

The logo features the text "DOE 2000" in a large, bold, blue serif font, with "Electronic Notebook Project" in a smaller, bold, blue serif font below it. The text is set against a light gray background with a subtle grid pattern. Two small, dark, rectangular icons resembling electronic components are positioned on either side of the top text. A vertical, glowing yellow bar is centered below the text.

**DOE 2000**  
**Electronic Notebook Project**

# **Development of an Interoperable Electronic Notebook Architecture**

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**Jim Myers**                **PNNL**  
**Noel Nactigal**            **Sandia National Labs**



Research sponsored by Mathematics, Information and Computational Sciences Office  
U.S. Department of Energy



# Background DOE 2000 Project



Computer Science and Mathematics

- **DOE 2000: R&D program to develop laboratories without walls**
  - Collaboration tools to unite expertise, instruments, and computers
  - Enable scientists to carry out cooperative research independent of geography

**ongoing since 1996**

- **Collaboration Tools Taxonomy**



## Persistent Information

- Email
- News group
- Papers
- Mail
- **Electronic Notebook**



## Real Time Information

- Telephone
- Video Conference
- Chat/White board
- Shared authoring & applications
- Shared VR space
- Instrument control



# Motivation for Notebooks in DOE2000



Computer Science and Mathematics

## Laboratory Notebooks are the Heart of Scientific Research

Used in many different ways:



Personal notebook  
Project notebook  
Instrument log book  
Design notebook

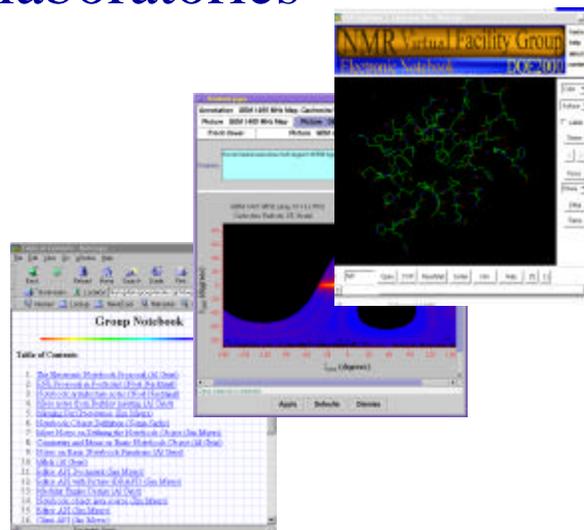
Experiment log book  
Record keeping  
Regulations

**Notebook is a chronological record of ideas, data and events.**

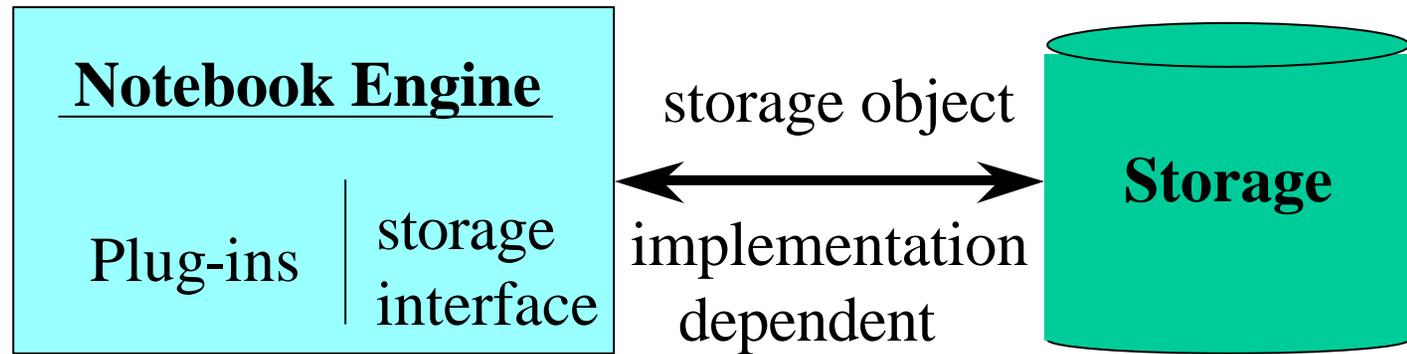


# Project Goals

- Design a common (open) Notebook Architecture
  - extensible as technology advances
  - interoperable with other notebook viewers
  - customizable for unique inputs & policies of a given project
- Develop reference implementations (hear of 2 today)
  - make them available to DOE laboratories
  - general research community
  - education
  - industry



# Notebook Architecture Design



Notebook Object

(Web Browser based)

- familiar interface
- widely used and available
- existing standard
- cross-platform
- lots of existing software

**Notebook Client**  
Optional plug-in  
data editors



# Notebook Object (NOB) Key to Interoperability



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NOB is the data standard used by notebook clients and editors to pass information back and forth.

- **Mandatory key-value pairs**
  - authorName (string)
  - objectID (engine specific object identifier)
  - dateTime (string in GMT format)
  - label (user-defined summary – important for nontext Nobs)
  - dataType (MIME type/sub type of data)
  - data (string or byte array)
  - dataRef (URL to data if data value is null)
- **User defined key-value pairs**
  - Provide means to customize notebook implementations

[www.csm.ornl.gov/enote/nob.html](http://www.csm.ornl.gov/enote/nob.html)



# Customization thru Nob and Editor API



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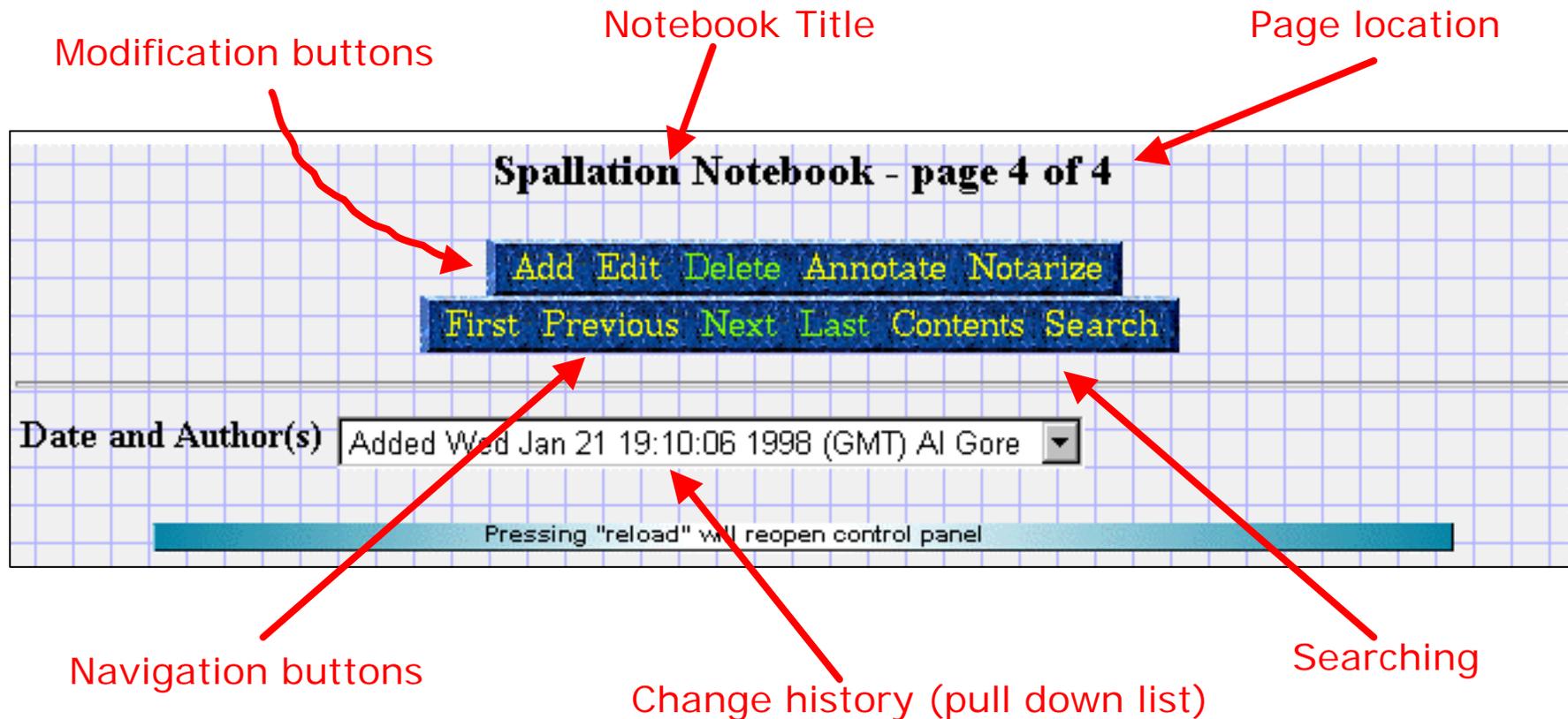
Adoption of a notebook standard requires a open architecture and also a means for vendors to customize or add value to their implementations.

- **NOb key-value pairs**
  - Can be used to integrate security, digital signatures
  - Provide for new and user-defined data types
  - Much more...
- **Editor API**
  - Provide means to extend notebook client editors
  - See URL below for required methods for new editors
  - See talk by Elena Mendoza at 1:30 for examples

[www.csm.ornl.gov/enote/editorAPI.html](http://www.csm.ornl.gov/enote/editorAPI.html)



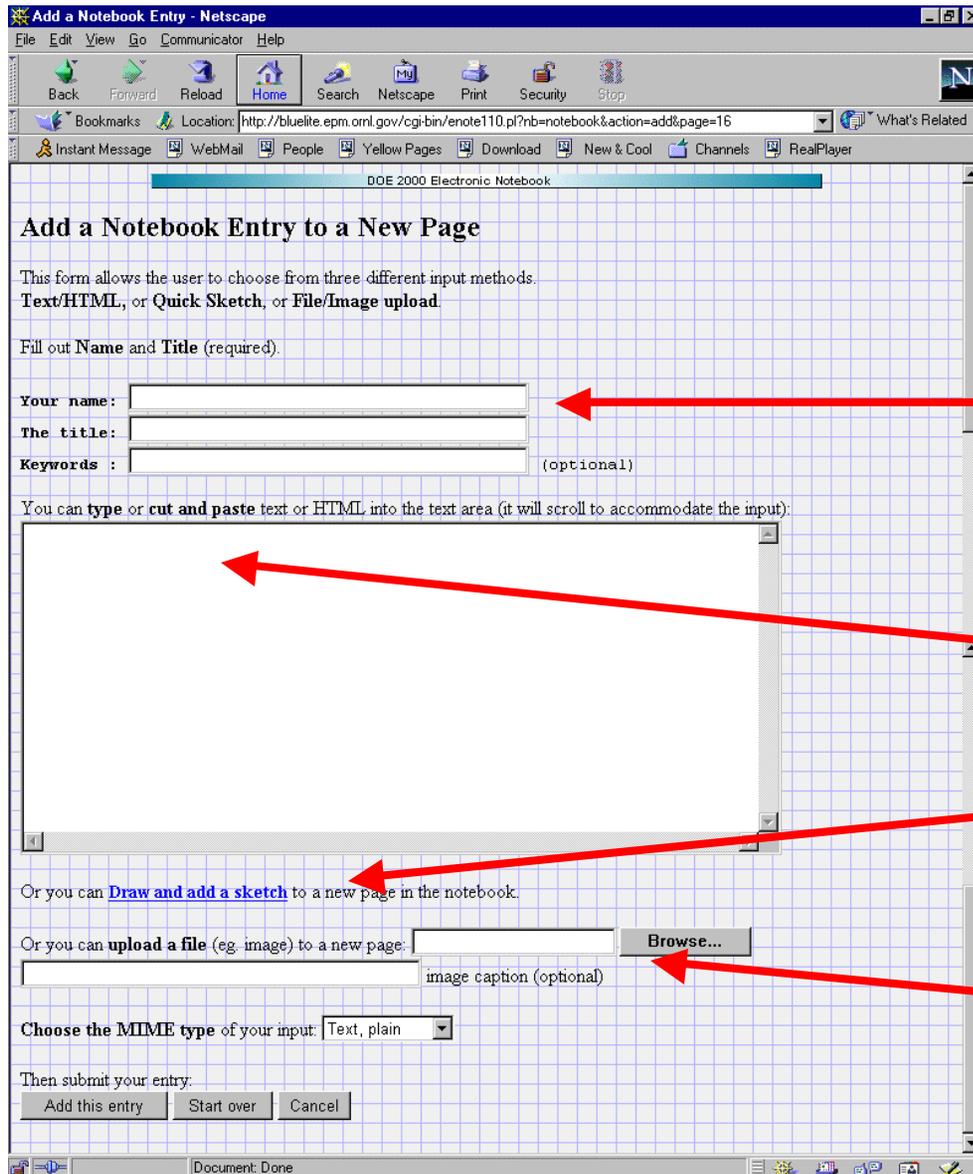
# Basic Functionality of Notebook



- **Non-compliance features requested by users**

- Editing existing pages (until notarized)
  - Deleting pages (but not actually removed)
- } Can be disabled at setup

# Features of Add Page



## Three input methods

1. Text/HTML
2. Quick sketch
3. File/image upload

Author (required)  
Title (required)  
Keywords

Type or cut and paste  
text or HTML

Freehand Sketch  
(Java applet)

Upload image and  
caption or file

# Customization thru Worksheet Templates

For certain experiments it is much more efficient to present notebook users with a custom form (worksheet) to record data.

Page Title/Subject:	<input type="text"/>			(req)	
Keywords :	<input type="text"/>			(req)	
Select Image Source (eg. image) to add to new page, Default = TPM Server	Default Server:	<input type="text" value="TPMServer"/>			
	HTTP Server:	<input type="text"/>			
	Note: A Full URL Path is Required, Blank entry defaults to TPMServer				
		Alternate Pre-Defined Image Sources <input type="text"/>			
Expt. Conditions:  Expt. Parameters which are BLANK are	Acc Voltage:	<input type="text" value="300.00kV"/>	Mag/Cam.Len.:	<input type="text" value="200kX"/>	Mode:
	SpotSize:	<input type="text" value="7"/>	Probe Current:	<input type="text" value="0.5nA"/>	X,Y,Z,Tx,Ty:
	Cond Aperture:	<input type="text" value="30um"/>	Obj Aperture:	<input type="text"/>	Proj Aperture:
	Gun Vac:	<input type="text" value="&lt;1x10-11T"/>	LCol Vac:	<input type="text" value="&lt;1x10-11T"/>	Col Vac:

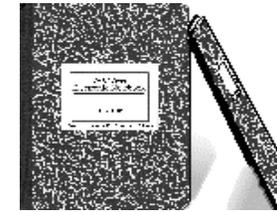


Selective Image grab

Some data automatically inserted by the instrument

Template produced by Nestor Zaluzec for the Materials Microscopy Collaboratory

# ORNL Electronic Notebook

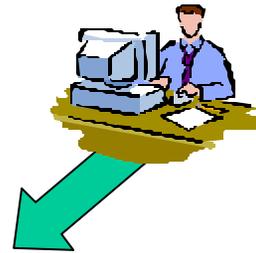
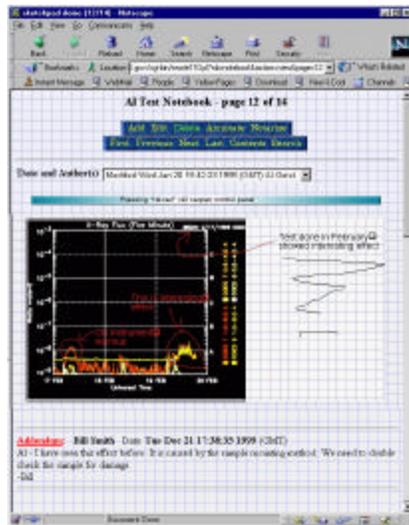


## Shared electronic notebook

Accessible with password  
through secure web site



Reading  
entries

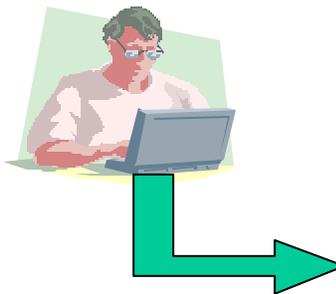


Drag and  
drop notes  
from private  
to shared  
notebooks



Annotation by  
remote colleagues

**Personal  
(stand alone)  
notebook**

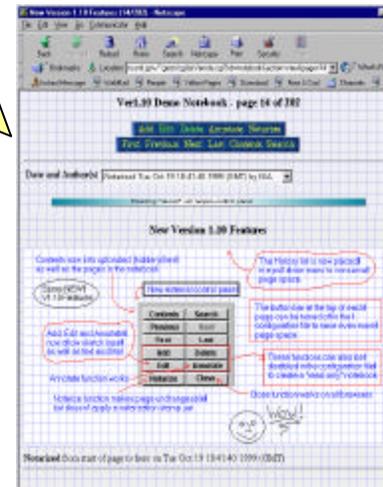


## Advantages and Features

- ↳ look&feel of paper notebook
- ↳ access from any web browser
- ↳ no user software to install
- ↳ can be shared across group
- ↳ or setup as personal notebook
- ↳ can run stand alone on laptop

## Input from

- Keyboard
- Wireless PDA
- Files
- Images
- voice
- Instruments
- sketchpad



[www.epm.ornl.gov/~geist/](http://www.epm.ornl.gov/~geist/)

# Many Uses beyond Compliant Notebooks



Computer Science and Mathematics



The technology lends itself to a broad set of uses many of which don't require any special compliance

## Existing Uses:

- shared project notes
- proposal development
- meeting notes
- instrument logs
- centrally updated manuals
- (chemical) inventory
- distance learning
- teaching tool
- patient medical records
- medical research logs
- project tracking
- private notebooks



# Popular across a Wide Range of Users

## Government

All DOE Labs  
NASA  
EPA  
USDA  
DOD

## Industry

Unilever  
Eli Lilly  
Berlex  
3M  
DynaCorp  
Kellogg  
EMS  
Scripps Howard  
Hydro-Qubec Power  
BP Chemicals  
Hoffmann La Roche  
Many more...

## Medicine

Mass. General Hospital  
St. Junes Childrens Hospital  
Chicago Medical Center  
Sloan-Kettering Cancer Center  
Walter Reed Army Hospital  
Etc...

## Education

Krell Institute  
Ohio State  
U. Delaware  
SUNY  
RPI  
U. Mass.  
NCSU  
Penn. State  
Portland State U.  
Shodor Education Foundation  
Many more...



[www.csm.ornl.gov/enote/allusers.html](http://www.csm.ornl.gov/enote/allusers.html)

**ornl**

# For Further Information

*DOE 2000* Electronic Notebook Website

[www.csm.ornl.gov/enote/](http://www.csm.ornl.gov/enote/)

Follow links to:

[Download free notebook software](#)

**More info on ORNL notebook**

[www.csm.ornl.gov/~geist](http://www.csm.ornl.gov/~geist)

**See other talks in this conference**

Thursday 1:30 by Elena Mendoza

Friday 4:15 by Al Geist