Agenda

11:00-11:10	**Welcome and Administrative Remarks,** Manish Parashar & Lynne Parker
11:10-12:30	**Panel: International Perspectives on the NAIRR** Moderator: Lynne Parker
12:30-1:30	**Readout and Discussion of Proposed Plans: Roadmap for Startup, funding, and sustainment,** Dan Stanzione
1:30-2:00	**Break**
2:00-3:00	**Readout and Discussion of Proposed Plans: Ownership, Administration, and Ethical/Responsible Research Controls**, Julia Lane
3:00-3:20	**Briefing: Creating a Logic Model for the NAIRR,** Brian Zuckerman, Emily Grumbling, & Lisa Van Pay
3:20-3:45	**Break**
3:45-4:45	**Readout and Discussion of Proposed Plans: Compute resources, Data resources, and Technical Integration,** Mike Norman
4:45-5:15	**Briefing: Authorities and Legal Questions Related to the NAIRR,** Emily Grumbling & Brian Zuckerman
5:15-5:25	**Questions from Public,** Manish Parashar
5:25-5:30	**Closing Remarks,** Manish Parashar

Working Group 1 Recommendations
Startup, Funding, Sustainment

Fei-Fei, Oren, Andrew, Lynne, Dan

7/25/22

Key Question 1 - Startup

- *What process should be followed to stand up the NAIRR? Should it be a phased roll out? Or begin with a pilot program? What are the details of that rollout plan or pilot program? How would initial efforts be staffed?*

Recommendations 1 and 2

- **Recommendation 1: Startup should take place in a phased approach.**
- **Recommendation 2: Run several rounds of solicitations to assemble the NAIRR**
- Solicit Project Office/Integration/Portal team first
  - Lay ground rules for Resource Providers
- Put a solicitation out for Resource Providers
  - Select ~1/3rd of projected total. (or a "pilot" set).
  - Solicitation can support Cloud, On-Prem, Dedicated or shared resources
  - Add extra time for initial integration
  - Resource Providers can provide compute, data, training/consulting, or other services.
- Staffing for Resource Providers provided by selected RPs.
- Staffing Training/Workforce site(s)
  - Need to start training likely *before* public launch to prep user community.

Key Question 1(b)

- *Should NAIRR begin with mostly open data as a first phase and then address the more difficult challenge of sensitive data? How would such an approach affect the value of a NAIRR?*

Predecisional

Recommendation 3

- **Solicit for *both* resources initially, but roll out Open Data to users first.**
  - Recommend starting work on both phases at once, but open data will require less lead time to get out to users.
  - Open Data can probably come online 6-12 months faster, even if both kinds of resources start work at the same time – there are substantially lower legal/user agreement thresholds..
  - Ensure Resource Providers solicited in the initial mix include at least one sensitive-data capable provider.

Key Question 2(a)

- *What level of investment will be needed to establish the NAIRR?*

    i.   *At what level should it be sustained?*

    ii.   *What capacity would that level of funding support?*

Recommendation 4

- **Recommendation: The initial budget should provide $200M for Resource Providers, plus costs for project office, portal, and training. Additional rounds of RP funding at similar scale should provide $200M each, repeated every two years. Total funding should begin at approximately $200M/year.**
  - Two categories of funding:
    - Resource Providers
      - 3 cohorts, $200M each, six year lifespans with 1/3rd awarded every 2 years.
      - $100M/year average cost.
    - Operations Costs
      - Project Office
      - Central Portal, Data Integration, Resource Integration
      - Training and Workforce efforts
      - Operations of systems and data resources
  - If 60% of RP funding went to compute, the estimate is this could provide 12-15M hours on quad-GPU nodes per year, or up to 400M "virtual GPU" hours for interactive sessions. Put another way, 50,000 students and researchers could each get about 250 hours on a quad-GPU server for AI research each year.

Key Question 2(b)

- *How would the funding model work in practice? E.g., how/at what levels should the funding flow to agencies to expand resources for NAIRR users, to the NAIRR management entity to maintain the cyberinfrastructure and broker access to non-Federal resources, and to users who are accessing the resources?*

  i.   How would resources be funded and integrated?

  ii. What, if any, constraints do regulations around the transfer of funding between Federal agencies have on the envisioned structure of the NAIRR?

  iii. How would decisions about transitioning or sunsetting resources be made?

Recommendation 5

- **A single "lead" agency or office should be determined, with contributions made via inter-agency transfer from all stakeholder agencies, in order to simplify contracting and accountability.**
  - One agency runs the solicitation and contracting processes for all parts of NAIRR.
  - Stakeholder agencies contribute funding via inter-agency transfer mechanisms.
  - Funding for NAIRR is appropriated via Congress at each agency, with suitable language to permit the transfer of funds to the lead agency.
  - An interagency working group provides oversight, input into solicitations, reviewers for panels, etc.
  - The working group solicits external reviews as needed to determine sunsetting mechanisms.

Key Question 2(c)

- *What is the role of partnerships in the funding model?*

- *What kind of partnerships should the NAIRR management entity pursue with private sector partners? With public sector partners?*

Recommendation 6

- **The NAIRR should provide mechanisms to allow partnerships to extend both the scope and user base of the resources from the public and private sectors.**
  - Public sector:– maybe NSCI like "user" or "client" agencies…
    - Provide opportunities for state/local governments and universities to co-fund or invest in additional researchers, in exchange for making their communities eligible or to receive additional allocations on NAIRR.
  - Private sector:
    - Allow private companies to be RPs
    - Create a model for additional in-kind support or other contributions, in exchange for access for their employees/clients, etc.

Key Question 2(d)

- *How could the NAIRR avoid adding unnecessary financial overhead to the use of the resources that researchers need?*

Recommendation 7

- **Access to NAIRR should be awarded directly to researchers, directly by funding agencies or the project office, to avoid incurring unnecessary overheads.**
  - NAIRR access could be converted to tokens or other units, good for computer time, data access, etc.
  - Awarding of an amount of access could be done by funding agencies contributing to NAIRR, or through a peer-review process run by the NAIRR project office.
  - By directly awarding access to researchers, versus charging costs on grants, substantial indirect costs could be avoided.

Key Question 3 - Sustainment

Sustainment

a. *What would be the sustainment plan for the NAIRR? Would it solely rely on Federal funding?*

b. *b. What role could partnerships play in sustainment?*

Recommendation 8

- **NAIRR must primarily be sustained through federal investment, with direct user fees only to scale beyond a base level.**
  - NAIRR's goals include broad accessibility and inclusion
    - The target primary user base is to include Universities and Colleges (students and researchers), government labs, and small businesses.
  - NAIRR therefore should provide a "free" (government provided) tier to these users (either coincident with grants, or via peer review of access requests).
  - A cost recovery tier can allow NAIRR to grow.
    - Direct chargebacks to users who desire more than can be allocated in the "free" tier.
    - Different thresholds can be set for different classes of users.
      - E.g., start cost recovery at a lower usage cap for large businesses, projects that have less government funding or aren't prioritized through the peer review process, etc.

Predecisional

WG2 Governance Committee: Response to Charge

Julia Lane (lead), Manish Parashar, Fred Streitz, Elham Tabassi

Note: Tables (and much else) draw on STPI report
Options for Governance, Administration, and Ownership of a National AI Research Resource.
E. Grumbling, L. Van Pay and M. Livingston,

Mission

- **The strategic objective for establishing a NAIRR is to strengthen and democratize the U.S. AI innovation ecosystem in a way that protects privacy, civil rights, and civil liberties.**

To achieve this objective, the NAIRR should be designed to help achieve four primary goals for AI R&D:

(1) spur innovation,

(2) increase diversity of talent,

(3) improve capacity, and

(4) advance trustworthy AI.

Process

- Reviewed charge
- Drew on year 1 report, theory of change, and indicators of success
- Governance presentation by Jason Owen Smith (University of Michigan)
- STPI report
- Space Telescope Science Institute/AURA governance
- ACDEB governance committee and Potok/Hart report

Charge to the group (part 1)

1. What form will the NAIRR management entity take (e.g., a federally-managed program office, a cooperative agreement to one or more external organizations, an FFRDC, etc. See Ch. 3 of the interim report)
   1. What would the organizational chart for this entity look like?
   2. What staffing levels and expertise would be needed for day-to-day NAIRR operations?
   3. Who would employ the NAIRR staff? If ownership of the NAIRR management entity changed, would the staff be able to transition with the management entity?
2. In relation to the vision of the NAIRR and its resources put forward in the interim report, what specific external advisory boards would be needed to guide its governance processes?
   1. How would these boards interact with the NAIRR management entity? And with the board of governors?
   2. What are the appropriate types and numbers of representatives to serve on these advisory boards? How long should their terms be? What selection process should be used?
   3. How will stakeholder perspectives (e.g., resource providers, user community) be integrated into governance processes and advisory functions?
3. How would the NAIRR management entity leadership and staff engage with resource (compute, data, and testbed) providers?

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Finding 1: The government has many options

The Federal government has many vehicles for establishing R&D infrastructures. These include government-owned, government-operated (GOGO); government-owned, contractor-operated (GOCO); and federally funded research and development centers (FFRDC), which are a special type of GOCO. They also include university or research center owned centers.   Another possible vehicle is public-private partnerships (PPP)

Table 1. Examples of Various Types of Ownership and Administration Entities for Research Resources

Example	Resource	Organization Designation	Owner/ Administrator	Funding Mechanism	Supporting Agency
Information Technology Laboratory	Database, software, funding	Federal Lab: GOGO	Government	Appropriated	NIST
Oak Ridge National Laboratory's OLCF	Compute, data, and visualization	Federal Lab: GOCO FFRDC	Government/ Contractor	Contract	DOE
Vera C. Rubin Observatory (formerly LSST)	Telescope, data	PPP	Consortium	Award (cooperative agreement) Contract, private donations	NSF DOE
COVID-19 HPC Consortium	Compute time	PPP	Consortium/ resource providers	Donation of resources	DOE OSTP
XSEDE	Compute, data, and visualization	Virtual Organization	University	Award (cooperative agreement)	NSF

Finding 2: There is a number of agencies that could support the NAIRR

- Numerous Federal departments and agencies have science and technology as part of their mission. Of these, many have appropriations for R&D and associated infrastructure as part of their budget, whether conducted or housed intramurally (at a government facility) or extramurally. Federal management, funding, or infrastructure sharing are options to consider for the NAIRR.

Table 2. Federal S&T Departments and Agencies that could participate in NAIRR activities

Federal Agency	Core, S&T, or Research Mission	Intramural or Extramural R&D
Department of Agriculture	Create a safe, sustainable, competitive U.S. food and fiber system, as well as strong communities, families, and youth through integrated research, analysis and education	Both
NIST*	Promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life	Both
NOAA*	Understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage coastal and marine ecosystems and resources	Both

| Federal Agency	Core, S&T, or Research Mission	Intramural or Extramural R&D
National Science Foundation	Promote the progress of science; advance the national health, prosperity, and welcome; and secure the national defense	Extramural
ODNI	Lead and support Intelligence Community integration; delivering insights, driving capabilities, and investing in the future	Both
USAID	Promote and demonstrate democratic values abroad, and advance a free, peaceful, and prosperous world	Extramural
USGS	Monitor, analyze, and predict current and evolving dynamics of human and natural Earth-system interactions and deliver intelligence to decision makers.	Both

* Organizations within the Department of Commerce

Sources: (Science.gov 2019; U.S. Department of Agriculture 2021; National Oceanic and Atmospheric Administration 2021; Department of Defense 2021; Department of Energy Office of Science 2021; Department of Homeland Security 2014; U.S. Department of Transportation 2021; Department of Veterans Affairs 2019; National Institutes of Health 2015; National Science Foundation 2014; National Aeronautics and Space Administration 2021; U.S. Agency for International Development 2021; U.S. Geological Survey 2021; Smithsonian Institution 2021)

Protection Agency		
NASA	Discover and expand knowledge for the benefit of humanity; enable human expansion across the solar system; support growth of nation's economy in space and aeronautics.	Both
National Institutes of Health	Seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability	Both

Predecisional

Recommendation 1: Organizational Structure - government owned, contractor operated entity

The committee recommends that the NAIRR be operated as a government owned, contractor operated entity. It recommends that the NAIRR management be structured as a hybrid infrastructure: a dedicated government program management office (PMO) and a dedicated operating entity (OE). Strategic direction would be provided by a steering committee comprised of high-level federal officials providing NAIRR funding. Programmatic and resource allocation decisions would be made by the OE with oversight by the PMO and reviewed by both a Board of Directors and a Science and Technology Advisory Board.
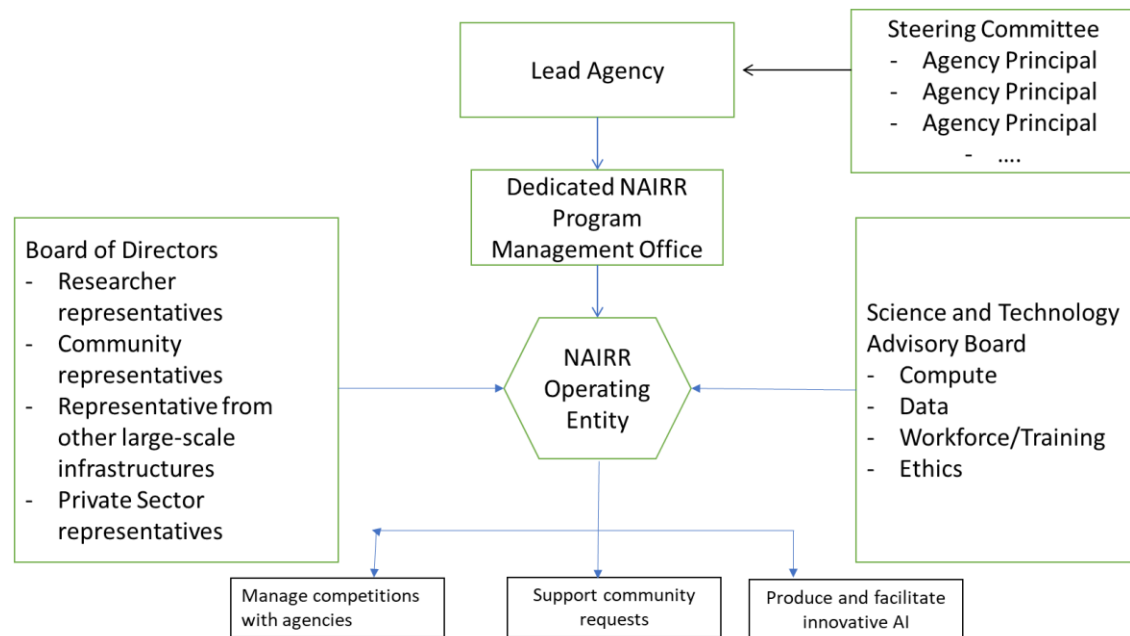
Evaluation: Every three years by independent external entity selected by Steering Committees, Boards and PMO

Predecisional

Recommendation 1.1: Steering Committee Structure and Responsibilities

The steering committee should be composed of principals (e.g., undersecretaries) representing agencies with equities in NAIRR. Agencies can petition to become members of the Steering Committee (through funding), or elect to leave. The steering committee can establish operational working committee to ensure that the agency's interests are addressed by the NAIRR.

- Working with the lead agency and the NAIRR PMO to develop the RFP soliciting bids for the NAIRR Operating Entity (OE), including establishing the terms and conditions and functions of the OE.

- Defining the KPIs (in conjunction with the NAIRR PMO, Board of Directors and Advisory Boards.

- Working with the lead agency and the NAIRR PMO to review candidates and select the OE awardee

- Final approval of OE awardee

- Defining the roles and responsibilities of the OE Director

- Approving the appointment of the OE Director

- Advocating for and delivering funding to support OE

- Evaluating NAIRR performance against defined KPIs annually

- Reviewing NAIRR contract every five years and electing to renew or dissolve the NAIRR

Recommendation 1.2: Program Management Office Structure and Responsibilities

The NAIRR PMO would be comprised of three to five federal agency staff. It would have no other responsibilities other than managing the NAIRR. It would be responsible for the following activities

- Developing the RFP and soliciting bid for the NAIRR OE
- Selecting the OE in conjunction with Boards and Steering Committee
- Leading search for OE Director in conjunction with Boards and Steering Committee
- Establishing evaluation criteria (KPIs) in conjunction with Boards and Steering Committee
- Identifying external independent evaluation entity in conjunction with Boards and Steering Committee
- Overseeing operations/processes; budget; asset allocation/utilization
- Quarterly evaluation of NAIRR execution

Recommendation 1.3: NAIRR Operating Entity Structure and Responsibilities

The NAIRR operating entity should be a distinct legal entity. It should contract with compute, data and training service providers rather than being a major provider in its own right. It should select an awardee for website/portal development, which must work closely with the resource providers to provide seamless, single-website access for participants It should have three major responsibilities

1. Partner with agencies to provide resources that support a given agency (or consortium of agencies) mission.

2. Support community requests for access to and use of resources (outside agency-supported mechanisms

3. Ensure the infrastructure stays at the cutting edge of science and technology, utilizing input from scientific and user communities and agencies, after review by the PMO.

Charge to the group (part 1)

1. What form will the NAIRR management entity take (e.g., a federally-managed program office, a cooperative agreement to one or more external organizations, an FFRDC, etc. See Ch. 3 of the interim report)
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3. How would the NAIRR management entity leadership and staff engage with resource (compute, data, and testbed) providers?

Finding 2: The NAIRR will need input from multiple communities

- The NAIRR serves many communities, so it will need input to support specific science efforts, in AI/ML and in multiple domain science research communities. And because it has so many operational requirements, it will need advice on a variety of operational issues, including technical resource design, development, management, interoperability, standards, or improvement; a user experience design, development, and improvement; ethical design, development, and use of research resources, legal and regulatory compliance, intellectual property management and agreements; as well as education and training

Governance Attributes of Example R&D Resources and Entities

Example Activity	Resources Provided	Lead Entities or Partners	Leadership Entities	Governance Bodies	Governance
Vera C. Rubin Observatory (LSST)	Telescope, data	AURA, LSST Corporation [501(c)3] NSF, DOE, SLAC	Director Project Management Office	LSSTC Board of Directors Science Advisory Committee	LSSTC Strate LSSTC Bylaw
Oak Ridge Leadership Computing Facility	HPC, computational tools, data analysis resources, networking	DOE/ASCR ORNL Industry partners	Director Leadership Team	OLCF User Group (OUG) OUG Executive Board	Annual user s Annual Opera OUG Charter
COVID-19 High Performance Computing Consortium[b]	Free compute time and resources for near-term COVID-19 research	US: 43 members from all sectors International: 2 labs and 2 collaborating initiatives XSEDE provides request submission platform	Chair Executive Director	Board Science & Computing Executive Committee Membership & Alliances Executive Committee Steering Group	
XSEDE[c]	Compute, educational tools, user support, research environment, data sharing, software tools, ML/data science tools, science gateways	University of Illinois at Urbana-Champaign 17 institutions NSF as funder Other agencies that fund resource components	PI Deputy Project Director Directors of the 4 leading Centers	XSEDE Advisory Board (XAB) User Advisory Board (UAB) Service Provider Forum (SPF) External evaluators	SPF Charter KPI and Metr documentatic User Code of Allocations pc Reviewer Ma 4 "canonical" cases
EarthCube[d]	Research environment, data, CI/software tools/services, user support, training, community building	Geosciences research community members and linked projects Member institutions CI community Council of Data Facilities members (research institutions) NSF as funder	PI, co-PIs Earth Cube Office Leadership Council	Council of Data Facilities (CDF) CDF Executive Committee Science & Engagement Team Technology & Architecture Committee Council of Funded Projects Nominations Committee Working Groups	Community p guidelines

Predecisional

Recommendation 2: The NAIRR should employ a number of advisory and oversight boards

- To ensure that NAIRR meets its various objectives, the NAIRR entity should employ a number of boards including oversight boards and advisory boards focused on different aspects of the NAIRR missions (e.g., science and technology, data policies, ethics, privacy, civil right/civil liberties, etc.) that will be tasked with evaluating and providing guidance on specific metrics/areas.

- Each board will comprise 6-8 members in consultation with NAIRR management (NAIRR PMO and OE)

- Special attention will be paid to the diversity, inclusivity, and representation/affiliation of board membership. Members should represent academia, government, and industry stakeholders, with the relative weights appropriate for each board.

Predecisional

Recommendation 2.1: The NAIRR immediately establish a Board of Directors

- The NAIRR should establish a Board of Directors that would have the responsibility of advocating for NAIRR, providing external management oversight, and identifying new directions for NAIRR to create value and serve the community. It would be comprised of representatives from the scientific community, the public at large, advocacy groups, the private sector, and representatives from other large-scale infrastructures with management experience.

Recommendation 2.2: The NAIRR should immediately establish a Science and Technology Advisory Board

- A Science and Technology Advisory Board should advise NAIRR on the latest and cutting-edge technological solution to keep NAIRR agile to adapt to rapidly changing needs in multiple domains and be aligned with the latest and greatest advances of the field. The Science and Technology Advisory Board should be comprised of diverse members representing the diversity of user communities and research needs in the Nation. The members should have multi-disciplinary background including expertise in the provision and use of compute and data infrastructures, workforce training, ethics, privacy and security, and domain expertise.

Recommendation 2.3: The NAIRR should evaluate the establishment of additional Advisory Boards as well as the composition of existing boards on an annual basis

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3. How would the NAIRR management entity leadership and staff engage with resource (compute, data, and testbed) providers?

Finding 3: The NAIRR, as a complex organization, will need to be transparent in its mission and metrics

- In order to create and support an "intricate latticework of collaborative ventures", the NAIRR will need to be fully transparent and accountable about how and why it both selects and decommissions resource providers
- The NAIRR will need to be proactive in ensuring that the public and providers understand its mission: (1) spur innovation, (2) increase diversity of talent, (3) improve capacity, and (4) advance trustworthy AI and how it measures success.

Recommendation 3: The NAIRR must establish a theory of change, develop KPIs and communicate the requirements to providers

Inputs	Activities	Outputs	Outcomes	Final Outcomes
• Compute • Data • Training	• Provide Access • Facilitate Collaborations • Offer support services • Review proposals • Communicate and educate stakeholders	• Compute platform • Data platform • High quality data • Portals • Testbeds • Training	• Sustainable infrastructure • Diverse Research Community • More AI researchers	• Innovation • Scientific progress • Trustworthy AI • Equitable access

Predecisional

- The NAIRR OE entity should work with the PMO, the advisory boards and the steering committee to develop RFPs that have clear descriptions of expectations, including milestones and deliverables, tied to the KPIs that are consistent with the mission of the NAIRR.

- Evaluation: There would be a mid term external evaluation by an external evaluator selected by the BOD according to the KPIs. Failure to perform according to expectations would trigger a probationary period. Longer-term failure to perform would result in decommissioning a resource provider.

Charge to the group (part 2)

4. What role would the NAIRR management entity have in vetting resources that become part of the NAIRR?

    1. How would the management entity decide upon new resources that need to be procured?

5. What would be the relationship between the NAIRR management entity and U.S. research funding agencies?

    1. What would be the agency roles and responsibilities and milestones to implement the NAIRR?

    2. How would the NAIRR management entity and agencies collaborate to identify new resources that are needed for the NAIRR?

6. How should the NAIRR management entity implement privacy, civil rights, and civil liberties requirements in practice?

    a. How should the processes be structured and managed and what best practices/mechanisms from academia and industry should the NAIRR management entity embrace?

    b. What type of mechanism(s) should exist to address questions/concerns from civil society groups including about decisions related to civil rights and civil liberties?

    c. Should ethical review processes be phased in as the NAIRR matures?

7. What role would the NAIRR management entity have in responding to concerns reported about research performed on the NAIRR and its outcomes?
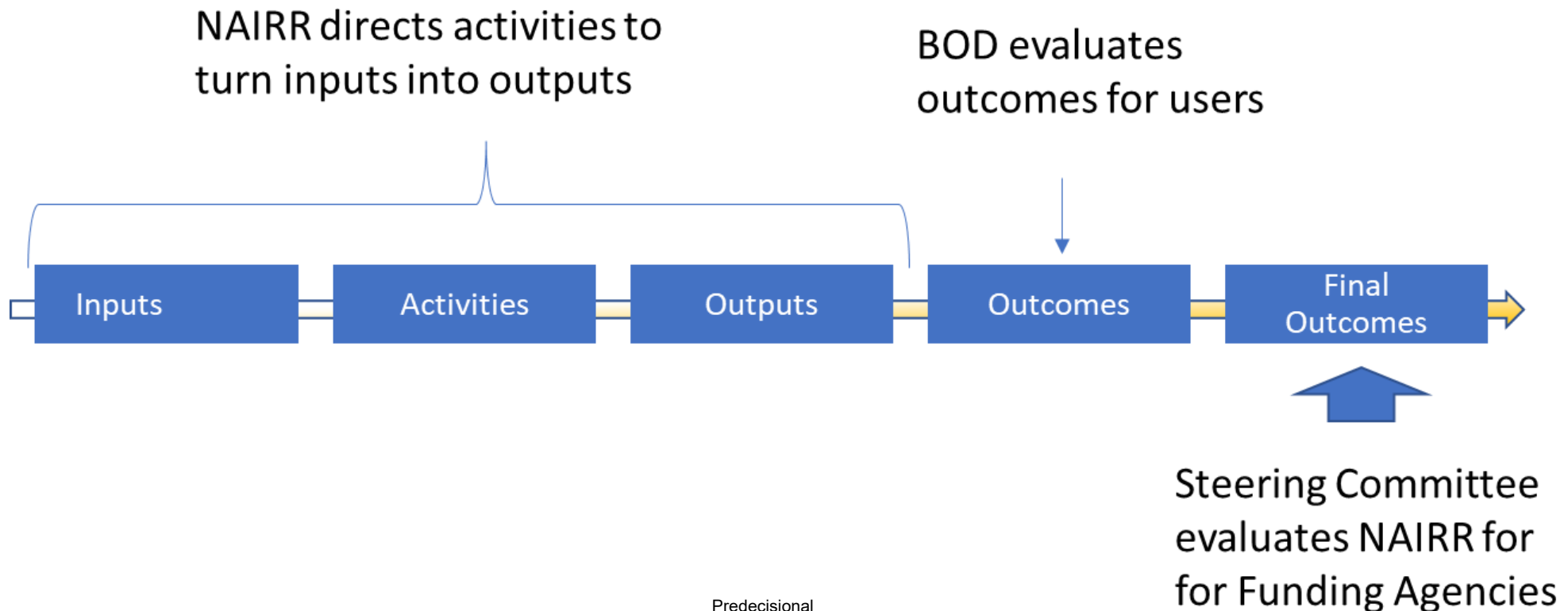
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Finding 4: KPIs are critical to informing resource allocation decisions

- Recommendation 4.1; The NAIRR should identify gaps in the provision of current capacity
- The OE and the PMO would be responsible for publishing semi-annual reports of the provider performance, comparing them to the KPI desiderata, and providing the reports of achievement and the gaps to the Board of Directors, the steering committee, the research and technology advisory board, and the stakeholder community

Recommendation 4.2 The NAIRR should identify emerging new areas of investment

The NAIRR would be responsible for maintaining cognizance of emerging technical fields. It would use existing information of new areas of potential investments (through a publicly available portal) that summarized the potential of a new field - as measured by scientific data sources such as publications, patents, grants – relative to the alternative, which would be new emerging fields, the potential to attract new talent to those fields, and the likely return on investment

Findings will be captured in an annual assessment that constitutes part of the report to the PMO and Steering Committee.

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    c. Should ethical review processes be phased in as the NAIRR matures?

7. What role would the NAIRR management entity have in responding to concerns reported about research performed on the NAIRR and its outcomes?

Finding 5: There should be multiple relationships between the NAIRR and funding agencies

- There would be at least the following types for relationships between the NAIRR and funding agencies:

- 1. Funding and oversight: NAIRR funds would flow through agencies, and agencies will provide oversight via the steering committee.

- 2. Support NAIRR resources: Support (fund) resources that are federated and made accessible via the NAIRR (NAIRR will include other resources as well).

- 3. Enable research: Provide resources to agency funded research projects

Recommendation 5: The OE should operate according to theory of change to engage with agencies

- The workflow would be developed and mapped to the theory of change (and indicated by evaluation criteria in answers 3-4.

Charge to the group (part 2)

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    1. What would be the agency roles and responsibilities and milestones to implement the NAIRR?
    2. How would the NAIRR management entity and agencies collaborate to identify new resources that are needed for the NAIRR?
6. How should the NAIRR management entity implement privacy, civil rights, and civil liberties requirements in practice?
    a. How should the processes be structured and managed and what best practices/mechanisms from academia and industry should the NAIRR management entity embrace?
    b. What type of mechanism(s) should exist to address questions/concerns from civil society groups including about decisions related to civil rights and civil liberties?
    c. Should ethical review processes be phased in as the NAIRR matures?
7. What role would the NAIRR management entity have in responding to concerns reported about research performed on the NAIRR and its outcomes?

Finding 6: NAIRR must be proactive in addressing privacy and civil liberties

It is important to avoid privacy and civil liberties turning into a check list or compliance exercise without much payoff. The impacts of any controls instituted should be evaluated, and adjustments made to optimize the value of any such steps.

- 1. PMO/OE should develop criteria and mechanisms for evaluating research proposal from a PCRCL perspectives.

- 2. PMO/OE should evaluate resources (compute, data) for PCRCL compliance

- 3. OE should enforce transparency from a research as well as resource perspective.

- 4. OE (with SC and PMO) should develop mechanisms for longer time oversight of research outcomes as well as for receiving and acting on inputs from the community about PCRCL issues

Recommendation 6: The NAIRR should establish institutions to protect privacy and ethics

Recommendation 6.1: The NAIRR should establish an Ethics Review Board
Recommendation 6.2: The NAIRR should provide support for auditing NAIRR resource utilization for privacy and civil liberties concerns.

- NAIRR could support a public repository for datasets. Towards that goal, it is vital to include controls for privacy of datasets that NAIRR hosts and a mechanism to check whether datasets with legal, ethical, or discriminatory issues have stopped being circulated. This could include support auditing for civil rights and civil liberties; and keeping an archive of datasets no longer being used that researchers could study to better understand common data issues and potential harms.

- To the extent possible, NAIRR should include policies, procedures, and controls to review research proposals and ongoing work in terms of their eventual harm or social good, recognizing that many downstream effects (both good and bad) may not be discernible at the outset.

Charge to the group (part 2)

4. What role would the NAIRR management entity have in vetting resources that become part of the NAIRR?
   1. How would the management entity decide upon new resources that need to be procured?
5. What would be the relationship between the NAIRR management entity and U.S. research funding agencies?
   1. What would be the agency roles and responsibilities and milestones to implement the NAIRR?
   2. How would the NAIRR management entity and agencies collaborate to identify new resources that are needed for the NAIRR?
6. How should the NAIRR management entity implement privacy, civil rights, and civil liberties requirements in practice?
   a. How should the processes be structured and managed and what best practices/mechanisms from academia and industry should the NAIRR management entity embrace?
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   c. Should ethical review processes be phased in as the NAIRR matures?
7. What role would the NAIRR management entity have in responding to concerns reported about research performed on the NAIRR and its outcomes?

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Finding 7: The federal government has a number of oversight mechanisms

- Oversight entities for government-funded activities can include new or existing Federal Advisory Committees (as governed in P.L. 92-463) if the resource leverages Federal resources, Committees of Visitors, agency program managers and leaders, and even agencies' Inspectors General should the need arise. Congress could also choose to exercise oversight via information gathering, hearings, or budget authorization or appropriations of participating Federal agencies, especially as the NAIRR TF was established through an Act of Congress.

Recommendation 7: The NAIRR should incorporate systematic measurement into KPIs

The NAIRR should establish KPIs which include systematic mechanisms to include community input.   These KPIs assess whether the resource has progressed appropriately toward its strategic and operational goals, how well it is serving its intended user community, and how well it complies with legal, regulatory, and governance requirements, including privacy and security requirements.

Science Advisory Board (SAB)
- Evaluates the science that is being advanced through NAIRR
- Provides guidance on possible future directions for AI research
- Composed of recognized AI experts from across multiple scientific communities
- Selected to represent academic researchers, with some industry and government representation.

Technical Advisory Board (TAB)
- Evaluates the technology that is being delivered and/or made available by NAIRR
- Provides guidance on upgrades and future directions
- Composed of recognized IT experts from across compute, data, and security communities
- Selected to represent industry, and government, with some academic involvement

Ethics Review Board (ERB)
- Evaluates the ethical use of AI and data by NAIRR awardees
- Evaluates the fairness and appropriateness of data delivered by NAIRR
- Handles concerns and/or complaints brought to their attention by NAIRR management or by the BOD
- Selected to represent user groups, scientific societies, advocacy groups, and government.

Examples of KPIs in report

Examples of Potential Performance/Success Indicators:

	Resources	Innovation	Diversity	Capacity	Ethics
Inputs: Resource Investments	Computational Data Testbed Training	Number/volume/cost of resources provided	Accessibility of resources provided measured by characteristics of users or institutions using institutional HR administrative data such as the IRIS/UMETRICS data	Scalability of resources provided in terms of level and trends using institutional HR administrative data such as the IRIS/UMETRICS data	Number of resources provided to promote responsible AI approaches
		Quality of resources provided_measured by downtime, speed, size	Quality indicators by subgroups using institutional HR administrative data such as the IRIS/UMETRICS data	Number of users, institutions, domains using institutional HR administrative data such as the IRIS/UMETRICS data	Deploy http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/

Predecisional

			the IRIS/UMETRICS data		guides/aequitas/
Activities: Usage of Resources	Computational	Number of successful jobs	User characteristics relative to counterfactual group, use of allocations within groups	Average percentage of resource utilization	Deploy http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/
		Average task turnaround			
	Data	Number of datasets accessed and reused in search and discovery platform	Use rich context approach to measure variety of types of data used, representativeness of data https://coleridgeinitiative.org/show-us-the-data/	Uptake and use of search and discovery platform Time to search and discover datasets	Deploy http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/
		Number of new datasets contributed and subsequently reused in search and discovery platform	Expansion of types of testbed data to new populations, domains, etc.	Speed of curation, speed of reuse	Deploy http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/
	Testbed (set up external administrative records approach to capture externally validated metrics through, for example,	Usage statistics for various testbeds – compared with each other	Usage statistics for various testbeds compared by fields, demographics, institutional locations using institutional HR administrative data such as the IRIS/UMETRICS data	Scientific impact of testbed use at individual and team level, subsequent funding, publication rates, change in collaboration networks relative to counterfactual as measured by administrative records sources such as IRIS/UMETRICS data	Deploy http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/

Predecisional

					guides/acquitas/
Outputs: Progress toward Goals	Computational Data Testbed Training Portals	Number of publications produced by NAIRR users broken out by - compute usage - data usage - training receipt - testbed	Demographics of NAIRR users as compared to the demographics of the nation of other comparable research activities broken out by - compute usage - data usage - training receipt - testbed	Longer-term career trajectories of student users of the NAIRR from linkage of HR administrative records with wage and employment data and compared with other comparable students broken out by - compute usage - data usage - training receipt - testbed	Impact metrics of research using NAIRR resources to advance approaches to responsible and trustworthy AI
		Number of research publications citing use of the NAIRR broken out by - compute usage - data usage - training receipt - testbed	Scientific impact of testbed use at individual and team level, subsequent funding, publication rates, change in collaboration networks relative to counterfactual	Use of the NAIRR resources in support of educational offerings and courses/tutorials	Adoption levels of responsible and trustworthy AI processes and tools developed through the NAIRR

	Resources	Innovation	Diversity	Capacity	Ethics
		datasets, models, methods, and tools developed using the NAIRR relative to comparable non NAIRR domains	relative to comparable non NAIRR domains		
		Capital raised/revenue of startups supported through the NAIRR – through links to administrative records https://www.nber.org/books-and-chapters/measuring-and-accounting-innovation-twenty-first-century/research-experience-human-capital-new-business-outcomes relative to comparable non NAIRR domains	Measures by demographic, institutional and domain subgroups relative to comparable non NAIRR domains		Deploy http://www.datasciencepublicpolicy.org/our-work/tools-guides/aequitas/
Impact: Strategic Effects	Computational Data Testbed Training	Number of AI research papers published by U.S.-based researchers relative to comparable non NAIRR domains broken out by - compute usage - data usage - training receipt - testbed	Overall demographics, institution and domains of "AI R&D community" over time relative to comparable non NAIRR domains	Number of students graduating with AI degrees relative to comparable domains – as measured by state and federal administrative records on education and workforce	
		Shifts in H-index of U.S. AI	Overall demographics,	Size of the national AI	

Towards a Logic Model for the National Artificial Intelligence Research Resource (NAIRR)

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July 25, 2022

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A Logic Model Is:

"a systematic and visual way to present and share your understanding of the relationships among the resources you have..., the activities you plan, and the results you hope to achieve."

W. K. Kellogg Foundation (2004): Logic Model Development Guide. Using Logic Models to Bring Together Planning, Evaluation, and Action. W. K. Kellogg Foundation. Battle Creek, Michigan.

A simple logic model:
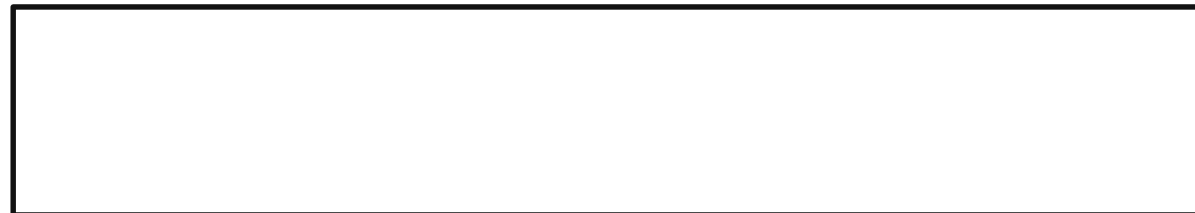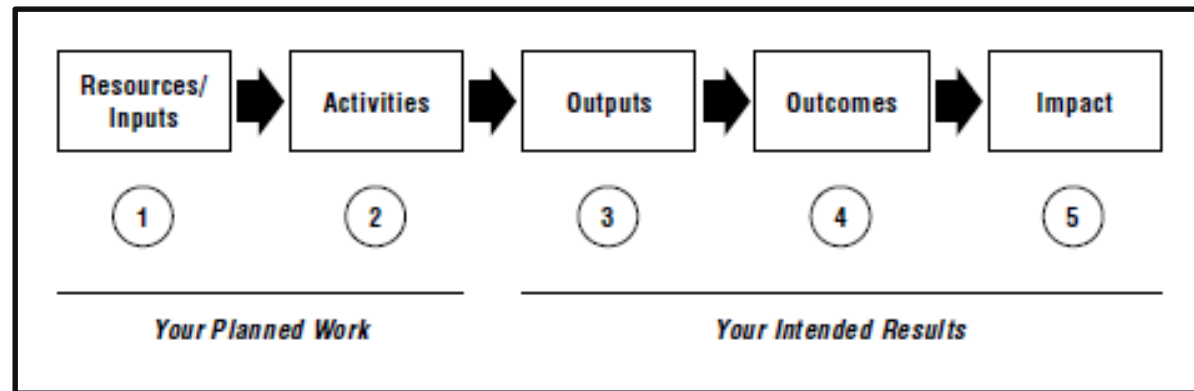
Value of a Logic Model in Designing the NAIRR
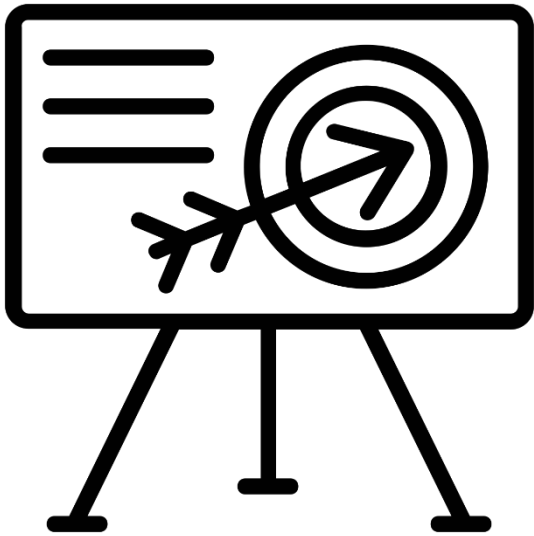
- Align proposed NAIRR activities with goals
  - Foster agreement on a plan for achieving the goals outlined in the interim report
  - Serve as the basis for identifying metrics and evaluation requirements
- Support future NAIRR planning and evaluation

From Goals to Outcomes to Metrics

- For each of the 4 NAIRR goals, STPI staff developed outcome statements, using the form, "The NAIRR will be successful if….."

- STPI staff derived 3-7 outcome statements from each NAIRR goal that have been refined based on WG activities and co-chair feedback

- STPI staff have begun considering potential metrics of success for each outcome statement and how these outcome statements will fit into the full logic model, along with activities and inputs

According to the Interim Report:

NAIRR Strategic Objective: to strengthen and democratize the U.S. AI innovation ecosystem in a way that protects privacy, civil rights, and civil liberties.

Spur Innovation

Increase Diversity of Talent
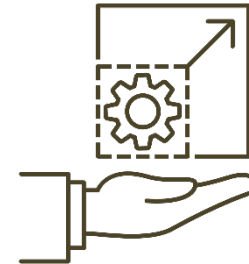
Improve Capacity

Advance Trustworthy AI

Goal Statement 1: Spur Innovation

The NAIRR should support the research, development, and translation of novel methods in foundational and use-inspired AI research

Outcome Statements for "Spur Innovation"

The NAIRR will be successful if NAIRR-supported research:

1. Leads to foundational and use-inspired research breakthroughs that collectively advance the field of AI

2. Leads to foundational and use-inspired research breakthroughs that collectively advance the full spectrum of S&E domains and societal and economic sectors

3. Is translated into use and innovations

Goal Statement 2: Increase Diversity of Talent

The NAIRR should increase the diversity of AI researchers by lowering the barriers to participation for all, regardless of background, organizational affiliation, or geographic location within the United States

Outcome Statements for "Increase Diversity"

The NAIRR will be successful if:

1. The NAIRR's design and implementation overcome barriers to access

2. The NAIRR's design and implementation promote equity of access

3. The NAIRR is used by a diverse community of AI researchers and practitioners across backgrounds, organizational affiliations, and geographic locations

4. Researchers and practitioners from traditionally underserved groups (e.g., based on background, organizational affiliation, and geographic location) consider the NAIRR to have continuing value as a research resource

Goal Statement 3: Improve Capacity
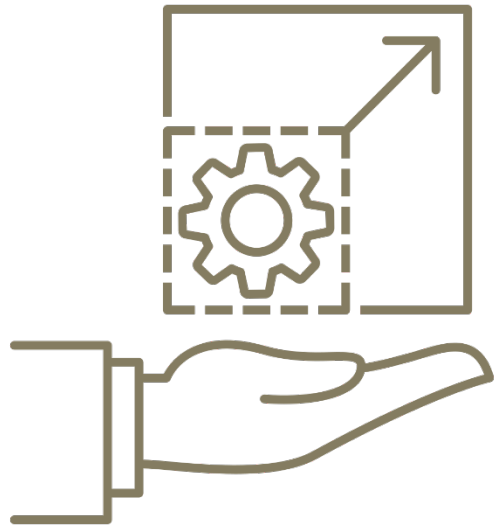
The NAIRR should promote AI skills and knowledge through expanded access to AI resources, ensuring that AI researchers in the United States are able to leverage the state of the art
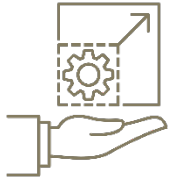
Outcome Statements for "Improve Capacity"

The NAIRR will be successful if:

1. It provides access to new computing capacity and other AI resources (e.g., compute, tools, testbeds, research datasets) to meet the needs of target users

2. The NAIRR provides access to **state-of-the-art** AI resources (e.g., compute, tools, testbeds, research datasets)

3. Increasing numbers of both AI researchers and practitioners in the United States make use of state-of-the-art resources (across NAIRR and other Federal government-supported platforms)

4. The resource is used by students, researchers, and practitioners to enhance their AI skills and knowledge

Predecisional

Goal Statement 4: Advance Trustworthy AI

The NAIRR should offer information, tools, and trainings in support of research that fosters the development and adoption of trustworthy and responsible AI

Outcome Statements for "Advance Trustworthy AI"

The NAIRR will be successful if:

1. NAIRR governance is recognized as setting a model for promoting trustworthy and responsible AI

2. NAIRR personnel are recognized as leaders in promoting trustworthy and responsible AI

3. NAIRR personnel define policies to protect privacy, civil rights, and civil liberties as part of NAIRR data use

4. Users of the resource conduct research that fosters the development and adoption of trustworthy and responsible AI

5. AI models and other research developed using NAIRR resources meet acceptable standards for trustworthiness, transparency, and auditability

6. The NAIRR makes available information, tools, and trainings to users related to the development and adoption of trustworthy and responsible AI

7. Users of the resource contribute to a nationwide community of practice regarding trustworthy and responsible AI

Some Sample Metrics for Task Force Consideration

- **Goal 1: Spur Innovation**
  - Impact metrics of publications from NAIRR-supported research (compared to control group)
  - Productivity/survival of startups with researchers who were trained using or who use the NAIRR

- **Goal 2: Increase Diversity**
  - Distribution of NAIRR users' institutional affiliations compared to control groups
  - Survey/interview data from NAIRR users identifying ease of NAIRR use and degree to which barriers to participation are overcome
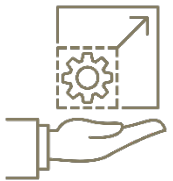
- **Goal 3: Increase Capacity**
  - Number and demographic distribution of users accessing state-of-the-art resources (as compared with control groups)
  - Career paths/outcomes of individuals trained/educated via the NAIRR

- **Goal 4: Advance Trustworthy AI**
  - Participation of NAIRR personnel in expert groups, advisory panels, or civic forums related to trustworthy and responsible AI
  - Number of individuals (NAIRR users and others) who access NAIRR trainings on responsible & trustworthy AI practices

Predecisional

IDA | **STPI**   14

Next Steps in Logic Model Development

- Receive TF member feedback on outcome statements
- Identify activities for achieving all outcomes
- Work with TF WG5 toward detailed metrics
- In alignment with TF deliberations, develop the remainder of the logic model (i.e., inputs, activities, and outputs)
- A draft for one aspect of the logic model (compute resources) shown on following slide

A Partial Logic Model Example: Compute Resources

Inputs

Federally-supported cyberinfrastructure
- NSF XSEDE/ACCESS
- DOE User Facilities (e.g., OLCF)
- NASA Advanced Supercomputing Facility

Universities and researchers
- On-premises high-performance computing resources
- Software, models, and tools

Industry
- Commercial cloud computing resources
- Software, models, and tools

Activities

NAIRR provides access to **compute (and storage) resources**
- Access to federated mix of existing Federally supported resources
- Purchase of new on-premise capacity
- Contracts with cloud service providers for scalable capacity
- Federated edge computing resources

NAIRR provides multiple levels of **system software** to support range of users
- Serverless AI applications (e.g., APIs)
- Standard AI software packages (e.g., TensorFlow)
- Infrastructure building blocks that advanced users can compose and customize

Outputs

Resources available
- Number of CPUs
- Peak processing speed (Teraflops)
- Storage resources (TB)

Uses and users
- Average number of users/day
- Average number of jobs performed/day
- Percentage utilization of compute resources

Research results
- Conference papers
- Preprints
- Peer-reviewed journal articles
- New computational tools/models/apps/workflows

Outcomes
(Examples)

Spur Innovation
- Research breakthroughs
- Research translated into use and innovations

Increase Diversity
- Resources available in equitable fashion
- Diverse community of users

Improve Capacity
- Resources meet users' needs
- Access to state-of-the-art resources

Trustworthy AI
- Research into trustworthy AI
- Models meet standards for trustworthy AI

Predecisional

WG3: Compute resources, data resources, and technical integration

Response to Charge

Mike Norman (lead)

Daniela Braga, Mark Dean, Andrew Moore, Dan Stanzione

Objective

- Develop recommendations for implementing the Task Force's vision of a federated cyberinfrastructure connecting the AI research community to computational, data, and testbed resources; as well as recommendations for how those resources should be managed.

Charge questions, part 1

- How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?

- To what extent should **code, models, workflows** developed with Federal funding and NAIRR support be made **freely available** through the NAIRR?

- Data
  - Should the NAIRR establish **acceptance criteria for datasets** that are integrated into the cyberinfrastructure, e.g., those include robust metadata, clear provenance, persistent identifiers? How would these standards be enforced to ensure the integrity of the data made available through the NAIRR?
  - What is the role of NAIRR staff in the **curation of datasets**, if any?
  - What should be the **relationship between the NAIRR and data.gov** and other relevant data repositories?
  - How might the NAIRR fit within the systems being put in place through the implementation of the **Evidence Act** around hosting and making accessible government restricted/sensitive data (e.g., "**America's DataHub**")?
  - Should the NAIRR include **state, local, and tribal datasets**? If so, what additional processes would need to be put in place to facilitate this inclusion?
  - How will **incentives for data contribution** work in practice?

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3

Charge questions, part 2

- Computational resources
  - What computational resources should be **included on day one**? What is the right **initial mix** of computational resources based on the needs of the AI research community?
  - How would the computational resource offerings **evolve** as the NAIRR matures?
  - How will the NAIRR facilitate **colocation of data and compute resources**?

- Testbeds
  - How could the NAIRR **facilitate connections** with and among various AI testbeds?

- Technical integration
  - How do **resources hosted elsewhere**, such as NIH high-volume sequence data, be integrated as a part of the NAIRR without being limited to NAIRR users?
  - What **services and software stacks** are needed to support joint experimentation allocation and provisioning of/deployment on multiple federated resources? **Should the NAIRR invest** in the development of a base software stack to allow for movement between federated assets? This may be as basic as providing training and examples of creating portable environments or as complex as encouraging the development of concise base environment by application type (computer vision, deep learning, etc.).
  - What are some **exemplar workflows** that combine distributed resources that the NAIRR would support? How would those workflows be supported through the NAIRR cyberinfrastructure?
  - What would be **available on day one of the NAIRR to support its federated architecture**? What aspects would be expected to be available for inclusion in later phases of the NAIRR?

Process

- Massive Google sheet to collect inputs (asynch)

- 2 Zoom meetings to discuss (synch)

- WG lead drafted recommendations for group discussion and approval

- Final report with more findings and footnotes

Executive Summary

- A NAIRR cyberinfrastructure should be created to provision, curate, and manage computational, data, testbed, tools, and algorithm resources to support advancing the research activities of the AI community.

- A NAIRR cyberinfrastructure should leverage existing computational and data resources from other government funded initiatives and commercially available resources (e.g. DOE, NASA, NNSA, NIH, NIST, NOAA, USGS, AWS, GCP, Azure, IBM clouds, etc.)

- A NAIRR technical advisory board should be established to review and approve resources for the continued operation and growth of the NAIRR cyberinfrastructure (testbeds, datasets, software packages, standards, computer systems, provisioning, etc.)

- A viable NAIRR cyberinfrastructure includes the integration of a complex and highly diverse set of heterogenous computing elements to support the broad set of AI application environments, from IoT to complex decision systems to scientific simulations and models.

- The complexity of the proposed NAIRR cyberinfrastructure requires a high level of flexibility and diversity in the way the infrastructure is provisioned, curated, managed, and made available to the research community.

Q1. How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?

- **Finding 1.1: There is a lot to build on**
  - NSF XSEDE: 27 allocated resources at 11 institutions (compute, data)
  - NSF LCCF: 2 AI-capable CPU and GPU clusters
  - NSF Cat2 testbeds: 2 AI-specific systems
  - DOE OS: 3 world-class HPC centers with AI capable dense GPU clusters
  - AWS, GCP, Azure, IBM clouds
  - many agency-owned resources (DOD, NASA, NNSA, NIH, NIST, NOAA, USGS and EPA)

Q1. How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?
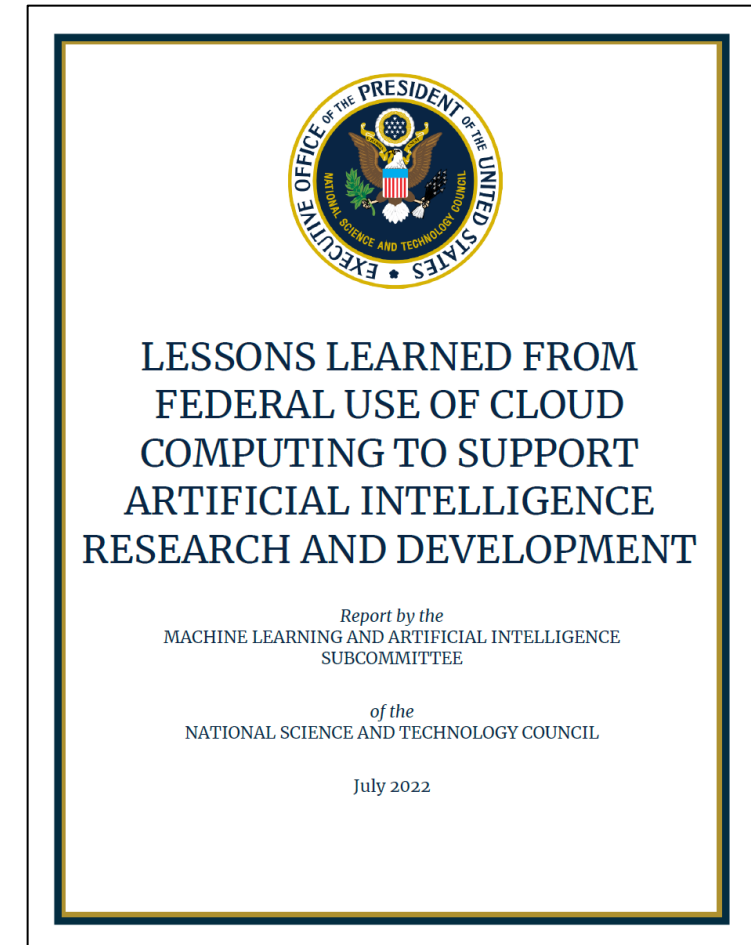
- **Recommendation 1.1: Resource provisioning**

Establish a network of NAIRR resource providers (RP) through one or more targeted solicitations from participating agencies (e.g., NSF, DOE, NIH). Solicitations would fund the expansion of AI-capable compute and data resources at existing advanced cyberinfrastructure sites (e.g., XSEDE), as well as the procurement of new AI-tailored resources at new or existing data centers.

Q1. How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?

- **Finding 1.2: Role of cloud in AI R&D**
  - Recent NSTC report highlights opportunities and challenges with incorporating cloud into Federal ecosystem of R&D resources
  - Cloud advantages:
    - Rapid technology refresh
    - Natural data sharing platform
    - Many AI services and tools
    - Secure
  - Lessons learned from 3 cloud pilots at NIH, NSF, USGS
  - Vision for the future

LESSONS LEARNED FROM FEDERAL USE OF CLOUD COMPUTING TO SUPPORT ARTIFICIAL INTELLIGENCE RESEARCH AND DEVELOPMENT

Report by the
MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE SUBCOMMITTEE

of the
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

July 2022

Q1. How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?

- **Recommendation 1.2: Commercial cloud contracts**

*The lead agency for NAIRR or the NAIRR operating entity should negotiate one or more public cloud contracts at **discounted rates** to provide NAIRR researchers access to the latest technologies and cloud-resident datasets.*

Q1. How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?

- **Recommendation 1.3: NAIRR Technical Advisory Board**

*Establish a standing NAIRR technical advisory board who will establish an **initial framework for the base NAIRR infrastructure**, including compute, data, and testbed resources. This will help NAIRR make decisions on provisioning and integration of the base infrastructure. The board will advise on the incremental enhancements and capability in the infrastructure, when to remove resources. **The board will also set user requirements.***

Q1. How will new computational, data, and testbed resources be **provisioned and integrated** into the NAIRR cyberinfrastructure? How will **user requirements** for all resources be determined?

- **Recommendation 1.4: Common software environment**

The NAIRR technical advisory board should periodically review the available open source software packages most used by AI researchers (e.g., PyTorch, Tensorflow) and specify the standard NAIRR-defined VM. All NAIRR RPs would be required to install and maintain the VM for their user base. Academic teams with their own on premise servers will be encouraged to adopt the NAIRR standard.

Q2: To what extent should **code, models, workflows** developed with Federal funding and NAIRR support be made **freely available** through the NAIRR?

- **Finding 2.1: Impacts of open source software**

AI research has grown explosively through the development and dissemination of open source software (OSS) frameworks such as TensorFlow, PyTorch, and their derivatives. Both of these packages were developed by commercial entities (Google and FaceBook, respectively) and could have been kept proprietary. Instead, they were released as open source software projects, much to the benefit and development of the AI research community. The success of these projects have inspired many other OSS projects and tools. A recent census of the MAD (Machine learning, Artificial Intelligence, Data) landscape lists over 500 companies, startups, and tools, many open source.

- **Recommendation 2.1: Adopt and encourage open software**

*NAIRR should adopt the principle of open source for products developed with federal funds. Exceptions should be provided for small businesses supported through SBIR/STTR given access to NAIRR, and where data is protected. We recommend these products be made freely available through the NAIRR so long as they are **mature, supported, and documented**; i.e., they have achieved production status. The transition from research prototype to production software takes effort. A **grant program** should be established to support transition to operations for potentially impactful research products.*

Q3.1 Should the NAIRR establish acceptance criteria for datasets that are integrated into the cyberinfrastructure, e.g., those include robust metadata, clear provenance, and persistent identifiers? How would these standards be enforced to ensure the integrity of the data made available through the NAIRR?

- **Recommendation 3.1: Acceptance criteria**

*The NAIRR should follow the **responsible AI guidelines** of transparency, unbias, model traceability, assurance of GDPR and Data Privacy in the data, redaction of PII; consent of use properly explained to data providers; oath preventing malicious usage of the resources; definition of malicious applications/unethical AI; definition of fields of applications that should not be touched because of the risk of threat or ethical dilemma.*

*The **NAIRR should establish acceptance criteria** for datasets targeted for integration into the NAIRR infrastructure. Datasets could be characterized into **3-4 groups/levels**, each having different levels of acceptance criteria. For example, you could have high, medium, and low levels of metadata, provenance, and persistent identifiers. A **review committee** should evaluate each dataset and determine how each should be categorized.*

- ***Anti-recommendation:** do not require all datasets be in analysis-ready form. Intermediate data also of value to the community if suitably documented*

Q3.2 *What is the role of NAIRR staff in the curation of datasets, if any?*

- Dichotomy of opinions
  - Yes, curate
  - No, let the marketplace do the curation (e.g., Kaggle)
- Observation: curation exists on a continuum
- Issue: who curates datasets created on NAIRR?
- Conclusion: try both ways and evaluate downstream

- **Recommendation 3.2: Establish a data acquisition function**

We recommend the NAIRR operational entity establishes a data acquisition function with identifies and requests access to existing curated datasets of value and interest to the user community.

- **Recommendation 3.3: Exploit the power of the marketplace**

Curation of AI data, models, and workflows should be done by the community in the marketplace. The community system and a system of reviews alongside proper terms of use signature would facilitate this curation.

Q3.3 *What should be the relationship between the NAIRR and data.gov and other relevant data repositories?*

- **Finding 3.3: Data.gov**

data.gov is not a data repository per se, but rather a website that points to other websites that contain information and sometimes actual data generated by agency projects. Most of the retrievable data on data.gov is html and text data, which might be of interest to some NAIRR researchers. Scientific numerical data sets are deeply buried and not easily accessible. Of potential interest to NAIRR are the AI use cases which agencies are required to deliver according to the Federal Data Strategy. NAIRR should acquire and replicate these data sets if they are not easily accessible.

- **Recommendation 3.4: Data ready-to-injest**

*NAIRR should **encourage, incentivize, and fund the creation of repositories where the data is "ready to injest".** We recommend NAIRR publish interoperability standards for such data repositories, and allow data repositories to compete in one of the tracks to be a "NAIRR data resource provider" -- if they can provide useful data to NAIRR users. Having such repositories/datasets "visible" inside NAIRR would be important to achieving its goals.*

Q3.4 How might the NAIRR fit within the systems being put in place through the implementation of the Evidence Act around hosting and making accessible government restricted/sensitive data (e.g., "America's DataHub")?

- **NCSES is NSF's statistical agency of S&E enterprise**
  - Outputs
  - Manpower
  - Global competitiveness

- **Finding3.4:** The creation of NAIRR will provide ADC with access to powerful data analysis resources with which to inform national policy decisions. Conversely, ADC can supply NAIRR researchers uniquely important statistical data with which to develop models of change.

https://www.americasdatahub.org/

Q3.5 *Should the NAIRR include state, local, and tribal datasets? If so, what additional processes would need to be put in place to facilitate this inclusion?*

Finding 3.5: Representation and inclusion

- **Roughly half of the 326,000 entries in data.gov are from state and local governments**. The problem of inclusion doesn't pertain only to the lack of representation of certain groups of people in the data because of the ethnicity they come from. While this is a big reason for bias (e.g lack of women data in credit scores, lack of darker skin representation in facial recognition), bias can be found in the data and machine learning model design, in the model testing and even in the data annotators lack of diversity. So this question needs to be thought of in a much larger scale regarding all the ways bias can be introduced in assets/models. However, it's also possible to accept purposefully built biased datasets to precisely compensate ML models that perform badly in a certain category.

Recommendation 3.5. Partnering with data.gov to increase inclusion

- *NAIRR should partner with data.gov to encourage additional contributions conforming to the NAIRR data acceptance standards.*

Q3.6 *How will incentives for data contribution work in practice?*

Recommendation 3.6: Data and models as a deliverable

- *Data and/or AI models created on NAIRR resources should be a deliverable of the project. A free curation service should be made available to researchers who wish to contribute data. Data created outside of NAIRR of interest to the NAIRR research community could be acquired through a suitable process.*

Recommendation 3.7: Incentives of the marketplace

- *In the context of a marketplace model, contributors to it should benefit from a special membership that allows them access to the NAIRR resources. The access can be tiered depending on how the NAIRR wants to define it. The incentives can be free access if the member contributes to data, to data curation, to a resource or to a service.*

Q4.1 *What computational resources should be included on day one? What is the right initial mix of computational resources based on the needs of the AI research community?*

- **Recommendation 4.1: Day one resource mix**

*On day one, NAIRR researchers should be able to choose between on premise HPC and commercial cloud resources that include a range of CPU and GPU options with **multiple accelerators per node**, high speed network, and sufficient memory capacity. Ideally, **a mix of dedicated and shared resources**. **Let the competition decide cloud/on-prem mix.***

*Consider a **mix of interfaces**, though at least one should provide direct access to the hardware via command line (as opposed to interactive, "notebook" like environments). Strive for architectural diversity -- not all needs to be hit in the initial cohort.*

*Have at least one **"experimental" resource** with something *other* than vanilla CPU/GPU Hardware (e.g. embedded/IoT infrastructure to support emerging ML/AI experiments in a cyber-physical environment).*

Q4.2 How would the computational resource offerings evolve as the NAIRR matures?

- **Recommendation 4.2: Evolution of the NAIRR**

*The NAIRR would **evolve through periodic solicitations**, developed in response to **user uptake and demand**. Continue to solicit production and experimental resources, continue to strive for **architectural and resource diversity**. NAIRR will add capability to support emerging areas of interest and need by the research community and industry.*

A committee would take input from the research community and determine what capabilities to add to the NAIRR infrastructure. All new capability would be added to the catalog of available infrastructure elements and accessed via the existing mechanisms provided. The key is to add capability that enables impact in areas of grand challenge to society and the research community.

***Decommissioning of components** would also be determined by a committee and the level of interest/use from the research community.*

Q4.3 How will the NAIRR facilitate colocation of data and compute resources?

- **Recommendation 4.3: Colocation of compute and data resources**

NAIRR should facilitate the colocation of data and compute resources in several ways:

(1) invest in the build-out of NAIRR AI commons infrastructure at the HPC centers coupled with capacity expansion for compute;

(2) negotiate contracts with the public clouds with educational discounts that provide access to the most popular compute and storage solutions for AI researchers;

(3) create and curate a catalog of available/existing datasets which may be distributed across the US. These datasets would not be co-located with the computational resources provided by NAIRR. But some datasets may be copied to co-located storage to facilitate better performance. This could be performed as a bulk process, a distributed file system, and/or via a caching algorithm (cached to local storage) to facilitate frequently used datasets.

Datatsets created using the NAIRR infrastructure would be stored on co-located NAIRR storage facilities. Thus there would be a mix of distributed and co-located datasets as part of the NAIRR infrastructure with multiple mechanisms to support efficient usage of those datasets.

Q5: How could the NAIRR facilitate connections with and among various AI testbeds?

- **Finding 5.1: NITRD maintains an inventory of AI testbeds**
  - Currently 40

- ***Observation: AI testbeds could benefit from the marketplace***

In a marketplace model, testbeds can be published and maintained by their creators with the incentive of exchange with other assets in the marketplace and to keep a good system of reviews.

- **Recommendation 5.1: Keep the NITRD AI testbed inventory up to date**

We recommend NAIRR work with NITRD to keep their inventory of AI testbeds up to date, and indicate which are open to new users. **NITRD may wish to transfer responsibility to NAIRR OE.** *Encourage testbeds to open up access to their resources through a formal program with funding for additional support people and equipment.*

https://www.nitrd.gov/apps/ai-rd-testbed-inventory/

Q6.1 *How are resources hosted elsewhere, such as NIH high-volume sequence data, integrated as a part of the NAIRR without being limited to NAIRR users?*

- **Finding 6.1: Federal data in the commercial clouds**

A number of federal agencies have placed large data sets of potential interest to external researchers in the commercial clouds, taking advantage of the public data hosting programs.

- **Recommendation 6.1: Externally hosted datasets**

NAIRR should serve as a clearing house to external datasets of interest to AI researchers and educators. This can be done through a marketplace mechanism or contracted service. Access controls established by the data provider or cloud host must be respected by the NAIRR portal. External data sets of particular interest could be acquired and replicated on NAIRR resources through an acquisition program.

Q6.2 *What services and software stacks are needed to support joint experimentation allocation and provisioning of/deployment on multiple federated resources? Should the NAIRR invest in the development of a base software stack to allow for movement between federated assets? This may be as basic as providing training and examples of creating portable environments or as complex as encouraging the development of concise base environment by application type (computer vision, deep learning, etc.).*

- **Recommendation 6.2: XSEDE/ACCESS as a model for federating resources**

The NAIRR operating entity should evaluate the XSEDE/ACCESS integration software stack for possible adoption, in whole or in part.

SP Resource - Software Integration Status
(expanse.sdsc.xsede.org)

Research Software Portal
Provided by XSEDE

COMMUNITIES ∨   LIFE CYCLE ∨   TOOLS ∨   NEWS   LOGIN

Step Status   **Software Status**

✓ = Required, ✓ = Optional, 🔗 = Clickable Link, ✓ = Pass, ✓ = Tentative Pass, ✗ = Fail, NA = Not Applicable, (*) asterisk in column header indicates a resource exit review

Click on column headers to switch between single resource view and all resource view.

Name	Category	XSEDE Level 1	XSEDE Level 2	XSEDE Level 3	Vendor	Vendor URL	Deployment Plan	Install Guide	User Guide
1. Grid Community Toolkit Client	Grid Software	✓	✓	✓			🔗	🔗	
2. Information Publishing Framework (IPF)	Information Services	✓	✓	✓			🔗	🔗	
3. Resource Description Repository (RDR)	Information Services	✓	✓	✓			🔗		🔗
4. AMIE	Accounting and Account Management	✓	✓	✓				🔗	
5. Common User Environment (CUE)	XSEDE Environment	✓	✓	✓				🔗	
6. Globus Toolkit GSISSH Setup on SSO Hub	Grid Software	✓	✓	✓					
7. Grid Community Toolkit GridFTP Service	Grid Software	✓	✓	✓			🔗	🔗	
8. Grid Community Toolkit GSI OpenSSH Service	Grid Software	✓	✓	✓			🔗	🔗	
9. Inca	Verification and Validation	✓	✓	✓				🔗	🔗
10. Local Resource Management	Various	✓	✓	✓					
11. Modules	XSEDE Environment	✓	✓	✓					
12. XSEDE Allocation Usage Lookup (xdusage)	Accounting and Account Management	✓	✓	✓			🔗	🔗	🔗
13. XSEDE CA Certificate Installer	Grid Software	✓	✓	✓			🔗	🔗	🔗
14. XSEDE Resource ID (xdresourceid)	Information Services	✓	✓	✓			🔗	🔗	
15. Community Software Area	XSEDE Environment	✓	✓	✓			🔗	🔗	🔗
16. Data Transfer Logging	Data Transfer	✓	✓	✓			🔗	🔗	🔗
17. Globus Sharing	Data Transfer	✓	✓	✓			🔗	🔗	🔗
18. Multi-Factor Authentication (MFA) with Duo	Authentication	✓	✓	✓			🔗	🔗	🔗
19. XSEDE Web SSO	Authentication	✓	✓	✓				🔗	
20. xsede-oauth-mapfile	Data Transfer	✓	✓	✓				🔗	🔗

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Q6.2 *What services and software stacks are needed to support joint experimentation allocation and provisioning of/deployment on multiple federated resources? Should the NAIRR invest in the development of a base software stack to allow for movement between federated assets? This may be as basic as providing training and examples of creating portable environments or as complex as encouraging the development of concise base environment by application type (computer vision, deep learning, etc.).*

- **Recommendation 6.3: NAIRR user portal**

*A portal similar in functionality to the NSF CloudBank user portal should be developed that supports **single sign-on, team allocations, collaboration tools, resource discovery, job submission, consolidated accounting, spend alerts, and cost-optimization on hybrid multi-cloud infrastructures** (mix of public and private clouds).*

Q6.2 *What services and software stacks are needed to support joint experimentation allocation and provisioning of/deployment on multiple federated resources? Should the NAIRR invest in the development of a base software stack to allow for movement between federated assets? This may be as basic as providing training and examples of creating portable environments or as complex as encouraging the development of concise base environment by application type (computer vision, deep learning, etc.).*

- **Recommendation 6.4: Potential software investments needed by NAIRR**

The NAIRR technical advisory board should assess the current state-of-the-art in data search and discovery services, as well as distributed and edge computing middleware, to determine if there is something that could be adopted for the NAIRR base CI. If such tools and services are lacking, or in an immature state, NAIRR should invest in the development of a base software stack that allows for movement between federated assets.

Q6.3 *What are some exemplar workflows that combine distributed resources that the NAIRR would support? How would those workflows be supported through the NAIRR cyberinfrastructure?*

- **Recommendation 6.5: Workflow software**

The NAIRR infrastructure should support distributed workflow orchestration software including Kubernetes, SAGE, HTCondor, Kepler, and Pegasus. These would be installed at NAIRR resource provider sites, and tutorials illustrating their use on AI workflows would be developed and disseminated through the NAIRR user portal.

Q6.4 What would be available on day one of the NAIRR to support its federated architecture? What aspects would be expected to be available for inclusion in later phases of the NAIRR?

- As recommended above, the NAIRR technical advisory board would periodically survey the evolving AI tool landscape and provide advice on additions or deletions from the NAIRR standard VM. Many new **AI workflow orchestration tools and templates** for standard AI analysis tasks such as **cnvrg.io** are emerging to meet the needs of industry researchers which might be suitable for adoption by NAIRR.

- **Recommendation 6.6: Day one federation**

On day one, the NAIRR should consist of: (1) a portal, that at the least indexes resources and training materials; (2) a set of resource providers that are actively accepting work; (3) a workable allocation and identity system; and (4) a workable data publication system that allows datasets to be added to a catalog with a DOI. Those 4 things are sufficient at launch, though there are more that should be added "soon" (e.g. common software stack, automated monitoring, AI commons/marketplace).

Executive Summary

- A NAIRR cyberinfrastructure should be created to provision, curate, and manage computational, data, testbed, tools, and algorithm resources to support advancing the research activities of the AI community.

- A NAIRR cyberinfrastructure should leverage existing computational and data resources from other government funded initiatives and commercially available resources (e.g. DOE, NASA, NNSA, NIH, NIST, NOAA, USGS, AWS, GCP, Azure, IBM clouds, etc.)

- A NAIRR technical advisory board should be established to review and approve resources for the continued operation and growth of the NAIRR cyberinfrastructure (testbeds, datasets, software packages, standards, computer systems, provisioning, etc.)

- A viable NAIRR cyberinfrastructure includes the integration of a complex and highly diverse set of heterogenous computing elements to support the broad set of AI application environments, from IoT to complex decision systems to scientific simulations and models.

- The complexity of the proposed NAIRR cyberinfrastructure requires a high level of flexibility and diversity in the way the infrastructure is provisioned, curated, managed, and made available to the research community.

Discussion of Potential Authorizations for the National Artificial Intelligence Research Resource (NAIRR)

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July 25, 2022

Science and Technology Policy Institute

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NAIRR Task Force (TF) Co-Chairs requested that STPI* introduce discussion of statutory authorities that could facilitate the NAIRR

# Potential reasons to authorize the NAIRR through legislation

- Depending on the specific activities that different entities must undertake, new statutory authorities might be needed

- Legally prescribing agency/other actions necessary to achieve the NAIRR vision in law could help ensure success
  - Could prescribe agency participation/collaboration that might otherwise not occur organically
  - Even if authorities already exist, stating them in law would reinforce that they apply for the NAIRR, and avoid ambiguity of interpretation of authorities
  - An Act of Congress would give extra weight to the NAIRR, highlighting it as a National priority

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Challenges associated with Congressional authorizations for establishing the NAIRR

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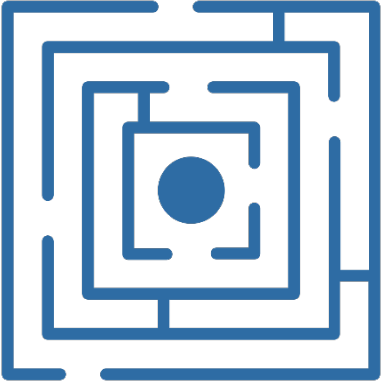
We begin with several assumptions about the NAIRR
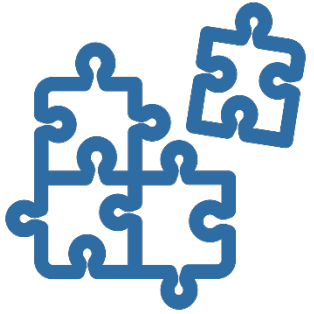
In carrying out the Initiative, the President, acting through the *Initiative Office, the Interagency Committee, and agency heads* as the President considers appropriate, shall carry out activities *that include the following*:

1. Sustained and consistent support for artificial intelligence *research and development through grants, cooperative agreements, testbeds, and access to data and computing resources*.

2. Support for *K-12 education and postsecondary educational programs, including workforce training and career and technical education programs*, and informal education programs to prepare the American workforce and the general public to be able to create, use, and interact with artificial intelligence systems.

3. Support for interdisciplinary research, education, and workforce training programs for students and researchers that promote *learning in the methods and systems used in artificial intelligence and foster interdisciplinary perspectives* and collaborations among subject matter experts in relevant fields, including computer science, mathematics, statistics, engineering, social sciences, health, psychology, behavioral science, ethics, security, legal scholarship, and *other disciplines that will be necessary to advance artificial intelligence research and development responsibly*.

4. Interagency planning and coordination of Federal artificial intelligence research, development, demonstration, standards engagement, and other activities under the Initiative, as appropriate.

5. *Outreach to diverse stakeholders, including citizen groups, industry, and civil rights and disability rights organizations*, to ensure public input is taken into account in the activities of the Initiative.

6. Leveraging existing Federal investments to advance objectives of the Initiative.

7. Support for a network of interdisciplinary artificial intelligence research institutes, as described in section 9431(b)(7)(B) of this title.

8. Support opportunities for *international cooperation* with strategic allies, as appropriate, on the *research and development, assessment, and resources for trustworthy artificial intelligence systems*.

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Source: 15 U.S. Code §9411(b). Italics ours.

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NAIIA authorities are general

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Federal agencies have a variety of existing authorities by which they support R&D, infrastructure, and partnerships

- e.g., Awards, grants, contracts, cooperative agreements, other transactions authority, memoranda of understanding

- Statutory/regulatory authorities
- OMB guidance
- Agency-specific policies and approaches

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Recommendation 3-1: Multiple Federal agencies should be funded to cooperatively support NAIRR resources and management, thereby serving the broadest range of research communities and national interests

Existing Authorities   **New Authorities**

- Existing authorities embed interagency coordination into the NAII

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Recommendation 3-5: The NAIRR should collaborate with resource providers to make a broad variety of resources available through the NAIRR user access portal

Existing Authorities

- NAIRR can leverage agencies' own resources and Federally supported resources
  - Federally supported cyberinfrastructure resources (e.g., NSF XSEDE/ACCESS, DOE scientific computing user facilities)
  - Government-owned datasets (e.g., from data.gov)

New Authorities

- Privately-owned datasets (e.g., training data for large, commercial models)
- Commercial cloud resources

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Recommendation 3-7: The NAIRR management entity should be explicitly charged with addressing diversity, equity, inclusion, and accessibility (DEIA) issues related to NAIRR supported AI R&D.

Existing Authorities	**New Authorities**
• Existing authorities permit this recommendation to be addressed by agencies in general	

What aspects of the NAIRR roadmap are expected to be challenging to implement?

Are there success stories/lessons learned about successful implementation of the kinds of activities outlined in Interim report and WG presentations?

What kinds of legal or regulatory challenges arose in implementing these success stories? How were these barriers overcome?

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