ESAAB-Equivalent Review

Office of Basic Energy Sciences

CD-3, Approve Construction Start
for the
Center for Nanophase Materials Sciences
A Nanoscale Science Research Center
at ORNL

February 2003

ORNL Site Office

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Management Contractor for DOE's
Oak Ridge National Laboratory

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CNMS Critical Decision-3 Outline

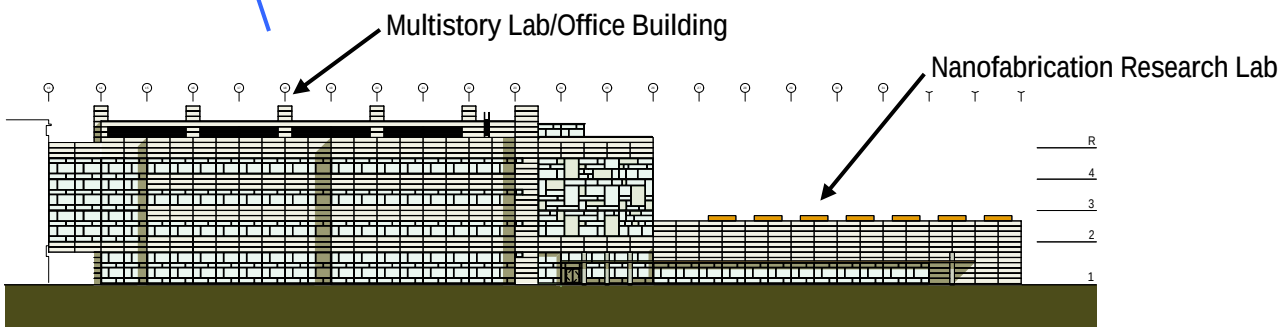
- Scope
- Cost
- Schedule
- CD-3 Prerequisites

Project Scope

- **The CNMS is composed of a multi-story building approximately 80,000 gsf, including a four story office and lab building and a connected single story clean room building and it will be located on Chestnut Ridge, which is also the site of the SNS**
  - **The Nanofabrication Research Laboratory is approximately 10,000 gsf, including clean rooms and support spaces**
  - **The four story portion of the facility includes wet and dry research labs, the Nanomaterials Theory Institute, and offices for staff and visiting researchers**
- **Technical equipment capabilities are defined in the Project Execution Plan**

Center for Nanophase Materials Sciences

- **CNMS will be located adjacent to the Central Lab and Office Building of the SNS**



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Nanofabrication Research Lab (NRL)

- **Clean rooms and service chases comprise 10,000 gsf and include class 100, class 1,000 and class 100,000 space depending on the equipment located in the space.**
- **Design features were provided to meet the EVA (Electromagnetic fields, vibration, and acoustic) requirements for the technical equipment.**

CNMS Technical Equipment Capabilities

- **Technical equipment capabilities were defined by the technical community at two nanoscience workshops.**
- **CNMS will provide:**
  - **Synthesis equipment for soft, hard and hybrid nanoscale materials**
  - **Nanofabrication equipment for patterning and synthesis on the nanoscale**
  - **Nanophase characterization (molecular, structural, chemical, magnetic) equipment**
  - **Dedicated computational resources**

CNMS Title II Cost Estimate

Conventional Facilities	30,240,000
Technical Equipment	24,910,000
Subtotal	55,150,000
Contingency (16% of subtotal)	8,850,000
Total Estimated Cost	$ 64,000,000
Other Project Costs	1,000,000
Total Project Cost	$ 65,000,000

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Funding Profile

FY	BA	Commitment	OPCs
PED			
2001	$ 0	$ 0	$ 0.250 M
2002	$ 1.5 M	$ 1.5 M	$ 0.225 M
2003	$ 1.0 M	$ 1.0 M	
Construction			
2003	$ 24.0 M	$ 24.0 M	$ 0.100 M
2004	$ 20.0 M	$ 20.0 M	$ 0.250 M
2005	$ 17.5 M	$ 17.0 M	$ 0.100 M
2006	$ 0	$ 0.5 M	$ 0.075 M
Total	$ 64.0M	$ 64.0M	$ 1.000 M

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CNMS Project Schedule

Task/Milestone	Completed
CD-0 (Approve Mission Need)	June 13, 2001
CD-1 (Approve Prelim. Baseline Range)	February 22, 2002
Title I & II Design Completed	December 9, 2002
External Independent Review	July 22-26, 2002
CD-2 (Approve Performance Baseline)	September 5, 2002
Independent Project Review	December 10-12, 2002
CD-3 (Approve Construction Start)	*February 3, 2003*
Construction Start	May 31, 2003*
CD-4a (Initial Operations)	February 28, 2005*
CD-4b (Full Operations)	September 30, 2006

*CD-4a delayed from December 2004 due to impact of FY2003 Continuing Resolution constraints on new construction starts. Dates based on construction funds available early February 2003.

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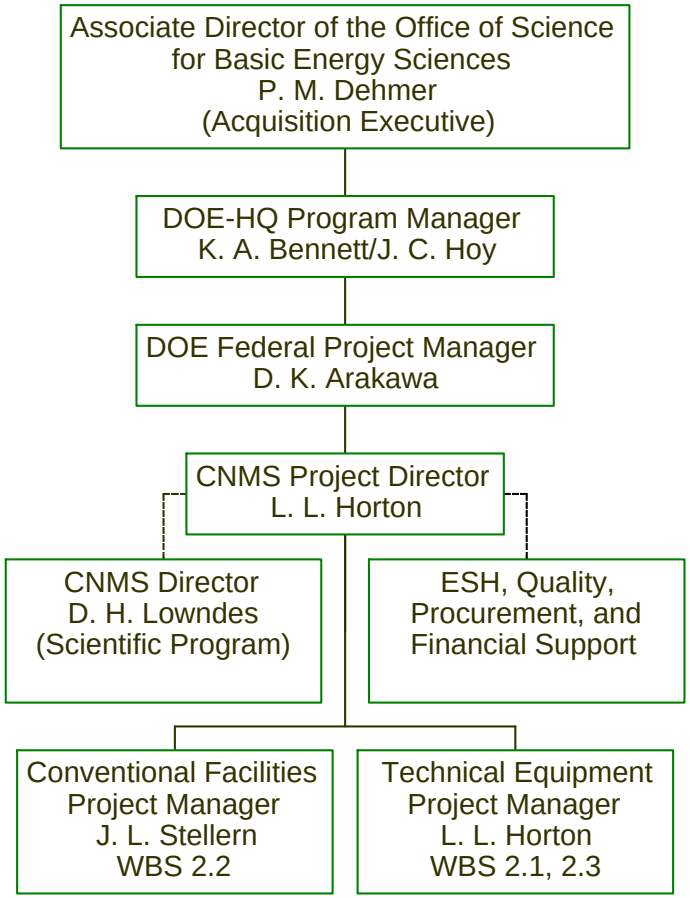
CNMS Project Organization Chart



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CD-3 Prerequisites

- Verification of Mission Need - yes
- Final Project Execution Plan and Performance Baseline - yes
- Final Design and Procurement Package - yes
- Budget and Congressional Authorization and Appropriation Enacted - pending
- Approval of Safety Documentation- yes
- Risk Assessment/Plan- yes
- Execution Readiness Independent Review - yes
- Excess Space - yes

Mission Need

- **Nanoscale Science Research Centers (NSRC) were recommended by the NSTC Interagency Working Group on Nanoscale Science, Engineering, and Technology as part of DOE's contribution to the National Nanotechnology Initiative.**
- **The CNMS will be a highly collaborative and multi-disciplinary user facility that provides a unique resource for nanoscale science research.**
- **The CNMS will integrate nanoscale research with neutron science, synthesis science, and theory/modeling/simulation.**

Final Project Execution Plan and Performance Baseline

- **The CNMS Project Execution Plan has been revised and is ready for approval**
- **The CNMS Performance Baseline was reviewed by the Execution Readiness Independent Project Review team and the Committee concluded "the CNMS project was being managed as needed to begin construction."**

Final Design and Procurement Package

- **The CNMS Final Design Drawings were completed on December 9, 2002 and reviewed by the Execution Readiness Independent Project Review team.**
- **The conventional facilities procurement bid package is being prepared by the construction manager.**

Budget and Congressional Authorization and Appropriation Enacted

- **The Senate passed an Omnibus Bill**
- **The House has yet to pass an Omnibus Bill**
- **The current Continuing Resolution expires on January 31, 2003.**

Safety Documentation

- **The CNMS ES&H plan was revised to include the latest chemical and gas inventory projections**
- **The CNMS Hazards Screening/Safety Assessment has been revised to incorporate the broad range of hazards (e.g., lasers, high pressures, etc.) and a brief description of how such hazards are controlled (e.g., relevant procedures) at ORNL**

Risk Assessment/Plan

- **The project risk assessment/plan was issued to:**
  - **identify risks to the project,**
  - **the likely cause and the seriousness of the problem, and**
  - **identify mitigation actions to prevent the problem from occurring or minimizing the impact to the project**
- **The project risk assessment/plan was revised following a recommendation from the Independent Project Review to more fully describe the methodology used in preparing/assessing the risks.**

Independent Project Review

- **The Office of Science conducted an Execution Readiness Independent Review of the CNMS on December 10-12, 2002.**
- **There was one action item from the review to conduct a formal external technical review of the conventional facilities design prior to award of the CNMS general construction subcontract.**
  - **ORNL awarded a subcontract to Abbie Gregg, Inc. (AGI) to perform an independent design review.**
  - **The final report from AGI will be completed on February 25, 2003; the award of the conventional facilities subcontract is scheduled for May 31, 2003.**

CNMS Space Elimination

- **Agreement signed by the ORNL Site Manager and the Thomas Jefferson National Accelerator Facility Site Manager to allocate 80,000 square feet of East Tennessee Technology Park (ETTP) space for offset of the new space from the construction of the CNMS.**

Federal Project Manager Assessment

- **Recommend (CD-3) construction start approval**

ESAAB-Equivalent Review

- **Questions?**

ESAAB-Equivalent Review

Backup Slides

Work Breakdown Structure

- 2.0 Center for Nanophase Materials
  - 2.1 Technical Equipmen
    - 2.1.1 Equipment
    - 2.1.2 Procurement
    - 2.1.3 Installation
    - 2.1.4 Test and Checkout
    - 2.1.5 Specification Developn
    - 2.1.6 Project Management
  - 2.2 Conventional Facilitie
    - 2.2.1 Design
    - 2.2.2 Construction
    - 2.2.3 Project Management
    - 2.2.4 Design Support
    - 2.2.5 Construction Managen
    - 2.2.6 Construction Support
    - 2.2.7 Title III Services
  - 2.3 Other Project Costs
    - 2.3.1 CDR/VE Study
    - 2.3.2 Scientific Scope Devel
    - 2.3.3 ES&H Documentation
    - 2.3.4 Engineering Support

CNMS Project Interfaces

- **The ORNL Site Office and the DOE SNS Project Office are participating in monthly coordination meetings with the CNMS project team and the SNS project team.**

- **An Implementation Plan for construction of the CNMS has been approved to describe how the interfaces between the CNMS and the SNS will be managed.**

Contingency/Risk Analysis

- **Contingency Analysis was performed for the individual WBS elements to determine the required amount of contingency**
- **Design and Design Support**
  - **Title I & II is complete**
  - **Specifications and Statement of Work for the Construction subcontract bid package is ongoing**
  - **0% contingency has been assigned**

Contingency/Risk Analysis (contd.)

- **Construction**
  - **Construction contract will be competitively bid. Changing market conditions could result in bids exceeding the estimate. There are additional risks of changes during construction due to errors in the design, differing site conditions and conflicts with other construction activities at the SNS site.**
  - **18.8% contingency has been assigned**

Contingency/Risk Analysis (contd.)

- **Technical Equipment (Equipment and supporting activities, including Project Management)**
  - **Over 90% of the technical equipment cost estimates were obtained within the past seven months.**
  - **No "design to order" procurements.**
  - **Over 50% of items are potentially foreign procurements.**
  - **15% contingency has been assigned.**
- **Construction Support, Construction Management, Project Management and Title III Support**
  - **The same risk of changes during construction will also impact the amount and duration of construction support, Title III support, etc. required.**
  - **15% contingency has been assigned.**

Turnover to Operations

- **For the conventional facilities, completion and turnover to operations will include a readiness assessment and the preparation of facility ESH documentation, including ISM hazard screening documentation. These activities will be completed prior to the CD-4a milestone in February of 2005.**

- **For each piece of technical equipment, turnover to operations will include an Acceptance Criteria List, ESH training and documentation, and a final readiness assessment prior to the CD-4b milestone in September of 2006.**

Environmental Strategy

- **CNMS was evaluated in the Environmental Assessment (EA) for the ORNL Facilities Revitalization Project.**
- **A Finding of No Significant Impact was issued June 2001.**
- **The CNMS scope proposed in the Conceptual Design Report was evaluated and it was determined that the FONSI remains valid.**

Acquisition Execution Plan

- DOE Under Secretary approved the Acquisition Execution Plan (AEP)
- UT-Battelle will use Knight/Jacobs for Title I and II engineering design, construction inspection, and construction management
- UT-Battelle will provide Architect-Engineer support, project management, procurement support, and construction support and utility tie-ins
- Knight/Jacobs will award fixed-price, subcontracts for construction activity
- UT-Battelle will procure technical equipment

Energy Conservation and Sustainable Design

- Design and construction of the CNMS will comply with 10 CFR 435. The project has completed a compliance analysis report.
- Sustainable building design principles are being applied to the design and construction of the CNMS. Standard practices will include using recycled content products, purchasing energy efficient and water efficient equipment and substituting less hazardous construction materials.
- Project waste disposal and recycle requirements will be incorporated into the CNMS procurement documents.

CNMS Technical Equipment

- **Soft Materials Characterization**
  - Gel Permeation Chromatography (GPC) and High Temperature GPC with Light Scattering Detector
  - UV–Vis Spectrophotometer
  - Fourier Transform Infrared Spectrometer (FTIR)
  - Nuclear Magnetic Resonance Spectrometer (NMR) - 600 MHz
  - Matrix–assisted laser desorption/ionization time–of–flight mass spectrometer (MALDI–TOF–MS)-benchtop
  - Physical characterization of polymers
  - Surface Analysis Equipment: Ellipsometer
  - Simultaneous Static and Dynamic Light Scattering Spectrometer

CNMS Technical Equipment

- **Nanophase Materials Synthesis and Characterization Equipment**
  - **MOPO and YAG Laser Systems**
  - **Continuous Wave (CW) Ti-sapphire Ring Laser**
  - **Tunable Raman Spectrometer**
  - **4-probe transport Scanning Tunneling Microscope**
  - **High–resolution Spin–polarized Scanning Electron Microscope (SEMPA)**
  - **X–ray Diffraction Laboratory for Multi–User Nanoscience**

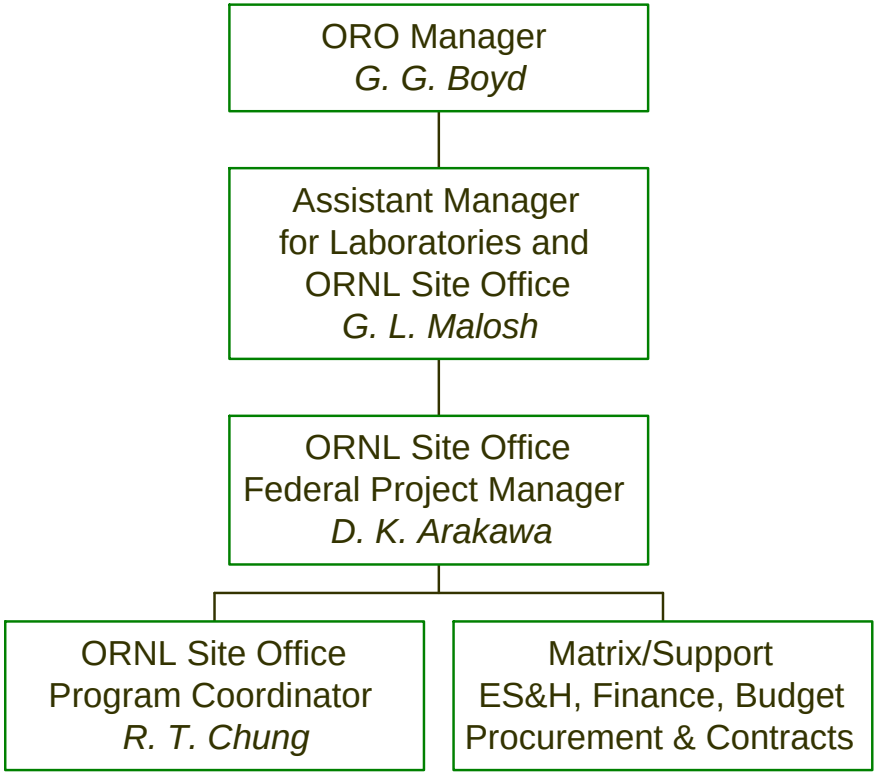
CNMS Technical Equipment

- **Nanofabrication Research Laboratory**
  - Direct Write Electron Beam Lithography (DWEBL) System
  - Double–Sided Contact Mask Aligner and Wafer Bonder System
  - Laser Pattern Generator/Mask Writer
  - Electron Beam Lithography and Photolithography Resist Processing Equipment and Development Tools
  - Plasma Etching and Deposition Equipment
  - Oxidation, Annealing, Diffusion and Low Pressure Chemical Vapor Deposition Furnaces
  - Thin Film Processing Equipment
  - Metrology and Inspection Tools
  - Ancillary Equipment
  - Focused Ion Beam (FIB) / Scanning Electron Microscope (SEM) (Dual–Beam System)

CNMS Technical Equipment

- **Nanomaterials Theory Institute**
  - 32-node Beowolf Cluster
  - 7 SGI Graphic Workstations
  - 16 screen video wall
- **General Use Equipment**
  - Laboratory Fume Hoods, furnishings, misc. equip.
  - Furniture and computers

ORO Organizational Interfaces



CNMS Construction Project Functional Organizational Detail

L. L. Horton
Director

B. P. Lovelace, Secretary

Financial Support
C. J. Cromwell
G. L. Scott

Technical Equipment
L. L. Horton
Project Manager

Conventional Facilities
J. L. Stellern
Project Manager

Other Project Costs
L. L. Horton
Project Manager

Environment, Safety, and Health
F. C. Kornegay

Operational Safety
R. B. Ogle

Procurement
B. R. Miller

Quality Assurance
M. C. Vance
W. E. Palmer

Technical Team

D. H. Lowndes,
CNMS Director
P. F. Britt
M. V. Buchanan
J. D. Budai
J. F. Cooke
P. T. Cummings
D. B. Geohegan
R. J. Kasica
D. G. Mandrus
E. W. Plummer
M. L. Simpson
J. M. Simonson
J. F. Wendelken

Conventional Facilities Project Team

C. L. Garren, Team Leader
F. Carden, Electrical
W. L. Collier, HVAC
R. M. Collins, Structural
R. C. Peters, Architectural
P. Stanish, Piping
J. Eckroth, Fire Protection
M. Siddiqi, AE/CM
Design Manger
J. Sells, AE/CM
Construction Engineer
G. C.Hart, Cost Estimator
J. H. Mikael, Scheduler

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