Automating Expertise Identification Using Information You Already Have

SAND2013-7742C

September 30, 2013

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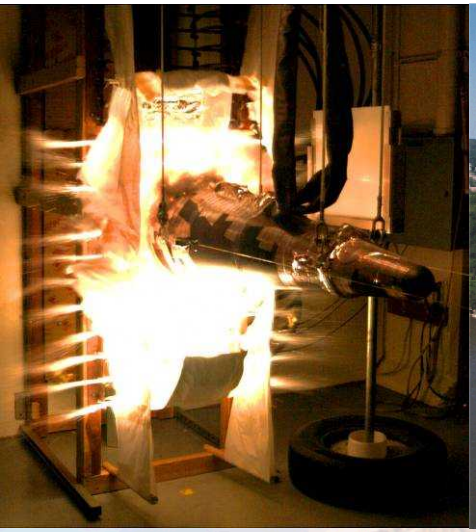
Four Mission Areas

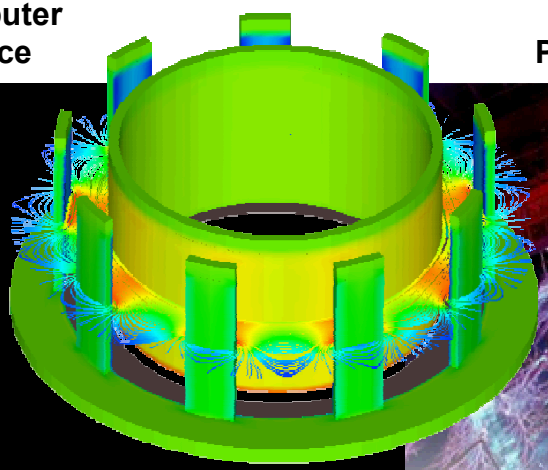
- Nuclear Weapons
- Defense Systems and Assessments
- Energy, Climate, and Infrastructure Security
- International, Homeland, & Nuclear Security



Enabled by Strong Science and Engineering

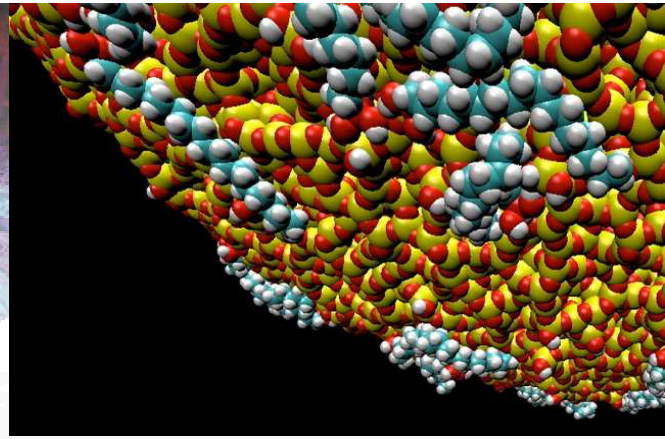
Research Disciplines

Computer Science

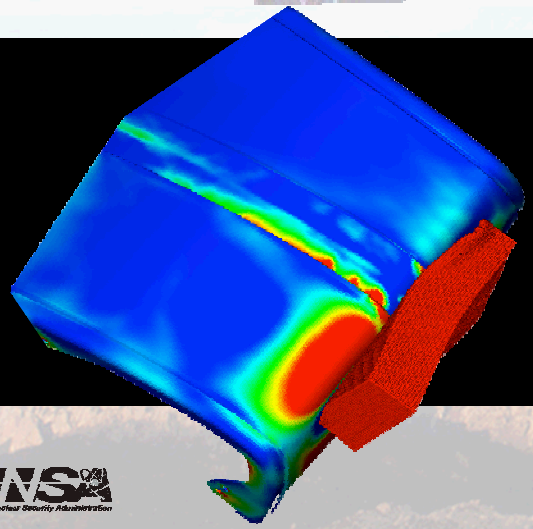


Pulsed Power

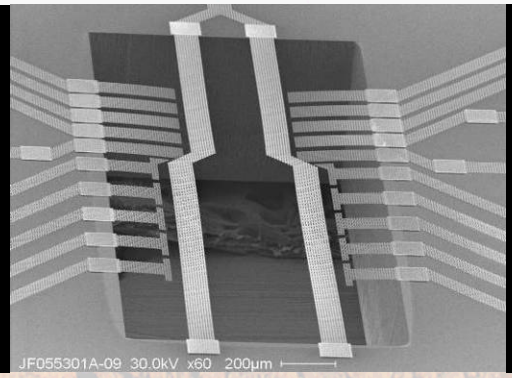
Materials



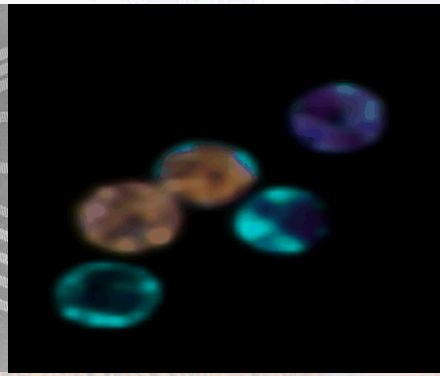
Engineering Sciences



Micro Electronics



Bioscience



Knowledge Systems Department

- Enterprise level technical solutions for information management, information analytics, and search.
- Develop and incorporate advanced techniques in content analytics and search into our information systems to improve usefulness of information and to improve the ability of the workforce to find the information they need to perform their jobs. Manual and automated techniques are used to make popular information easily findable.

Expertise Identification Tool Drivers

An expertise identification tool enables Sandia and its workforce to more effectively, efficiently, and accurately network and respond to questions related to our expertise.

- We can better respond to external requests regarding our capabilities
- It will enable identification of internal collaboration partners and reduce duplication of effort.
  - Who can do it or help me do it?
  - Has this been done before?
  - How do I find experts (individuals or organizations) that I might collaborate with?
- When somebody leaves, what knowledge and skills are they taking with them? Do we need to fill in? Who else at the lab has this expertise?
- How have Sandia's areas of expertise changed over time?

Expertise Identification Project

The Problem

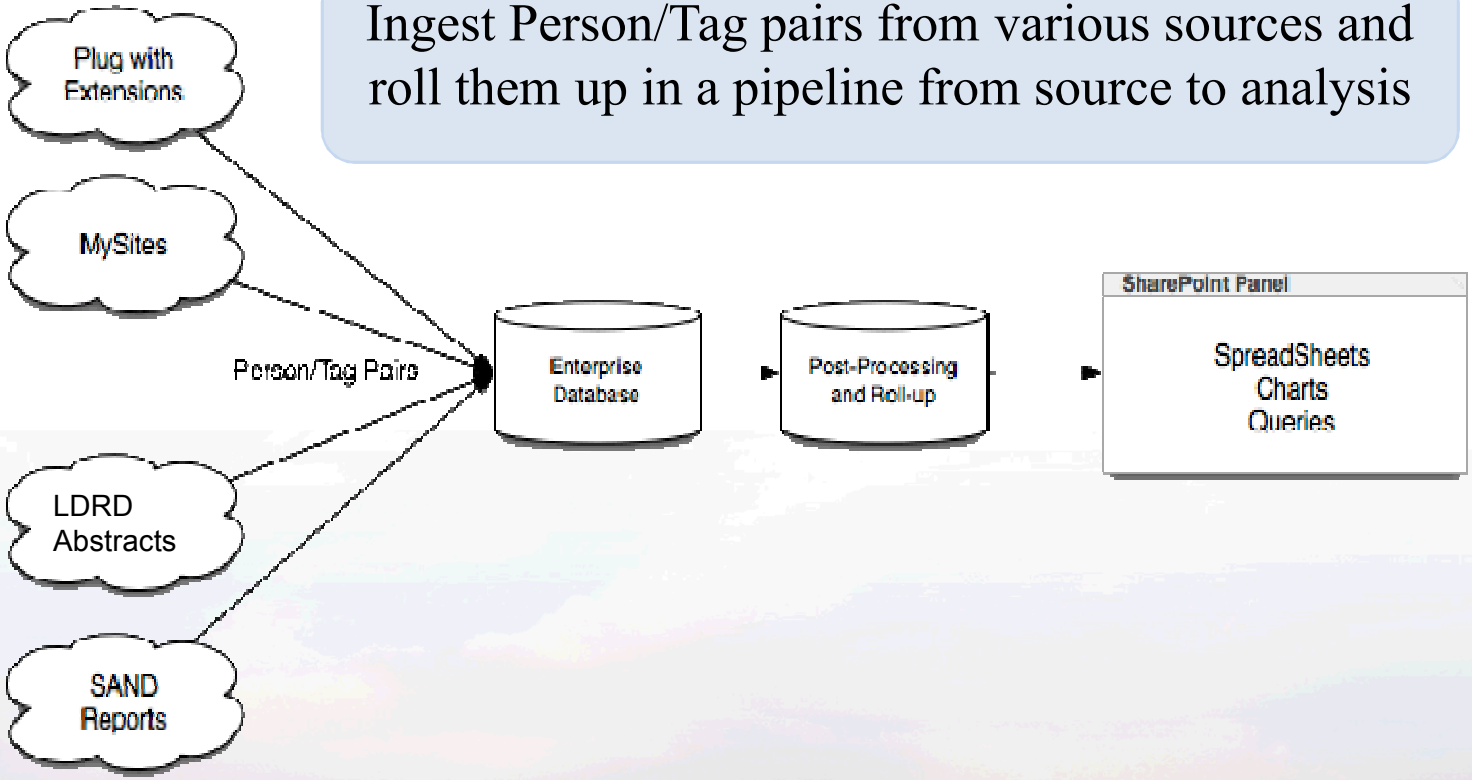
- Previous attempts to identify expertise have failed because they required staff to manually enter their own information about knowledge, skills, and abilities. Many staff will not enter their information and, if they do, it quickly becomes out of date.

A Solution

- Extract expertise from multiple, existing, free-text information sources and present results in an interactive display.
- A key advantage of this approach is that it is self-maintaining. It uses information already in our environment, and it is kept current through normal work process .

“Big Picture”

Ingest Person/Tag pairs from various sources and roll them up in a pipeline from source to analysis



Sources of information

Currently using

- **Published reports (SAND)**
- **Laboratory Directed Research and Development (LDRD) abstracts**
- **Microsoft MySite entries**
- **Social Networking site (Plug Q&A)**

Other potential sources of information

- Patent Database
- email messages and distribution lists
- Performance management objectives
- Web pages and SharePoint sites
- Book and Report requests
- Resumes
- Degrees
- Training course completions
- Conference attendance

First example based on SAND Reports

- **Published reports are assigned to a high level subject category by Librarians**
  - (based on COSATI codes - Committee on Scientific and Technical Information)
- **A database was created made up of subject categories, authors, and authors organization.**
- **This enables us to infer organizational and individual competency.**
- **Results are displayed using SQL Server Reporting Services (SSRS)**
- **More documents (references) in a category implies more expertise in that category**

Pulling the Data Together

Using Citrus, a Sandia developed text analysis tool, we pull persons and tags from various sources and put them into a table.

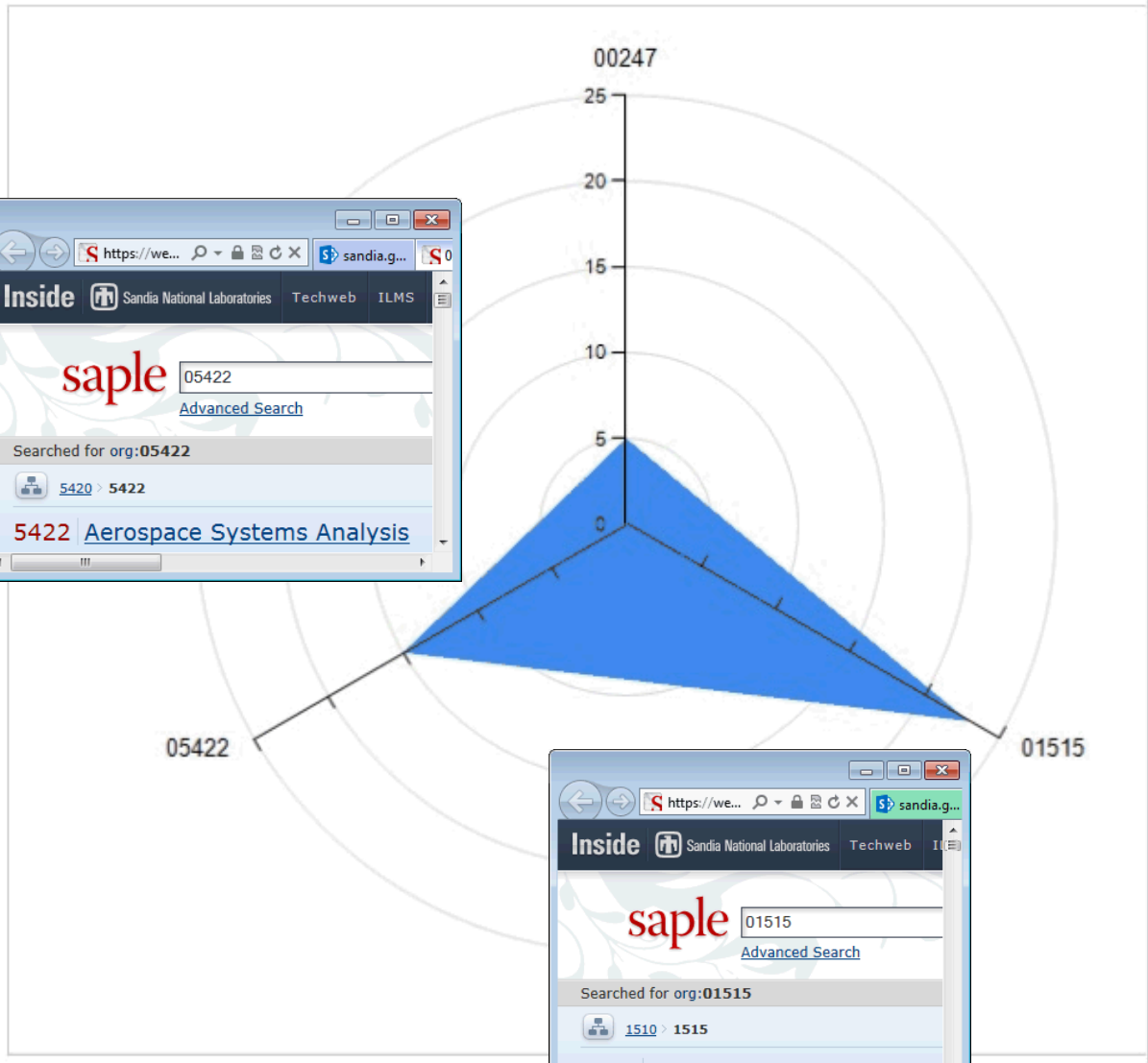
There are four columns:

- **Person_Ref – who it is**
- **Skill_Tag – a name for a expertise**
- **Date – when the evidence was collected or created**
- **Source – where the evidence came from.**

SELECT * FROM TEST_SKILLS_RECORD;

PERSON_REF	SKILL_TAG	DATE	SOURCE
	microscopy technique	2011-07-19 10:49:25.834	SAND
	microscopy, electron instrumentation	2011-07-19 10:49:25.857	SAND
	protein analysis	2011-07-19 10:49:25.857	SAND
	human intrusion	2011-07-19 10:49:25.858	SAND
	intrusion detection	2011-07-19 10:49:25.858	SAND
	radiation monitoring instrumentation	2011-07-19 10:49:25.858	SAND
	human intrusion	2011-07-19 10:49:25.858	SAND
	intrusion detection	2011-07-19 10:49:25.858	SAND
	radiation monitoring instrumentation	2011-07-19 10:49:25.858	SAND
	material accountability	2011-07-19 10:49:25.858	SAND
	nuclear weapons united states	2011-07-19 10:49:25.859	SAND
	weapons systems	2011-07-19 10:49:25.859	SAND
	nuclear stewardship	2011-07-19 10:49:25.859	SAND
	nuclear weapons united states inventory control	2011-07-19 10:49:25.859	SAND
	artificial intelligence	2011-07-19 10:49:25.859	SAND
	intelligent agents computer software	2011-07-19 10:49:25.859	SAND
	intelligent control systems	2011-07-19 10:49:25.859	SAND
	military intelligence	2011-07-19 10:49:25.86	SAND
	artificial intelligence	2011-07-19 10:49:25.86	SAND
	intelligent agents computer software	2011-07-19 10:49:25.86	SAND
	intelligent control systems	2011-07-19 10:49:25.86	SAND
	military intelligence	2011-07-19 10:49:25.86	SAND
	artificial intelligence	2011-07-19 10:49:25.86	SAND

Orgs with Expertise in 'aeronautics' by Number of References



Parameters

Minimum Number of References

5

Source

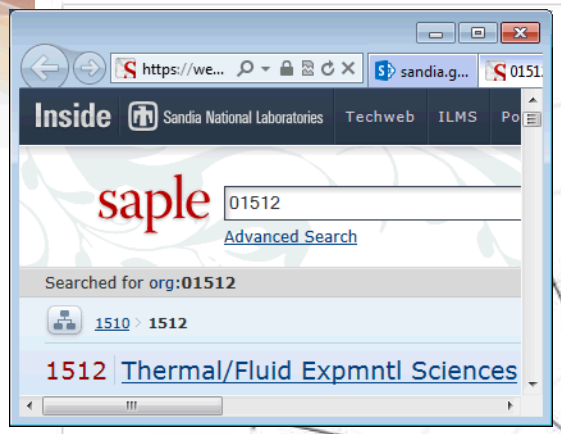
SAND Reports

Competency

aeronautics

- atmospheric science
- behavioral/social science
- computers
- earth science/oceanography
- engineering (non-electrical)
- fluid mechanics
- mathematics
- missle technology
- navigation/communication/detection/countermeasures
- ordnance
- solid-state physics
- space technology
- thermodynamics
- weapon systems
- **aeronautics**
- astronomy
- biological/medical science
- ceramics
- chemistry
- electronics/electrical engineering
- energy conversion (non-propulsive)
- explosives/pyrotechnics/ammunition
- materials
- metallurgy
- methods/equipment
- military science
- nuclear safety
- nuclear science/technology
- physics
- propulsion/fuels

Orgs with Expertise in 'fluid mechanics' by Number of References



Parameters

Minimum Number of References

5

Source

SAND Reports

Competency

fluid mechanics

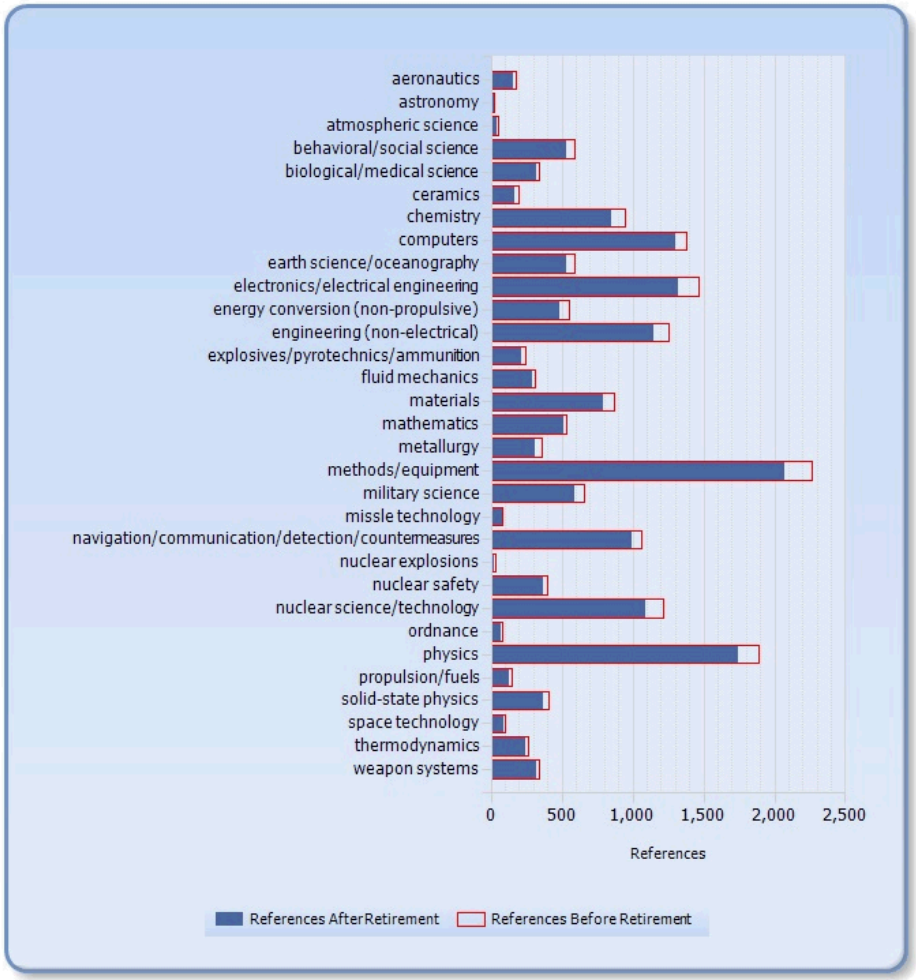
- atmospheric science
- behavioral/social science
- computers
- earth science/oceanography
- engineering (non-electrical)
- fluid mechanics
- mathematics
- missle technology
- navigation/communication/detection/countermeasures
- ordnance
- solid-state physics
- space technology
- thermodynamics
- weapon systems
- aeronautics
- astronomy
- biological/medical science
- ceramics
- chemistry
- electronics/electrical engineering
- energy conversion (non-propulsive)
- explosives/pyrotechnics/ammunition
- materials
- metallurgy
- methods/equipment
- military science
- nuclear safety
- nuclear science/technology
- physics
- propulsion/fuels

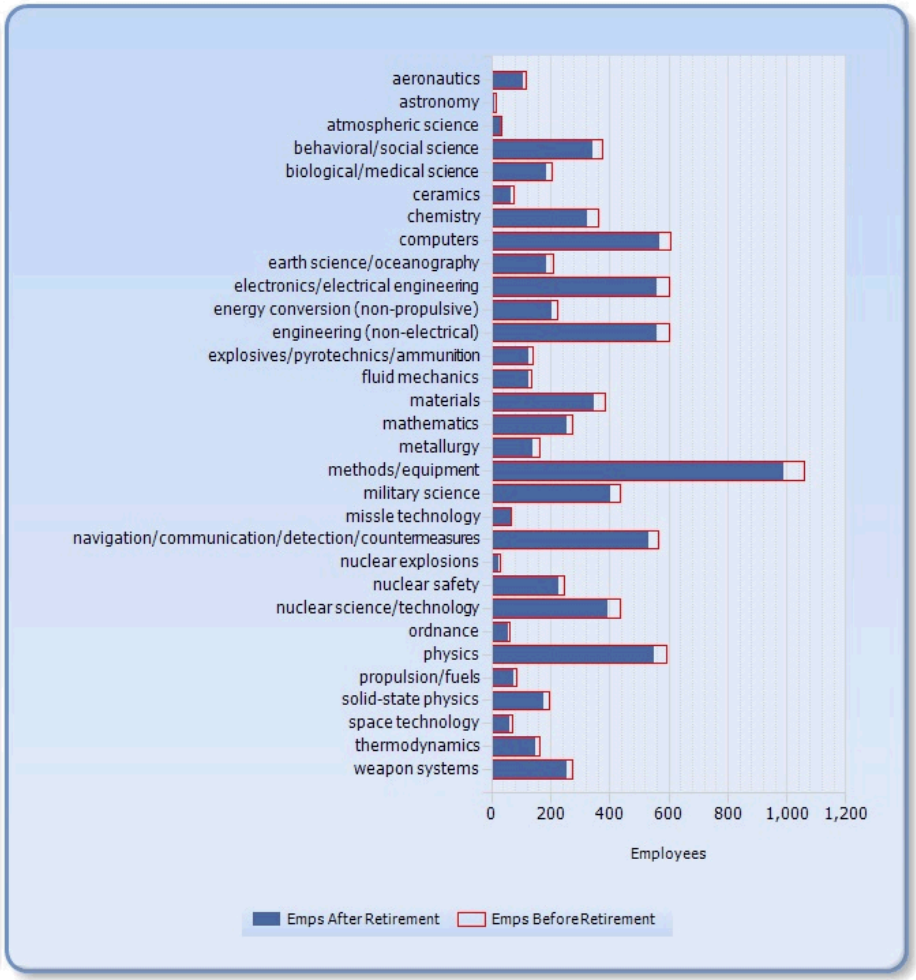
Apply

Loss of expertise due to retirement

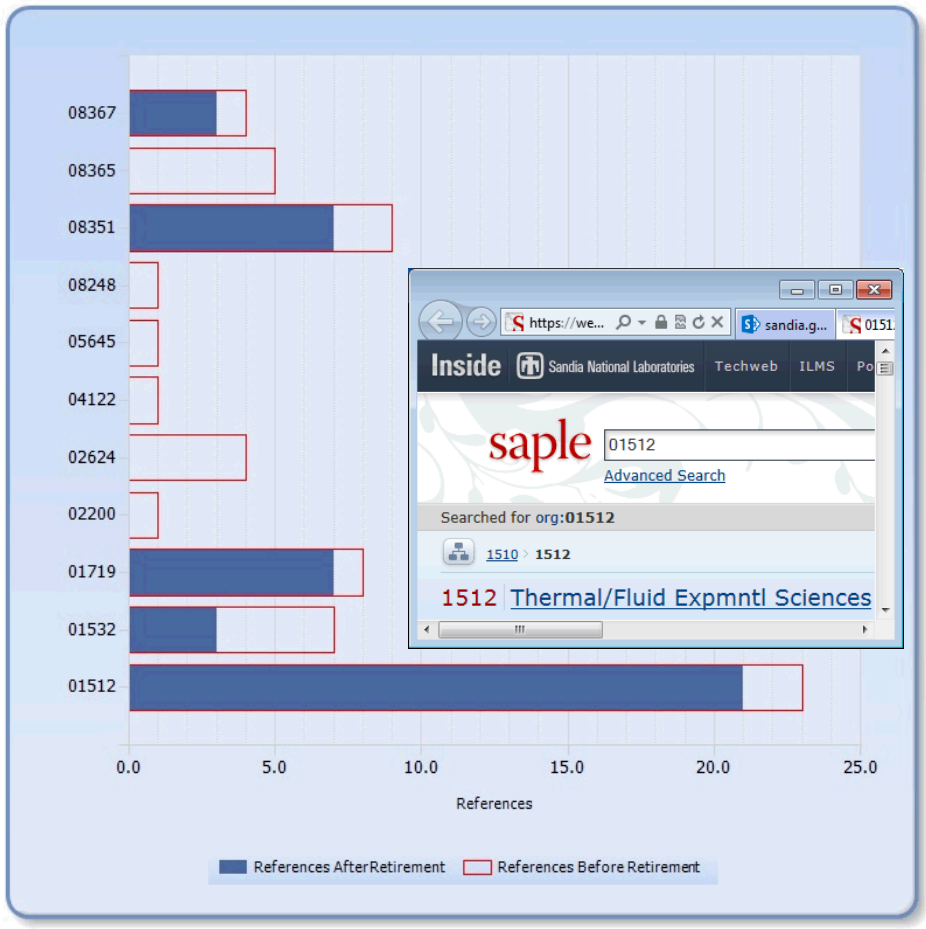
- Our HR Department asked if we could identify lost expertise due to recent retirements.
- Using a subset of our SAND report data, we calculated the number of references associated with an organization at the start of the year.
- We reduced the number of references associated with the organization if they were authored by a person who retired from that organization.
- On the following graph, the right hand side shows the reduction of employees due to retirement (red outline - before, blue solid bar - after).
- The left had side shows the number of references associated with an organization (red outline - before, blue solid bar - after).

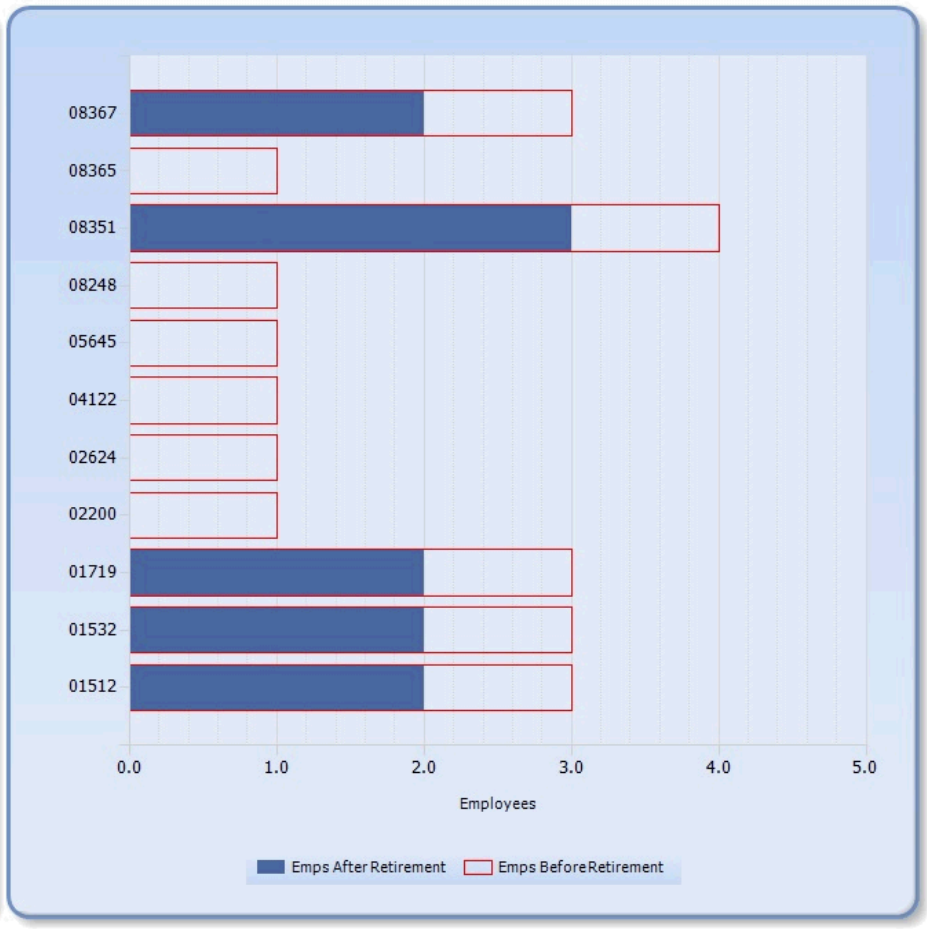
Loss of expertise due to retirement



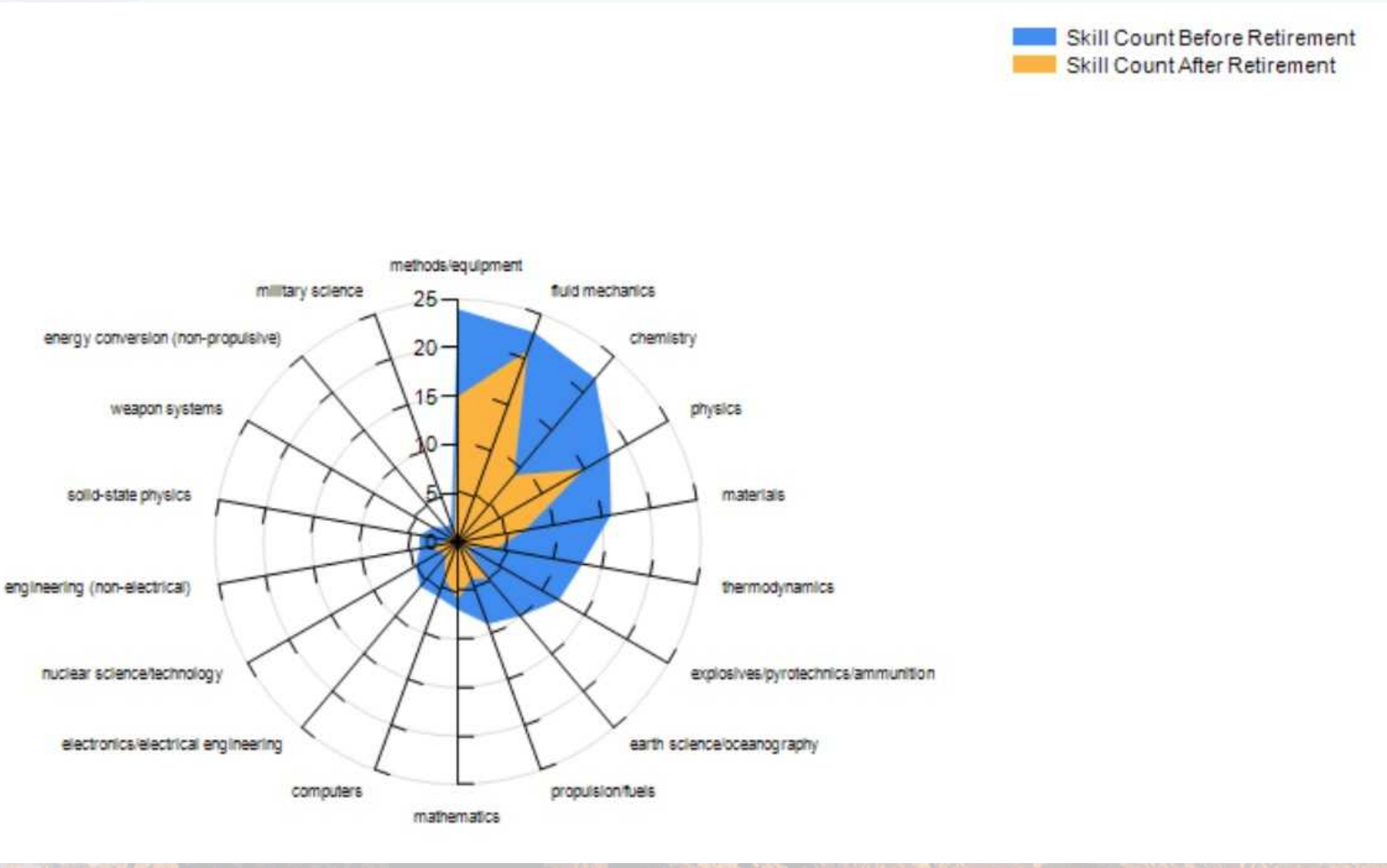


Loss of expertise in fluid mechanics

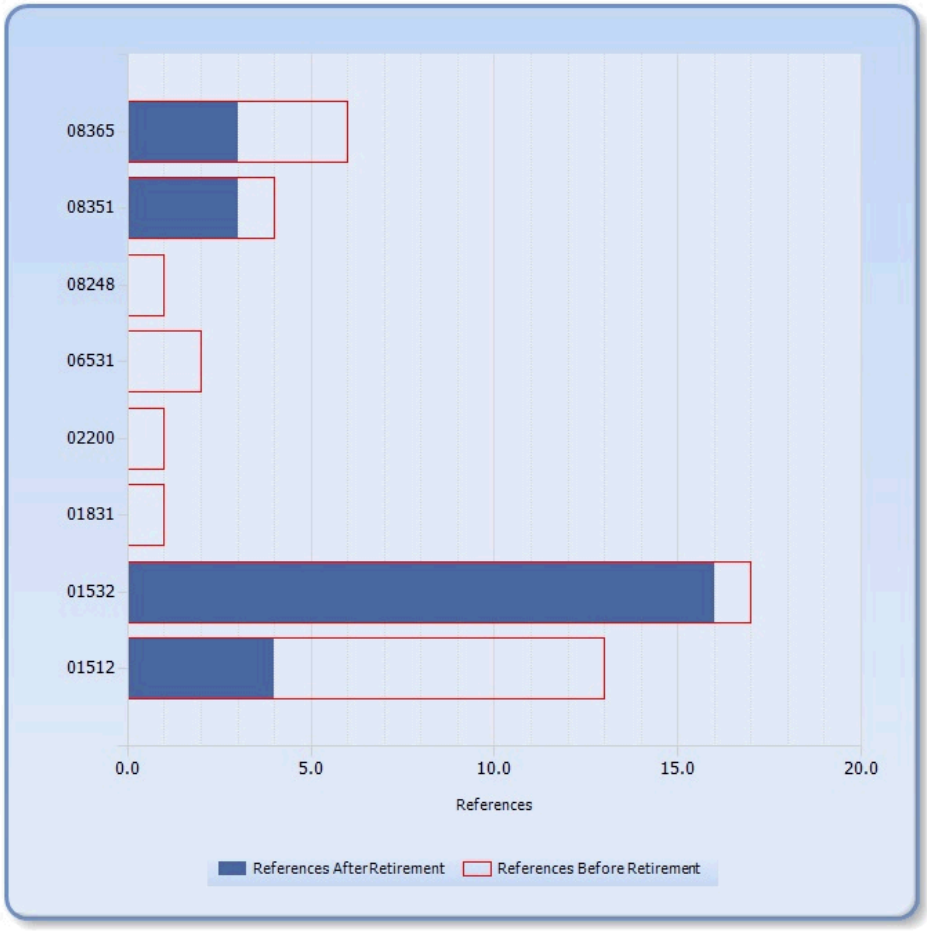


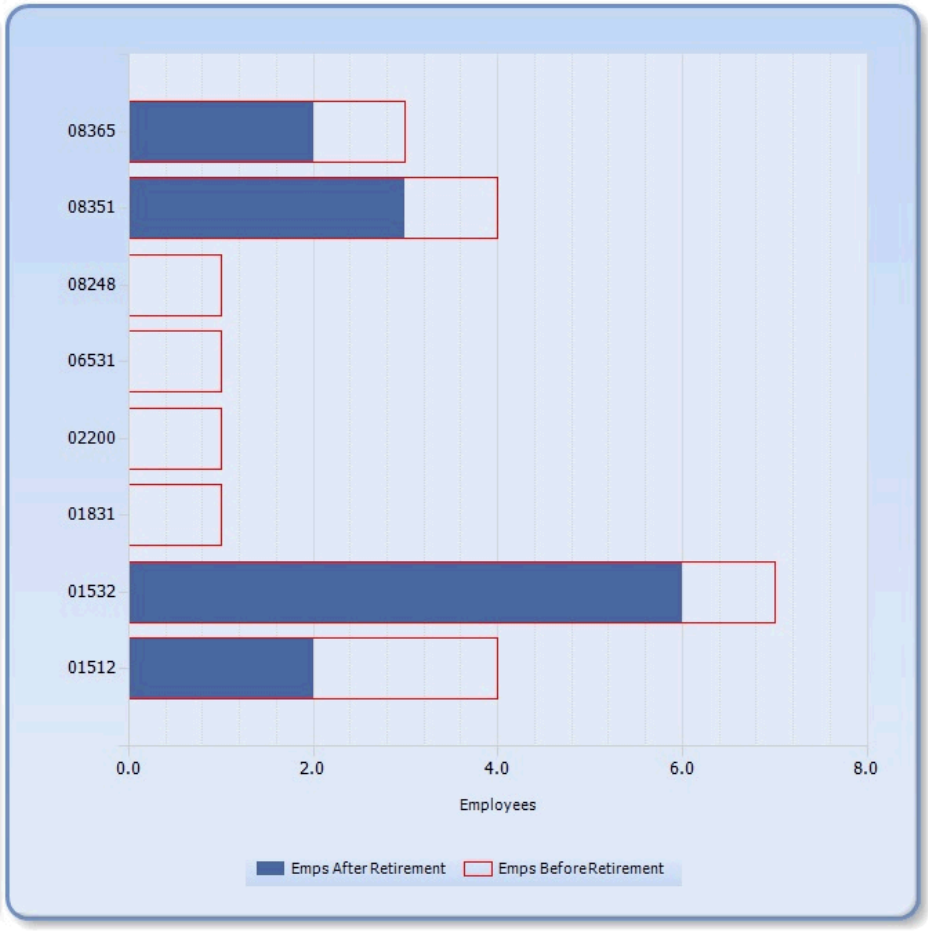


Loss of expertise in other areas in 1512



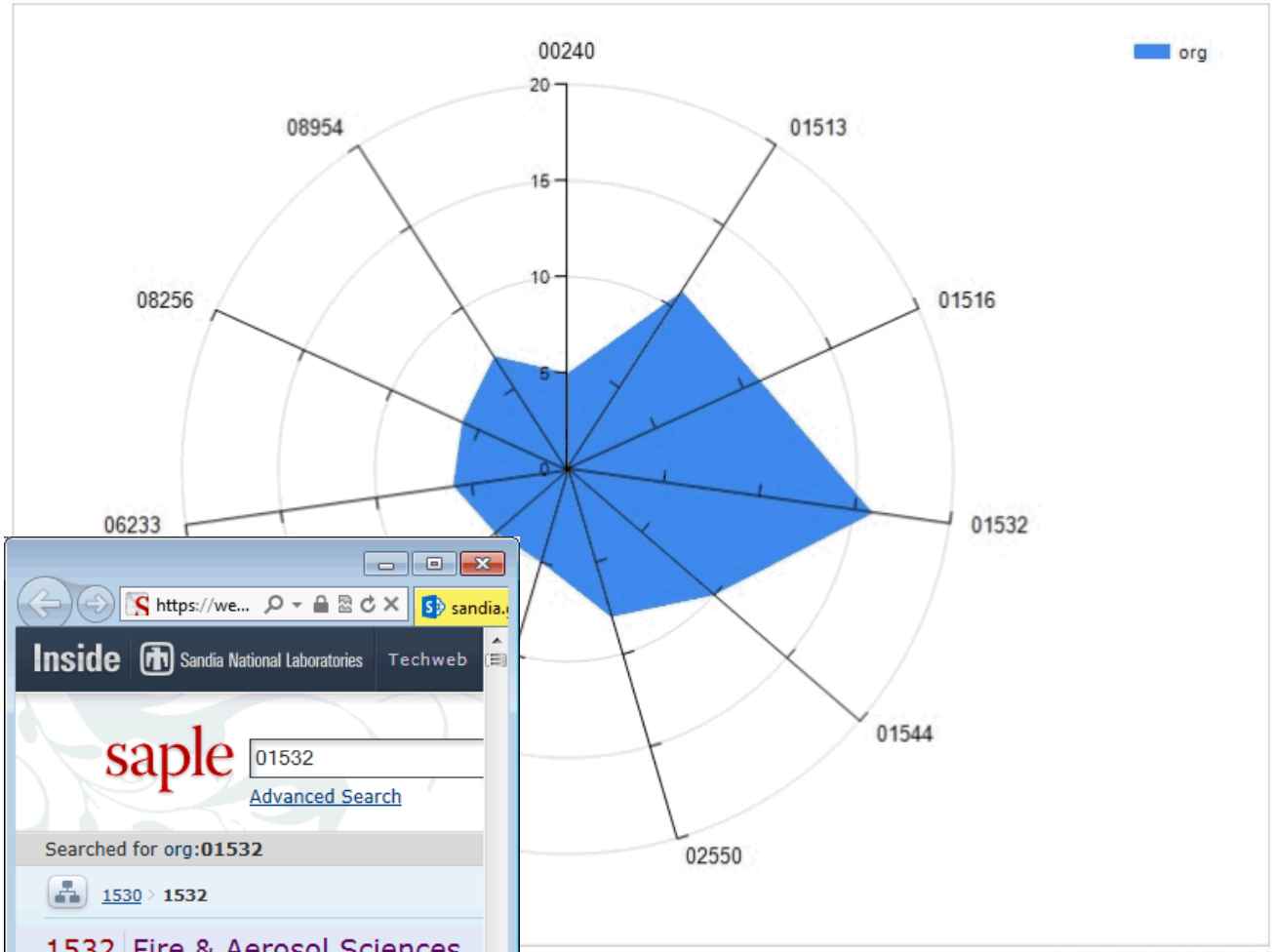
Loss of expertise in thermodynamics





As expected, 1532 shows a high level of expertise in thermodynamics

Orgs with Expertise in 'thermodynamics' by Number of References



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Parameters

Minimum Number of References

5

Source

SAND Reports

Competency

thermodynamics

aeronautics
astronomy
biological/medical science
ceramics
chemistry
electronics/electrical engineering
energy conversion (non-propulsive)
explosives/pyrotechnics/ammunition
materials
metallurgy
methods/equipment
military science
nuclear safety
nuclear science/technology
physics
propulsion/fuels
atmospheric science
behavioral/social science
computers
earth science/oceanography
engineering (non-electrical)
fluid mechanics
mathematics
missle technology
navigation/communication/detection/countermeasures
ordnance
solid-state physics
space technology
thermodynamics
weapon systems

Apply

For a broader view, we can display expertise by Division
(Based on a subset of SAND Reports)

Skill tag	00001	00002	01000	02000	03000	04000	05000	06000	08000	09000	11000	Employees	References	Ref/Empl
aeronautics	0	1	2	0	0	0	2	0	0	0	0	5	33	6.60
astronomy	0	0	1	0	0	0	0	0	0	0	0	1	9	9.00
atmospheric science	0	0	0	0	0	0	0	1	0	0	0	1	6	6.00
behavioral/social science	0	1	2	0	0	1	0	3	0	0	0	7	39	5.57
biological/medical science	0	0	5	0	0	0	0	0	4	0	0	9	53	5.89
ceramics	0	0	8	1	0	0	0	1	0	0	0	10	72	7.20
chemistry	0	2	26	4	0	0	2	7	6	0	0	47	361	7.68
computers	0	1	29	3	1	0	16	9	5	8	0	72	487	6.76
earth science/oceanography	1	1	3	6	0	0	7	15	1	0	0	34	274	8.06
electronics/electrical engineering	0	2	36	8	0	0	14	1	1	2	0	64	465	7.27
energy conversion (non-propulsive)	0	0	2	4	0	0	4	14	2	0	0	26	226	8.69
engineering (non-electrical)	0	1	18	5	0	0	10	10	6	0	0	50	329	6.58
explosives/pyrotechnics/ammunition	0	0	2	1	0	0	1	2	1	0	0	7	46	6.57
fluid mechanics	0	0	8	0	0	0	2	0	0	0	0	10	91	9.10
materials	0	2	28	2	0	0	4	1	9	0	0	46	323	7.02
mathematics	0	0	18	1	0	0	3	0	0	0	0	22	147	6.68
metallurgy	0	2	5	1	0	0	1	1	3	1	0	14	98	7.00
methods/equipment	1	3	41	9	1	0	15	4	9	0	0	83	542	6.53
military science	0	1	0	0	0	0	0	3	0	0	0	4	21	5.25
navigation/communication/detection/countermeasures	1	1	7	4	0	0	15	3	0	0	0	31	201	6.48
nuclear safety	0	0	2	0	0	0	0	2	0	0	0	4	21	5.25
nuclear science/technology	0	2	22	5	0	0	11	29	1	1	0	71	566	7.97
ordnance	0	0	0	0	0	0	0	1	0	0	0	1	5	5.00
physics	1	2	59	8	0	0	21	4	8	0	1	104	920	8.85
propulsion/fuels	0	0	2	0	0	0	0	0	2	0	0	4	24	6.00
solid-state physics	0	1	11	1	0	0	3	0	1	0	0	17	124	7.29
space technology	0	0	0	0	0	0	0	1	0	0	0	1	7	7.00

And drill down by expertise in this case, fluid mechanics

Competency	Source	Division	Center	Org	SNL Id	Person ref	References	Ref/Empl
fluid mechanics	SAND	01000	⊟ 01500	01512			18	
				01513			6	
				01513			7	
				01513			12	
				01515			9	
				01515			9	
				01516			9	
				01516			10	
						8	80	10.00
			Total			8	80	10.00
		05000	⊟ 05400	05422			5	
						1	5	5.00
			⊟ 05900	05942			6	
						1	6	6.00
			Total			2	11	5.50

Or drill down by Center, in this case, Centers in Division 1000

Skill tag	01100	01200	01300	01400	01500	01600	01700	01800	Employees	References	Ref/Empl
aeronautics	0	0	0	0	2	0	0	0	2	17	8.50
astronomy	0	0	0	0	1	0	0	0	1	9	9.00
behavioral/social science	0	0	0	0	1	0	0	0	1	5	5.00
biological/medical science	0	0	1	1	0	0	2	1	5	31	6.20
ceramics	0	0	0	0	2	0	0	6	8	58	7.25
chemistry	5	0	0	0	7	0	5	9	26	207	7.96
computers	0	0	3	9	12	1	2	2	29	209	7.21
earth science/oceanography	0	0	1	0	2	0	0	0	3	22	7.33
electronics/electrical engineering	3	0	0	0	2	3	19	9	36	270	7.50
energy conversion (non-propulsive)	0	0	0	0	1	0	0	1	2	12	6.00
engineering (non-electrical)	0	0	0	3	11	0	1	3	18	126	7.00
explosives/pyrotechnics/ammunition	0	0	0	0	2	0	0	0	2	14	7.00
fluid mechanics	0	0	0	0	8	0	0	0	8	80	10.00
materials	5	0	0	0	6	1	1	15	28	216	7.71
mathematics	0	0	1	5	12	0	0	0	18	125	6.94
metallurgy	2	0	0	0	1	0	0	2	5	29	5.80
methods/equipment	2	1	3	3	14	6	5	5	39	275	7.05
navigation/communication/detection/countermeasures	1	0	0	0	1	0	4	1	7	41	5.86
nuclear safety	0	0	0	0	2	0	0	0	2	11	5.50
nuclear science/technology	2	0	6	2	6	4	1	0	21	160	7.62
physics	5	1	2	2	14	14	9	7	54	503	9.31
propulsion/fuels	0	0	0	0	1	0	0	0	1	5	5.00
solid-state physics	4	0	0	0	1	0	2	4	11	79	7.18
thermodynamics	0	0	0	0	5	0	0	0	5	33	6.60
Total	29	2	17	25	114	29	51	65	332	2,537	7.64

And then drill down by Groups, in this case, Groups in 1500

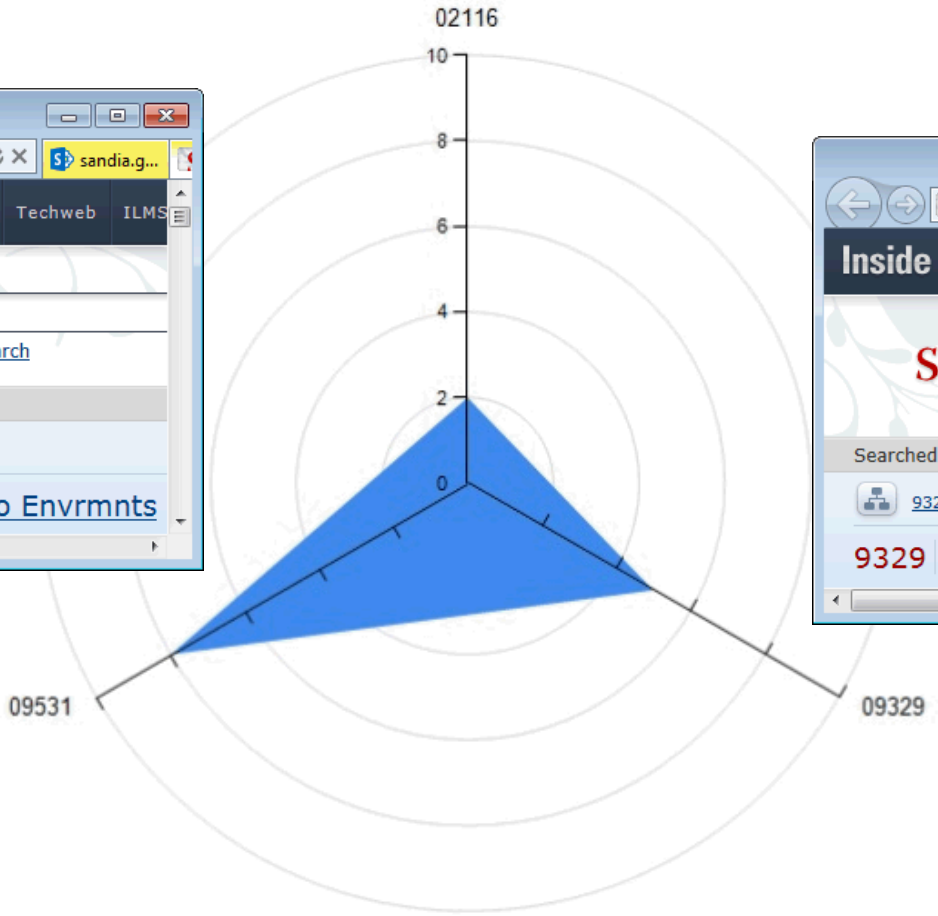
Skill tag	01500	01510	01520	01530	01540	Employees	References	Ref/Empl
aeronautics	0	2	0	0	0	2	17	8.50
astronomy	0	0	1	0	0	1	9	9.00
behavioral/social science	0	0	0	1	0	1	5	5.00
ceramics	0	0	1	1	0	2	10	5.00
chemistry	1	5	1	0	0	7	59	8.43
computers	1	3	4	0	4	12	87	7.25
earth science/oceanography	0	1	0	0	1	2	17	8.50
electronics/electrical engineering	0	1	1	0	0	2	19	9.50
energy conversion (non-propulsive)	0	0	0	0	1	1	5	5.00
engineering (non-electrical)	0	1	4	1	5	11	85	7.73
explosives/pyrotechnics/ammunition	0	1	0	1	0	2	14	7.00
fluid mechanics	0	8	0	0	0	8	80	10.00
materials	0	3	3	0	0	6	58	9.67
mathematics	0	4	3	0	5	12	83	6.92
metallurgy	0	0	1	0	0	1	9	9.00
methods/equipment	0	4	4	3	3	14	101	7.21
navigation/communication/detection/countermeasures	0	1	0	0	0	1	6	6.00
nuclear safety	0	0	0	2	0	2	11	5.50
nuclear science/technology	0	1	2	2	1	6	38	6.33
physics	0	9	4	1	0	14	104	7.43
propulsion/fuels	0	1	0	0	0	1	5	5.00
solid-state physics	0	1	0	0	0	1	5	5.00
thermodynamics	0	3	0	1	1	5	33	6.60
Total	2	49	29	13	21	114	860	7.54

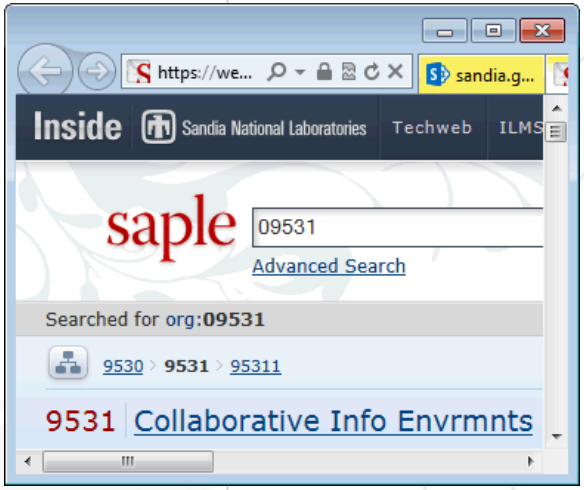
Down to Department and Person

Skill tag	Source	Dept	SNL Id	Person ref	References	Ref/Empl
aeronautics	SAND	01515			9	
					8	
	Total				17	8.50
chemistry	SAND	01512			9	
		01516			11	
					14	
					9	
	Total				43	10.75
computers	SAND	01516			6	
					6	
					7	
	Total				19	6.33
earth science/oceanography	SAND	01514			10	
	Total				10	10.00
electronics/electrical engineering	SAND	01513			13	
	Total				13	13.00
engineering (non-electrical)	SAND	01516			6	
	Total				6	6.00
explosives/pyrotechnics/ammunition	SAND	01516			9	
	Total				9	9.00
fluid mechanics	SAND	01512			18	
		01513			6	
		01514			7	
					12	
		01515			9	
					9	
		01516			9	

Taking a look at another source, MySites

Orgs with Expertise in 'SharePoint' by Number of References





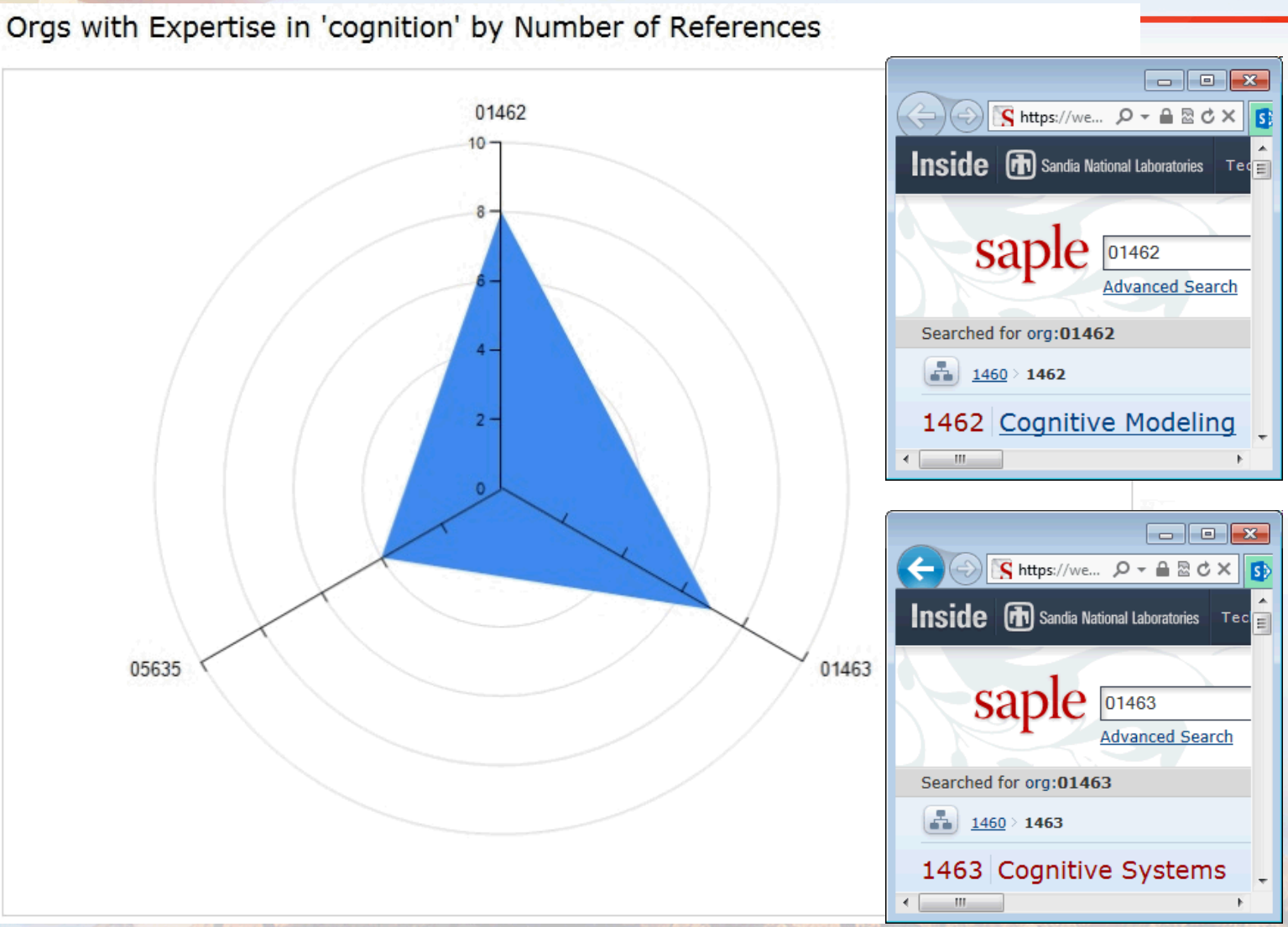
Sample MySite entries for two people

person ref	Skill Tag	MYSITES	Total
	Computer Graphics	2	2
	Enterprise Analytics	2	2
	Enterprise Information Management System (EIMS)	2	2
	Information Access	2	2
	Scientific Visualization	2	2
	TechWeb	2	2
	Video Streaming	2	2
	Total	14	14
	Behavioral Modeling	1	1
	Data Mining	1	1
	Enterprise Analytics	1	1
	Enterprise Search	1	1
	Networks Grand Challenge LDRD	1	1
	SAS	1	1
	Search Algorithms	1	1
	SPSS	1	1
	Statistical Modeling	1	1
	Text Analytics	1	1
	Text Mining	1	1
	Total	11	11

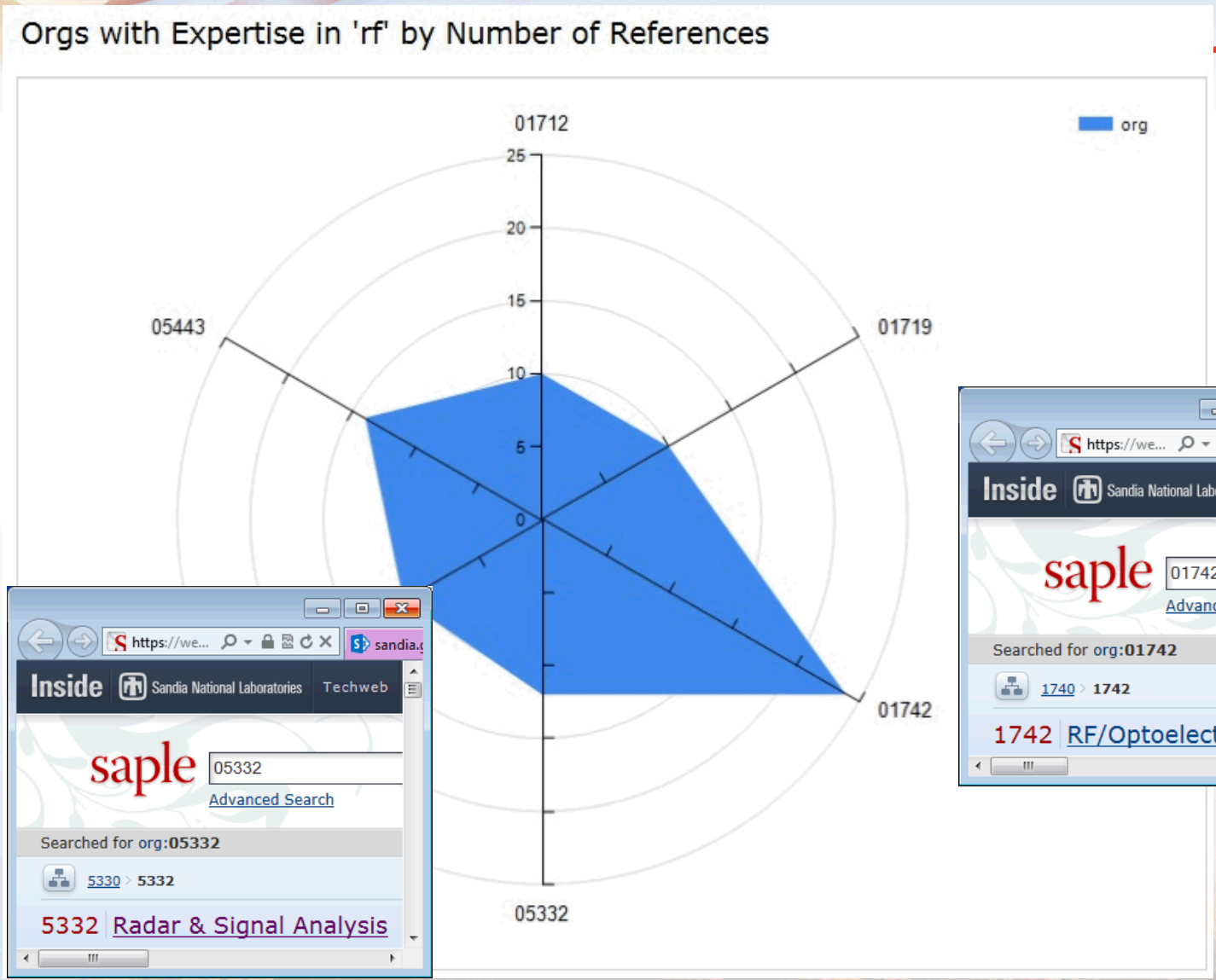
Another source of information – Laboratory Directed Research and Development (LDRD)

- **LDRD Projects have a Principal Investigator (PI) and possibly team members. All are assumed to have expertise in the project.**
- **Used Natural Language Processing to extract noun and noun phrases from LDRD titles and abstracts**
  - Generated 70K terms and phrases
- **Reduced complexity by**
  - Lemmatization and Stemming
  - Removing Stop Words – expanded to include Sandia-centric terms
- **Expertise and number of references are rolled-up to the organization level**

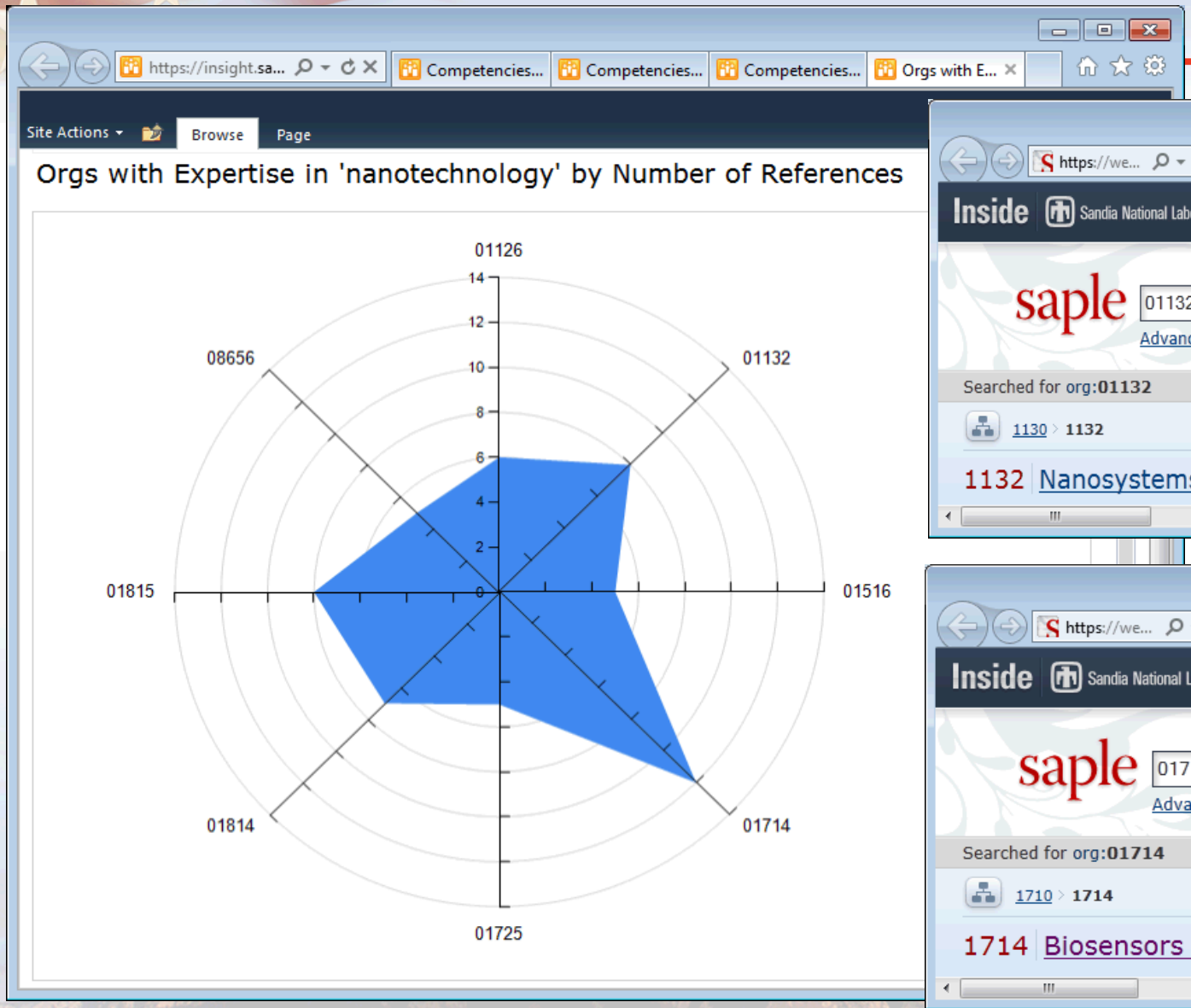
Addition of LDRD data enables more technology areas
This example shows orgs with expertise in cognition

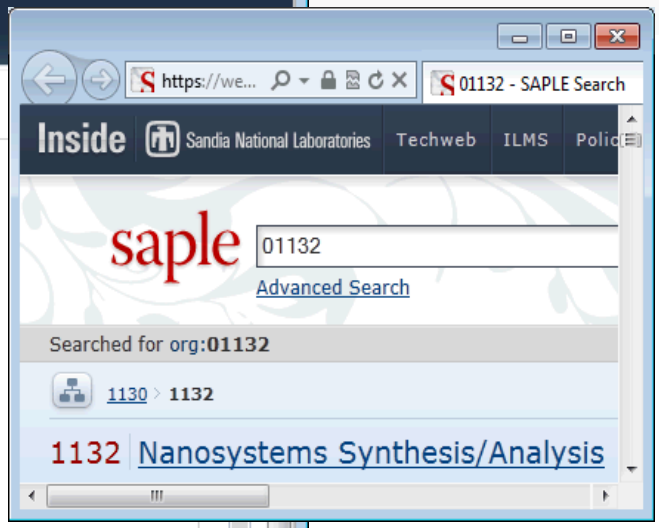


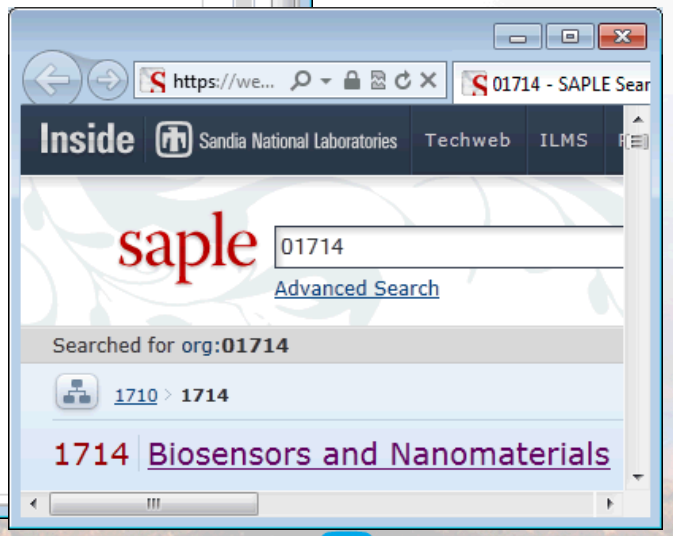
This example based on LDRD data shows organizations with expertise in RF (Radio Frequency)



And this example based on LDRD data shows organizations with expertise in nanotechnology







Good news, bad news

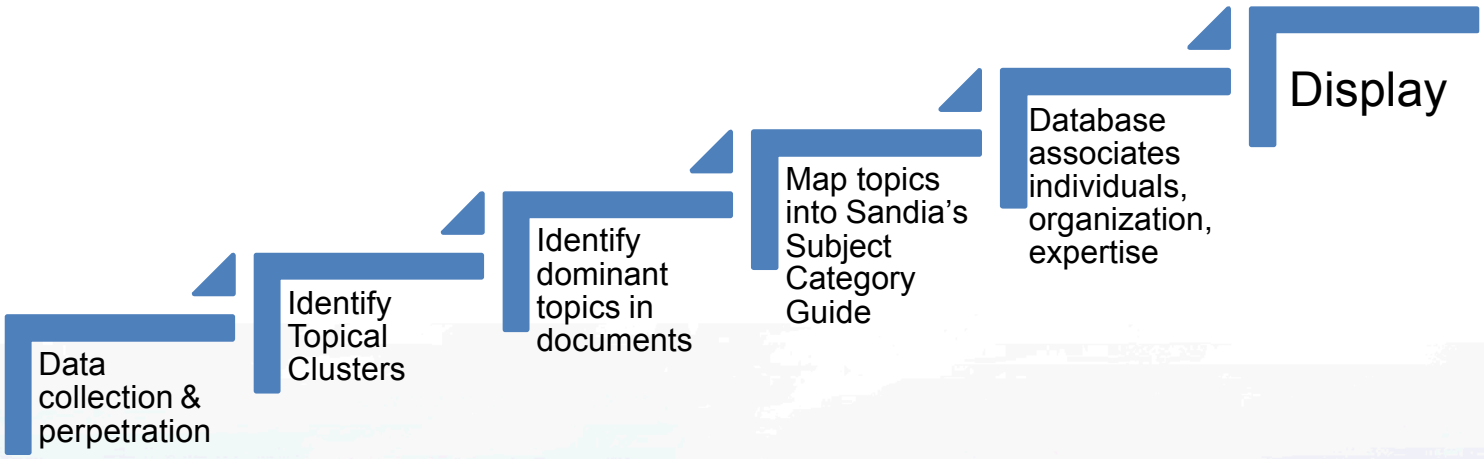
There are a lot more terms to choose from.

There are a lot more terms to choose from.

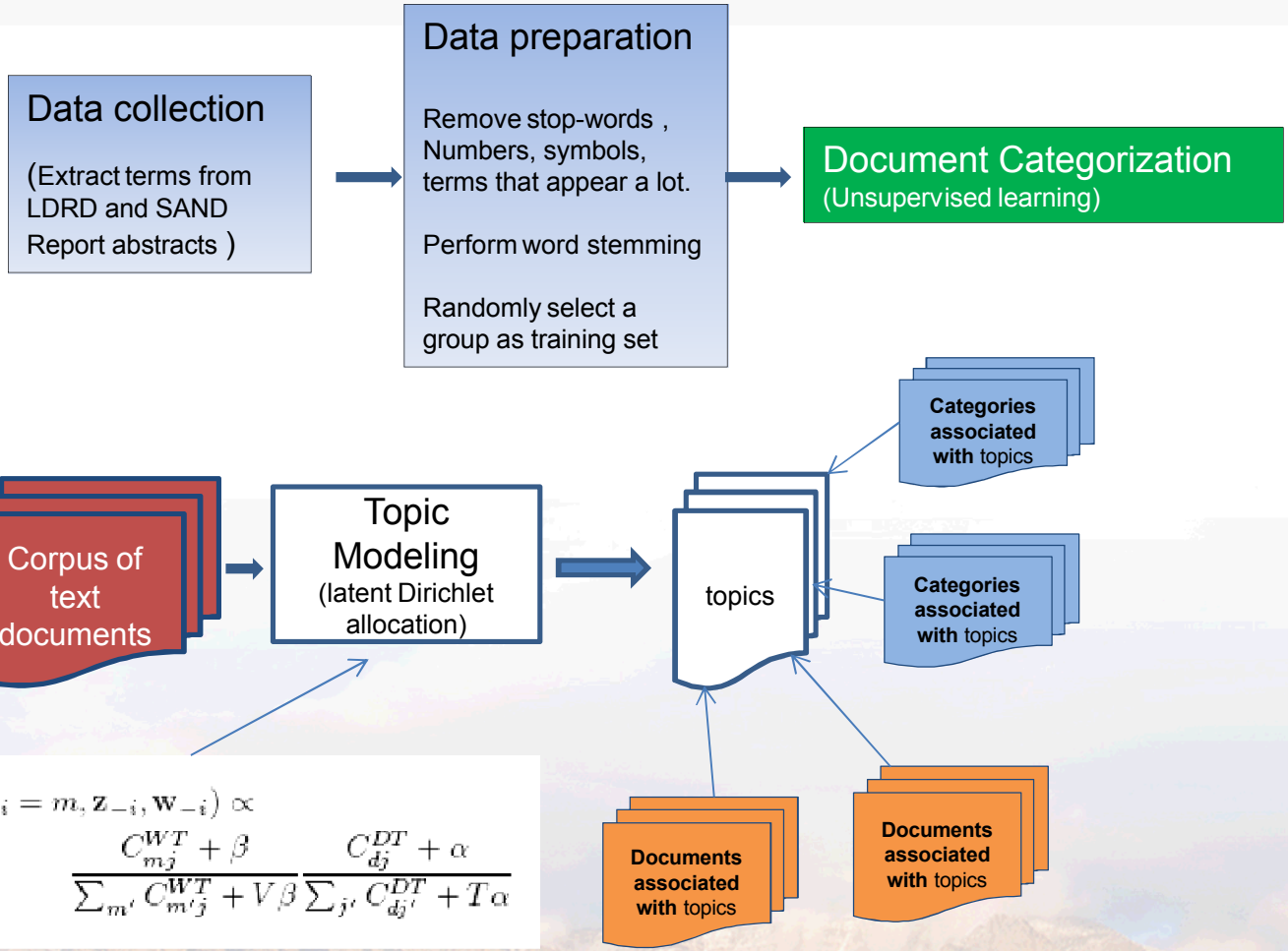
Materials Research Foundation

- **Focused on Sandia's Materials Research Foundation to explore techniques for automatically mapping expertise to a taxonomy.**
  - Organizations performing materials research are known. Employees belonging to these organizations are assumed to have expertise in materials research.
  - LDRD and SAND Report titles and abstracts authored by employees of materials research organizations are analyzed and categorized.

Overview of the process to map expertise to a taxonomy

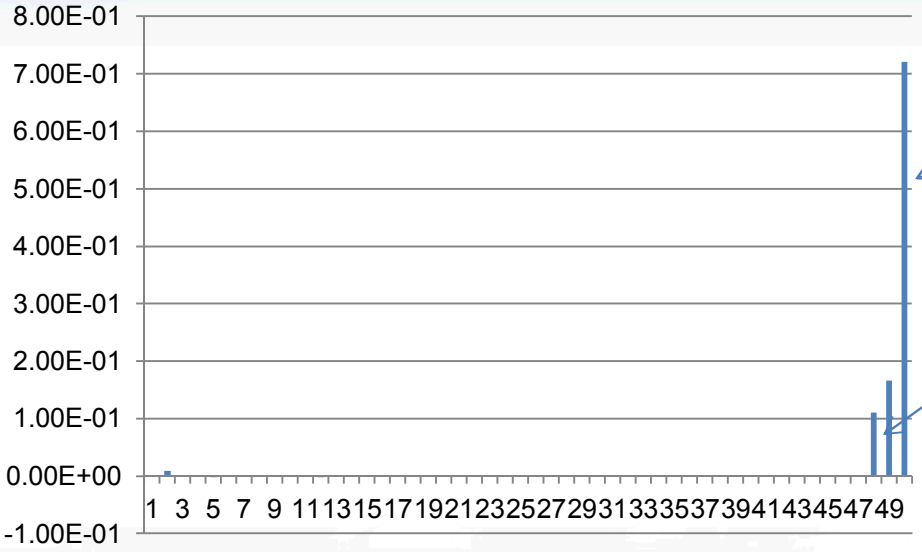


Intelligent reduction of number of terms and associating documents to categories



Example of a document associated with topics

Distribution of topics in the SAND abstract 92255



Topic 049	Topic 048
thermal	scale
safety	study
weaklink	rate
glass	simulation
nuclear	relationship
composite	case
seal	investigation
ceramic	describe
lead	change
edge	examine
fail	achieve
oxidation	nus
cycling	metal
leak	power
propose	physics
pot	performance
reentry	experimentally
exist	variability
capacitor	apply
heating	match

abstract (partial)
glasses filled with ceramic or metallic powders have been developed for use as seals for solid oxide fuel cells (sofc's) as part of the u.s. department of energy's solid state energy conversion alliance (seca) program. the composites of glass (alkaline earth-alumina-borate) and powders were shown to form seals with sofc materials at or below 900°c. wetting studies indicated good wetting was achieved on the micro-scale and reaction studies indicated that the degree of reaction between the filled glasses and sofc materials, including spinel-coated 441 stainless steel, at 750c is acceptable. a test rig was developed for measuring strengths of seals cycled between room temperature and typical sofc operating temperatures. seals that leaked could be resealed by briefly heating them to 900°c.

Excerpt from Sandia Subject Category Guide

11	Materials Science	
	A	Adhesives and Seals
	B	Ceramics, Refractories and Glasses
	C	Coatings, Colorants and Finishes
	D	Composite Materials
	E	Fibers and Textiles
	F	Metallurgy and Metallography
	G	Miscella
	H	Oils, Lub
	I	Plastics
	J	Rubbers
	K	Solvents
	L	Wood ar

11		Materials Science	
	A	Adhesives and Seals	Adhesives, Glues, Binders for all types of materials. Sealants, Seals, and Gaskets for all purposes. For propellant binders, See ROCKET PROPELLANTS (21I).
	B	Ceramics, Refractories and Glasses	Ceramic materials, including Glass, Brick, Porcelain, Tiles; Nonmetallic refractory materials. For heat-resistant metals and alloys, See METALLURGY AND METALLOGRAPHY (11F).
	C	Coatings, Colorants and Finishes	Paints, Paint primers, Varnishes, Plastic and Rubber coatings; Dyes and pigments. For chemistry of dyes, See ORGANIC CHEMISTRY (07C). For metal coatings, See METALLURGY AND METALLOGRAPHY (11F).

Associating topics with categories
Search topics for category terms

Use a Group of Words (phrases) from Subject Category Guide and other Sources to identify the associated topics

e.g., category 11B, “Ceramic, Glass, Refractories…”
Topic 4, 28, and 49 contain 11B terms

Subject Category Guide Search
(With terms in a predefined Category)

Search the Topics
(locate topics that contain one or more category terms)

Topic 04

stress
experiment
pressure
shear
interface
sample
state
crack
indentation
residual
strength
glass
fracture
length
datum
tension
curved
gpa
analysis
demonstrate

Topic 28

probe
glass
produce
divertor
behavior
small
flux
point
feature
initial
profile
structure
field
mechanism
langmuir
general
fracture
spring
sheet
mount

Topic 49

thermal
safety
weaklink
glass
nuclear
composite
seal
ceramic
lead
edge
fail
oxidation
cycling
leak
propose
pot
reentry
exist
capacitor
heating

11	Materials Science
A	Adhesives and Seals
B	Ceramics, Refractories and Glasses
C	Coatings, Colorants and Finishes
D	Composite Materials
E	Fibers and Textiles
F	Metallurgy and Metallography
G	Miscellaneous Materials
H	Oils, Lubricants, and Hydraulic Fluids
I	Plastics
J	Rubbers
K	Solvents, Cleaners and Abrasives
L	Wood and Paper Products

Group documents based on topics

Search the Topics
(locate the topics that contains one or more category terms)

↓

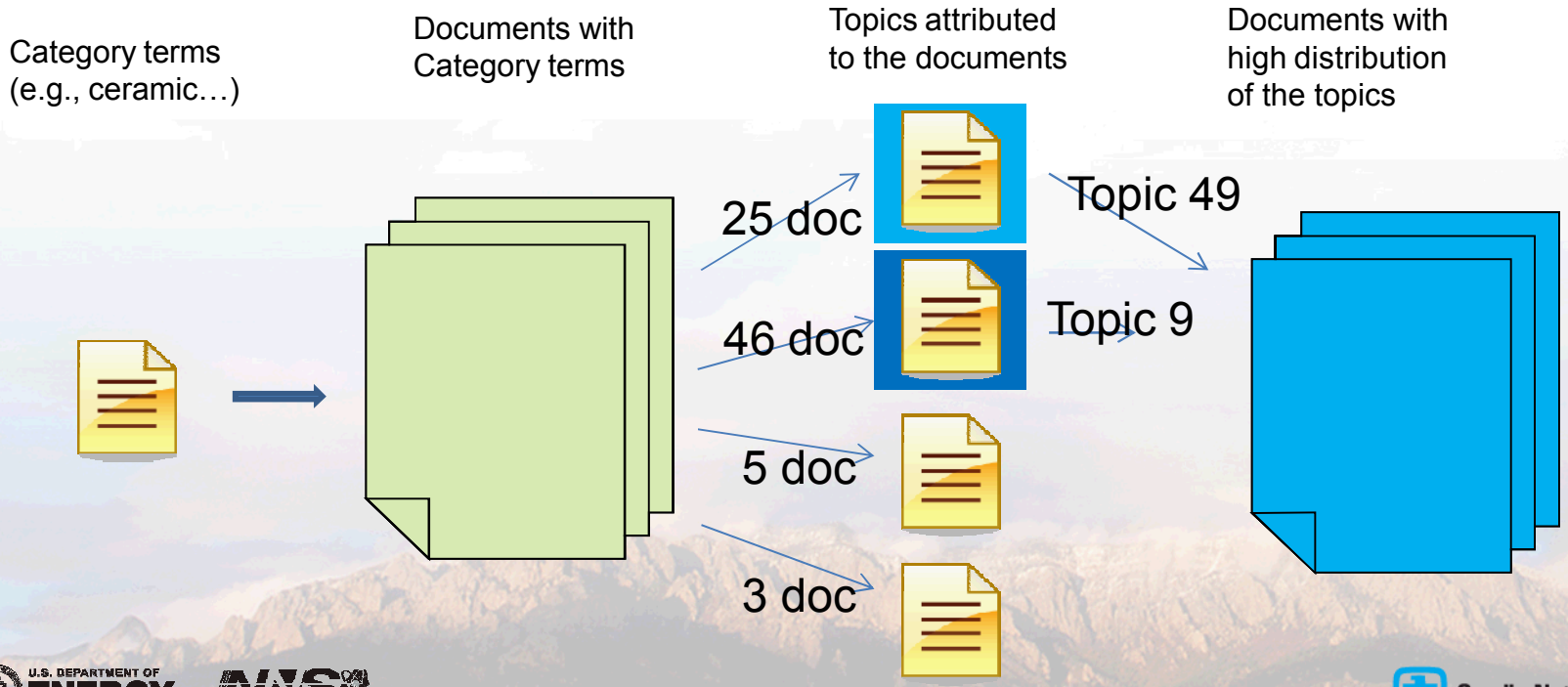
Group the Documents
(the documents with high distribution of a topic)

Item	Title
4	PbO-free composites for low temperature packaging
151	Laser Spray Fabrication for Net-Shape Rapid Product Realization
155	Solution Synthesis and Processing of PZT Materials for Neutron Generator Applications
156	Effect of Composition and Processing Conditions on the Reliability of Cermet/Alumina Components
281	Freeforming of Ceramics and Composites from Colloidal Slurries
595	Real-Time Design of Improved Powder Pressing Dies Using Finite Element Method Modeling
841	Fabricating Microcomponents from Silicon-carbonitride by a Novel Microcasting Process
983	Engineered Window Glass for Architectural Surety Applications

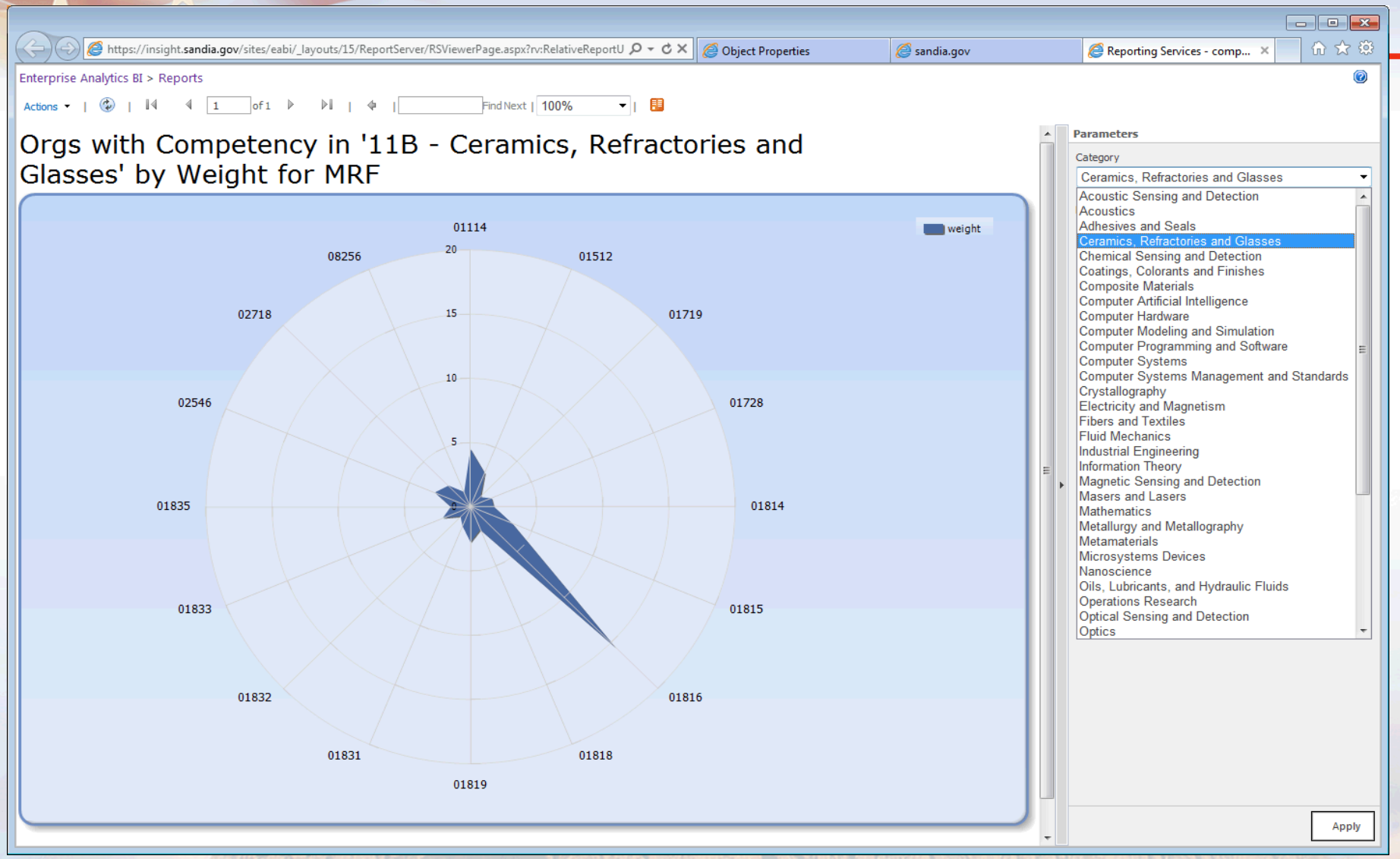
Associating topics with categories
Search abstracts for category terms

Search the Documents
(locate the documents that contain one or more category terms)

Attribute Doc to Categories
(assigned to group based on the distribution of a topic of the doc)



Display the results



Staff in Organization 1816 with publications in Category 11B

Enterprise Analytics BI > Reports

Actions | 1 of 1 | Find Next | 100%

Org	Employee	11B - Ceramics, Refractories and Glasses
01816 - Electronic, Optical, and Nano		3.17947
		2.01279
		1.88171
		1.53810
		1.14287
		1.09524
		1.01230
		0.66666
		0.66666
		0.42424
		0.36786
		0.32500
		0.28334
		0.20001
		0.20001
		0.14286
		0.12500
		0.12500
		0.10000
	Total	15.48912
Total		15.48912

Documents by a selected author in Category 11B, primarily in Ceramics

https://insight.sandia.gov/sites/eabi/_l Techweb Reporting Servi...

Enterprise Analytics BI > Reports

Actions | 1 of 1 | Find Next | 100%

Employee	Doc ID	Title	11B - Ceramics, Refractories and Glasses
	2008-3612	Thermal Properties of Zirconia-Rich Lead Zirconate Titanate Ceramics	0.50001
	2008-7247	Field-induced strain near the Curie temperature for PZT ceramics	0.40000
	2012-9071	Ca(ZrTi)O3 Ceramics for Energy Storage Applications	0.33334
	2009-1449	Temperature Dependent Hydrostatic Depoling Behavior in a Niobium Modified Lead Zirconate Titanate Ceramic	0.33333
	2009-0116	Lead-Free Compositions Microstructure Texture Engineering and Nanoparticles for Advanced and Innovative Materials Applications	0.30000
	2012-1370	Creation and characterization of macroporous ceramics for use as molten salt battery separator layers	0.28572
	2011-8583	Magnesium Oxide Ceramic Foams from Particle-Stabilized Emulsions	0.28572
	2012-8994	Highly Porous Ceramic Foams from Magnesium Oxide-Stabilized Pickering Emulsions	0.25000
	2012-3409	Highly porous ceramic foams from magnesium oxide stabilized Pickering emulsions	0.18182
	2009-7301	Barium Titanate Nanocomposite Capacitor FY09 Year End Report	0.16667
	2009-1518	Nano-scale PLZT Capacitors: Fabrication and Electrical Properties of High Energy Density Devices	0.14286
Total			3.17947

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Clicking the authors name brings up their MySite page
Clicking the document ID brings up the document

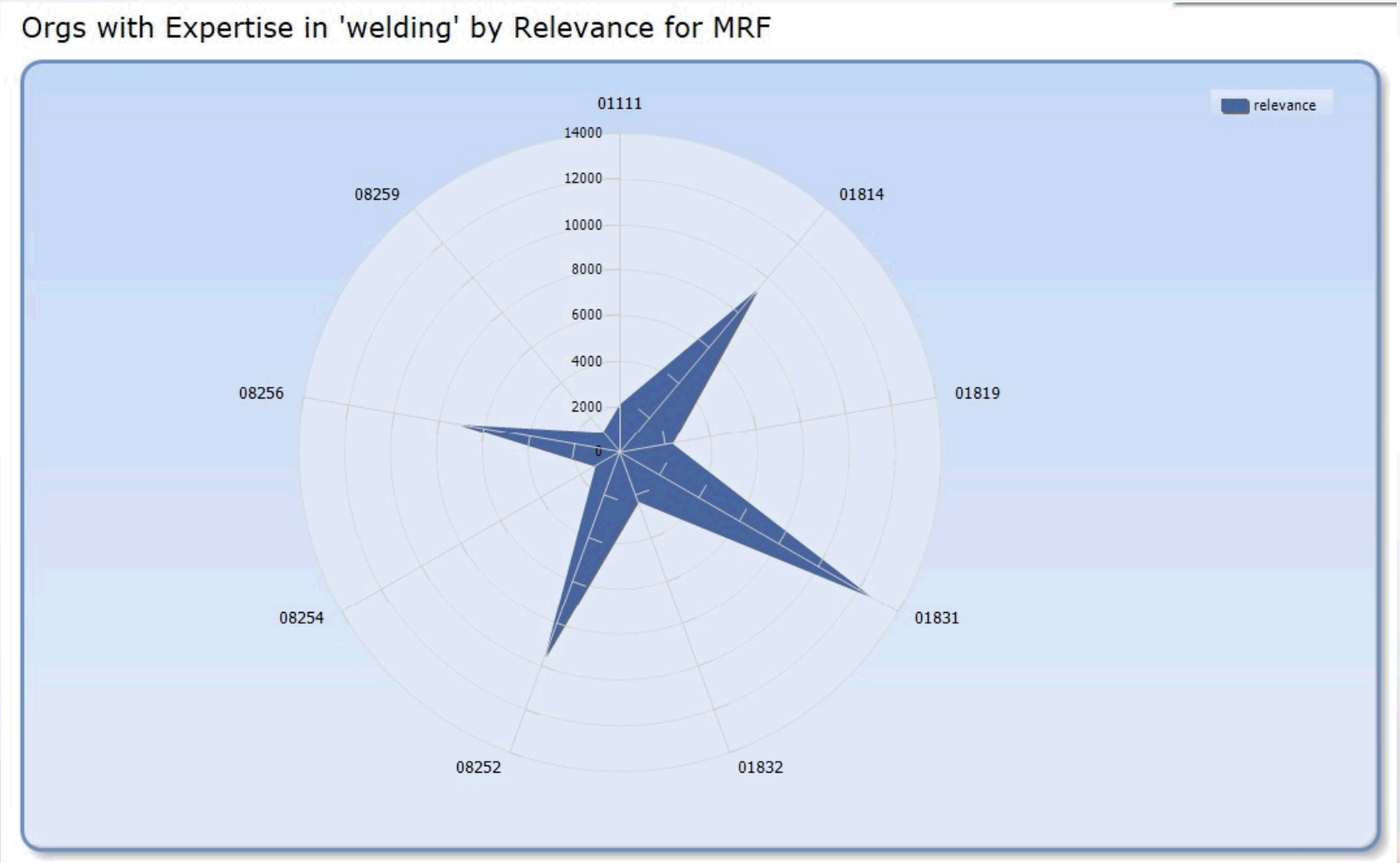
Creation and Characterization of Macroporous Ceramics for Use as Molten Salt Battery Separator Layers

SAND2012-1370A

Sandia National Laboratories
PO Box 5800, Albuquerque, NM 87185-0346

Highly porous and permeable ceramic foams are useful to many applications ranging from catalyst supports, filtering molten metal alloy, tissue engineering scaffolds and high temperature insulation. One potential route for manufacturing ceramic foams pioneered by Akartuna et al. (2008) is to make concentrated Pickering emulsions stabilized by ceramic micro- or nano particles which are then dried and sintered. Pickering emulsions are very stable to coarsening or coalescence and because of their yield stress can be shaped and molded. Here, a Pickering emulsion is generated using surface modified magnesium oxide particles resulting in high interfacial area emulsions which are very stable. …

Added a general search capability



A deeper look at a particular organization

Employees with Expertise in 'welding'

Org	Employee	Status	Relevance
01814 - Comp Materials & Data Science		Active	3,777
		Active	3,654
		Inactive	1,345
		Inactive	488
Total			9,264

Documents Related to 'welding'

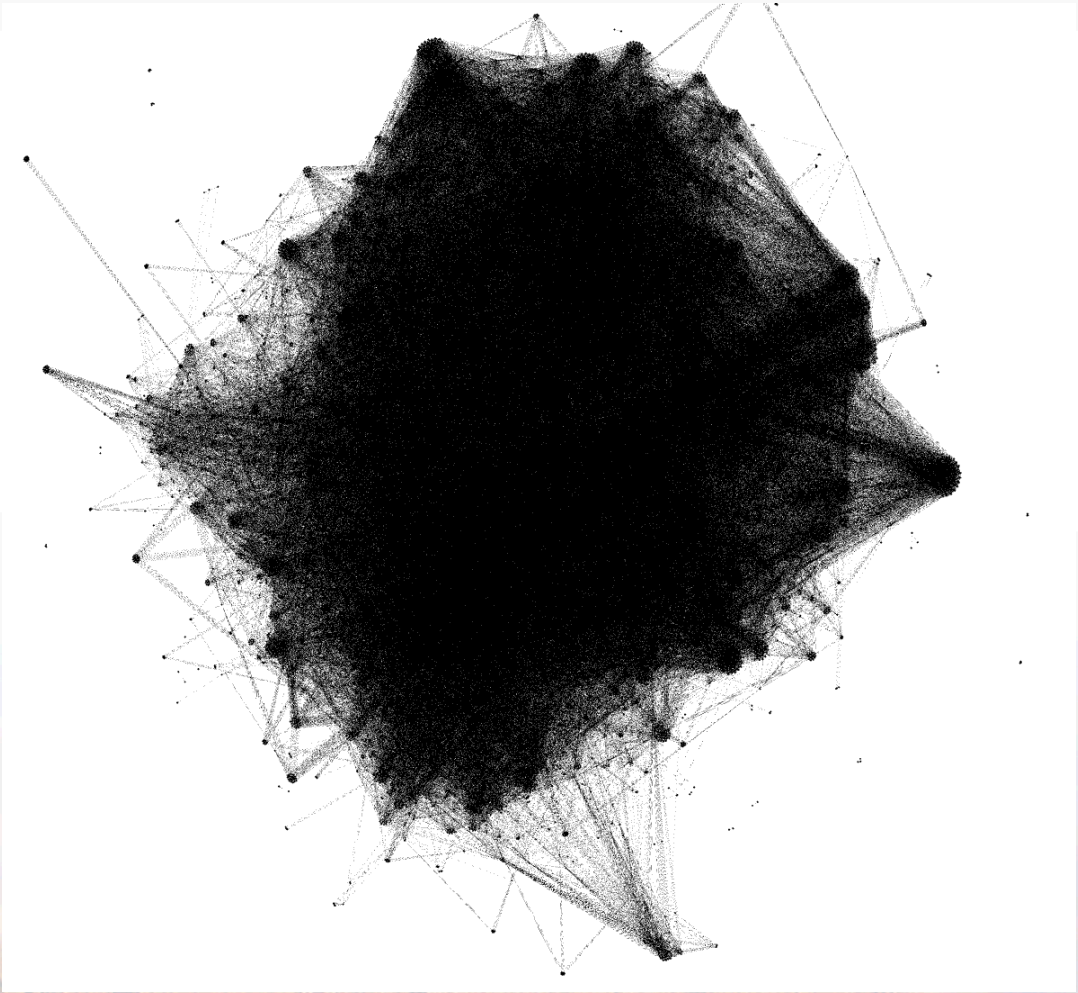
Employee	Status	Source	Doc ID	Title	Relevance
	Active	SAND	2012-7614	Coupling 3D Quantitative Interrogation of Weld Microstructure with 3D Models of Mechanical Response	1,331
			2012-4467	3D Characterization-Aided Modeling of Weld Deformation of 304L Stainless Steel	1,259
			2012-7672	Weld Porosity Characterization in Three-Dimensions within 304L Stainless Steel	1,187
	Total				3,777

We are experimenting with different ways to visualize and roll up the expertise data

- Clusters of expertise
- Clusters of organizations with similar expertise
- Mapping of Organizations to expertise

Hair Ball

- We clustered expertise tags to lump similar ones together.
- Each vertex is an expertise tag.
- Vertices are connected by a line if one or more people had both expertise tags.
- The graph is almost useless, but one surprising finding is that the expertise at Sandia is highly interconnected.

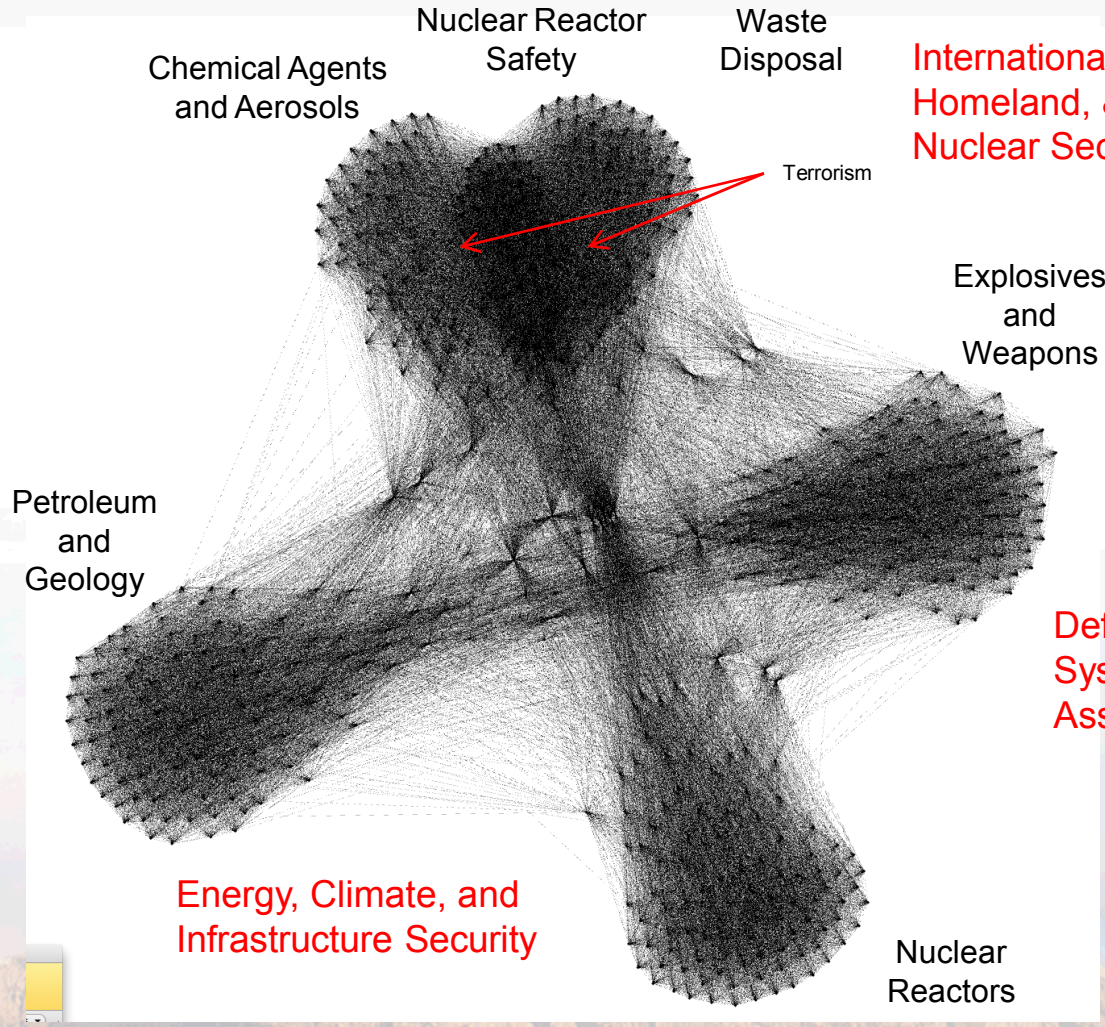


Computing the Central Competencies

The graph was reduced from approximately 7000 nodes to 500 nodes using K-Core, which reduces the graph to its central elements. There appears to be four main clusters, with one of the clusters split into three sub-clusters.

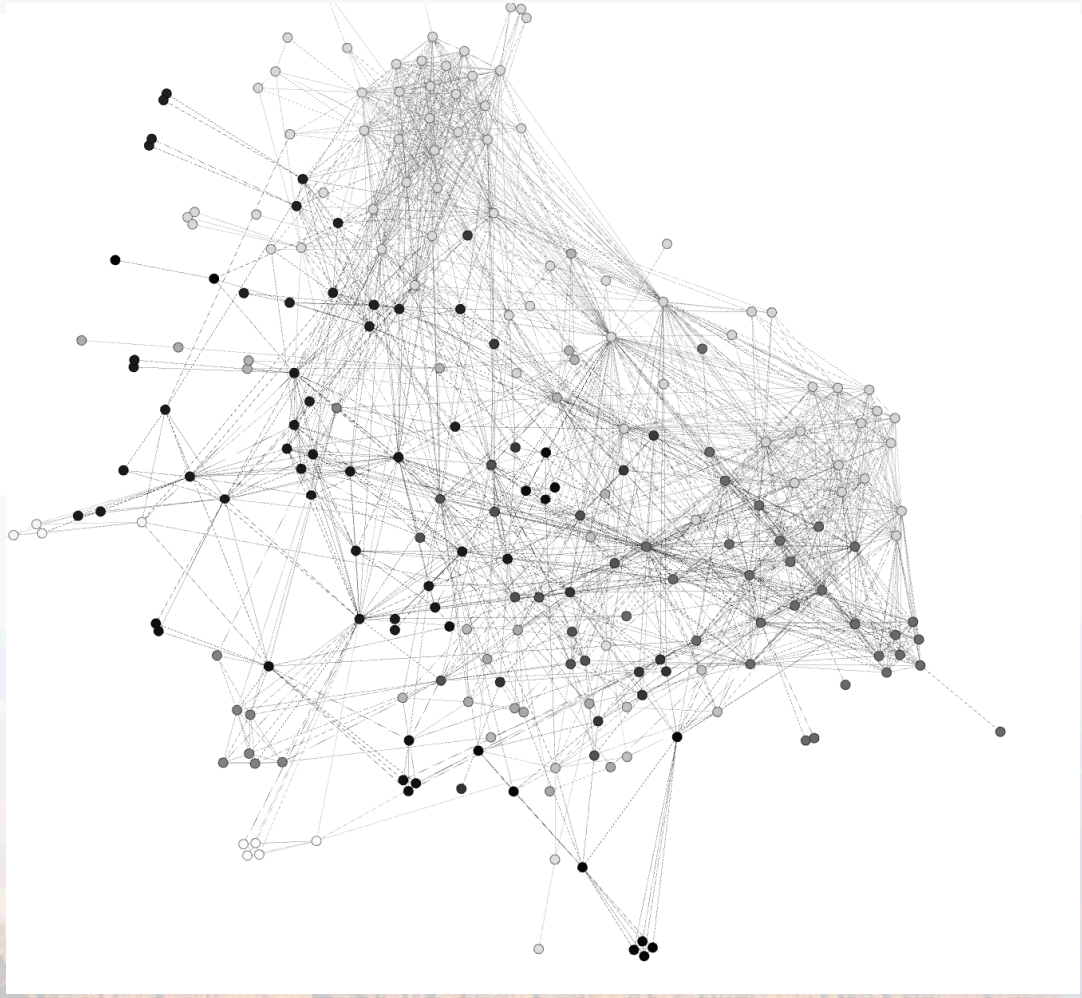
The clusters were labeled based on a subjective evaluation of the terms contained in the clusters

Items in red correspond to Sandia's four mission areas, which correlate well with the clusters.



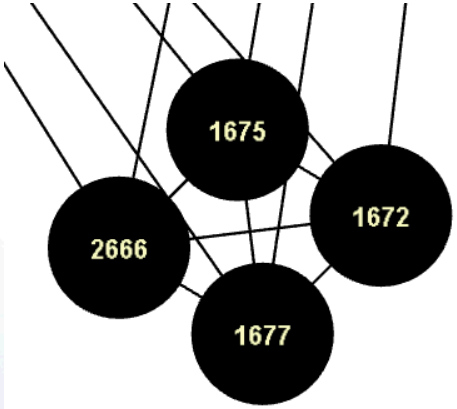
Relationships Among Organizations

- Rolled up the expertise to an individuals' organization and then generated a graph showing relationships among organizations based on individuals with the same expertise.
- Went through several iterations, eventually dropping all expertise tags that occurred less than three times.
- Ran community detection on the resulting graph.
- The orgs are highly interconnected, but there are clear clusters.

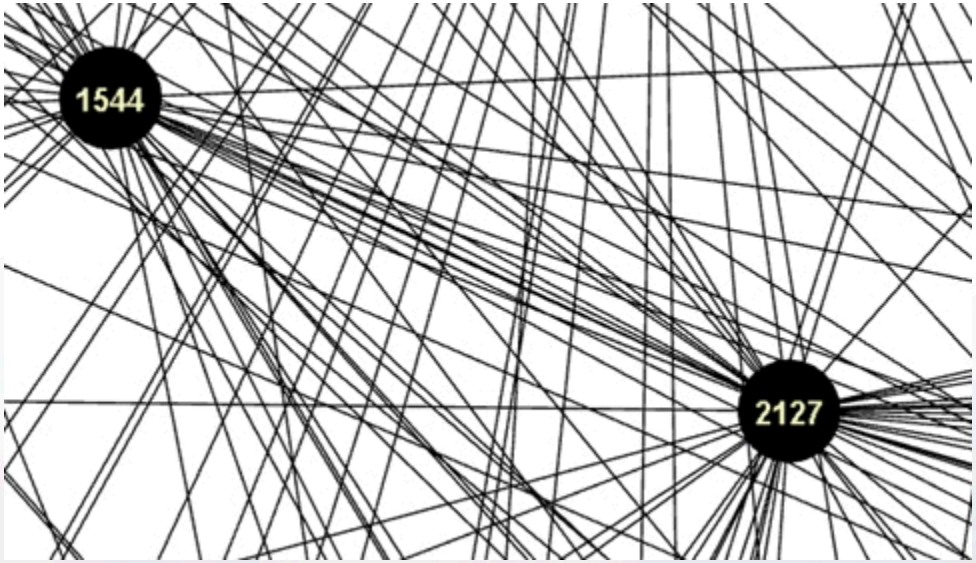


Individual Clusters and highly connected Organizations

There tend to be several clusters from the same organizational group linked together along with a few other orgs.

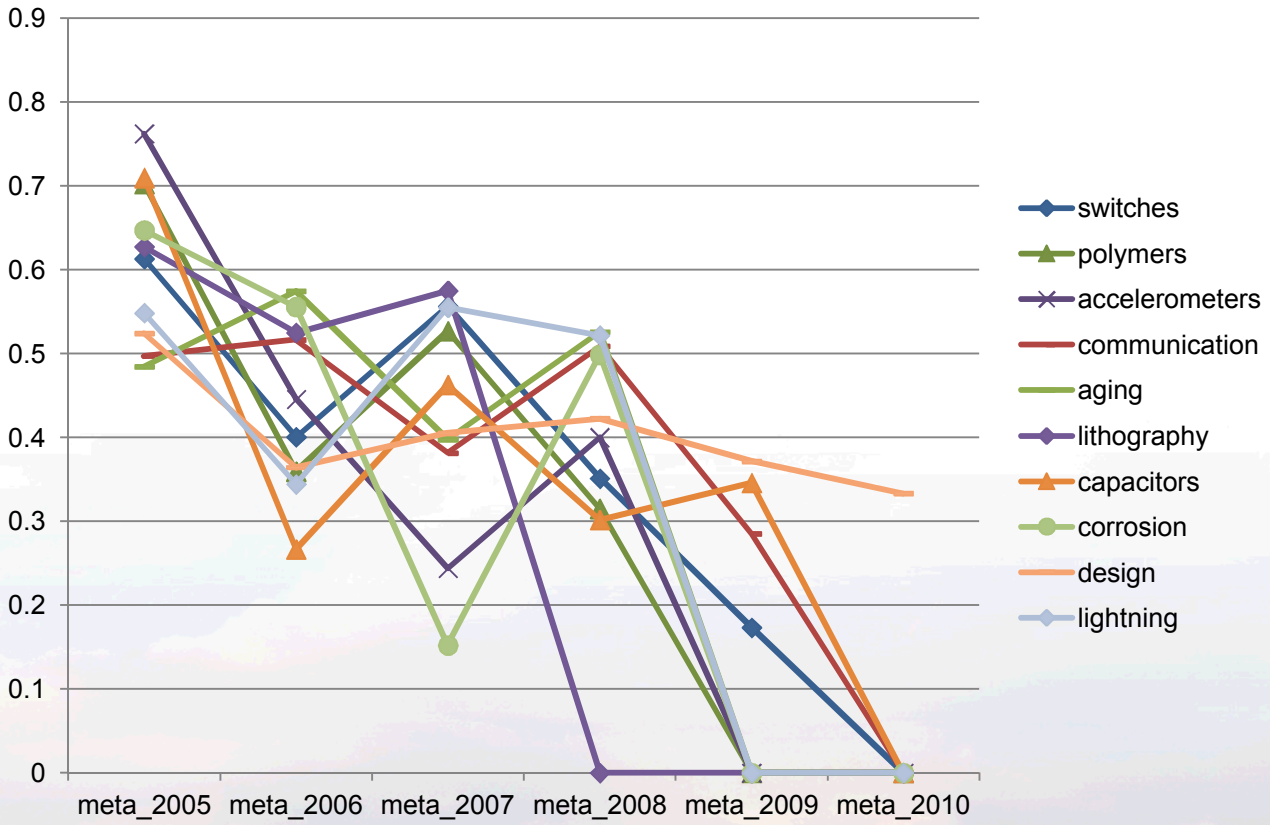


This graph points out some organizations are highly interconnected with other orgs.



Keyword trending

- Another area we looked at was keyword trending
- This graph shows basic trending in Sand Report keyword data
- This graph shows terms declining in usage over the last 5 years.



A challenge we explored
Matching free-text entries for expertise

Challenge

- Managers asked to enter desired competencies
- Staff asked to enter a list of skills
- Each asked to enter information in their own words
- Each used different terms

Approach

- Look for common terms
- Use fuzzy logic: How “near” is Term1 to Term2 in a corpus of documents?
- Assign a relationship measure
  - Exact match 1.0
  - At least one matching term 0.75
  - Fuzzy matching – relationship varies by proximity

Comparing free text entries for expertise

Desired vs. Actual Competencies

SL Dept	Desired Skill Tag	Relationship Measure	Actual Skill Tag
⊞ 09533	⊞ Apache Configuration	0.624	Linux System Administration
	⊞ Application code development and support	0.750	support
		0.604	Enterprise and Oracle Middleware
			Enterprise SOA
	⊞ Application infrastructure analysis and troubleshooting	0.750	analysis
			our analysis
		0.604	Enterprise and Oracle Middleware
			Enterprise SOA
	⊞ Application patching	0.604	Enterprise and Oracle Middleware
			Enterprise SOA
	⊞ Authentication	0.582	nuclear science/technology
	⊞ ColdFusion Administration	0.750	ColdFusion
	⊞ Cyber security	1.000	Cyber Security
		0.750	security

Future Work

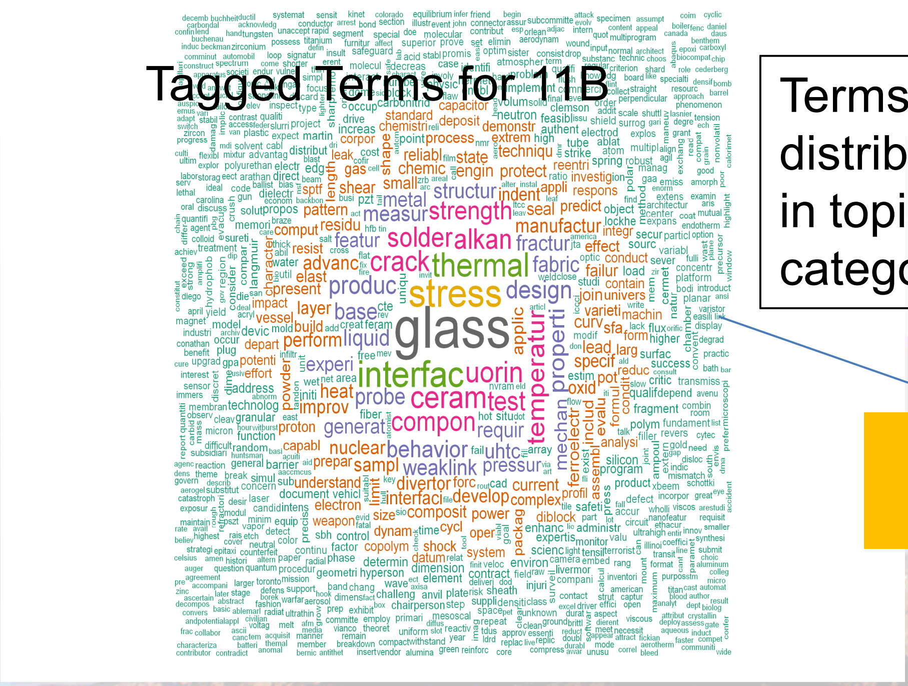
- Add additional sources of information
- Use a classification engine to map documents to categories
- Incorporate results from expertise identification tool into enterprise search results.
- Present expertise for an individual or an organization as a profile instead of as a single expertise
  - E.g. Jenny is an expert in computer modeling (0.6) the performance of a ceramic material (0.3)used in a neutron generator (0.1)

Semi-Supervised Classifier Generation (continued)

Group the Documents
(the documents with high Distribution of a topic)

Attribute Doc to Categories
(assigned to group based on the Distribution of a topic of the doc)

Develop the IDENTIFIERs
(tag the grouped documents, combine with topic terms and related terms from Other sources to form a group of weighted Terms that will be used to classify a doc To a category)



Terms and their distribution in topics, categories

Terms from other sources:
- Web of science
- Material Science Wikis

IDENTIFIER/CLASSIFIER for a Category

Once the training set is complete, use it to assign new documents to categories