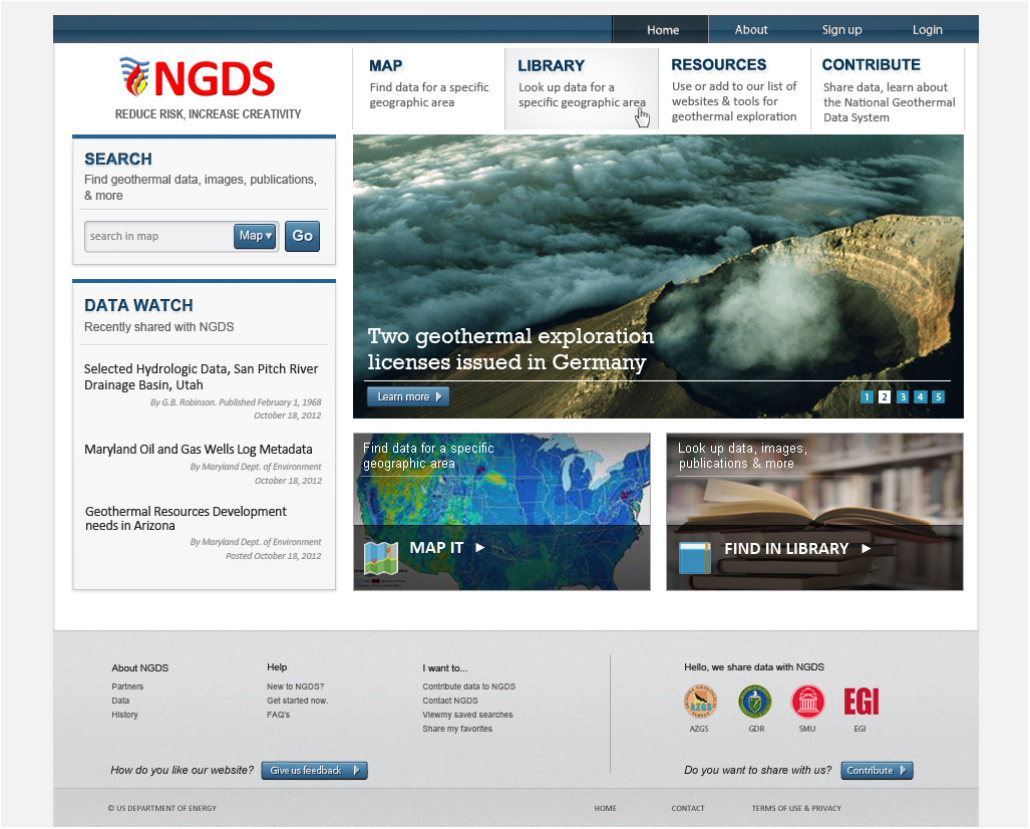


National Geothermal Data System Design and Testing

Project Officer: Arlene Anderson

Total Project Funding:$4,992.089.00

April 22, 2013

Principal Investigator
Harold Blackman
Boise State University

Track 3

Relevance/Impact of Research

- NGDS Design and Testing is a part of the larger NGDS Initiative
- Other NGDS projects deal with system data development and population
- Our Project Objective is to provide *access to* data from all geothermal resources to all parties to further enhance *their decision making* ability based upon available data *that will in turn* support the discovery and generation of geothermal sources of energy

- Increase the efficiency of exploration, development and usage of geothermal energy by providing an effective, searchable database to support financial risk analysis
- Assist state and federal agencies in making land and resource management assessments
- Foster the discovery of new geothermal resources by supporting ongoing and future geothermal research
- Increase public awareness of geothermal energy

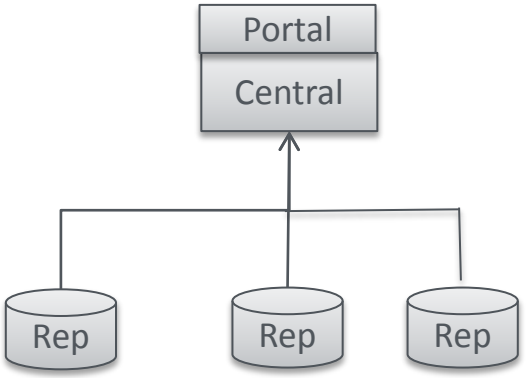
Relevance/Impact of Research

- Our innovation lies in the creation of a free, downloadable, federated system that will be able to organize, and access data stored in:
  - different systems
  - different places
  - by different people
- Our data system consists of a network of three linked communities:
  - Data providers who will expose information to the system through standardized, internet accessible interfaces and interchange formats
  - Software developers who will build applications that utilize the data in the system, and make it easier for end-users to interact with the system
  - End-users who will utilize the software and information provided by the system in order to understand and develop geothermal resources

Relevance/Impact of Research

The NGDS consortium is defining data formats and software products free for download and use!

- The NGDS data formats
  - Template formats for geo-data
  - Metadata standards
- NGDS Software Products



1. NGDS Node-in-a-box Repository
   - Install this software package on your server and start storing and publishing data using standardized OGC protocols

2. NGDS Central Node
   - This software package provides the central entry point for searching the entire grid of repositories
   - Provides an efficient portal for searching resources

Relevance/Impact of Research

Increase NGDS impact by providing effective architecture, and relevant, easy to use software for providers and end users.

- System Architecture
  - System will include data from a wide range of topics, from well logs and drilling data to temperature, geochemical, and geo physical measurements, as well as journal articles
  - Catalogue services will support data providers as well as users in discovery and access through standardized metadata for describing resources, content models for geothermal data, and common web-protocols for exchanging information
- Data provider software
  - Redistributable, open-source software will provide simple ways to register data sources, load data, and expose those data in a node in NGDS
- End user software
  - Access will be provided to users through the NGDS website, that leads to a map-centric search application to support finding, visualizing, mapping, and acquisition of data

Scientific/Technical Approach

- Phase I/II review (May/June 2012) indicated a need to re-plan so a new project management plan and resource loaded scheduled were delivered
- Three major parallel paths are being followed:
  - data assessment, import, integration, and testing
  - software development
  - sustainability

Scientific/Technical Approach

- Data assessment, import, integration, and testing are composed of two major elements:
  - Data assessment: determining the amounts and types of data available to the NGDS resulting in consortium member work plans
  - Data import, integration and testing: enabling discovery and download of annotated files with geothermal data, discovery and access of web-services with geothermal data, and automated import of metadata and data, including production data integration

Scientific/Technical Approach

- Software development is following agile development process
  - Created software requirements specification
  - Selected software development environment
  - Employing multiple sprints (15 to 19 dependent on funding and schedule)
  - Resulting in distribution and rollout of a redistributable software package
- Sustainability
  - Create a plan for the future of NGDS

Scientific/Technical Approach

- There is one long-term issue:

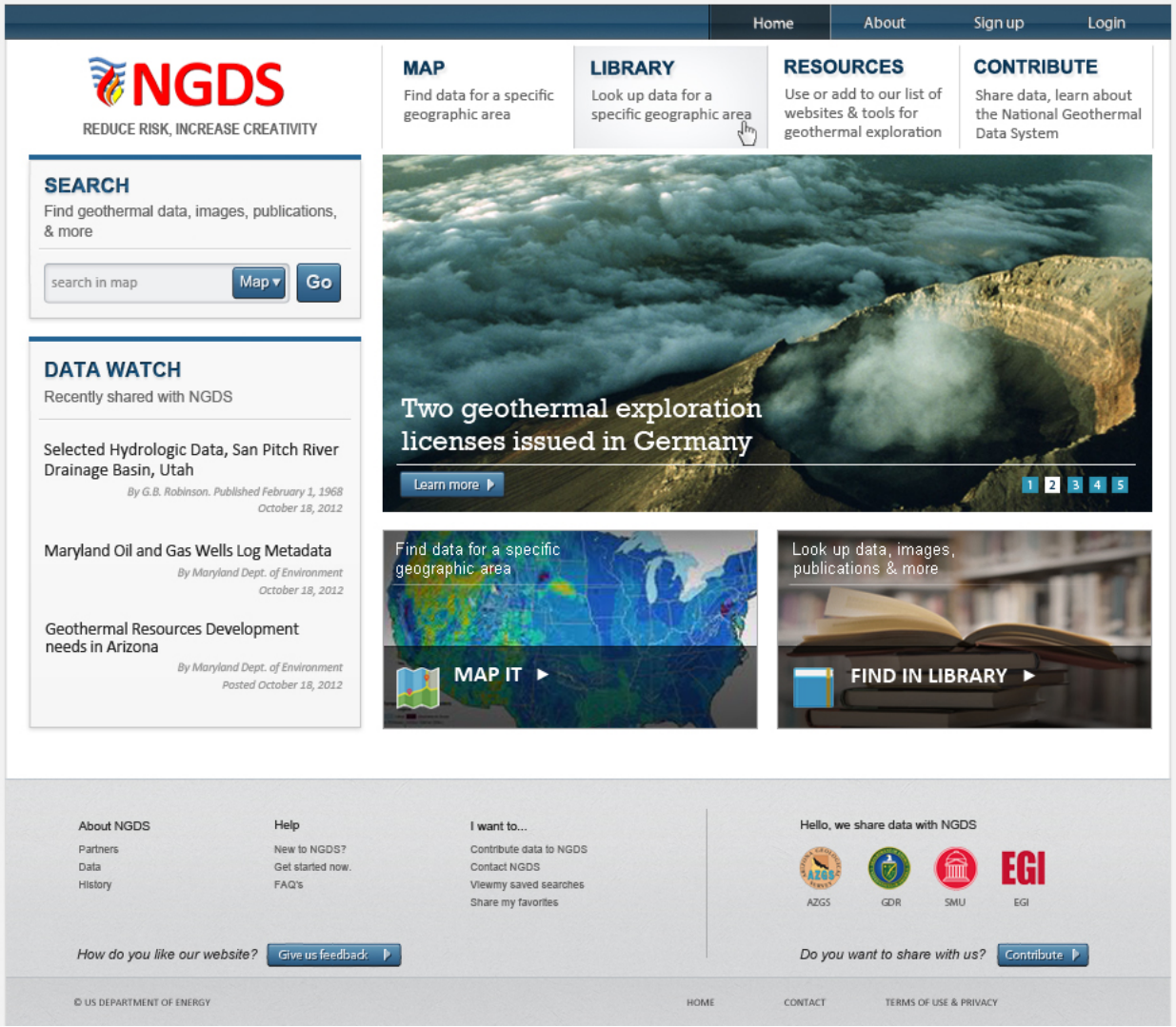
  NGDS funding is limited
  - Only so many features can be realized
  - Bug fixing must come to a halt once the funding is used up
  - Internet technology evolves rapidly beyond the project horizon

- Solution lies in Open Source:
  - NGDS development will be made available under an open source license
    - Shall be attractive to an open source community for further enhancements
  - Make use or hook into an already existing open source project
    - Foster cooperation with existing open source projects
    - Search for solutions beyond national borders

Accomplishments, Results and Progress- Data

- Data Assessment Task is complete and results are documented in two reports
  - 1. Data Acquisition for National Geothermal Data System
    - Defines and describes the catalogue
    - Provides research protocols for metadata, data delivery, and description of the metadata and content models and schema
  - 2. NGDS Design and Testing Sub recipient Data Inventory
    - Provides a complete inventory and plan for each sub recipient including Arizona Geological Survey, Energy & geosciences Institute at the University of Utah, Geo-Heat Center at the Oregon Institute of Technology, Nevada Bureau of Mines and Geology-University of Nevada-Reno, and Stanford University
  - Data providers are updating catalogues of their repositories with metadata that meets the requirements of the content models making the catalogues searchable
  - Each data provider has processed thousands of data records to support NDGS
  - Repositories collect structured data (well headers or heat flow) and unstructured data such as publications
  - Data is made digitally available and exposed as Web Feature Services, Web map services and or Web coverage services

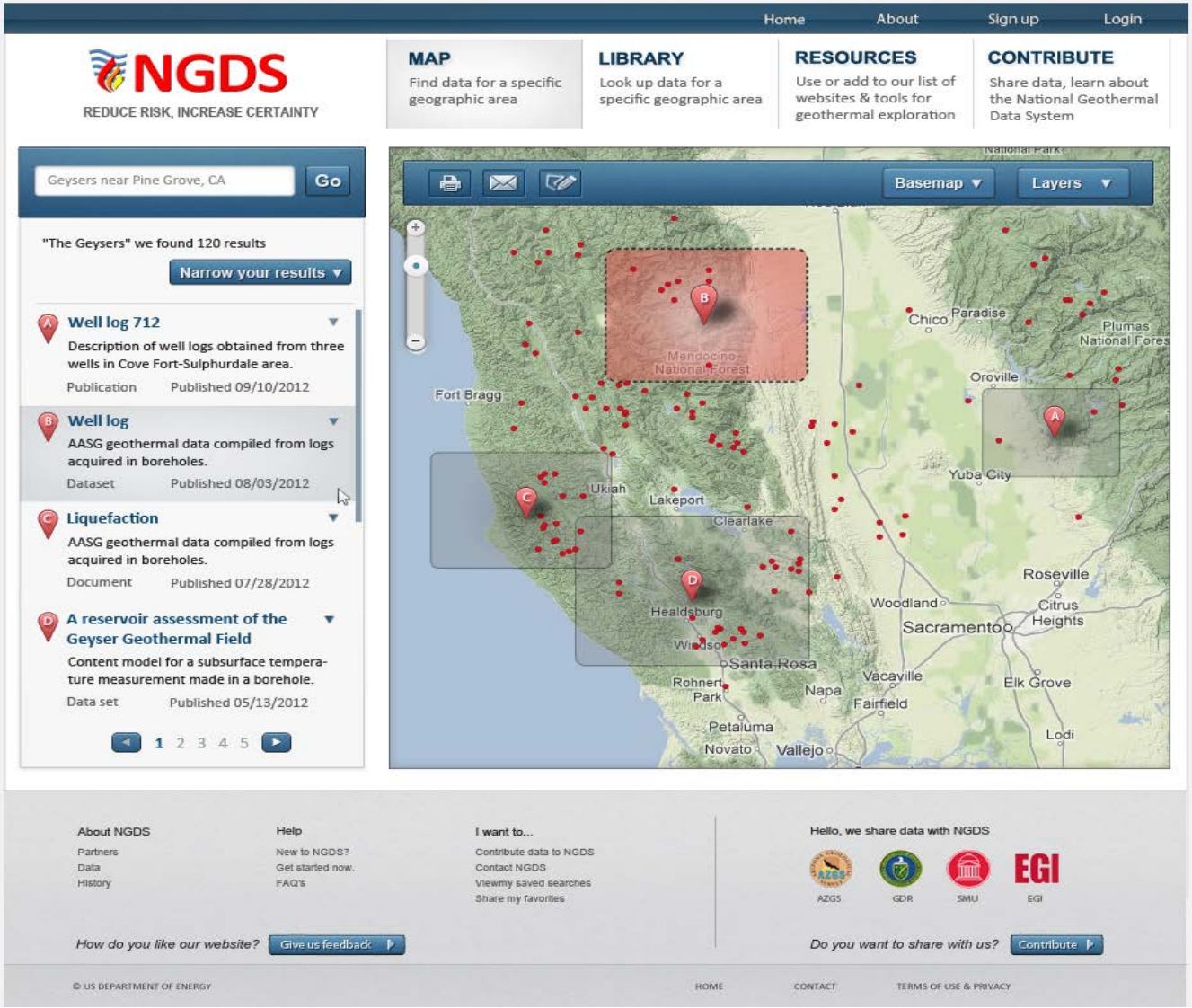
Accomplishments, Results and Progress- User Concept



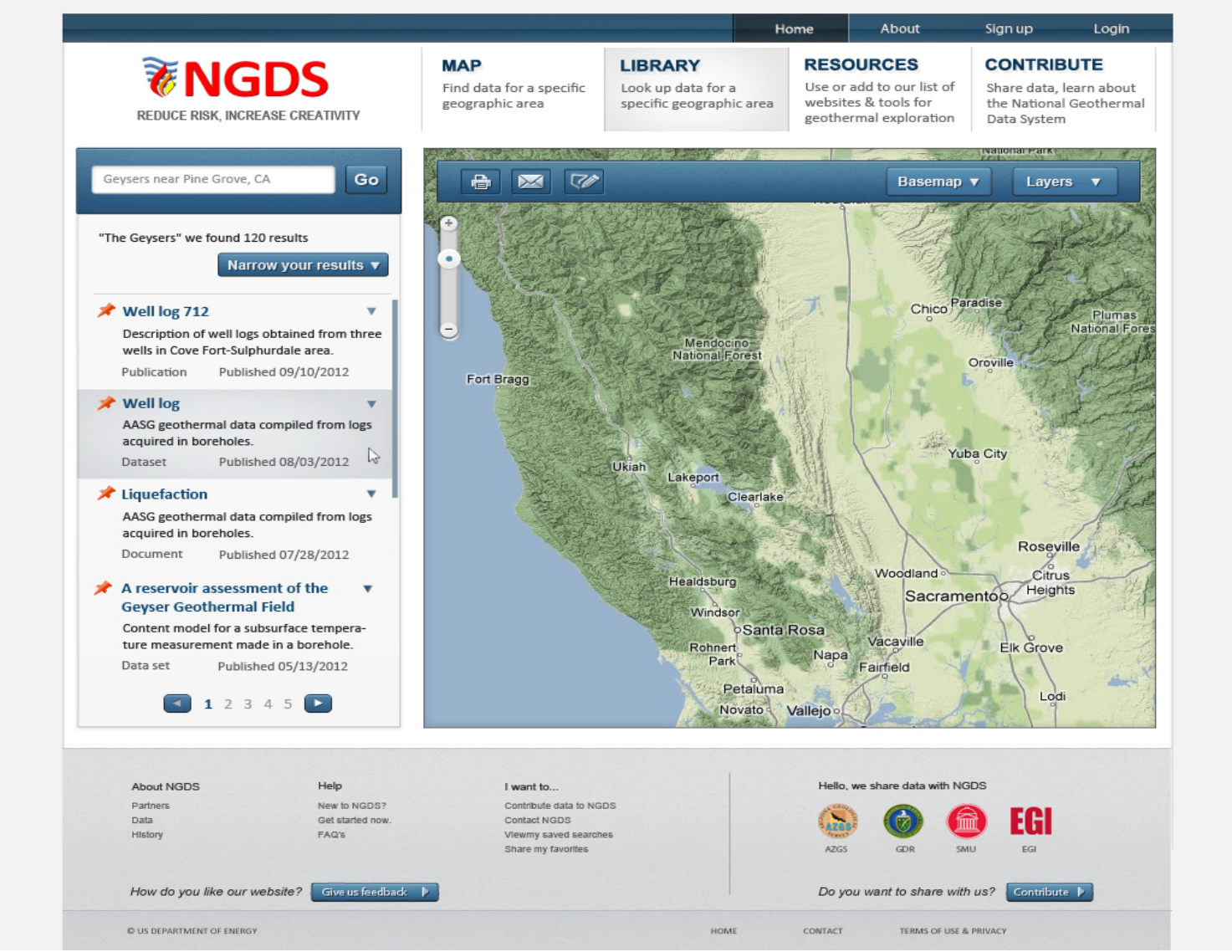
Concept based on User Research

Capability includes map and library based searches, plus faceted search capability

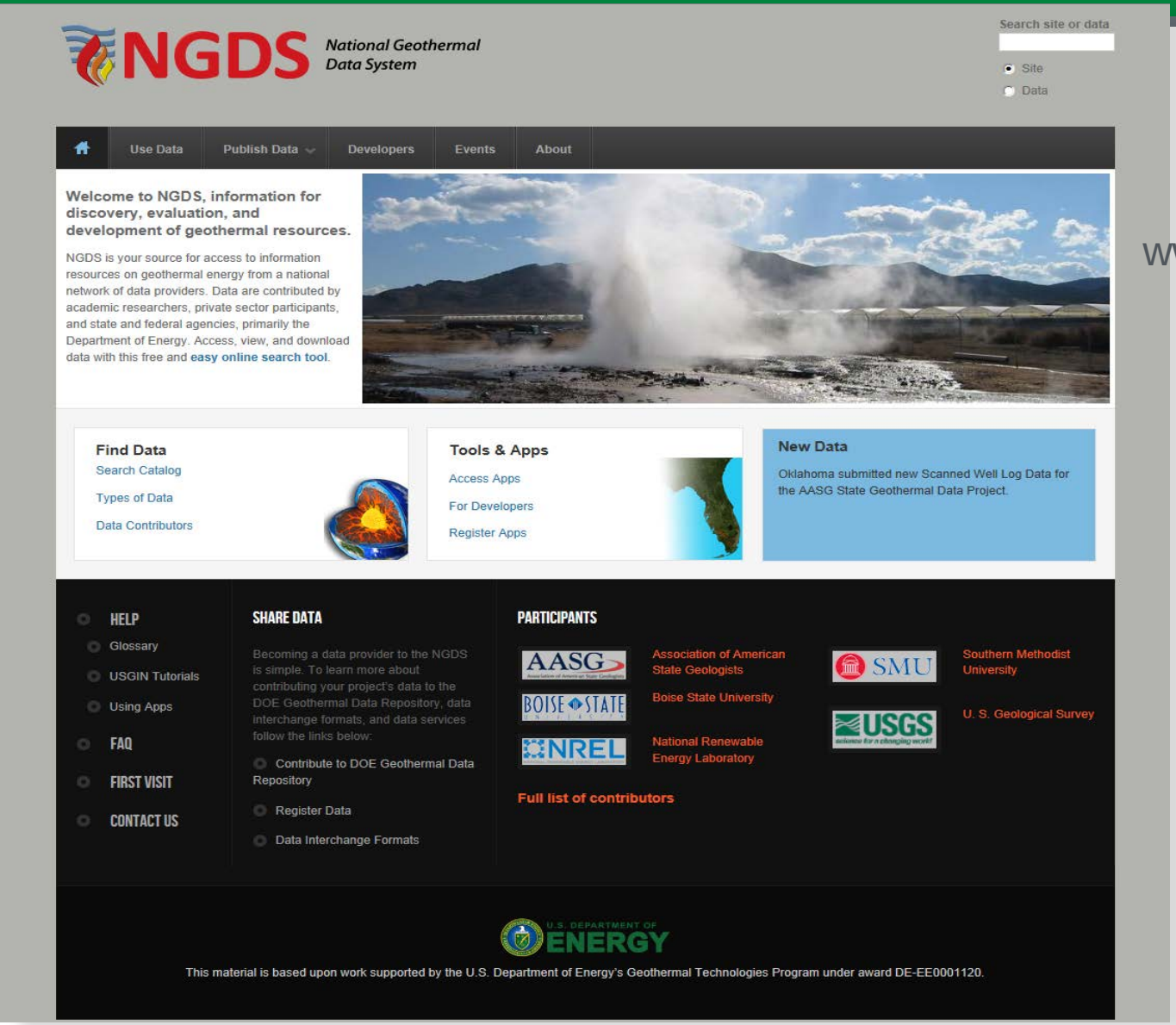
Accomplishments, Results and Progress- User Concept



Accomplishments, Results and Progress- User Concept



Accomplishments, Results and Progress- Web Site



www.geothermaldata.org

Accomplishments, Results and Progress- Software Requirements

- Software Requirements Specification completed December 2012
- Specification went through extensive review by project technical monitors
- Five basic needs for NGDS are:
  - Enable data collectors to create and administrate a repository for geothermal data
  - Enable end user/data consumers including:
    - Search for geothermal data across repositories
    - Evaluate discovered data
    - Acquire selected data
    - Analyze selected data

Accomplishments, Results and Progress- Software Development

- Accomplishments in Sprints 1 through 3 include:
  - CKAN selected as software development environment
  - CKAN was installed and scripts developed for build and development environments
  - CKAN upload mechanism developed and server solutions for Python CKAN were studied
  - Use cases refined for development
  - Prototype map, upload page, and first version UI were completed
  - Extension for data harvesting developed
  - Plugins for metadata and geoserver functionality were researched
  - Message sequencing for uploading of structured data were developed

Accomplishments, Results and Progress- Data Import-Sustainability

- Pilot data import, integration, and testing
  - Content model repository updated with new schemas and content models
  - ISO metadata support and CSW integration built into node in a box
  - Metadata converted and added from Arizona Geological Survey, Energy & Geosciences Institute, Geo-Heat Center, Nevada Bureau of Mines and Geology, and Stanford University
  - Total data amount to over 20,000 records
    - This includes metadata records, well logs, geologic map series, and technical documentation (journal articles)
  - Server-side functions testing begun to ensure functionality
- Sustainability Plan
  - Data collected from potential end users including existing business models from similar systems (CUAHSI)
  - Existing NGDS nodes provided cost and personnel data
  - Draft plan out for review

Accomplishments, Results and Progress

Original Planned Milestone/Technical Accomplishment	Actual Milestone/Technical Accomplishment	Date Completed
Data Assessment	Results contained in 2 reports: Data Acquisition for National Geothermal Data System", and "NGDS Design and Testing Sub Recipient Data Inventory	December 2012
User Research and Experience Concept	Results documented in wireframes and user stories	November 2012
Software Requirement and Design Specification	Documented in "Software Requirements Specification NGDS Version 2.7"	December 2012
Project Website	May be found at geothermaldata.org	October 2012

Future Directions

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Milestone	Status	Expected Completion
Software Development, Iteration and Usability	Completed 4 sprints, on schedule for remaining	9-13 or 3-14
Pilot Data Import, Integration, and Testing	Data review and entry will continue	9-13 or 3-14
Distribute, document & rollout	Not started	9-13 or 3-14
Service Testing & maintenance	Ongoing in software development	9-13 or 3-14
Sustainability plan	Draft out for comment	9-13 or 3-14
Phase III Review	DOE will make a go/no-go decision prior to phase IV	May 31, 2013

Mandatory Summary Slide

- NGDS has made good progress since July of 2012
- As planned, the system will support geothermal exploration and research
- Ultimate number of features included in the system will be dependent upon our success, time and money
- Sustainability of the system is critical and implementation of the final plan is essential for the future of NGDS

Project Management

Timeline:

Planned Start Date	Planned End Date	Actual Start Date	Current End Date
July 1, 2012	September 30, 2013	July 30, 2012	September 30,2013 or March 31, 2014

Budget:

Federal Share	Cost Share	Planned Expenses to Date	Actual Expenses to Date	Value of Work Completed to Date	Funding needed to Complete Work
4,992,089.00	0	3,082,673.66	3,082,673.66	3,082,673.66	1,909,415.34

- Project is not planned using earned value techniques- we are actively managing the project through a combination of techniques
- Resource loaded plan, sprint plan, data work plans, weekly, now biweekly team meetings, with specific subgroup meetings on software and user interface development
- Weekly reporting by each contributor on weekly basis including cost and schedule estimates
- Quarterly meetings with the larger NGDS team for coordination
- Participation in major technical meetings for community feedback
  - Geothermal Energy Expo 2012
  - Stanford 38th Workshop on Geothermal Reservoir Engineering 2013
- Requested no cost extension to allow more complete data integration, and to test NGDS nodes