



UC San Diego

National Data Platform (NDP) as an AI Engine

7NRP 2026, May 5, 2026 – San Diego, California

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Founding Director, **Societal Computing and Innovation Lab**
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A big part of my time is spent on AI strategy at different scales... especially for AI readiness.

- How do we create the systems that enable researchers and students to use AI?
- Are we truly enabling AI, or just providing access to compute and storage?
- How do we accelerate safe AI adoption and impact in science and society?
- How do we effectively train an AI-savvy workforce?
- How can we turn AI prototypes into reliable, reusable, scalable real-world workflows?

So... do we have an AI bottleneck?

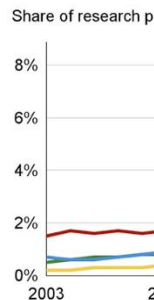
Or do we need more to be AI-ready?

The Real Bottleneck is not the AI

We do not have an AI shortage.

We have a data readiness, interoperability, workflow, and operationalization problem.

More and more scientists are working with AI



Source: Richard Van Noorden and Jeffrey M. Perkel, "AI and science: what 1,600 researchers think," Nature, September 27, 2023. Based on keyword searches of the Scopus database.

AI systems fail when data, compute, workflows, and governance are disconnected.







UNDERSTANDING 

Application Flexibility
Ability to integrate AI-driven capabilities into operational systems

Infrastructure Scalability
Compute, storage, and performance readiness

Source: <https://kansoftware.com/insights/blog/ai-readiness-assessment-enterprise-architecture-guide>

Is Either Ready for AI - or It's Not
to ensure your data can support Agentic AI

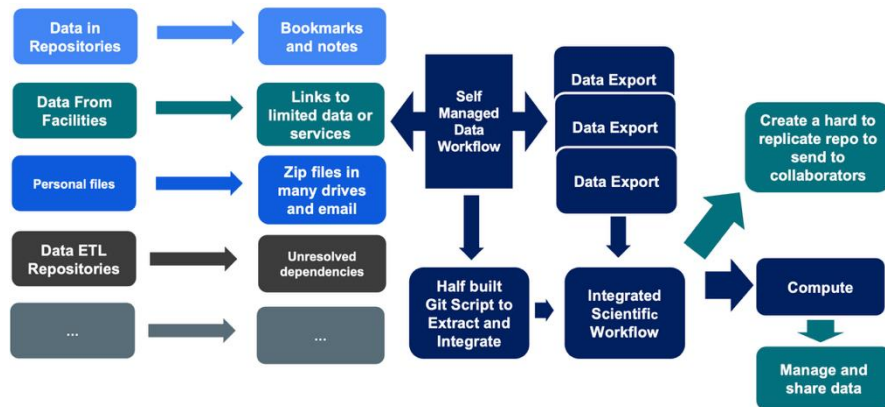
 access Structured and content (PDFs, etc.) into one file layer.	<input checked="" type="checkbox"/>  Contextual metadata Use administrative, structural, descriptive, and semantic metadata to make data machine-readable and governed.
 Semantic enrichment Normalize terms, vocabulary, and taxonomies across geographies and systems for consistent understanding.	<input checked="" type="checkbox"/>  Lineage & traceability Track data from source to AI output for compliance, auditability, and trust in automation.
<input checked="" type="checkbox"/>  Role-based access control Enforce role- and attribute-based controls to prevent unauthorized queries and data leaks.	<input checked="" type="checkbox"/>  Modular, context-rich output Structure content (in RDF/XML) for safe retrieval, reuse, and orchestration in agentic workflows.

The future is not a better chatbot.

The future is AI operating on trusted national-scale scientific and societal infrastructure.

GPUs alone are not AI Infrastructure, Our Workflows are Broken

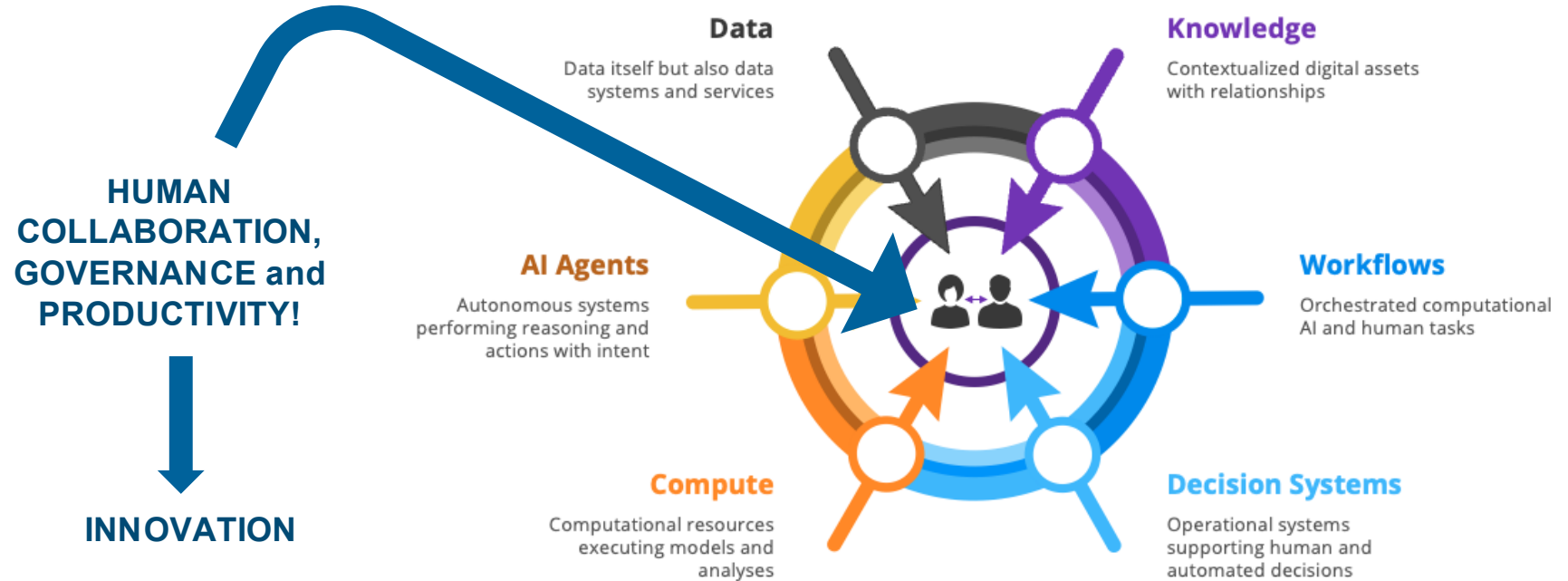
Why Is Existing AI Infrastructure Incomplete?



- Data silos and static repositories
- Non-interoperable metadata and weak provenance
- Inaccessible compute and broken data to compute link
- Limited workflow continuity and human bottlenecks due to usability of discovery and orchestration
- Lack of agent-ready services

The New AI Infrastructure *for research and education

Creating an Engine for Scalable AI Innovation and Impact















































NDP as an AI-Ready Innovation Engine

Data ↔ Knowledge ↔ AI Agents ↔ Workflows ↔ Compute ↔ Decision Systems



<https://www.nationaldatapatform.org/>

(PI: Altintas)

 <p>Ilkay Altintas UC San Diego Cyberinfrastructure, AI Research, and Data Commons</p>	 <p>Melissa Floca UC San Diego Needs Assessment and Capacity Building</p>	 <p>Amarnath Gupta UC San Diego Data Integration and Management</p>	 <p>Chuck Meertens University of Colorado, Boulder Earthscope Use Case Development</p>	 <p>Manish Parashar University of Utah Cyberinfrastructure, AI Research, and Data Systems</p>											
<p>Our Team</p>															
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 <p>IR Ivan Rodriguez UC San Diego</p>	 <p>Jaya Saha UC San Diego</p>	 <p>Kristin Sankaranarayanan UC San Diego</p>	 <p>ST Subhrajit Duggirala UC San Diego</p>	 <p>Alexander Tane UC San Diego</p>	 <p>Jesse West UC San Diego</p>	 <p>Bo Zhang UC San Diego</p>									

National Data Platform

.... enabling interoperable data and AI integrated workflows.

The screenshot shows the National Data Platform website. At the top, there is a navigation bar with links for 'My Hub', 'Education Hub', 'Catalog', 'About', 'Events & Press', and 'User Stories'. A 'Get Started with NDP' button is also present. The main content area features the heading 'Open Data, Available Access and AI Service' and a sub-heading 'Building the best nation's federated data ecosystem. Explore data. Run analyses. Transform AI training.' Below this is a button that says 'Explore our catalog of datasets >'. To the right is a map of the United States composed of small blue and white squares. Below the map are logos for partner organizations: San Diego Supercomputer Center, SCI (www.sci.utah.edu), EarthScope Consortium, UC San Diego, The University of Utah, and University of Colorado Boulder. At the bottom, there are three statistics: '5811 data collections and livestreams', '5 data and AI services', and '1266 registered users'.



A **broad, federated** and **extensible** data ecosystem to promote collaboration, innovation and customizable use of data on top of existing national infrastructure capabilities.

<https://www.nationaldatapatform.org/>

UC San Diego



University of Colorado
Boulder



What does NDP solve for AI-readiness?

Fragmented access to data, models and services

Complexity of formats, interoperability and context



NATIONAL DATA PLATFORM

<https://www.nationaldatapatform.org/>

Disconnect between producing & sharing data

Lack of user experiences enabling collaboration

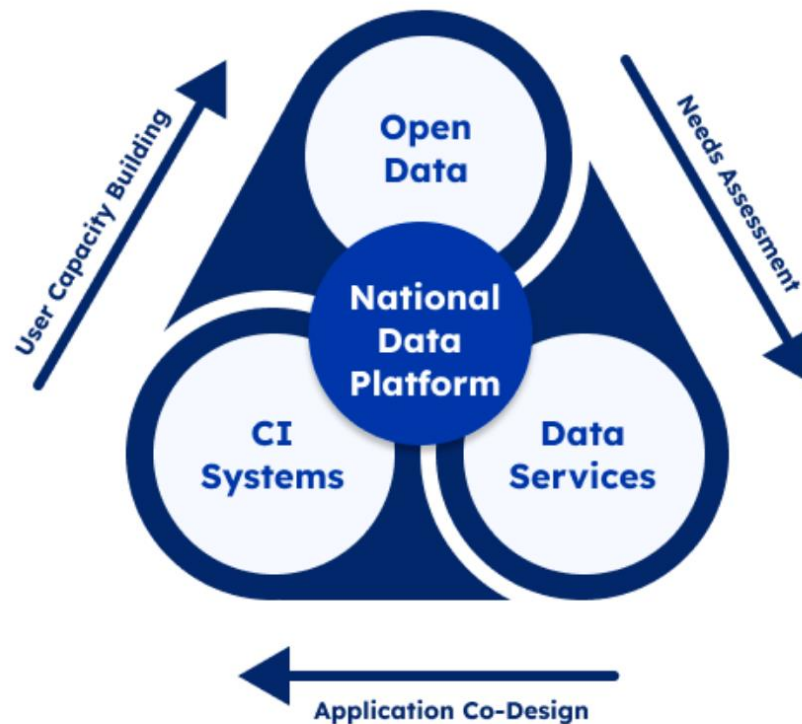
Hard to customized service deployment practices

Integration of AI agent in and across user workflows

Need for scalable or specialized compute readiness

Disconnect between research & education capacity

Last three years....



Focus on Usability, Interoperability and Composability



Centralized portal for discovery, access and use workspaces for research and education



A scalable **platform** for using, developing and deploying composable services and application workflows at **distributed endpoints**



NDP: A Federated Data Platform



Central Deployment of NDP

- **Extensive** catalog of data & services
- Advanced **data discovery** tools
- **Collaborative** workspaces
- **Interactive** classrooms & data challenges
- Open knowledge networks & **conceptual search**

Lightweight software stack that enables a *custom data experience*

- Deployed virtually **anywhere**
 - **Near data** or compute
- Connects to **NDP core services**
- **Customized** services and data access
- **Bring-your-own** resources
- **Community** controlled



Underlying our AI-ready ecosystem approach is composable (federated) services and systems at the

comp CI-New: Cognitive Hardware and Software Ecosystem
Community Infrastructure (CHASE-CI)



2017-2021

Smarr, Larry L (University of California-San Diego) ; Kreutz-Delgado, Kenneth ; Rosing, Tajana S ; Altintas, Ilkay ; DeFanti, Thomas A



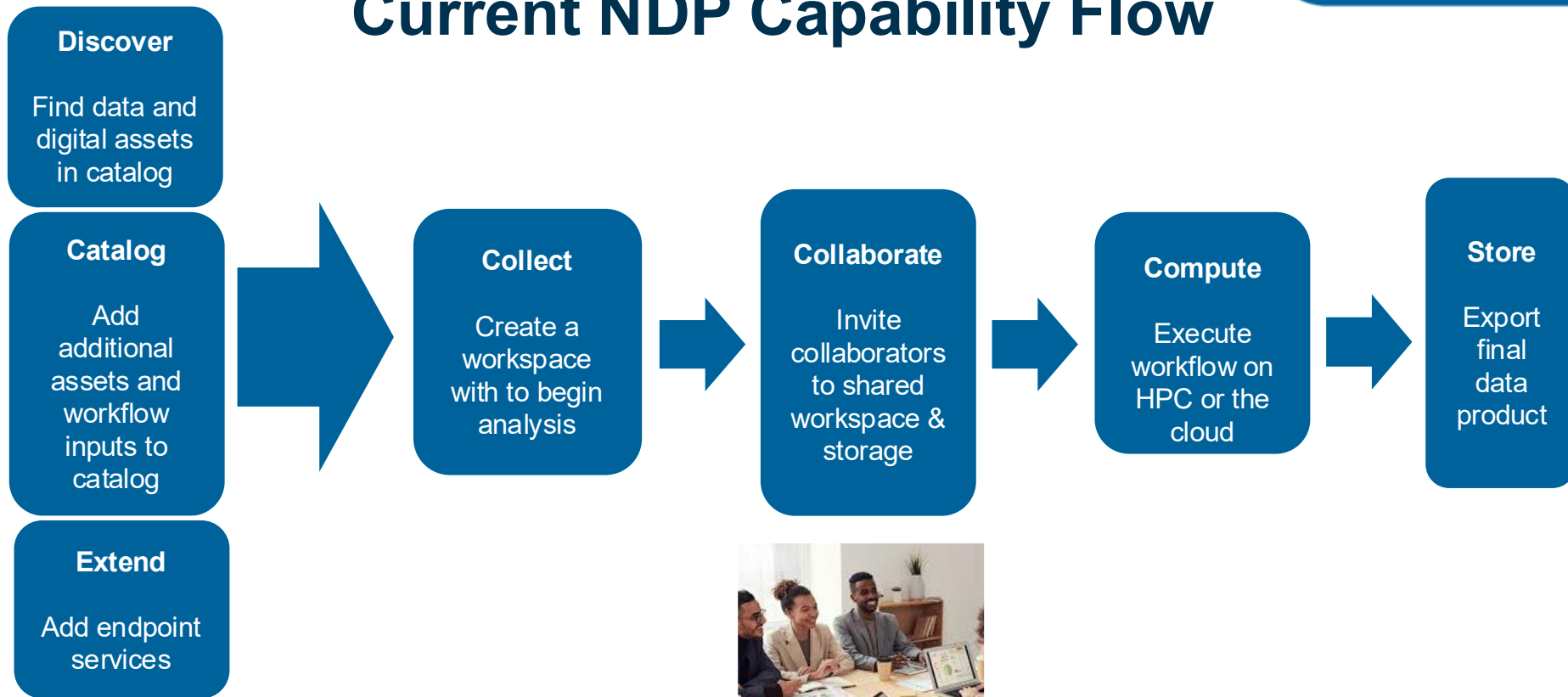
Edge

...

NSF Award Number 1730158. Directorate for Computer and Information Science and Engineering, Division Of Computer and Network Systems. 2017.

HPC

Current NDP Capability Flow





So what gets enabled when a federated infrastructure like NDP for usability, interoperability and composability exist?

Streamlining access and use for education...

National Data Platform Education Hub

- Intuitive wizards to create **compute-ready classrooms** for your students to use
- Full range of digital assets available via **reusable and reproducible materials** that use AI, data, and compute services
- Formal and **informal learning materials**
- Group **data challenges** with large data

<https://www.nationaldatapatform.org/>



NATIONAL DATA PLATFORM

UC San Diego DSE 203 (Amarnath Gupta)

- **Exercise:** Constructing knowledge graphs with large datasets

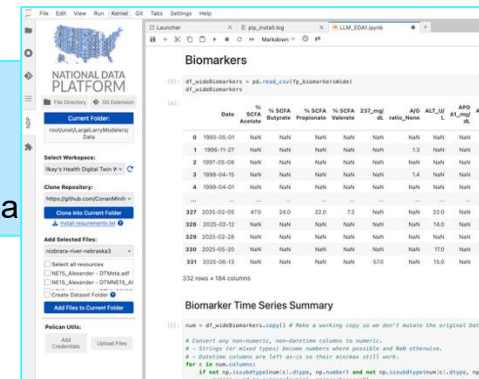


Example Student Project with NAIRR USPTO Dataset



UC San Diego BENG 211 (Benjamin Smarr)

- **Exercise:** Time series analysis of physiology data



Real world discovery as part of in-class experiential learning

Each image drawn from a different student group project carried out in *Bioengineering 211: Molecular Systems*, taught by **Prof. Benjamin Smarr, Fall 2025, UCSD**

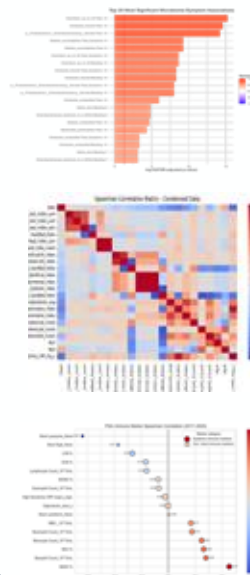
- 1) Prof. Larry Smarr donated 11 years of microbiome, clinical data, and metabolomics timeseries data



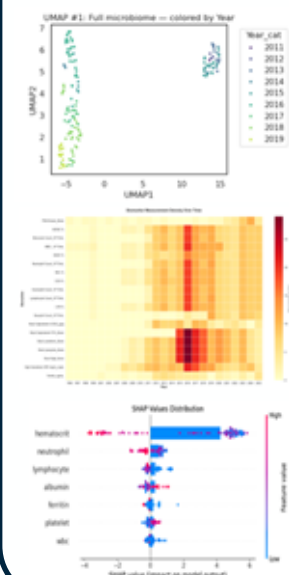
Students visualize multi-modal time series



Students explore big data models & statistics



Students train ML & explainable AI



- 3) Stable Jupyter workspace with NRP compute support

- 2) Data loaded to NDP Education Hub created with group workspace

- 4) Students carry out discovery science as experiential learning



NDP improves talent pipeline by giving students cutting edge data science experience, supporting team-driven discovery, and providing scalable solutions for data-enable education.



NATIONAL DATA PLATFORM

My Dashboard

- Catalog
- Education Hub

[← Go Back](#)

Frost Risk Forecasting Data Challenge

F3 Innovate

The Frost Risk Forecasting Challenge invites participants to build and evaluate machine learning models to predict the probability of frost events across California's diverse agricultural microclimates. Using multi-year weather observations, teams will explore data-driven methods to anticipate damaging frost conditions and increase resilience for growers.

Prize: Top Research Track Awards: • First Place – \$1,500 • Second Place – \$750 • Third Place – \$400 Presentation & Recognition: Teams submitting valid, reproducible entries will receive a Certificate of Participation. The top 3 teams will also earn Digital Credentials verifiable through F3's open badging system. Mentorship & Collaboration Opportunities: Selected teams will be invited to join future sprint design teams and commercialization cohorts supported by F3 Innovate and partner institutions.

Overview Rules and Eligibility FAQ Modules

Background

[Official Challenge Brief.pdf - Click to download](#)

Frost is one of the most damaging weather risks to California's specialty crops, particularly during bloom periods. Traditional forecasting methods are often limited in accuracy. This challenge explores whether modern machine learning approaches can improve short-term frost risk forecasts.

Home > Stories > NDP in Action: Forecasting Frost Risk with F3 Innovate



NDP in Action: Forecasting Frost Risk with F3 Innovate

JARRETT HALEY • FEBRUARY 25, 2026

Frost damage is the highest-rated weather hazard for economic loss to crops across the United States. In California's Central Valley, a single unseen frost event caused an estimated \$500 million in damage to citrus crops literally overnight. While frost events happen infrequently, their devastating effects demand vigilance.

Protective actions involve extensive labor, fuel and coordination — deploying them too often is expensive, but deploying them too late can be worse. Navigating this trade-off effectively calls for data-driven approaches that provide more localized warnings and clearer estimates of risk.

This need inspired the Frost Risk Data Challenge organized by F3 Innovate, a Central Valley-based nonprofit focused on building an agricultural innovation ecosystem. As the first external organization to design and lead a data challenge on the National Data Platform (NDP), F3 Innovate provided student and research teams real datasets to build probabilistic forecasts of frost conditions and show how those forecasts could inform agricultural decisions.

Built for ease

With only a short runway to launch the challenge, F3 Innovate needed a platform that could handle participation

Credits: Ryan Dinubilo, Priscilla Koepke (F3 Innovate)

<https://nationaldataplatform.org/stories/ndp-in-action-forecasting-frost-risk-with-f3-innovate>



Education needs content!

Content == Customizable compute-ready digital assets like data, notebook, readings, models, agents, ...

NDP Agentic AI Classroom for 7NRP

Education Hub

- Statistical analysis (mean, median, min, max, std)
- Threshold-based area calculations
- Interactive WMS map visualization
- Distribution charts and histograms
- Multi-county comparisons
- Ranking and filtering

Architecture

```

User Question
  ↓
ConversationalAgent (manages history)
  ↓
Pydantic AI Agent (processes with LLM)
  ↓
Tools (search_datasets, compute_stats, etc.)
  ↓
  
```

README

- Response (with data/maps/charts)

Available Tools

The enhanced agent includes these tools:

- search_and_select_dataset - Find relevant datasets by topic
- get_county_statistics - Compute zonal statistics
- get_area_above_threshold - Calculate area above a threshold
- get_area_below_threshold - Calculate area below a threshold
- show_map - Display interactive WMS map
- get_value_distribution - Get data distribution for charts

Model Options

OpenAI GPT-4o-mini (Default)

- Fast and reliable
- 60 second default timeout
- Requires OpenAI API key

NRP Qwen3 (Alternative)

- Open-source model
- 180 second default timeout
- Requires NRP API key
- Set MODEL = "nrp" in the configuration cell

Agent AI

26 | UC San Diego

Open →

My Dashboard

7NRP : Agentic AI

Institution	UC San Diego
Academic Term	Spring 2026

Modules

CLM AI Agent

UC San Diego

An AI agent system is provided that allows for exploration and analysis of the California Landscape Metrics (CLM) datasets through natural

[View →](#) [Launch option](#)

Dataset RAG Chatbot

UC San Diego

Dataset RAG Chatbot example using NRP's LLM Service

[View →](#) [Launch option](#)

SDG&E GOES Satellit...

San Diego Supercomputer Center

This workspace demonstrates NDP Science Agent, a natural language interface for scientific data exploration built on the National Data Platform, NDP

[View →](#) [Launch option](#)

National Data Platform – Education Hub

Content Development Workshop Aug 4-6, 2026

Provide
your
contact
details to



- The National Data Platform (NDP) provides an integrated environment for data discovery, collaborative workflows, and scalable computing.
- As part of this ecosystem, the Education Hub curates modular, reusable learning content that allows students and educators to engage directly with real-world datasets, models, and tools.
- A three-day workshop will bring together educators, administrators and researchers interested in shaping the next generation of AI-enabled, data-driven learning experiences. models, and tools.



NATIONAL DATA PLATFORM



Education and research should bridge to innovation in a unified platform and process.

Many examples in NDP... including the great NAFSI Hub we heard from this morning.

Spectropolarimetric Inversion in Four Dimensions with Deep Learning

Contact: Curt Dodds, University of Hawaii




SPIn4D, NSF#2008344 

The value I see in NDP and OSDF is facilitating others' use of our data, and vice versa," says Dodds. "Our telescopes here in Hawaii collect very unique data, but how do we get 100 terabytes of important data from Hawaii to a researcher in Chicago? We need to send and receive data both ways and be able to work with it together—traditional methods don't do that efficiently."



The Daniel K. Inouye Solar Telescope in Hawaii. Credit: DESTINGQURANSP

NDP in Action: Astronomical Data of Astronomical Size

 National Data Platform (NDP)
107 followers

May 15, 2025

Big data can be transformative, but it can also be challenging to manage. How do researchers access, share, and work with datasets that measure in the terabytes or even petabytes? Curt Dodds and colleagues at the University of Hawaii's Institute for Astronomy are now tackling this challenge with the power of the National Science Foundation (NSF)-funded National Data Platform (NDP).

Dodds leads a team of IT engineers who support the Institute, which regularly collects enormous amounts of data from telescopes and other instruments on the islands. His interest in facilitating open access to data, especially to advance AI and machine learning applications, led him to the communities surrounding the NDP, the National Research Platform (NRP), as well as the Open Science Data Federation (OSDF) and its software layer, Pelican, all of which are also NSF-funded.

<https://www.linkedin.com/pulse/ndp-action-astronomical-data-size-national-data-platform-1fwnv/>

- Data from telescopes and other instruments as well as valuable solar simulation data **stored on OSDF** via Pelican interface
 - Through 2021-2023, the SPIn4D team modeled and ran solar simulations using 10 million CPU hours on the NSF's Cheyenne supercomputer, producing a massive dataset of 110 terabytes.
- **NDP catalogs** for multimodal data is being developed as public and private catalogs
 - Textual, conceptual, and map-based spatiotemporal search capabilities
 - 13 TB of data was cataloged and published to NDP users
 - Jupyter notebooks to explore the data was published to NDP users
- Linking data to **AI workflows through NDP JupyterHub on NRP**
- **NDP Education Hub** will be used to deliver online, interactive course content using this data to introduce students to solar spectropolarimetry

NDP Innovation Templates

CENIC, NRP and NDP in Action



Iron Horse Vineyards Testbed A CENIC AIR Living Laboratory

Credits: Joy Sterling and David Munksgard (Iron Horse Vineyards), Tom DeFanti and John Graham, Kate O'Laughlin, Pedro Ramonetti (UCSD and CENIC), Jake Gonsalves, Joe Ording, Sara Kassis, and Roya Salek (Sonoma State University)



- Joy Sterling on FCC task force reviewing US precision agriculture, with final report delivered at end of 2024
- Chaired subgroup that examined demand for broadband connectivity and recommended serving US agricultural infrastructure
- Beyond improving sustainability and wine quality, the Iron Horse Vineyards Testbed is a platform for education and inspiration
- Working with Sonoma State, Santa Rosa Junior College, UC San Diego, and others, the project;
 - Provides hands-on training in sensors, drones, data science, and viticulture
 - Attracts young people into agriculture through real-world innovation
 - Builds a pipeline of talent to steward farming and sustainability in the future

Making data from Iron Horse Vineyards discoverable, usable and interoperable within research and education workflows...

Add to my NDP Hub to customize.



Public Workspaces for Sensor Data Access and Education in NDP

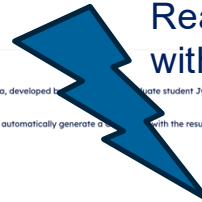
Iron Horse Vineyard - Sensors Data Access

Creator: Kate O'Laughlin

Iron Horse Vineyard - Education Workspace

Creator: Pedro Ramonetti

Ready to launch on NRP with data and code.



Data is available in NDP catalog.

IoT Sensor Data
by Iron Horse Vineyards
Resources: 2

Multispectral Drone Imagery
by Iron Horse Vineyards
Resources: 2

Fetches data from InfluxDB sensors every 15 min

Programatically Accessible Resources

Catalog Assets 4 of 640

Source catalog assets

- IoT Sensor Data

Workspace Codebase 4 of 640

Source provided workspace codebase

<https://github.com:nautilus.io/ihv-iron-horse-vineyard-workspace.git>

Launch options

- Fetches soil moisture, air quality, temperature, CO2
- Data engineering to make it clean and basic graphing/group
- Machine learning: temperature prediction, feature importance, Humidity prediction, anomaly detection, health of sensors based on anomaly
- Summary at the bottom

Custom NDPs -- cNDPs

Powering many custom platforms using the NDP federation stack, with special community-facing capabilities.



- Built on top of a NDP using core NDP services
- Authentication, Catalogs, Project Spaces, Workspaces
- A customized look-n-feel expanding NDP endpoint backend with a specialized user experience
- Lite and full versions depending on the community and needs



Enabling Collaborations for a Wildfire Resilient Future

Wildfire Science and Technology Commons

FireForge Data Challenges Explore Community About Support

Documentat

Shrubwise Data Challenge is in Motion!

Winners will collaborate with us to publish a conference paper and present your findings with \$6-10k in travel support.

More Details >

950+ Wildfire Commons Catalog Entries

100+ Experts in our Network



Wildfire Science and Technology Commons

Catalogs Data Challenges Explore

Education Hub

Explore Community Resources

Data Challenges Workspaces Projects Classrooms

- ALS&TLS Data Demo
- IFPRS Data Processing for Interagency Tracking System
- Synoptic Demo
- Intelimon Model Building Example

Open Collaborations for a Wildfire Resilient Future

<https://www.wildfirecommons.org/>



U.S. National Science Foundation

NAIRR Pilot National Artificial Intelligence
Research Resource Pilot

Advancing US Innovation in Artificial Intelligence

UC San Diego

NDP Sandbox for NAIRR

Welcome to Nairr Sandbox Workspaces

Advancing US Innovation in Artificial Intelligence

The NAIRR Pilot aims to connect U.S. researchers and educators to computational, data, and training resources needed to advance AI research and research that employs AI. Check out the sandbox workspaces and education models below.

Sandbox Workspaces

NAIRR Pilot Sandbox projects are for anyone interested in exploring AI related allocation. These sandboxes are isolated environment used for experimentation and development, separate from the main production environment. It allows academics, scientist and students to try out new features, try out server configurations, or play with AI tools without impacting the live system. Think of it as a playground where you can play with different tools and ideas without breaking anything that's already working.

The following NAIRR Pilot projects have datasets within the National Data Platform.

HydroGEN: National Hydrology AI Digital Twin Pilot

Company: **Hydroframe**

We aim to build the first digital twin of the complete terrestrial hydrologic cycle from bedrock to treetops across the United States. Once developed, the model can be continuously updated and improved with new information from remote sensing products and gauge observations. Our digital twin will generate monthly national forecasts in real time daily, and all outputs will be publicly hosted and freely accessible. [Demo Project Page](#)

[View the Public HydroFrame Workspace](#)

OpenTopography: Digital Elevation Model Data

OpenTopography facilitates community access to high-resolution, Earth science-oriented topography data and related tools and resources. OpenTopography is supported by the National Science Foundation under Award Numbers 2410799, 2410800, & 241080.

OpenTopography-hosted high-resolution raster topography datasets have been selected for integration into the National Science Foundation's (NSF) National Artificial Intelligence Research Resource (NAIRR) Pilot Program. [News Page](#)

NAIRR pilot resources page (Available open data and models). [Open Data Page](#)

[View the Public OpenTopography Workspace](#)

- Demonstrate how NDP can enable integrated cataloging, discovery and use of NAIRR resources for data, models and computing in AI research/education workflows
- Catalog NAIRR resources with example notebooks demonstrating use
- Demonstrate use of NAIRR resources in teaching and training activities
- Integrate NRP and CloudBank resources in research workflows

<https://ndp.nairrpilot.org>

The Future of NDP....

The next generation of AI in research and education is not isolated. It is federated and it will live inside national infrastructure. We need to build our infrastructure as an engine for innovation supporting human AI collaboration.

AI Agents

- Discover data and link knowledge
- Map services to compute
- Assemble and coordinate workflows
- Support humans in real time

Humans and Systems

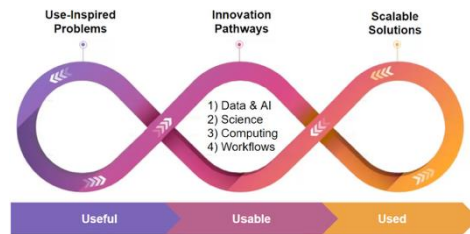
- Control and govern
- Collaborate and innovate
- Enable transparent conduct
- Ensure provenance and trust

The HARD Problems

AI will not transform society by itself. Societal innovation models coupled to platforms that organize data, computing, and collaboration around shared goals will.

Challenge: Building a scalable national ecosystem where AI can operate responsibly.

- governance
- provenance
- security
- trust
- incentives
- sustainability
- operational adoption



Governance & Collaboration

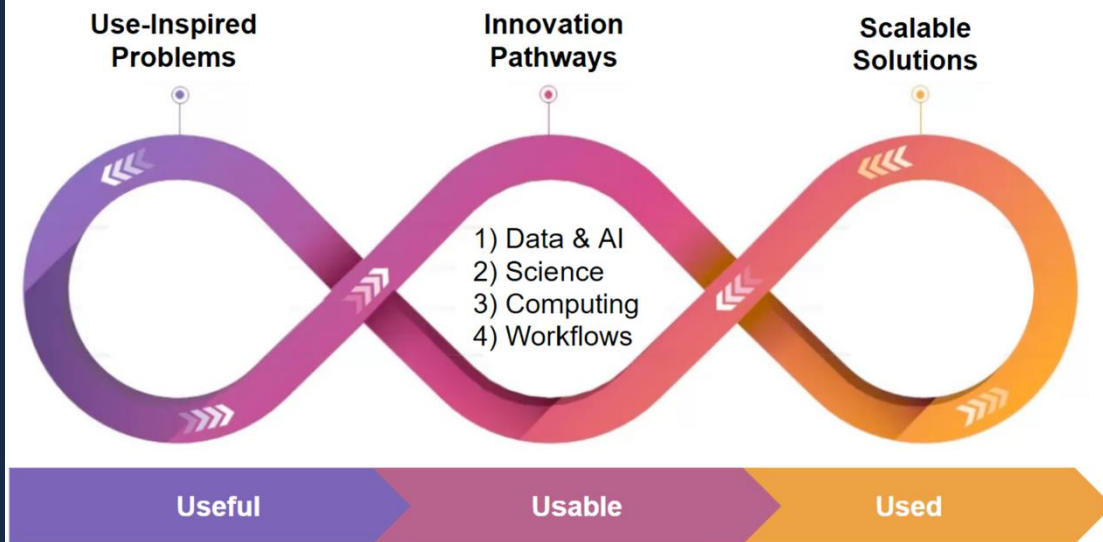
User-facing Virtual Environments

Application Workflows

Federated Data and AI Services

Federated Hardware

Our Innovation Approach



SCIL's **societal computing and innovation approach** is a connective framework to enable new innovation pathways and to imagine, design, build, and scale solutions to society's most pressing problems, where **data, science, and technology work in concert for the public good and resilience.**

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UC San Diego

Thank you!

İlkay ALTINTAŞ, Ph.D. (ialtintas@ucsd.edu)



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Architecting for Collective Data-Integrated Societal Impact

- Involve diverse users in architecting
- Identify access, use, expertise and education gaps
- Improve the experience of working with data
- Connect data to knowledge systems and services
- Create an ecosystem approach to capacity building
- Incubate use-inspired solutions to scale
- Explore new models of allocation
- Develop and teach models of sustainability and scale



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