RFP "How To" Guide:

*For the preliminary proposal due by **June 1, 2017 at 6pm Eastern Time**, the only questions you will need to answer are shown in the column to the left of this page (Sections 2-9). For Sections 3-9, you will be asked to upload a pdf of your response.*

Please refer to the following resources when submitting your RFP response through the RFP365 system:

- RFP365 Responding to an RFP Help Topics
- RFP365 Support Channels
  - Phone: 816.287.0737
  - Email RFP365 Team: support@rfp365.com
  - "In Application" Help
- Email PAWR Project Office team: pawr-prerfp@us-ignite.org

Key Dates:

Proposers' Day (attendance encouraged, but not required)

April 27, 2017

Hyatt Centric Arlington, VA Please register here: https://goo.gl/forms/tRzheVwF1zpGnAT22

Cost Sharing

- **Voluntary committed cost sharing is prohibited.** Proposers and/or proposing partners may contribute resources to a given research platform and any capabilities needed to expedite permitting and other regulatory approvals:
  - All such resources must be clearly described in "Facilities, Equipment and Other Resources" section of
  - The Budget & Budget Justification should include the total request for funds, including the costs of all platform equipment and services to be covered by the award (plus applicable indirect costs)
- **Finalists selected for site visits will hold an in-depth technical negotiation with the PPO to secure exact details for proposed deployment and operation planning**
- **The final awarded proposal will contain three parts:**
  - Facilities, Equipment and Other Resources section specifying contributions from the proposer and/or proposing partners, along with in-kind contributions from the Industry Consortium
  - Budget for funding to be provided by NSF, including federally-negotiated indirect costs
  - Budget for funding to be provided by the Industry Consortium

Facilities, Equipment, and Other Resources

- Describe facilities and resources that are available to the proposing team to support the proposed platform, including, but not limited to:
  - Research and development facilities
  - Backhaul
  - Deployment sites
  - Power supply
  - Network operations support
  - Any capabilities needed to expedite permitting and other regulatory approvals typically required to deploy and operate wireless networks
- Any community facilities, equipment, and other resources should be explicitly listed in this section

Review and Selection Process

- For Preliminary Proposals, **PPO team will conduct an internal review process vs. merit review criteria and encourage/discourage full proposal submission**

- For Full Proposals, one or more review panels will be convened, **based on well-established NSF merit review procedures:**
  - Drawn from academia, industry, community, and the government sector
  - Names will not be released beyond the PPO
  - Assigned to each proposal based on expertise and pursuant to conflict-of-interest rules
  - Provide recommendations to the PPO Project Director, who will collaborate with PPO team to put forward site visit candidates to NSF and the Industry Consortium

- **The PPO team will work with the finalists and the PAWR Industry Consortium during the site visits to identify feasible technology contributions**
  - Based on these site visits and additional technical negotiations with the finalists, up to two winning proposals will be selected
  - Appropriate subawards of cash and in-kind contributions will be administered to the two winning proposals

Merit Review Criteria (1-3)

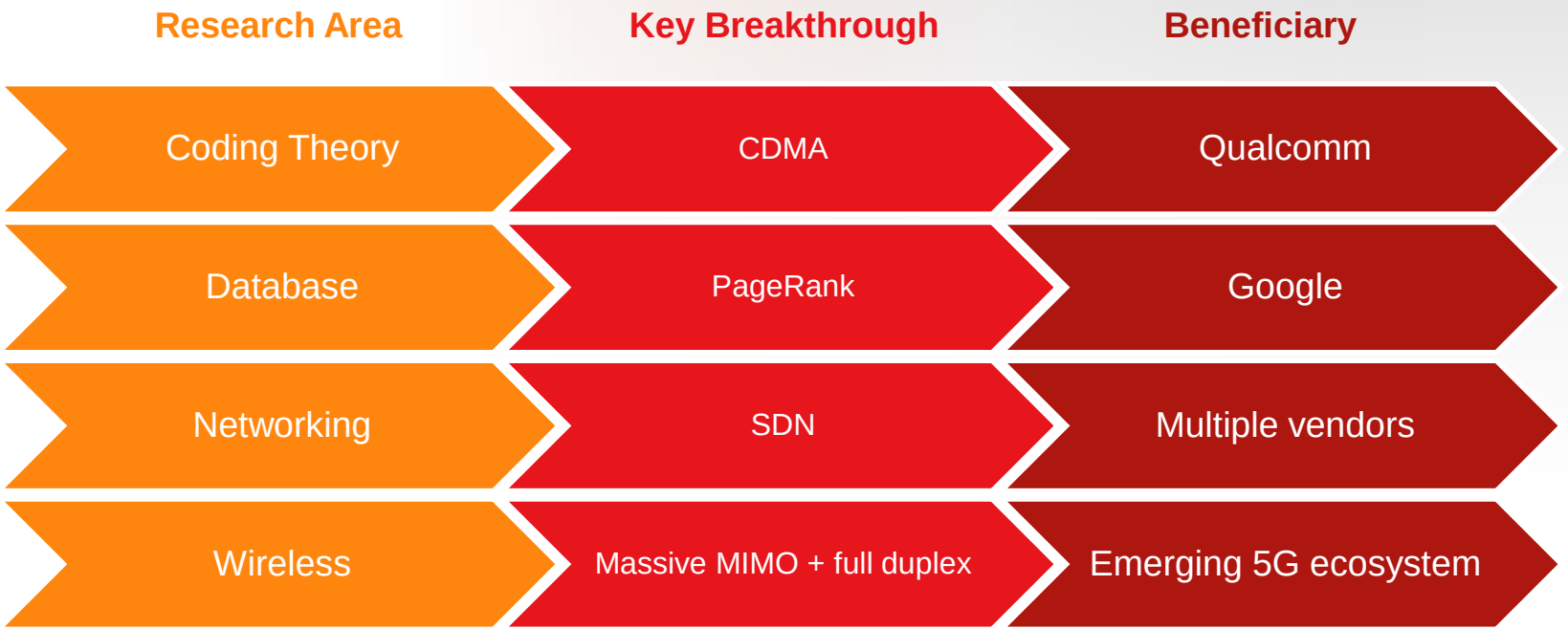
1. Vision and Technical Merit	• Is the research platform focused on disruptive, transformative technologies and applications instead of incremental approaches? • Is the platform design well motivated? • Do the proposers demonstrate awareness of existing academic and industry testbeds? • If so, does the platform complement such existing testbeds? • Is the platform development plan technically sound (required for Full Proposal only)?
2. Research Community	• Does the plan show commitment and evidence of capability to attract a broad and diverse group of academic and industry researchers in both the short and long term? • Is there broad research community support for the proposed platform? Who are the early users? • Will new transformative research be uniquely enabled by the proposed platform? • Does the platform balance the competing needs of short-term vs long-term research of industry and academic researchers?
3. Community Engagement	• Is there close alignment with community and other local stakeholders? • Is there a detailed plan for regular coordination with key stakeholders? • Is the PAWR deployment connected to the broader innovation and economic development organizations and plans of the proposed region? • Does the platform development plan leverage local support for deployment and operations (e.g., contributed value) – required for Full Proposal only?

Merit Review Criteria (4-6)

4. Alignment with PAWR Vision	Does the proposal provide convincing evidence that the proposed platform will support: • Reproducibility of research; • Usability; • Interoperability; • Programmability; • Open Access; and, • Diversity
5. Implementation plan	• Does the project team have the right expertise and experience to implement the vision as well as details of the research platform? • Does the proposing team have a track record of operating experimental testbeds that can help assess their ability to manage this project? • Does the plan follow the timeline suggested by the PPO, with sites operational as soon as possible and platform fully operational by year 3? • Is the deployment plan feasible, with clearly designed goals, timelines, and deliverables (required for Full Proposal only)?
6. Sustainability	• Are there long-term plans to evolve the platform beyond the 5 years of initial operations? • Is the operational model sound? Is it financially sustainable? How will research on the platform be funded (e.g., user fees, local financial support)?

Value Propositions

Together, achieve fundamental research breakthroughs similar to past/recent successes, e.g.:



DEVELOPING EFFECTIVE PAWR PARTNERSHIPS

Language Regarding Partnerships in the PAWR Request for Proposal (RFP)

- “The success of the PAWR program ultimately rests on **collaboration** among three important stakeholders within the information technology innovation ecosystem: university researchers, private sector companies, and local communities.”
- “Academic institutions and non-profit organizations such as local communities are strongly encouraged to form teams to respond to this RFP in order to adequately **achieve the goals** of the PAWR program.”
- “Teams comprised of both academic and institutions and local non-profit/community leadership will be considered the **strongest and most sustainable** teams.”

Vision for Effective PAWR Partnerships

Academic institutions

Technical know-how and experience administering wireless research platforms

Local Communities

Project implementation support, community stakeholder engagement

Benefits of Participation in PAWR Program

High visibility research that impacts communities

Benefits to Academic Researchers

- Access to at-scale wireless research platforms
- Expanded opportunities to access wireless research funding from NSF, Federal Agencies and Non-governmental sources
- Enhanced potential to advance the commercial readiness of an experimental wireless technology or innovation
- Opportunity to engage industry and develop research projects with industry input

Benefits to Local Communities

- Millions of dollars of direct investment in the economy of a community hosting a PAWR platform
- Recurring economic benefit from industry and government-funded research on PAWR platform
- Potential for job creation as wireless companies opt to locate a base of operations in communities hosting PAWR platforms
- Opportunity to test and refine innovative approaches to community services utilizing wireless technologies

Reviewers will Assess “Community” Engagement

Community Engagement is one of the six merit review criteria used to evaluate proposals during the Preliminary and Full Proposal phases.

Start the discussions early:

- Community administration and academia operate under different timelines, rules, and procedural steps
- Consider both the value of research outcomes and citizen privacy
- Detailed criteria listed under “Merit Review Criteria”

Important to demonstrate how a local community is providing support for the proposed PAWR platform.

Effective Partnerships: How can the PPO help?

Academic institutions

Resource for researchers with respect to outreach to local community leaders and can help “make the case” for PAWR participation

Local Communities

Resource to local community leaders with respect to outreach to community stakeholders, etc.

Community Examples

Geographical separation must be justified and explained in proposal.

Community with Wireless Experts

Comm. A + Wireless Experts in Comm. A or B + Comm. B

Comm. A + Wireless Experts in Comm. B

Examples of Support

Yes!

- Making sites available for base station installations
- Creating “maker spaces” for city-wide teams to converge and plan development/research
- Accelerating licenses and permits for deployment of technology in specific areas
- Sharing data that may influence the platform design and application/service focus
- Engineering support toward platform installations on site
- Donations of equipment

No!

- Contributing $ towards platform development
- Covering salaries for the academic team, engineers associated with external entities

Voluntary committed cost sharing is prohibited. Enabling facilities/ equipment/services are encouraged.

Illustration of the Importance of Cooperation between Academic Institutions and Local Community Leaders: IRB and Privacy Considerations

At-scale experimentation within the PAWR program requires more than the infrastructure

Users, usage scenarios and policies that facilitate and support user participation

Support a critical density of users related to a specific research area.

Proposers are encouraged to articulate how user participation will be encouraged on their platform!

Institutional Review Board (IRB) considerations

Additional policies that protect the privacy and security of residents in communities hosting PAWR Platforms

Platforms develop new privacy and security policies

May cover experiments that collect radio level or network level data.

PPO Efforts to Facilitate Partnerships and Teaming

- Maintaining a repository of companies, academics and local community leaders with an interest in PAWR
- Facilitating connections for wireless researchers and local government leaders in their university’s host community
- Providing list of private companies with an interest in PAWR to wireless researchers and local community leaders.

PPO Outreach Team

Academic Outreach

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Local Community Outreach

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Industry Outreach

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TECHNICAL DISCUSSION

Research Focus Areas

Flexible enough to enable multiple verticals, not limited to:

- Spectrum Sensing
- Dynamic spectrum sharing
- SDN, NFV, Edge Computing architectures
- Security
- Cellular, WiFi,802.X wireless technology
- Network performance, measurement and analytics

Architecture Elements

PAWR Site Elements:

- Programmable Wireless (RF, Baseband) Substrate
- Wireless and/or Fiber backhaul
- Software configurable edge infrastructure (SDN, NFV)
- Modular Hardware; extensible; BYOD
- White-Box and Black-Box User Equipment

RFP

*Each compliant full proposal should describe how at least **10-20** sites will be deployed over the initial five-year period-of-performance, in multiple locations, with **at least 4 radio sites and 2 local cloud computation sites operational by 12 months** after award and the complete build out including **all sites** and local cloud implementations operational by the **third year** of the award date*

PAWR Deployment Plan

ONLY REQUIRED FOR FINALISTS

- Deployment Size $\propto$ Time to become operational.
- Significance of Topologies enabled.
- Incremental Deployment schedule.
- OPEX exceeds CAPEX. Budget accordingly.
- Time or geographical sharing of environment.

The Platform Development Plan (PDP) is the section that describes activities, budget, and schedules for all design, deployment, and operations activities relating to the advanced wireless research platforms

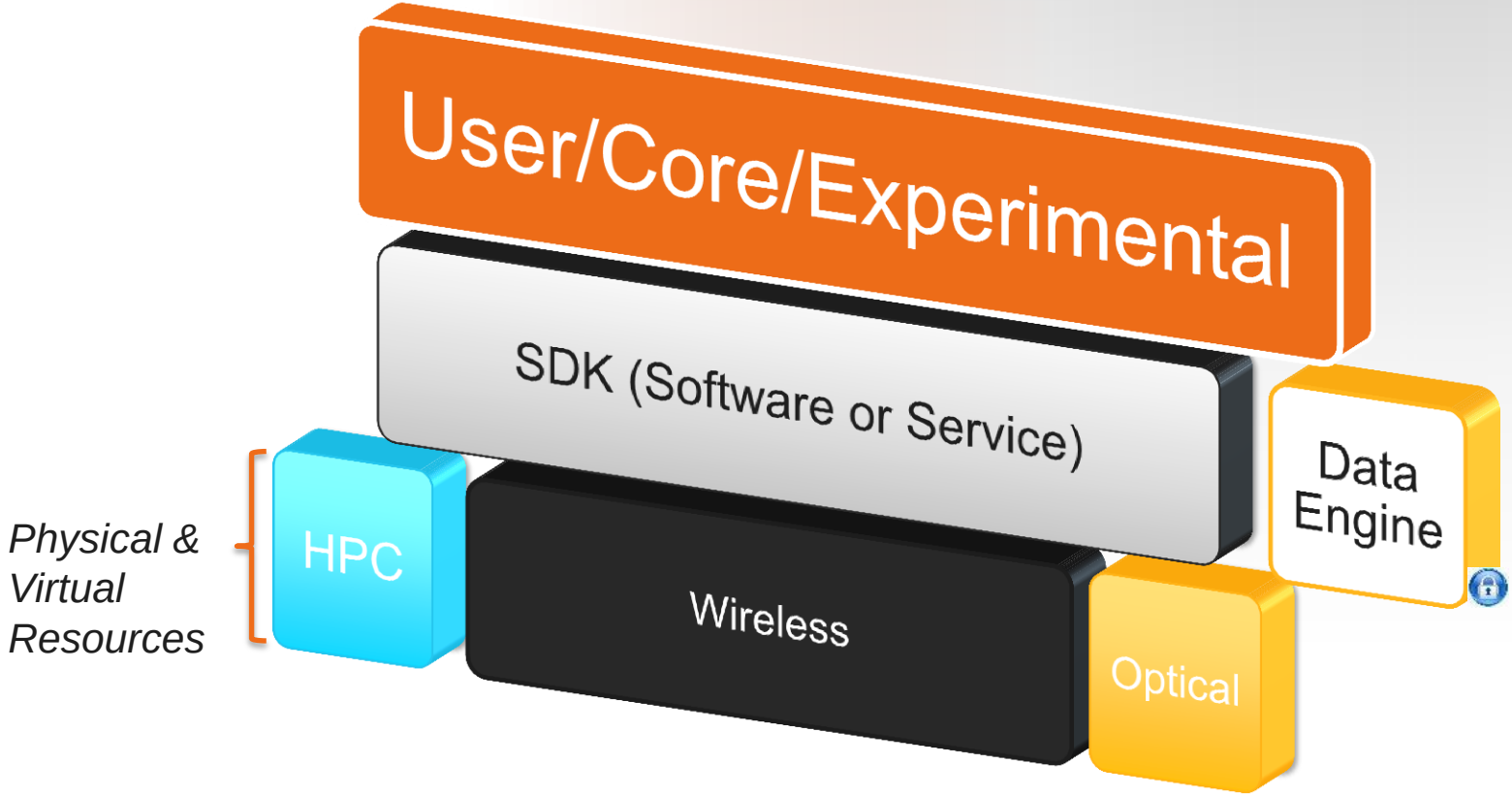
PAWR Operations Plan

ONLY REQUIRED FOR FINALISTS

- Setup Network Operations capabilities.
- Budget Dedicated staff to manage operations.
- Responsible for compliance and maintenance.
- Interface with experimenter community.
- OPS team are lead users and platform experts.

The Platform Development Plan (PDP) is the section that describes activities, budget, and schedules for all design, deployment, and operations activities relating to the advanced wireless research platforms

PAWR Services Framework



PPO-Provided Services

- Account and Identity Management
- Spectrum Use Coordination
- Experimental Lifecycle Management
- Namespace and Data Model Management
- Federation with other research platforms

During the full proposal writing stage, PPO believes that the proposers will each discuss with the PPO, where the implementation work for the services framework is most easily performed.

Role of Key Personnel

Operational Staff

Day-to-Day Operations
Maintenance
Experimenter Support
Management

Research Staff

Innovation
Research
S/W Development
H/W Development

Industry In-Kind Contribution

RFP

Equipment at the radio site, at edge sites (e.g., IP aggregation equipment), at the core, supporting network testing, end-user devices, as well as engineering design services, cloud services, and deployment cost offsets at the radio site, edge, and network core (e.g., backhaul, site rental on a community-by-community basis. During proposal preparation, proposers should not feel constrained to use only this set of equipment and services from the Consortium.

- **Finalists** selected will receive comprehensive technical details and cost information about equipment and services sponsored by consortium members.

- **Finalists** selected for Reverse Site Visit will hold a technical negotiation to leverage pre-commercial and custom equipment/services, if feasible.

Sample Technical Negotiation

I have a really cool idea about a fully autonomous spectrum management application

That is cool. I have a radio that supports that

I want to develop a custom radio that has more processing power on the sensing channel; maybe GPP on the radio

I don't know about that. Adding multi-core processor might take 12-18 months and cost $XXX,XXX.

PPO Technical Team

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PPO ROLE & ORGANIZATION

Proposer Compliance and Policy Considerations

Federal Compliance

Budget Justification

- Procurement Management Policies and Procedures
- Financial Management Policies and Procedures
- Necessary, reasonable, allocable, and allowable costs and cost estimates

Required resources: 2 CFR 200 Uniform Guidance, FAR Part 31, NSF Proposal and Award Policies and Procedures Guide

Strong Project Management

Section X: Contributions of Key Personnel

- Experienced Project or Construction Management
- Microsoft, Primavera or other project planning software
- Earned Value Management
- Project Management best practices
  - For example, Risk Management Plans, Change Control Policies, Acquisition Plans, etc.
  - Risk adjusted project costs and schedule
- Helpful resource: NSF Large Facilities Manual
- Incremental funding based on successful milestone achievements

Measures of Success

Success

- Collaboration among three important stakeholders within the information technology innovation ecosystem:
  - University researchers
  - Private sector companies
  - Local communities
- Sustainability of the platforms for the duration of the program and beyond is a critical factor in the success of the PAWR program

Metrics and KPIs

- Planning and Schedules
  - We have a plan from RFP through Award
- Tasks and Deliverables
  - We operate to an approved GANT
- Budgets and Variations
  - We are held accountable to 5% variations
- Technology and Vision
  - Partner to select the best
- Launch and Operate

Appendix

Value Propositions

Industry

Take advantage of 4 simpler, flexible, multi-use research platforms staged over 3-5 years, to shape fundamental wireless research by:

Helping to select best, most flexible research platforms needed to meet researcher and industry needs

Helping to shape research topics covered by 50% of research time funded by NSF and other agencies, plus gaining preferential access to those research results, 6 months ahead of time

Gaining preferential access to research time for proprietary company research on these large platforms covering the ~50% of remaining research time (with Founding Members getting more access times than others)

Focusing research to increase number of potentially disruptive research efforts and speed time-to-market

Expanding pool of wireless experts through education, training, and nurturing of today's students

Research Community

Enhancing ability to guide researchers' efforts with industry as equal partner in line with industry trends and expressed topic areas of interest

Speeding up transfer rate from university research to industry end users

Communities

Building core wireless capabilities through creative university partnerships

Attracting government and company research funding and local wireless jobs

Utilizing advanced wireless capabilities to enhance city services

Value Propositions (con’t)

Together, achieve fundamental research breakthroughs similar to past/recent successes, e.g.: