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Navigating Nuclear Science: Enhancing Analysis Through Visualization

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Abstract

Data visualization is an emerging technology with high potential for addressing the information overload problem. This project extends the data visualization work of the Navigating Science project by coupling it with more traditional information retrieval methods. A citation-derived landscape was augmented with documents using a text-based similarity measure to show viability of extension into datasets where citation lists do not exist. Landscapes, showing hills where clusters of similar documents occur, can be navigated, manipulated and queried in this environment. The capabilities of this tool provide users with an intuitive explore-by-navigation method not currently available in today's retrieval systems.

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Navigating Nuclear Science: Enhancing Analysis through Visualization

Introduction

Information overload is a universal problem. The Intelligence, nonproliferation, arms control, and treaty monitoring communities, among others, have been wrestling with an increasing flood of information. Many effective information retrieval tools are currently on the market. Tools such as these, however, are continually trying to keep pace with the demands made on them. Data visualization, on the other hand, is an emerging technology that could provide high payoff in addressing related issues. This project experimented with integrating these two technologies.

Our high-level goal was to couple a data visualization tool with text retrieval techniques in new ways as applied to information management problems. The plan was to leverage previous work as much as possible and to provide a demonstration system within 6 months. A limited evaluation phase using in-house analysts was also planned. As a first example, we tailored the data to the potential needs of nuclear proliferation analysts.

To provide the visualization tool, we leverage heavily off the Navigating Science project. This is an internally funded research effort that seeks to enhance user interaction with datasets through a landscape visualization tool. Scientific and technical journal articles are plotted onto a landscape around which a user can navigate, zoom, and execute SQL queries. Mountains in the landscape appear as the result of a cluster of documents occurring close together. Documents occur close together if they are similar. Similarity can be measured in a variety of ways. In the Navigating Science project the landscape is built from the Institute for Scientific Information (ISI) Science and Technology database and similarity was measured based on the citation lists of the respective documents. This appears to be a good measure of similarity as authors themselves have designated these relationships. Using this technique, a nuclear landscape was created using the Nuclear Technology subset of the ISI's database that contains 15,283 documents.

In order to add content to the citation-based landscape, it was decided to integrate Foreign Broadcast Information Service (FBIS) documents. Nuclear proliferation analysts use FBIS documents and other similarly formatted text in their analysis. Since FBIS records did not include associated citation lists, a second similarity measure, which depended on the text itself, was required. This text-based measure compared the new documents with those on the existing citation landscape and plotted them based on the best matches. RetrievalWare, a sophisticated information retrieval engine marketed by Excalibur, was purchased to facilitate that activity. After domain filtering, a set of 11,682 FBIS documents for the years 1994 through 1996 remained, and these were added to the citation landscape.

During the limited evaluation phase, in-house analysts experimented with the resulting demonstration system and provided input to its usefulness and suggestions for continued development.

We start the report with an example of how the nuclear landscape might be used. Then we briefly describe how the citation-based landscape was formed. Most of this document is devoted to describing how 'content', the full text documents, were added to the landscape. The underlying issues are how the data should be organized, how similarity between documents could be measured, and how new similarity measures using text could be merged with co-citation similarity measures. Though not discussed in this report, effort also went into putting the demonstration system together and getting the alpha code integrated into a smooth environment for the analyst evaluation. The ability to view abstracts and full text, and the color-coding of document markers by source were among the features added to the software for this project. A brief summary of the analyst feedback and a discussion for future work is included. Appendix A is a tutorial describing commands available in the Navigating Nuclear Science environment. Appendix B and C provide sample FBIS and ISI data, respectively. The evaluation form used by the analyst is in Appendix D.

Plutonium Smuggling: An Example

Given the current landscape, a user can sit down in front of the computer and see the high level clusters and labels. From the *Manual SQL* command, the user might then request a search on the *title* field for a phrase such as *plutonium smuggling*. A cluster of colored dots shows up on the landscape representing documents whose titles contain that phrase. Positioning the crosshairs over the cluster and executing the zoom command allows the user to see more detail in that area and ultimately will bring him to the actual papers represented as triangles. Amongst the highlighted papers are other non-highlighted papers. These adjacent papers' titles contain the following phrases: *plutonium trafficking*, *nuclear smuggling*, *weapons-grade plutonium impounded*, *danger of black market plutonium*, *nuclear terror threat*, and *authorities search for plutonium hiding place*. The user can then pick any of those documents and depending on the source and availability of the data can view the entire original text, the abstract or simply the author, journal, country, and date of the article.

In similar fashion, a search on *chernobyl* retrieves documents adjacent to others whose titles included "*Novovoronezh Nuclear Plant on Brink of Shutdown*" and "*Greenpeace Protests Reactor Meltdown Experiment*." By picking the second paper and examining the full text window, the latter can be seen to be discussing the Cadarache Nuclear Test Center.

A search on *silicon* shows a large number of highlighted papers in many areas of the landscape. Some areas have to do with *silicon products*, some with *silicon detectors* and others with *properties of silicon carbide*. A user may navigate through several clusters depending on his or her interests and how the landscape's similarity measures divided the reference space. Labels on hills are commonly occurring phrases that occur within the titles and give the navigator a sense of the underlying topic. As one zooms in, hills divide into subhills with refined labels. A user interested in *waste cleanup* may find the attribute space defined based on the type of contaminant, what was contaminated, what method of treatment was applied, or even an unexpected attribute. How to divide the space effectively is a topic for further research as is understanding how to cluster and plot documents not adequately represented in the landscape.

In our experiments, we used the clusters already defined in the citation landscape and then, using a text-based similarity measure, mapped the new documents onto the old.

Creating the Citation-Based Landscape

The landscape is created by clustering papers together based on the cited/citing relationships among the scientific papers. Five years of citations (with abstracts) relating to nuclear science and technology papers appearing in scientific journals, a subset of ISI's Science Citation Database, covering 1991-1995, approximately 15,283 articles, were used to build the “frame” of the landscape.

The ISI document information is stored in an Oracle relational database. The fielded data include: identifier, title, journal, year, author, author organization, city, and country. The user can access the data stored in the relational data base through the visualization software via several menus and/or an SQL query capability.

The similarity measure was calculated based on the citation list of the ISI documents. The x-y coordinates for each ISI were generated by the following ordination algorithm. The underlying landscape was generated from the x-y locations of the ISI documents.

Ordination

In placing a new document on the landscape, it should be located near the documents it matches, and the strength of the matching should be taken into consideration. A two-phase algorithm was used to address this problem. We first place the document at a location that minimizes a measure of the total weighted distance to its matches, and we then perturb the locations to keep documents from being too close together.

For the first phase of the algorithm, we minimize a function that penalizes the new document for being far from its matches. The function is simply the sum over all matches of the quality of the matching multiplied by the square of the distance to the matching document. Let (x,y) be the location of the new document, (x^i,y^i) be the location of matching document i and q^i be the quality of the match with document i. Then we want to find values for x and y which minimize the following function.

$$\sum_i q^i((x-x^i)^2+(y-y^i)^2)$$

This minimization problem can be solved analytically by setting the derivatives equal to zero. The solution is

$$x = (\sum q^i x^i)/(\sum q^i)$$
$$y = (\sum q^i y^i)/(\sum q^i)$$

After the documents are placed in their respective positions, a second “density” calculation comes in to play. The algorithm given above, may compute similar locations for dissimilar documents. To avoid this situation, a density metric will “penalize” documents that are too close. Those with connections will tend to remain close, while those without will drift to less crowded localities. The use of a density metric reduces the algorithmic complexity of the graph algorithm from $\Theta(N^2)$ in a brute force approach, to $\Theta(N)$.

Adding "Content" to the Landscape

The task of adding the FBIS data to the citation-based ISI landscape was broken down into two major steps: Preprocessing the FBIS text and adding a FBIS document to the ISI Landscape.

Preprocessing the FBIS text

(a) ***Filter FBIS documents***: The FBIS data needed to be filtered to eliminate those documents that were clearly not within the nuclear domain context of the ISI landscape. Elimination of documents clearly off the topic was not difficult. Of the total FBIS set, approximately 30% were retained for further processing.

Where to plot, how to process or even how to detect documents that are slightly off the topic, however, is an area requiring more research.

(b) ***Extract Oracle fields***: In order to access the FBIS data through the visualization software, fields, as defined in the ISI Oracle database, needed to be extracted from the FBIS data. The set of sought database fields included identifier, title, journal, year, author, author organization, city, and country. Some of these fields were always filled, such as identifier and title. Others, such as author organization, were more frequently not filled.

This heuristic process was implemented in C code. *Country*, for example, might be extractable in one of several ways: directly within a tagged HTML field, as part of the title, or as a mapping of a city name, such as *Moscow*, to a country name, *Russia*.

Adding a FBIS Document to the ISI Landscape

For each FBIS document:

(a) ***Find top ISI document matches using a text-based similarity measure:*** Using a high-content word list created from the ISI titles, a profile for the FBIS document was created and used as input into RetrievalWare. RetrievalWare returned a list of the top ISI matches.

(b) ***Find cluster within the top 10 ISI matches:*** This step was added because typically the set of top matches were scattered throughout the citation landscape. Using the full-match set resulted in a location where none of the matches existed. (An example of this is presented later.)

(c) ***Find X,Y landscape location:*** The ordination algorithm requires a list of document pairs and their corresponding similarity measure. Pairs were formed for the FBIS document with each of the ISI matches in the top cluster. The match value returned by RetrievalWare was used as the similarity measure. The ordination program calculated the x-y coordinates of each FBIS document.

Document Matching

Keyword Lists

In order to find good keywords for use during the filtering and similarity measure calculation steps, individual words in the 15,283 ISI document titles were counted to

obtain frequently occurring nouns. The 960 unique words that occurred at least 10 times within the titles were considered as keyword candidates. Frequently occurring compound nominals, such as *breeder reactor*, were additionally reported. From this list, two keyword lists were generated.

The first keyword list was used for filtering. This list needed to contain words that would allow selections of documents from FBIS that would be relevant to this nuclear technology domain. The terms needed to be generic enough to catch nuclear domain specific articles while eliminating those not specific to this domain. With human intervention, the list was narrowed to 102 keywords. Occurrence of any of these keywords within a FBIS article resulted in its mapping on the landscape. Terms like *nuclear* and *actinide* were included, while terms such as *algorithm*, *activity*, and *fiber* that had meanings outside this domain were eliminated.

The second keyword list was used for retrieving similar documents thus providing a similarity measure. Though most of the words in the previous list were also included here, exceptions included words like *nuclear* which were not sufficient discriminators within the nuclear technology domain. More specific phrases such as *nuclear safety*, *nuclear submarine*, *nuclear test*, *nuclear waste*, *nuclear-matter*, *nuclear-powered*, *nuclear-reaction*, *nuclear-structure*, and *thermonuclear* were included as were more highly technical terms that may have had meanings in other domains. This list contained 738 keywords or keyword phrases.

Automatic generation of these high-content keyword lists may be possible using word frequency lists either from the landscape clusters specifically or possibly even from general language usage frequency lists.

Document Profiles

The frequency with which a high-content word occurs in a document is usually proportional to the importance of that word to the document subject classification. If a high-content word occurs in the document title, that too is usually a significant event. Based on a counting scheme of one count for each occurrence of the word in the text and five counts for each occurrence in the title, a profile was generated for each FBIS document using the second keyword list described above. The sum of the count was used as a weight for that word in the matching strategy. Obviously, some high-content words are more important than other high-content words; weighing on this basis, however, was not done within the constraints of this project.

The following is an example profile:

diffusion:6 energy:4 fusion:6 gaseous:5 laser:18 photon:3 uranium:23 vapor:7.

In this case, the term *uranium*, may have occurred in the document 23 times, or alternatively, it may have occurred in the title once (with a weighted value of five) and 18 other times within the text itself. The above sample follows the format expected of RetrievalWare input. Referred to as multipliers, users doing search queries may weigh some words more heavily than others by using the above format.

RetrievalWare

RetrievalWare from Excalibur was purchased as an information retrieval tool to aid in the derivation of a similarity measure between FBIS documents and ISI document titles.

This sophisticated tool provides term expansion, thesaurus linking, word stemming, morphology, term weighing, and profiling.

Expanding Terms

Term expansion is a feature that allows search terms to expand to variant spellings, synonyms, antonyms, broader terms, narrower terms, hypernyms, hyponyms, member sets, and anything else a user cares to define. There is a great deal of flexibility in terms of how much or little one cares to expand and how much weight one wishes to give to that expansion.

Term expansion, as shipped, is supported through a concept hierarchy based on an early version of *WordNet*, which was developed at Princeton and was also used in *ConQuest*, a predecessor of *RetrievalWare*. *WordNet* is public domain and available through the FTP site at NMSU at Las Cruces. *RetrievalWare* has morphological rules that strip words to their roots that then can match the entries in the hierarchy, dictionaries, and thesauri. Users can also add their own data to support term expansion. The next section briefly describes the incorporation of the *International Energy: Subject Thesaurus* which is relevant to the searches in this domain. This is a very technical thesaurus and usually resulted in favorable expansions.

International Energy: Subject Thesaurus

A thesaurus text file was obtained from the Sandia Technical Library through Mary Compton. The accompanying documentation describes the thesaurus as follows:

> "The *International Energy: Subject Thesaurus* contains the standard vocabulary of indexing terms (descriptors) developed and structured to build and maintain energy information databases. Involved in this cooperative task are (1) the technical staff of the US DOE Office of Scientific and Technical Information (OSTI) in cooperation with the member countries of the Energy Technology Data Exchange (ETDE) and (2) the International Nuclear Information System (INIS) staff representing the more than ninety countries and organizations recording and indexing information for the international nuclear information community."

The thesaurus was reformatted to be compatible with RetrievalWare requirements for dictionary input. This included

(1) stripping plural forms to their roots,
(2) removing comments starting mid-line,
(3) adding comment character semicolon to beginning of full lines not relevant to this application (dates of addition to thesaurus, for example),
(4) adding three lines before each main entry (".", "!", "@N") to indicate the beginning of a new noun entry,
(5) translating term designators (NT=narrower term, BT=broader term, RT=related term, etc.) to numbers for RetrievalWare reference, and
(6) updating the expand.wgt file with new entries and weights.

After being compiled using RetrievalWare utilities, the thesaurus was linked in and indexes rebuilt using this additional resource.

For highly technical terms, profitable expansions did occur. *Magnetron* for example matched to titles containing *klystron* and *RF systems*. *CERN* was defined as the *EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH*. Expansions of *scattering* included *target, collisions, interactions, dispersion, rescattering,* and *backscattering. Actinide* was the broader term for *uranium, thorium, plutonium, fermium, curium*.

Multipliers

Multipliers are input numbers from the search query that indicate how heavily different terms are to be weighed. If a term is expanded through a synonym, the resulting total contribution to the match considers both the multiplier and the expansion weight as designated is the *expand.wgt* file. The following example query shows multiple terms, each followed by a colon and a multiplier.

diffusion:6 energy:4 fusion:6 gaseous:5 laser:18 photon:3 uranium:23 vapor:7.

The FBIS document profile of keywords with counts served as input. If the profiles exceeded 50 words, the RetrievalWare recommended limit, words with lower weights were eliminated from the profile prior to the RetrievalWare call.

Output

Given the above search query, RetrievalWare returned the following as its top 10 matches within the ISI titles:

1.(41) 5C234489 DETERMINATION OF TRACE IMPURITIES IN URANIUM-OXIDES BY LASER ABLATION INDUCTIVELY COUPLED PLASMA MASS-SPECTROMETRY
2.(41) 5B2F2FDC TIME-RESOLVED EMISSION FROM LASER-ABLATED URANIUM
3.(40) 5B3302D9 DETERMINATION OF URANIUM AND THORIUM IN ALUMINUM WITH FLOW--INJECTION AND LASER ABLATION INDUCTIVELY COUPLED PLASMA MASS-SPECTROMETRY
4.(30) 5E32130F RADIATION TRANSPORT EFFECTS IN THE TARGET CHAMBER GAS OF THE LASER FUSION POWER-REACTOR SIRIUS-P
5.(30) 5C062558 VAPOR-PRESSURES OF URANIUM AND URANIUM NITRIDE OVER UN%S
6.(29) 5D18029E FISSION-GAS BUBBLE BEHAVIOR IN URANIUM-DIOXIDE
7.(29) 5C333057 A TEM AND TDS STUDY OF GAS-RELEASE FROM BUBBLES IN KRYPTON--IMPLANTED URANIUM-DIOXIDE
8.(29) 5D032C05 BEAM TESTS OF THE D-CIRCLE-DIVIDE URANIUM LIQUID ARGON END CALORIMETERS
9.(27) 5C182403 PHOTON DETECTION BASED ON PULSED, LASER-ENHANCED IONIZATION AND PHOTOIONIZATION OF MAGNESIUM VAPOR - QUANTUM EFFICIENCY VERSUS ION YIELD - INVITED LECTURE
10.(27) 5C1601FD PHOTON DETECTION BASED ON PULSED LASER-ENHANCED IONIZATION AND PHOTOIONIZATION OF MAGNESIUM VAPOR - EXPERIMENTAL CHARACTERIZATION

The number in parenthesis reflects the relative quality of match followed by the document ID and then the title. Notice that the top 3 matches all contained both *uranium* and *laser,* the most highly weighted terms. In match number 8, the word *liquid* contributed to the match based on an expansion of the word *vapor*. Match number 3 is the only one not containing the word *uranium*, but it did match 3 other terms: *gas, laser* and *fusion*.

Clustering

As evidence for why this step is necessary, consider the top 10 matches returned by RetrievalWare on the search query,

diffusion:6 energy:4 fusion:6 gaseous:5 laser:18 photon:3 uranium:23 vapor:7.

Those documents' X and Y coordinates within the ISI landscape were as follows:

1.(41) 5C234489	**-51.926807 -23.050751**
2.(41) 5B2F2FDC	**-57.419243 -25.357195**
3.(40) 5B3302D9	**-60.443371 -25.200346**
4.(30) 5E32130F	**-115.907021 239.147995**
5.(30) 5C062558	**-181.018417 109.919579**
6.(29) 5D18029E	**-95.882904 55.000320**
7.(29) 5C333057	**-96.083763 54.969456**
8.(29) 5D032C05	**5.860003 -88.703384**
9.(27) 5C182403	**-57.040417 -21.270412**
10.(27) 5C1601FD	**-54.994022 -21.139843**

Using the coordinates of these top 10 ISI documents as input to the ordination algorithm would have positioned the FBIS document somewhere in the middle of the 10 matches and in fact near none of them. Since this scattering happens frequently, it results in a landscape where the FBIS documents mostly plot to the center.

To mediate this problem, a clustering algorithm, based on the coordinates, was applied to ISI document matches, and only those papers contributing to the largest cluster were passed on to the ordination algorithm for FBIS coordinate calculation. The applied clustering algorithm uses the simple criteria that a document can merge with its neighbor' s cluster if it is within 10 counts of both coordinates of that neighbor, e.g.,

$$(|x - x_i| \leq 10) AND (|y - y_i| \leq 10)$$

This means an entry need not be within ten counts of all members of its cluster only with its closest. Using this simple merging criteria relieved the algorithm of needing to calculate radius or other complex calculations. This algorithm is sometimes applied in computer vision applications in merging adjacent regions. If no 2 documents fulfilled this criteria, it was relaxed until at least two documents formed a cluster. On average, this clustering algorithm returned 4 matches per document instead of 10. In the above set, papers 1,2,3, 9 and 10 are considered clustered.

This process did not eliminate any FBIS or ISI papers from the landscape; it only affected the FBIS placement.

Ordination of the FBIS Documents

In this implementation, the citation landscape was first built from the ISI documents. The FBIS documents were then added to that stabilized landscape. The parameters that affect FBIS placement are still being experimented with and optimized for best placement.

Similarity Measure Variants

The text-based similarity measure used to add the FBIS documents to the citation landscape is the match value returned by RetrievalWare. For each FBIS document, a profile, based on the high-content keyword list derived from ISI document titles, was built. The profile was used as input to RetrievalWare to determine the best matches against **only the titles** of the ISI documents through its standard matching procedures with some tuning of the user selectable options.

Two variants on this procedure were experimented with when the abstracts were received late in the project cycle. (1) Match the FBIS document profile against the abstract and not just the title of the ISI documents. (2) Match based on query-by-example (full text) rather than profile.

With a better similarity measure, one would expect the returned documents (1) to be better matches than those currently returned, a subjective measure, and (2) to be better clustered, a more objective measure.

Neither of the two variants produced an improvement in the initial experiments. Noise, in the form of matches to low-content words, resulted in scattering in the x-y locations of top matches. Perhaps this in not surprising. For example, the last section of Appendix C shows three documents that are highly related based on citation. Interestingly, however, there is almost no keyword overlap.

Matches based on Profile Query Against ISI Abstracts

This variant used the profile generated as before from the FBIS full text, but matched to the ISI abstract instead of the ISI titles only. The example here shows the top four ISI matches to a sample FBIS profile along with their coordinates in the ISI citation landscape. Notice the scattering of the coordinates.

FBIS DOCUMENT TITLE::
China: Breakthrough Advances in Domestic Nanotechnologies Research

FBIS PROFILE (as before)::
curvature:1 electron:2 electronic:1 microscopy:1 probe:3 radius:1 scale:4 scanning:1 superconductivity:1 system:4 thermal:4

ISI MATCHES USING ABSTRACTS (previously used titles only)::

1.(84) 5E163B34:: Coordinates: **96.904144 61.001053**
5E163B34 Thermalization of ion bombardment induced large and sparse cascades in metals is studied. We introduce a model where nonequilibrium electron and ion distributions relax simultaneously, and coupling between the thermal ions and valence electrons allows . . .

2.(65) 5D100327 :: Coordinates: **-41.286942 -43.080833**
5D100327 The status of the project for the construction of the ALPI superconducting linear accelerator is described, with information on the building, the radiation shield, the beam transport system, the cryogenic system, the machine cryostats, the . . .

3.(64) 5D2A3DE0:: Coordinates: **122.534233 94.166924**
5D2A3DE0 The molten-zone model for vacancy loop formation from a displacement cascade predicts that the probability of loop formation should scale with the melting temperature. To investigate this Possibility the areal defect density, the loop . . .

4.(60) 5B140A40 Coordinates: **-102.211700 102.990227**
5B140A40 This paper describes a part of the work performed on the determination of the thermophysical properties of alloys in the binary system Li-Pb. The preparation of the eutectic alloy from the pure elements and its characterization using . . .

Query-by-Example

This experiment attempted to investigate whether the query-by-example option provided by RetrievalWare would provide better clustering than that currently obtained through the profile method.

Initially, RetrievalWare was asked to retrieve the ISI document abstracts similar to a FBIS document. When the resulting matches were so scattered, we used RetrievalWare to match ISI documents abstracts to one selected ISI abstract. Even for this specialized case, the resulting matches did not form a cluster.

QUERY-BY-EXAMPLE SELECTION::
(5E163B34 Thermalization of ion bombardment induced large and sparse cascades in metals is studied. We introduce a model where nonequilibrium electron and ion distributions relax simultaneously, and coupling between the thermal ions and valence electrons a)

QUERY-BY-EXAMPLE MATCHES TO SELECTION::
1.(48) 5E163B34 Thermalization of ion bombardment induced large and **-96.904144 61.001053**
2.(20) 5C2118D9 The photon shutter is one of the critical elements on the **-100.937187 -53.613987**
3.(18) 5C101F96 Much theoretical work has shown that in some limit it is **25.021225 -27.328699**
4.(18) 5D303867 The proton-stripping reaction (In(C, B)Sn)-In-115-C-12-B- **-15.129437 100.976433**
5.(18) 5D1F07A8 Frozen samples of twelve alkanes and benzene were irra **-26.912819 -15.935616**

Analyst Feedback

Eight analysts were asked to provide feedback on the current demonstration system. Each was given a brief 5-10 minute demo and then asked to interact with the tool. The basic outline that was followed, including sample questions, is included in Appendix D.

As relates to navigation and display, the most common complaint had to do with a confusion between the crosshairs and cursor arrow. This affected ease of use in zooming and picking of papers. Several users also didn't like the combination of keystrokes and mouse control with many suggesting double clicks or mouse-controlled scrolling. Many of these valuable suggestions are being incorporated during the continuing development phase of the visualization tool.

At a higher level, users were asked for comments related to the value of this kind of tool in accomplishing their work. Users compared the process to a library search where one goes to the shelves looking for a specific book (or a document picked through an SQL search) and finds related relevant books nearby (or related documents nearby). The ability to be able to reach out and “feel” or “touch” the data was perceived as a positive attribute of the system.

Currently nuclear proliferation analysts are using keyword-based information retrieval (IR) systems. Feedback indicated that the visualization aspects of this tool would need to be fully integrated with such an IR system or many of its capabilities if these analysts were to find this tool useful.

Future Work

Since the usefulness of this tool will depend heavily on the quality of the matching, the clustering and the ordination, more work needs to be done in this area to get a higher quality landscape. The citation landscape was thickly populated in a few areas. Adding the FBIS documents to those areas sometimes created overcrowding, exclusion areas, sensitivity to small changes in values, and other artifacts that should be further researched. Where to place documents whose topic area is not already well represented in the landscape also needs to be researched as well as understanding better the interaction and overlap of citations and keywords. Where the abstracts became available late in the fiscal year and we needed to choose between different citation landscape versions quickly, time was not taken to fully exploit the full text possibilities.

As per the actual construction of a landscape, some analysts were interested in the kind of control that they might have, while others were concerned with the ease of construction. Some were interested in having a static landscape across several datasets, while others mentioned that having the ability to build one on the fly would increase its usefulness for web searching. Within all these themes, however, is the need to be able to move between different datasets easily and automatically.

Nearly all the analysts immediately started trying to use the expanded kind of SQL functionality that they currently have at their workstations. Though we have some of those functions, analysts will likely demand full integration, or at least better interaction, with a retrieval tool. Feedback about the tool, in general however, was very positive.

Conclusions

As stated in the Introduction, information overload is a universal problem. While effective retrieval tools exist, the typical users of text search engines input 1-3 terms [CLA97], get a list of documents, and then further refine the target list either with more search terms or by selecting a document for use in a query-by-example. The potential for the visualization environment that is being explored here is that an analyst can examine data organized in ways that do not require the formation of a linguistic search strategy. The organization of the data in this concept gives users a visual way to search the data thus eliminating the need to ask the right question. Users can zoom out to a global view, zoom in on details, examine trends occurring over time, or see how the results of traditional queries are scattered throughout the landscape. The purpose of this discover-by-navigation concept is to provide feedback to the user in an intuitive, visual environment. The purpose is to provide an alternate attack on the overload problem.

While there are numerous questions to be researched, the preliminary evaluation of this tool indicates that further research is warranted.

References

[CLA97] Clarke, Charles L.A.; Cormack, Gordon V.; Tudhope, Elizabeth A. "Relevance Ranking for One to Three Term Queries", RIAO97 Conference Proceedings, McGill University, Montreal, Quebec, Canada, June 1997.

[EXC97] Excalibur Technologies Corporation, RetrievalWare Version 6.0, 10440 Little Patuxent Parkway, Columbia, MD, 1997.

[JOH82] Johnson, R. A.; Wichern D.W. Applied Multivariate Statistical Analysis, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1982.

[WOR93] WordNet 1.4 Copyright 1993, public domain software, Princeton University.

Appendix A: Getting Started on Navigating Science

The Navigating Science software currently runs on SGI machines. After logging on, click on the *NAV* Icon.

Because the larger visualization product has features that we are not interested in for this application, the bottom window can be removed (or actually run as a background job). To do this set the *tether* option in the bottom window by clicking on its checkbox, then with the mouse still in the lower window, type <*alt-F3*>. (Holding the <*alt*> key down while striking the <*F3*> key.)

To select the dataset to be viewed, select <*open*> from the <*file*> menu. Select <*datasets*> and then double-click on <*nuc_tech_fbis*> to load the nuclear technology ISI with FBIS data.

Moving About in the Landscape

At this point, a landscape is presented. Several keystrokes allow movement within the landscape.

- ***z*** - zoom into the landscape to the next level of detail. A single keystroke steps it; holding the key down results in continuous zooming activity. The crosshairs should be over the area of interest.
- ***x*** - unzoom to previous less detailed level.
- ***m***- move landscape; place large crosshairs over area of interest; typing 'm' will move that area toward screen's center.
- ***p*** - (with right mouse button) pick the document under the crosshairs. (more about this later)
- ***t*** - unzoom to top level.

The mouse can also be used to move about the landscape. Pressing a mouse button results in a display of a set of crosshairs in the center of the screen. Placement of the mouse close to the crosshairs center results in slow movement. Faster movement occurs proportional to the distance from the center.

Left Button: Move mouse along upper vertical line and the view gets larger (but level of detail does not change as it does with *z* and *x* keystrokes). Move mouse along lower vertical line and the view gets smaller.

Center Button: Move mouse along the vertical line and the horizontal plane tips forward or backward.

Left or Center button: Move mouse along left horizontal line causes rotation of landscape in counter-clockwise direction; right horizontal line causes clockwise direction.

Right Button: Click right button and the hill or document under the crosshairs is selected. Document information is displayed under the toolbar. If used with ***p***, the document will be considered picked for options under the *Connections* menu.

Menu Options affecting Landscape Appearance

As options from several of the dropdown menus will be useful during the manipulation of the landscapes, it is convenient to pull these dropdowns off their menus to keep them visible. As an example, highlight the Landscape option under the Configuration menu. Notice that a second menu drops down. From it, select the first option, which looks like a line of dashes ("----------"). This selection opens a small options window that can be keep open and placed in a convenient location near the edge of the viewing space.

The *Landscape* options include *Island*, *Grassland*, and *Wireframe*. These selections change the immediate appearance of the landscape, but have no impact on the data or state.

Connections and *Peak Labels* options both under the *Appearance* menu are other examples of option groups that may be useful to have conveniently selectable.

The *Peak Labels* options include *Titles* or *Journals*. In the landscape each of the hills has a label derived from the set of titles or the set of Journal names. Through a clustering algorithm a frequently occurring phrase within the set of titles or journal names is selected. This option allows a user to select which source is used for the labeling of the hills.

Viewing Connections at the Document level

Using the *z* command many times ultimately results in the viewing of individual papers. The clustering of the documents that results in the hills in the landscape is based on co-citation of the documents. Documents that cite one another cluster into the same hills. When viewing the landscape at close range where the individual papers are visible, options to view document citations can be selected from the *Connections* options. If paper A cites papers B, C and D, those connections can be viewed. Options include the following:

Show None : show no connections
Show Picked : show the connections of the picked documents
Show Local : show the connections only if on visible island
Show All : show all connections even if they go off the island

Outgoing : show connections going out of picked paper
Incoming : show connections coming into selected paper
(Line color changes from blue to red; blue end is paper doing the citing; red end is paper cited.)

These 2 sets of options work together. If *Show Picked* is selected but nothing is picked, no lines are shown. If *Show Picked* is selected, but neither *Outgoing* nor *Incoming* is selected, no lines are shown. If *Outgoing* and/or *Incoming* is selected but *Show None* is selected, no lines are shown.

Using SQL to Pick Papers

Individual papers can be *picked* or *unpicked* (since it is a toggle operation) by placing the crosshairs over the desired paper and holding '*p*' while clicking the right mouse button.

Papers as a group can be picked using SQL commands. To bring up the SQL dialog box, select *Manual SQL* from the *Windows* menu. The text in the box reads *Show papers where X*

is *Y*. The *X* is a drop down menu where one can select an item such as Institution, Author, Country, Province, State or other loaded database field. The *Y* is filled in by the user in ALL CAPS. In this way, for example, a user can *pick* all papers where the COUNTRY was AUSTRIA. Papers that are picked show up on the landscape as highlighted in a particular color. Consecutive selections show up in different colors. Papers picked in this method can be used in the Show Picked operation described above.

Under the *Information* menu, one can select *general* or *title. Title* shows just the title of the last picked paper (under the tool bar). *General* expands that output to include the authors, organizations, journal, publication year, country, and abstract.

Clear All from the SQL dialog box deselects all the picked papers.

Other Options

Numerous options are intuitive to use and easy to find at the top of the screen or as options within the menus. For example, the length of the title displayed can be adjusted as whether it is centered or right-justified over the document pyramid marker. The default zoom factor can be increased for faster zooming, especially for thickly documented areas. Year selections can be made either to a particular year or a range of years.

Appendix B - Sample FBIS document

<doc><ht>"fbten011___96253"</ht>
<au>FBIS-TEN-96-011</au>
FBIS Report<ht><phrase><f 108>FBIS Report</f></phrase></ht>
Environment ∧ World Health
<abs> </abs>
<date1>28 Oct 1996</date1>
<f 100>ENVIRONMENT</f>
<f 101>RUSSIA</f>
<h3><ti>Russia: Official--No Environmentally Harmful Objects in BSF</ti></h3>
<ht><f 107><phrase>Russia: Official--No Environmentally Harmful Objects in BSF</phrase></f></ht>
<f 102>LD2810163796 Moscow ITAR-TASS in English, 1628 GMT 28 Oct 96 </f>
<f 103>LD2810163796 </f>
<f 104>Moscow ITAR-TASS</f>
<f 105>English </f>
BFN
<f 106>[By Anatoliy Yurkin]</f>
[FBIS Transcribed Text] MOSCOW, October 28 (Itar-Tass)
-- The Black Sea fleet has no chemical and nuclear objects which can do damage to the environment, said Viktor Zakharov, the head of the service of radiation, chemical and biological defence of the Russian navy.
"We have not any special objects in the Black Sea region which could pollute the environment very badly. We deploy usual ships, working on usual kinds of fuels, just the same as civil vessels: oil, fuel oil and others. There are not any other unusual substances which may cause pollution," he said in an exclusive interview with Itar-Tass on Monday.
Zakharov expressed bewilderment in connection with the statement by Minister of Environment and Nuclear Security of Ukraine Yuriy Kostenko, who told today's news conference in Kiev that a "special commission, a member of the Ukrainian-Russian group for the Black Sea fleet," was estimating the losses inflicted on the environment by the Black Sea fleet."
"I would have known the composition of this commission if it had existed. Besides, representatives of the Black Sea fleet and the Russian Navy should have been members of this commission," he said.
Therefore the Ukrainian minister's statement that "the sides have reached an agreement in this field," is bringing about "quite certain feelings," the admiral noted.
Characterising the ecological situation in areas of the stationing of the Black Sea fleet as not causing an alarm, Admiral Zakharov expressed a supposition that certain circles in Ukraine were using an "ecological factor" in their political interests.
"The Black Sea seamen are engaged in military training, control over life support and survival systems of all fleet structures and strictly fulfil all requirements concerning environmental protection. There have not been any conflicts with the local leadership, and it is strange to hear of some many-billion compensations for the alleged damage done," Zakharov stressed.

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</doc>

Appendix C - Sample ISI Input

Document ID/YR/Journal name/Title:

5A32223590NUCL PHYS B9103480276 ENHEAVY-BARYON WEAK FORM-FACTORS/
5A32223690NUCL PHYS B9103480293 ENCOMMENT ON HEAVY BARYON WEAK FORM-FACTORS/
5A32223790NUCL PHYS B9103480297 ENTHE COUPLING OF THE ODDERON/
5A32223890NUCL PHYS B9103480310 EN1ST QUANTUM CORRECTIONS TO GLUON GLUON COLLISIONS IN THE ONE-INSTANT ON SECTOR/
5A32223A90NUCL PHYS B9103480345 ENSTRANGENESS, GLUE AND QUARK MATTER CONTENT OF NEUTRON-STARS/
5A32223B90NUCL PHYS B9103480373 EN2-PARTICLE SCATTERING IN THE CHERN-SIMONS-WITTEN THEORY OF GRAVITY IN 2+1 DIMENSIONS/

Document ID/Abstract:

5A3424B8Depth profiles of tritiated water in concrete walls measured in a heavy water reactor are analyzed using a diffusion model. The apparent diffusion coefficient of tritiated water in concrete made with a standard mixing proportion is 3.3 X 10(-11) m2/s. In addition to the primary diffusion mechanism, there is evidence of a second mechanism, possibly a fast diffusion process. The diffusion model can be applied to tritiated water penetration into concrete when the concrete walls of fusion reactors are exposed to air containing tritiated water vapor. In the heavy water reactor, the average concentration of tritiated water in the air over 20 yr is estimated to be approximately 2.0 X 10(-2) Bq/cm3. The tritium inventory in concrete is approximately 1.0 X 10(7) Bq/m3 in the region <0.65 m deep. A 0.2-m-thick concrete wall is sufficient to prevent tritium release into the environment from exceeding the regulatory limit.
5B023594Cadmium vapour contained together with a noble gas in a quartz fluorescence cell at a controlled temperature, was irradiated with pulsed dye-laser radiation which excited the Cd atoms to the 5(3)P1 state. The effective decay rate of the 5(3)P1 atoms was determined in relation to the Cd or noble-gas densities by methods of fluorescence spectroscopy with time resolution. The experiments yielded the total depopulation cross sections of 167, 1.1 x 10(-3), 3 x 10(-4), 6.1 x 10(-4), 1.3 x 10(-3) and 3.3 x 10(-3) angstrom2 for collisions with ground-state Cd, He, Ne, Ar, Kr and Xe atoms, respectively.
5B023596Two methods to determine the order of the atom formation reaction from the absorbance signal profile are proposed. In one method, the first-order assumption, which is often used to develop various Arrhenius-type plots in graphite furnace atomic absorption spectrometry (GFAAS), is graphically verified by plotting log (A(m)T(m)2 vs log integral-t(m)/x A dt, where the subscript m indicates the value of the subscripted term at the absorbance maximum. The linearity of this plot verifies the first-order assumption. The other method allows one to determine the order of the atom formation reaction at the maximum of the absorbance signal using the equation, n(m) = [GRAPHICS} The order of the atom formation reaction of copper from a pyrolytically coated graphite tube was found to be 0.95 +/- 0.04 by the graphical method, and 1.01 +/- 0.04 by the method of calculation, indicating that the atomization of copper does indeed follow first-order kinetics.

Document ID/Coordinates:

5A322235 41.317013 -85.969978
5A322236 40.711315 -85.667725
5A322237 8.995581 -90.649246
5A322238 65.104424 -83.316132
5A32223A 34.821796 -55.320351
5A32223B 69.103348 -121.870552
5A32223D 84.882843 39.022392
5A33081E 29.807905 -107.082466
5A330820 63.434776 -128.430496
5A330821 58.298901 -119.334084

Three Citation-Related ISI Document IDs/Coordinates/Titles/Abstracts:

Three adjacent papers are shown here along with their landscape coordinates, titles, and abstracts. The first is a popularly cited paper. The second two reference this paper and none others in the landscape. There is very little overlap in the words or their expansions, so it is unlikely that a text-based similarity measure would have found the connection. An evaluation of that connection for the sake of the landscape is not done here.

5C2A1BEE -55.384487 -25.663755
ATOMIC SPECTROMETRY UPDATE - ADVANCES IN ATOMIC-ABSORPTION AND FLUORESCENCE SPECTROMETRY AND RELATED TECHNIQUES/

5C2A1BEEThis is the second review describing developments in atomic absorption and atomic fluorescence spectrometry since the restructuring of the earlier third and fourth ASU reviews on 'Atomization and Excitation' and 'Instrumentation' in 1990. Thus it follows on from the review published last year (J. Anal. At. Spectrom., 1991, 6, 187R) and includes fundamental processes and instrumentation in the areas of atomic absorption and atomic fluorescence spectrometry together with advances in related techniques such as atomic magneto-optical rotation spectrometry and laser-enhanced ionization. The review of 'Atomic Emission Spectrometry' may be found in JAAS, Volume 7, Issue 4. The full references, names and addresses of authors can be readily found from the Atomic Spectrometry Updates References in the relevant issue of JAAS. However, as an additional service to readers an abbreviated form of each literature reference quoted (except for those of Conference Abstracts) is given at the end of the review. Comments as to possible improvements in future reviews are always welcome.

5B2E21A2 -55.996498 -24.979151
PECULIARITIES OF CCD AND PHOTODIODE ARRAYS APPLICATION TO X-RAY IMAGE DETECTION/

5B2E21A2 Some properties such as diffusion noise, time and spatial distortions, etc., of solid-state semiconductor imagers in the X-ray region are described. The influence of these properties on the performance of one- and two-dimensional rapid image detection systems based on matrix CCDs is discussed.

5B2E2187 -55.226997 -24.947424
FUNDAMENTALS OF INELASTICALLY SCATTERED X-RAY SYNCHROTRON RADIATION AS A PROBE FOR THE ELECTRONIC-STRUCTURE OF CONDENSED MATTER/

5B2E2187 Several interactions of X-ray photons with the electrons of condensed matter are included under the general term "inelastic scattering". Each of these interactions can be established as the basis for the study of some electronic properties. X-ray Compton scattering is the only spectroscopical method in which the momentum and not the energy is of importance, while the X-ray resonant Raman spectrum contains information about the phase of the valence electron wavefunction, and finally the X-ray Raman spectra provide information similar to that of XANES and EXAFS but easier. Which inelastic interaction is dominant for a given sample depends on the combination of the energy of the incident photon and the scattering angle. The tunability of the synchrotron X-ray beam, the high flux and degree of polarization are the reasons that the synchrotron facilities are the only places where the study of condensed matter via inelastic scattering can be carried out. Presented here are the interactions with the common characteristic omega-1 > omega-2, and the advantages of employing the synchrotron radiation sources in the utilization of these interactions as tools in the solid-state investigation.

Appendix D - Analyst Test of the Nuclear Science and Technology Landscape

Test No: _____

Date of Test: _____

The landscape consists of

- 5 years of citations (with abstracts) relating to nuclear science and technology papers appearing in scientific journals, a subset of ISI's Science Citation Database, covering 1991-1995
- 3 years of FBIS selections relating to nuclear science and technology, covering mostly 1994-1996.

The landscape is created by clustering papers together based on the cited, citing relationships among the scientific papers. Then FBIS documents are added to the landscape, based on a text matching program between the text of the FBIS documents and the text in the titles of the ISI documents.

We are asking you to test the mechanics of using the landscape and determine if this type of navigation tool would be useful to you (if it were composed of text sources which you use to do your work).

Part One: Navigation and Display

Controls

You are viewing the top level of the landscape, all years and all records are included in the display. Use the mouse to fly around the landscape, rotating and tipping it. Directions for Mouse Navigation are given on the chart by the monitor. Try the control keys listed on the other chart. Move different clusters of peaks to the center of the landscape and zoom in and out.

Do you find it easy or hard to use the mouse and keys to navigate?

Are any of the navigation controls hard to use or misleading? If so, which ones?

Other comments on navigation:

Landscape Views

You have a choice of viewing the landscape as a mountain range on an island, a mountain range surrounded by grasslands, and as a wire-frame outline of the mountains. Go up to the menu bar. Under Configuration select Landscape. Rip off the menu and move it somewhere out of the way on the desktop. Select wire-frame. Navigate the landscape in this mode. Then switch to island. In the wireframe mode you can see that the ISI documents are represented are red and the FBIS documents are blue.

If you strongly prefer one view over another, which do you prefer?

Other comments on the landscape views:

Peak Labels

The peak labels are generated on the fly from the titles of the papers/articles which are included in the cluster of related papers which form a peak. As you zoom in and out, notice the labels on the peaks. Go up to the menu bar. Under Appearance select Peak Labels. Rip off this menu and move it somewhere out of the way on the desktop. Switch back and forth between journals (journal titles) and titles (article titles) as you move about the landscape.

You may choose to have more or fewer labels displayed on the landscape. Go up to the menu bar. Under Appearance select Number of Labels, then either More or Less.

Is the option of labeling the peaks using journal titles helpful?

Are the labels generated from article/paper title words useful?

Other comments on the peak labels:

Information Displays

Zoom down to the lowest level of the landscape, where individual documents appear as colored triangles. You can select a document by placing the crosshairs over it on the landscape and pushing the right mouse button. When a (blue) FBIS paper is selected, the text is displayed as HTML using a browser to view the text. When a (red) ISI paper is selected, the text is displayed in a window. Select a document and look at the information displayed. Go up to the menu bar. Under Information select General. This is the full information available from the ISI record. Experiment with selecting both FBIS and ISI documents at different levels of the landscape.

Is it easy or hard to select a paper using the mouse control?

Do you prefer the FBIS browser display or the ISI window display for document information?

Other comments on information displays:

Connections

Zoom down to the lowest (most detailed) level of the landscape, where papers appear as colored triangles. Go up to the menu bar. Under Appearance select Connections. Rip off the menu and move it somewhere out of the way on the desktop. At the bottom of the menu, turn on outgoing and incoming connections. Now try different options from the upper part of the menu and see the links which are displayed. (Blue ends of the links are attached to the paper citing and red ends are attached to the paper being cited.) ("Pick" a paper by putting crosshairs on it and simultaneously pushing the ***p*** key; if you want to select Show Picked)

Is the display of links helpful in understanding the relationships of the papers?

Is the color coding of the links useful?

Other comments on the paper-level display:

Queries

Another way to "pick" documents is to pick a class of documents, rather than one individual. You can pick an entire class at once by performing an SQL query. Using ***t***, zoom up to the highest level of the landscape. Go up to the menu bar. Under Windows, select Manual SQL. Place the SQL window in a convenient location on the desktop.

Try an SQL query (title word, author name, institutional affiliation of an author, country of affiliation of an author, etc.). Zoom down to the lowest level to examine the effect of the SQL queries at the paper level. Note that the colors of the dots are the colors of the triangles at this level. Use the ***t*** key to get to the top of the landscape. Note how the colored dots are visible even at the highest level. Try a second query. Note that each time a query is made, those documents which meet the criteria are indicated by a different color on the landscape.

Comments on the SQL query capability:

Date Ranging

You can control the time period being displayed by using the time bar at the upper right of the screen. Currently the entire 5 year period is selected. Using ***t***, zoom out to the highest level of the landscape and select a one year time span by clicking on the down arrow. Slide the bar from one end of the time window to the other. Watch how the landscape changes over time. Zoom to an intermediate and then to the lowest level of the landscape and test the sliding time window at these positions.

Comments on date ranging:

Part Two: Applicability to Intelligence Problems

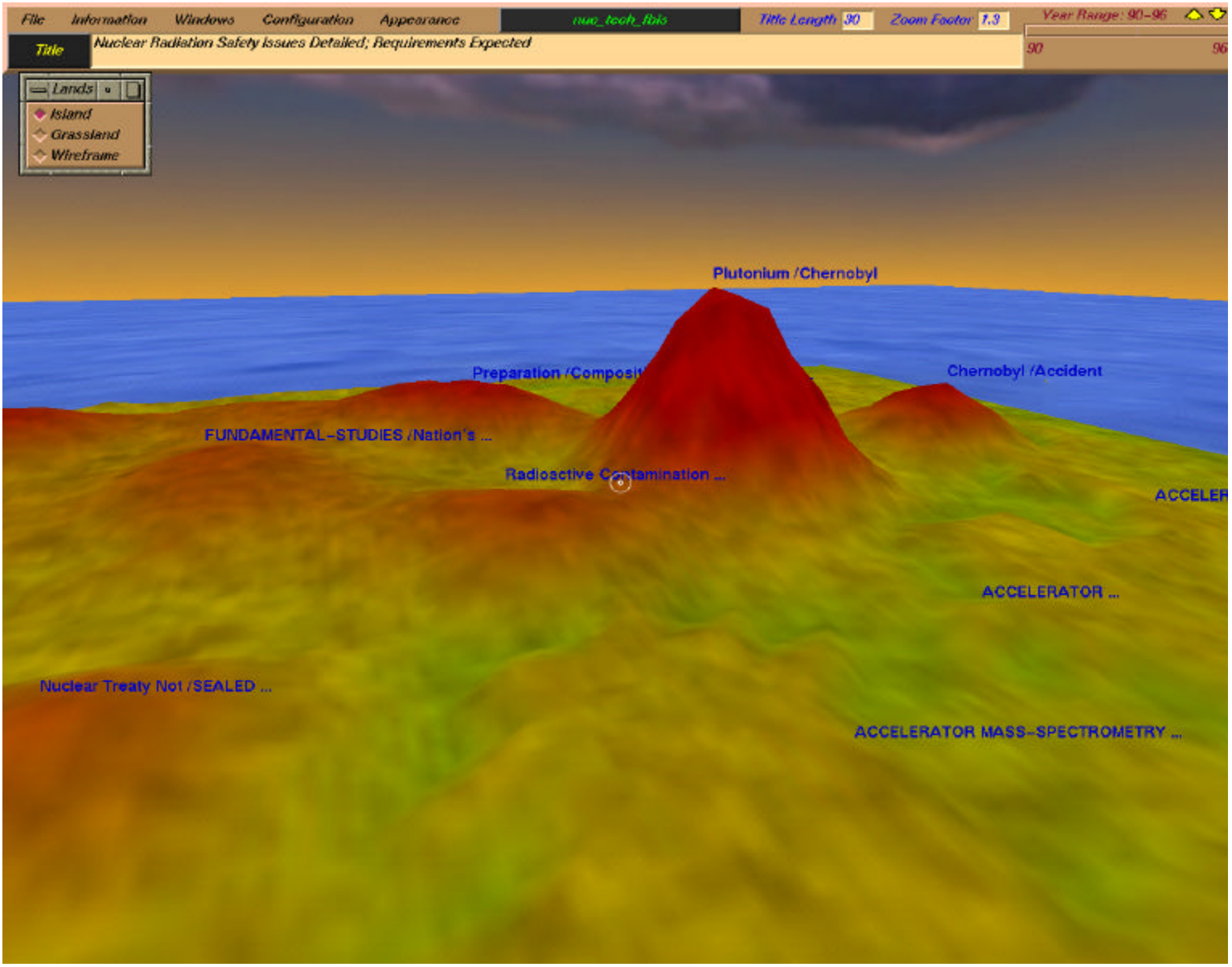
Experiment with the ISI nuclear science and technology landscape augmented by FBIS data to see if you find this approach to exploring unknown data useful. Imagine that the landscape is populated with additional documents, including those used by you in your analysis.

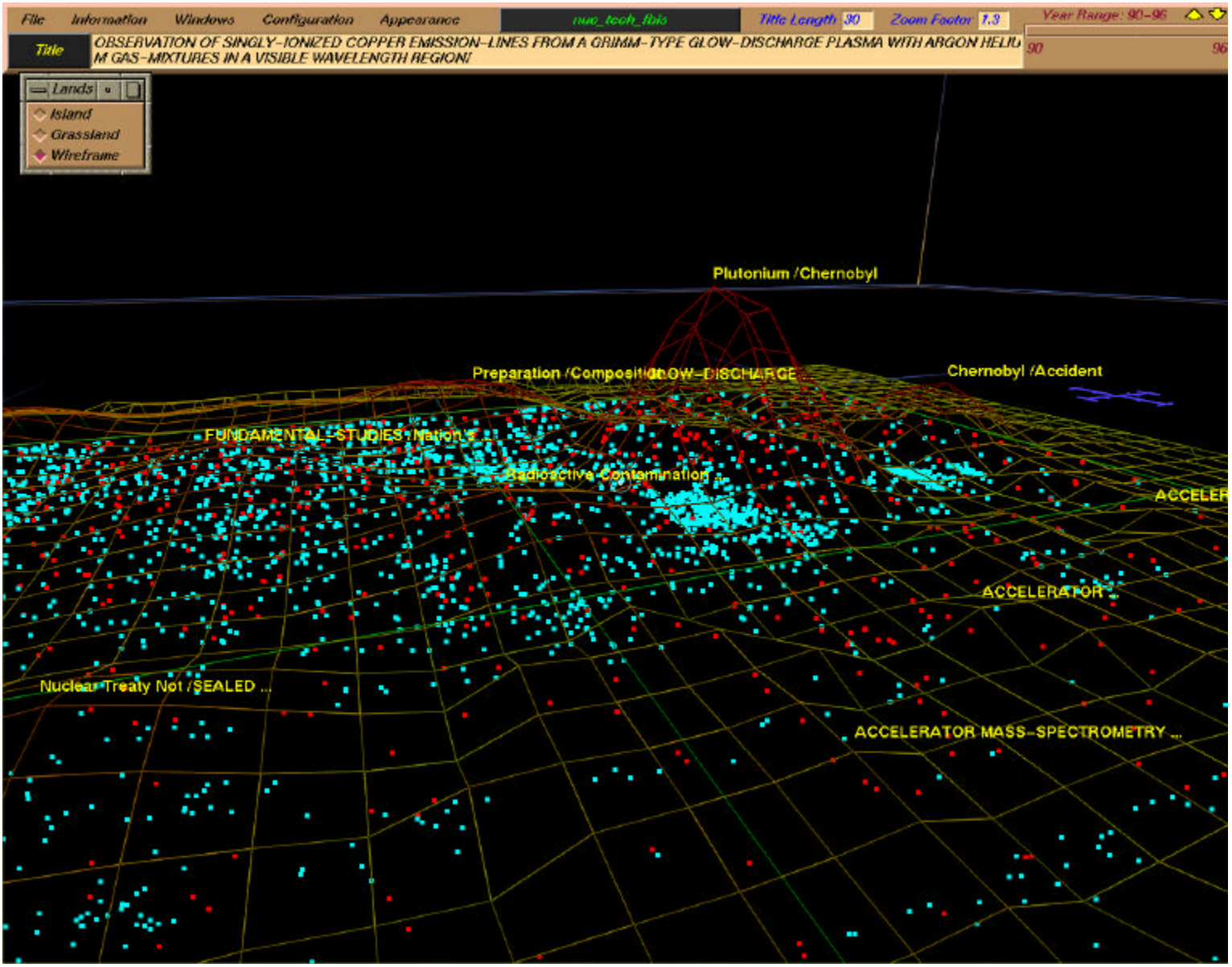
Try picking documents through an SQL query, and then seeing where they fall on the landscape by viewing them from the top level of the landscape. To get started, try an SQL query for ***plutonium smuggling*** in the ***title*** field. View it from the top level and then try some of the capabilities of the software: browsing through zoom, date ranging for trend analysis, additional SQL queries, etc.

If this tool were available on your workstation or network, how would you use it to explore data?

Which features would be useful to you in applying this tool to the kinds of problems you work?
Date ranging?
SQL queries?
Flying through the information space without having to formulate searches?
Other?

What capabilities need to be added to make this tool more useful to you?


File
Information
Windows
Configuration
Appearance
nuc_tech_fbis
Title Length 30
Zoom Factor 1.3
Year Range: 90-96
Title
Nuclear Radiation Safety Issues Detailed; Requirements Expected
90
96
Lands
Island
Grassland
Wireframe
Plutonium /Chernobyl
Preparation /Composi
Chernobyl /Accident
FUNDAMENTAL-STUDIES /Nation's ...
Radioactive Contamination ...
ACCELER
ACCELERATOR ...
Nuclear Treaty Not /SEALED ...
ACCELERATOR MASS-SPECTROMETRY ...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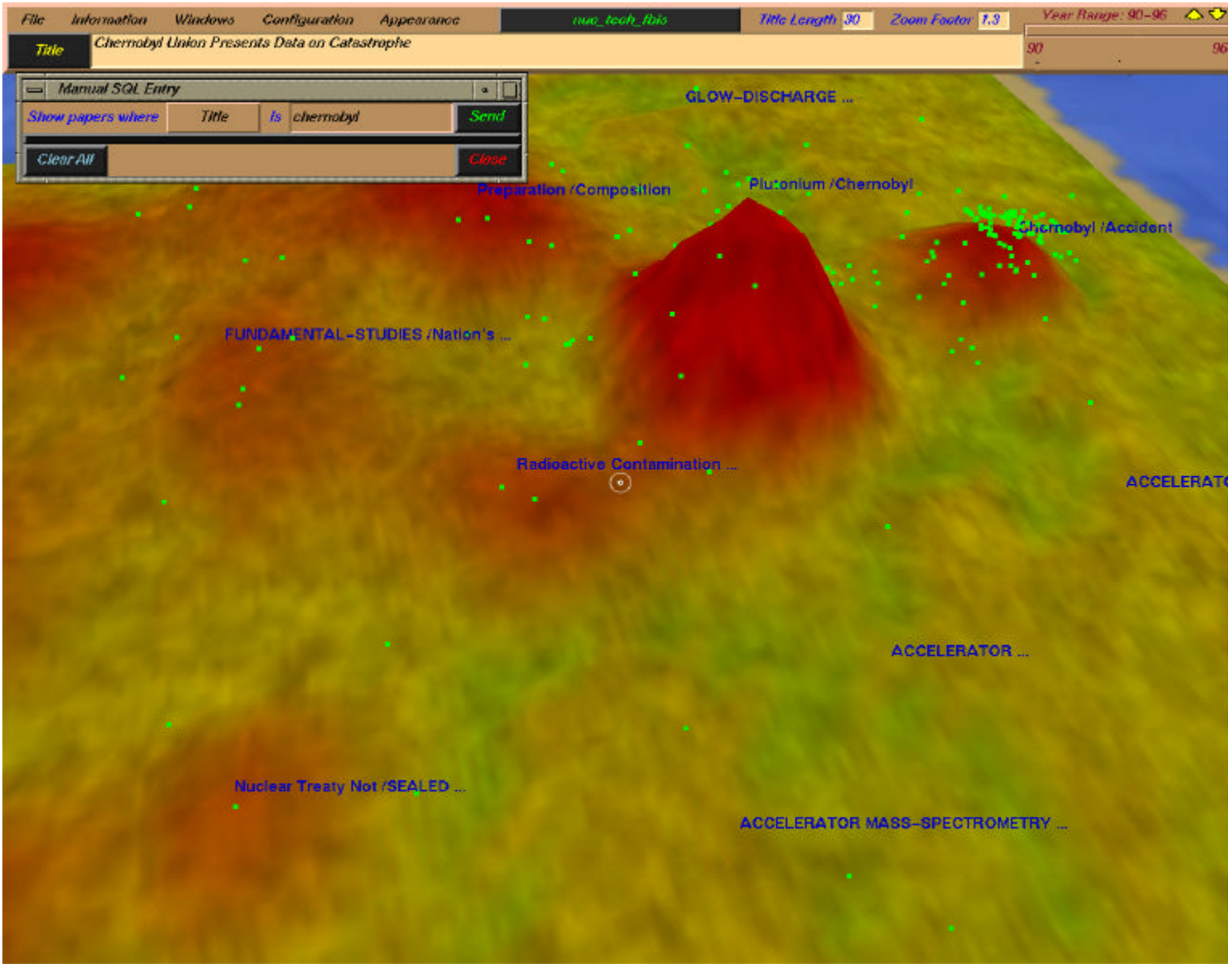
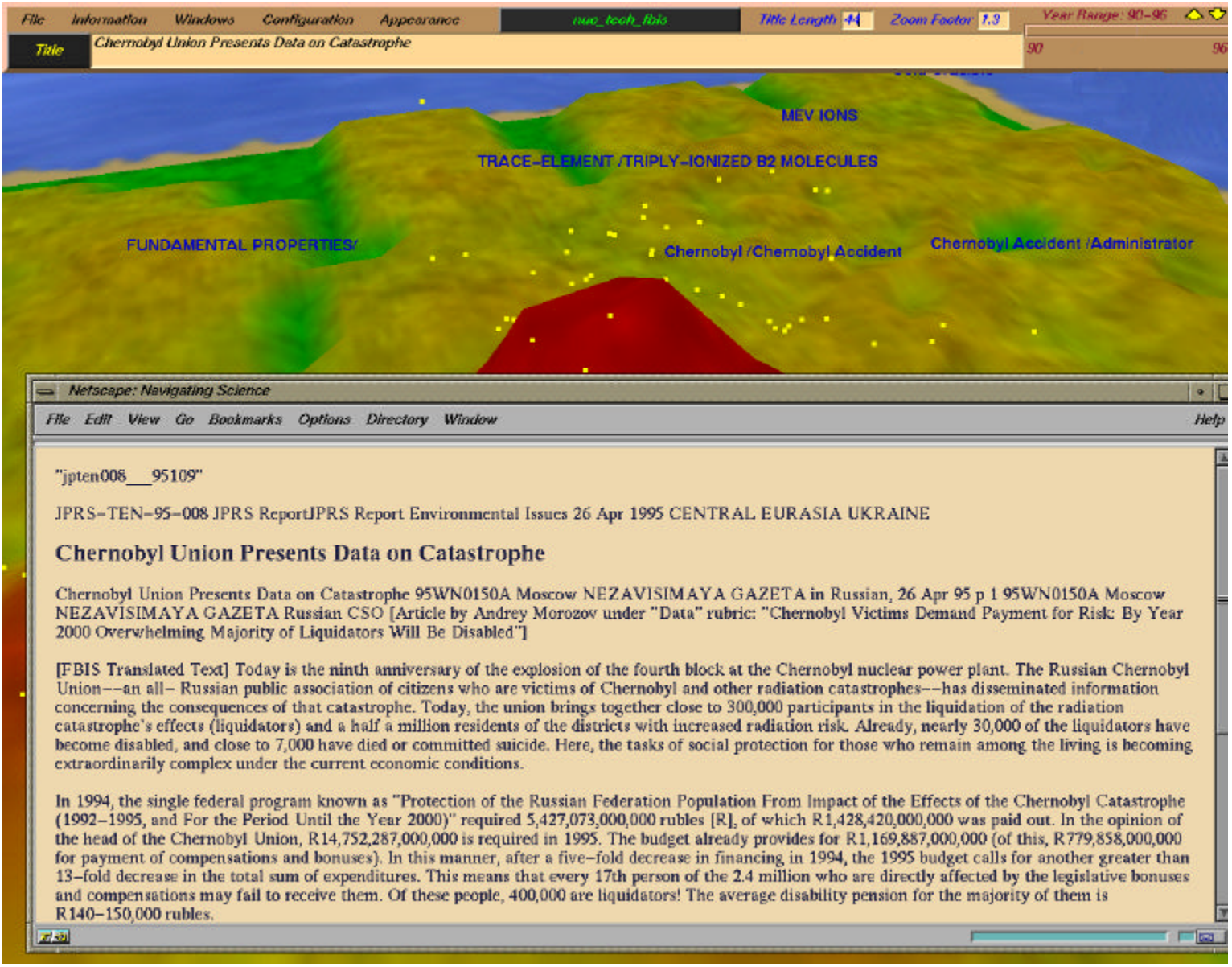
Information
Windows
Configuration
Appearance
nuc_tech_lbls
Title Length 30
Zoom Factor 1.3
Year Range: 90-96
Title
OBSERVATION OF SINGLY-IONIZED COPPER EMISSION-LINES FROM A GRIMM-TYPE GLOW-DISCHARGE PLASMA WITH ARGON HELIU
M GAS-MIXTURES IN A VISIBLE WAVELENGTH REGION!
90
96
Lands
Island
Grassland
Wireframe
Plutonium /Chernobyl
Preparation /Composition GLOW-DISCHARGE ...
Chernobyl /Accident
FUNDAMENTAL STUDIES Nation's
Radioactive Contamination ...
ACCELER
ACCELERATOR ...
Nuclear Treaty Not /SEALED ...
ACCELERATOR MASS-SPECTROMETRY ...


File
Information
Windows
Configuration
Appearance
nuc_tech_fbis
Title Length 30
Zoom Factor 1.3
Year Range: 90-96
Title
Chernobyl Union Presents Data on Catastrophe
90
96
Manual SQL Entry
Show papers where
Title
Is
chernobyl
Send
Clear All
Close
GLOW-DISCHARGE ...
Preparation /Composition
Plutonium /Chernobyl
Chernobyl /Accident
FUNDAMENTAL-STUDIES /Nation's ...
Radioactive Contamination ...
ACCELERATO
ACCELERATOR ...
Nuclear Treaty Not /SEALED ...
ACCELERATOR MASS-SPECTROMETRY ...



"jpten008___95109"

JPRS-TEN-95-008 JPRS ReportJPRS Report Environmental Issues 26 Apr 1995 CENTRAL EURASIA UKRAINE

Chernobyl Union Presents Data on Catastrophe

Chernobyl Union Presents Data on Catastrophe 95WN0150A Moscow NEZAVISIMAYA GAZETA in Russian, 26 Apr 95 p 1 95WN0150A Moscow NEZAVISIMAYA GAZETA Russian CSO [Article by Andrey Morozov under "Data" rubric: "Chernobyl Victims Demand Payment for Risk: By Year 2000 Overwhelming Majority of Liquidators Will Be Disabled"]

[FBIS Translated Text] Today is the ninth anniversary of the explosion of the fourth block at the Chernobyl nuclear power plant. The Russian Chernobyl Union--an all- Russian public association of citizens who are victims of Chernobyl and other radiation catastrophes--has disseminated information concerning the consequences of that catastrophe. Today, the union brings together close to 300,000 participants in the liquidation of the radiation catastrophe's effects (liquidators) and a half a million residents of the districts with increased radiation risk. Already, nearly 30,000 of the liquidators have become disabled, and close to 7,000 have died or committed suicide. Here, the tasks of social protection for those who remain among the living is becoming extraordinarily complex under the current economic conditions.

In 1994, the single federal program known as "Protection of the Russian Federation Population From Impact of the Effects of the Chernobyl Catastrophe (1992-1995, and For the Period Until the Year 2000)" required 5,427,073,000,000 rubles [R], of which R1,428,420,000,000 was paid out. In the opinion of the head of the Chernobyl Union, R14,752,287,000,000 is required in 1995. The budget already provides for R1,169,887,000,000 (of this, R779,858,000,000 for payment of compensations and bonuses). In this manner, after a five-fold decrease in financing in 1994, the 1995 budget calls for another greater than 13-fold decrease in the total sum of expenditures. This means that every 17th person of the 2.4 million who are directly affected by the legislative bonuses and compensations may fail to receive them. Of these people, 400,000 are liquidators! The average disability pension for the majority of them is R140-150,000 rubles.

File
Information
Windows
Configuration
Appearance
nuc_tech_fab
Title Length 22
Zoom Factor 1.3
Year Range: 90-96
Title
PERFORMANCE-CHARACTERISTICS OF THE 3-MV TANDETRON AMS SYSTEM AT THE NATIONAL-OCEAN-SCIENCES-AMS-FACILITY!
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Abstract
Operational and machine performance parameters are discussed for the National ocean Sciences AMS system. The system n-routinely measures between 50 and 100 carbon samples per week in largely unattended mode using one of two functional high-current ion sources. System development and procedures are described that enable us to resoh and maintain the high precision level required for the measurement of deep sea water dissolved inorganic carbon samples.
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