GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[X] ORIGINAL [ ] REVISION NO. _____

Project No. G-34-803 (T5094-2A1) GTRC/GIT XXXX DATE 4 / 24 / 85

Project Director: A. D. Van Nostrand MISC School/Lab XXXX English

Sponsor: Alfred P. Sloan Foundation

Type Agreement: Grant 85-4-15

Award Period: From 4/2/85 To 6/30/86 (Performance) 8/1/86 (Reports)

Sponsor Amount:	This Change	Total to Date
Estimated:	$	$
Funded:	$ 245,000	$ 245,000

Cost Sharing Amount: $ _____ Cost Sharing No: N/A

Title: RETLA Extension

ADMINISTRATIVE DATA — OCA Contact Ralph Grede x4820

1) Sponsor Technical Contact:

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212/582-0450

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630 Fifth Avenue
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Defense Priority Rating: _____ Military Security Classification: N/A

(or) Company/Industrial Proprietary: N/A

RESTRICTIONS

See Attached _____ Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with GIT - However no equipment is proposed.

COMMENTS:

Continuation of G-34-802. Overhead rate fixed @ 15%.

SPONSOR'S I. D. NO. 02.500.015.85.002

COPIES TO:

Project Director
Research Administrative Network
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Accounting
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Reports Coordinator, (OCA)
Research Communications (2)
GTRC
Library
Project File
Other A. Jones

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 10/16/86

Project No. G-34-803 School/~~Lab~~ English

Includes Subproject No.(s) N/A

Project Director(s) A. D. Van Nostrand GTRC /~~GIT~~

Sponsor Alfred P. Sloan Foundation

Title RETLA Extension

Effective Completion Date: 7/31/86 (Performance) 8/31/86 (Reports)

Grant/Contract Closeout Actions Remaining:

- [ ] None
- [X] Final Invoice or Final Fiscal Report
- [ ] Closing Documents
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. G-34-802 Continued by Project No.

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Project File
Other A. Jones
I. Newton
R. Embry

FORM OCA 69.285

2.11

House Bill H. R. 2006 to Clarify the Regulation of Solid Waste at DOE Facilities

and

House Bill H. R. 2593 to Require EPA to Establish and Regulate Radioactive Emission Standards at DOE Facilities

H. R. 2009 is a bill to amend the Solid Waste Disposal Act to clarify the jurisdiction of the EPA over the regulation of solid mixed waste, especially at DOE facilities. Both H. R. 2009 and H. R. 2593 are currently in committee review. The plan for future action on these two bills may call for a consolidation and for changes resulting from the hearing on mixed wastes.

99TH CONGRESS
1ST SESSION

H. R. 2009

To amend the Solid Waste Disposal Act to clarify the jurisdiction of the Environment Protection Agency over the regulation of solid waste mixed with radioactive materials at Department of Energy Atomic Energy Act facilities.

IN THE HOUSE OF REPRESENTATIVES

APRIL 4, 1985

Mr. LUKEN (for himself and Mr. WYDEN) introduced the following bill; which was referred to the Committee on Energy and Commerce

---

A BILL

To amend the Solid Waste Disposal Act to clarify the jurisdiction of the Environment Protection Agency over the regulation of solid waste mixed with radioactive materials at Department of Energy Atomic Energy Act facilities.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "Mixed Hazardous Waste Amendment Act of 1985".

FINDINGS

SEC. 2. The Congress finds that—

(1) the generation, transportation, treatment, and storage of solid waste mixed with radioactive material

poses potential hazards to public health and safety unless carefully planned and managed;

(2) the Department of Energy's Atomic Energy Act facilities are real or potential producers of such solid waste mixed with radioactive material; and

(3) the authority of the Environmental Protection Agency to regulate the disposal of solid waste mixed with radioactive material at the Department of Energy's Atomic Energy Act facilities should be clarified.

PURPOSE

SEC. 3. The purpose of this Act is to clarify the intent of Congress that the generation, transportation, treatment, and storage of solid waste mixed with radioactive material is subject to the Solid Waste Disposal Act, and that the disposal of solid waste mixed with radioactive material at Department of Energy Atomic Energy Act facilities, and at other facilities not licensed for the disposal of radioactive materials, is also subject to such Act.

CLARIFYING AMENDMENT TO DEFINITION OF SOLID WASTE

SEC. 4. Section 1004(27) of the Solid Waste Disposal Act is amended—

(1) by inserting "(A)" after "(27)";

(2) by striking out ", or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923)"; and

(3) by adding at the end thereof the following new subparagraphs:

"(B) Except as otherwise provided in subparagraph (C), the term 'solid waste' does not include source, special nuclear, or byproduct materials as defined in section 11 of the Atomic Energy Act of 1954 (42 U.S.C. 2014).

"(C) The term 'solid waste' shall include materials described in subpargraph (B) when—

"(i) such materials are part of any mixture or combination, if the other constituent part of such mixture or combination is a "solid waste" within the meaning of subparagraph (A), and

"(ii) such materials (I) are in the stage of generation, transportation, storage, or treatment, or (II) are disposed of at an Atomic Energy Act facility of the Department of Energy or other unlicensed location;

except that, this subparagraph shall not apply to wastes disposed of at a 'repository' as defined in section 2(18) of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101(18)).".

APPLICABILITY OF AMENDMENTS

SEC. 5. (a) This Act and the amendments made thereby are clarifying in nature with respect to the purpose stated in

section 3, and shall not be construed as altering the intent of Congress as to whether the Solid Waste Disposal Act, as in effect prior to the amendments made by this Act, applies to mixtures and combinations of solid waste which contain radioactive material which are disposed of at facilities licensed by a State or by the Nuclear Regulatory Commission, or as altering the applicability of any standards or requirements issued pursuant to the Solid Waste Disposal Act.

(b) Nothing in this Act shall be construed to affect, modify, or amend the Uranium Mill Tailings Radiation Control Act of 1978.

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99TH CONGRESS
1ST SESSION

H. R. 2593

To require the Administrator of the Environmental Protection Agency to establish certain standards for radioactive emissions from atomic energy defense facilities of the Department of Energy and to monitor radioactive and nonradioactive emissions from such facilities.

IN THE HOUSE OF REPRESENTATIVES

MAY 23, 1985

Mr. WYDEN introduced the following bill; which was referred jointly to the Committees on Armed Services, Energy and Commerce, and Public Works and Transportation

---

A BILL

To require the Administrator of the Environmental Protection Agency to establish certain standards for radioactive emissions from atomic energy defense facilities of the Department of Energy and to monitor radioactive and nonradioactive emissions from such facilities.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Military Radioactive Emissions Control Act of 1985".

SEC. 2. RADIATION STANDARDS AND EFFLUENT LIMITATIONS FOR ATOMIC ENERGY DEFENSE FACILITIES.

(a) STANDARDS FOR RADIOACTIVE RELEASES FROM LOW-LEVEL RADIOACTIVE WASTE.—Not later than 1 year after the date of the enactment of this Act, the Administrator of the Environmental Protection Agency shall, by rule, promulgate standards for the protection of the environment and the public health and safety from radioactive releases from the management and disposal of low-level radioactive waste at atomic energy defense facilities. Such standards shall not be less stringent than any environmental radiation protection standards or guidances that the Administrator may promulgate for radioactive releases from the disposal of low-level radioactive waste at facilities licensed by the Nuclear Regulatory Commission.

(b) WATER POLLUTION STANDARDS.—Section 502(6) of the Federal Water Pollution Control Act (33 U.S.C. 1362(6)) is amended by inserting after the first sentence the following: "With respect to discharges from atomic energy defense facilities (as such facilities are defined in section 5 of the Military Facility Radioactive Emissions Control Act of 1985), such term includes source material, special nuclear material, and byproduct material (as such materials are defined in section 11 of the Atomic Energy Act of 1954).".

(c) RADIONUCLIDE EMISSION STANDARDS.—

(1) Not later than 180 days after the date of the enactment of this Act, the Administrator shall, pursuant to the authority of the Administrator under the Clean Air Act (42 U.S.C. 7401 et seq.), revise the national emission standards for radionuclide emissions from atomic energy defense facilities.

(2) Such revised standards shall be equivalent to the environmental radiation protection standards established by the Administrator for commercial nuclear power operations.

(3) Such revised standards shall provide that an atomic energy defense facility may exceed such standards only if the President determines that a temporary and unusual condition exists at such facility and continued operation of such facility is in the national security interest. Not later than 30 days after any exceeding of such standards under this paragraph, the Secretary of Energy shall submit to the Congress a report setting forth the reasons the exceeding of such standards was required, the extent to which the operation of such facility is expected to result in radionuclide emissions in excess of such standards, and a schedule for achieving compliance with such standards.

SEC. 3. MONITORING BY ENVIRONMENTAL PROTECTION AGENCY.

(a) IN GENERAL.—The Administrator shall conduct sufficient monitoring, on a continuous or periodic basis, to permit the Administrator to analyze the extent of compliance of atomic energy defense facilities with emission standards, dose standards, effluent standards, effluent limitations, maximum contaminant levels, radiation guidances, and radiation standards established by the Administrator under section 2 or any other provision of Federal law.

(b) ONSITE MONITORING AND INSPECTION.—The Administrator shall conduct such onsite monitoring and inspection as the Administrator determines to be necessary to carry out this section.

(c) SPECIFIC MONITORING ACTIVITIES.—The monitoring conducted under this section shall include—

(1) stack and effluent monitoring at the site of atomic energy defense facilities;

(2) environmental monitoring of offsite areas, including surface waters;

(3) an assessment of the cumulative levels of radioactive and nonradioactive materials in sediments of surface waters in offsite areas; and

(4) any additional monitoring that the Administrator determines to be necessary to carry out this section.

SEC. 4. ANNUAL REPORT.

The Administrator shall annually submit to the Congress a report setting forth the findings and conclusions of the Administrator as a result of the monitoring conducted under this Act. Each such report shall include—

(1) a summary of the data, findings, assessments, and characterizations made by the Administrator under section 3;

(2) an analysis of the extent of the compliance of atomic energy defense facilities with emission standards, dose standards, effluent standards, effluent limitations, maximum contaminant levels, radiation guidances, and radiation standards established by the Administrator under section 2 or any other provision of Federal law; and

(3) any recommendations of the Administrator for legislative or other action to ensure the compliance of atomic energy defense facilities with such standards, limitations, levels, and guidances.

SEC. 5. DEFINITIONS.

For purposes of this Act:

(1) The term "Administrator" means the Administrator of the Environmental Protection Agency.

(2) The term "atomic energy defense facilities" means all facilities of the Department of Energy at

which any of the following functions are performed in whole or in part:

(A) naval reactor development and decommissioning;

(B) weapons activities including defense inertial confinement;

(C) verification and control technology;

(D) defense nuclear materials production;

(E) defense nuclear waste and materials by-product management and disposal;

(F) defense nuclear materials security and safeguards and security investigations; and

(G) defense research and development.

(3) The term "low-level radioactive waste" has the meaning given such term in section 2(16) of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101(16)).

SEC. 6. REIMBURSEMENT BY DEPARTMENT OF ENERGY.

The Secretary of Energy shall reimburse the Administrator for any expense certified by the Administrator to have been incurred by the Environmental Protection Agency in carrying out the provisions of this Act.

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2.12

The Spokesman-Review and Spokane Chronicle Editorial on Monitoring DOE Facilities

One way that citizens respond to issues before the Congress is to express themselves in newspaper editorials. This one is from The Spokesman-Review and Spokane Chronicle, Spokane, Washington.

Nuclear-monitoring job calls for independence

On glorious spring days like Tuesday, when flowers burst with color, sunshine cascades from a clear blue sky and the world seems fresh and young again, it is difficult to believe that our government contaminated Eastern Washington and endangered its inhabitants with the radioactive byproducts of nuclear-weapons production.

But it happened.

During the 1940s, '50s and '60s, when the Hanford Nuclear Reservation churned out plutonium for the U.S. nuclear arsenal, spring appeared every bit as beautiful and carefree as it does now.

The radioactive particles and gases that leaked in substantial quantities from Hanford's reactors and processing plants were, in most cases, invisible. The government, fearing a political backlash that could hamper its bomb production, decided against warning the communities it was contaminating.

If iodine 131 made its way into the thyroids of children or if plutonium dust lodged in the lungs of farmers or Hanford workers, they felt nothing. The suffering from radiation exposure comes years and decades later — in the form of thyroid disorders, lung cancer, leukemia and other nightmares.

If Hanford has claimed any victims, no one can say, for sure, who they were. Cancers do not come with labels identifying their cause. It will take careful epidemiological research to determine whether there have been any victims.

Not until Feb. 27, when the U.S. Energy Department released 19,000 pages of previously secret Hanford documents, did the public have any concept of the magnitude of Hanford's radiation pollution.

Now that the problem has come to light, House Majority Whip Tom Foley has supported calls for a congressional investigation into Hanford's releases; he also has urged the disclosure of data regarding still-classified radiation releases. For that, the Spokane Democrat is to be commended.

Like the still-unresolved controversy over disease caused by fallout from open-air nuclear-bomb tests in Nevada, the Hanford contamination presents Congress with a difficult challenge.

First, the public is entitled to impartial analysis of the amount of contamination and its public-health consequences. The agencies that concealed Hanford's releases in order to perpetuate bomb production cannot be trusted to perform this analysis.

Next will come questions about whether any victims should be compensated. Clearly, individual lawsuits would not work; even in similar cases, jury verdicts produce uneven results.

Compensation, if research shows there were victims, would be desirable. But what hope is there that some federal program would — or could — compensate Hanford's victims when the government still refuses, inexcusably, to compensate cancer-ridden military veterans who were exposed not merely to invisible dust from a distant weapons plant but to the blast and fallout from open-air nuclear-bomb tests in Nevada and the Pacific?

At the very least, the American public deserves an accounting of what harm it may have suffered from the construction of its nuclear arsenal.

And the issue isn't only what happened in the past. Plutonium production continues at Hanford today. As it did in the 1950s, the government continues to assure us that Hanford poses no danger.

The belated disclosure of past contamination is commendable, but the secrecy that surrounded those incidents at the time they occurred shows a need for some assurance that future incidents will not be concealed.

No such assurance is possible as long as nuclear-weapons plants are monitored only by the agency responsible for producing bombs; that invites concealment to keep production rolling.

If weapons plants also were monitored by an agency assigned to public health, the public would have a better chance of protecting itself from its own government.

WEDNESDAY, APRIL 9, 1986

THE SPOKESMAN-REVIEW
Founded 1883

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2.13

Testimony of Mary Walker, Assistant Secretary DOE, Before the House Subcommittee on Energy Conservation and Power

The summary, statement, and testimony of Mary Walker, Assistant DOE Secretary, given before the Subcommittee on Energy Conservation and Power, present a defense of the DOE environmental record and its action, in response to the Oak Ridge lawsuit (RCRA).

Summary Statement
of
Mary L. Walker
Assistant Secretary for Environment, Safety and Health
U.S. Department of Energy

Before the

Subcommittee on Energy Conservation and Power
and the
Subcommittee on Energy and Commerce
of the
U.S. House of Representatives

April 10,1986

It is the policy of the Department of Energy to conduct its operations "in compliance with the letter and the spirit of applicable environmental statutes, regulations, and standards."

The Department originally believed that certain of its facilities, that is, its Atomic Energy Act (AEA) defense facilities, were not subject to the Resource Conservation and Recovery Act (RCRA). However, the Department's position today and since 1984 is that both RCRA and AEA requirements are applicable to mixed waste resulting from DOE operations. Where the application of a RCRA requirement is inconsistent with AEA requirements, adaptations may be required.

On the related subject of byproduct material, the Department is currently evaluating public comments on the proposed rule that was published in November 1985. In addition, the Office of the Assistant Secretary for Environment, Safety and Health is conducting a policy review of the byproduct issue. Whatever the outcome of these efforts, it shall be DOE's policy that its wastes will be treated in a way that protects the public health and the environment.

In response to DOE's overall environmental challenges, Secretary Herrington has taken several initiatives that represent his personal commitment to a quality environment and to the safety and health of DOE workers and the public.

Statement of

Mary L. Walker

Assistant Secretary for Environment, Safety and Health

U.S. Department of Energy

Before the

Subcommittee on Energy Conservation and Power

and the

Subcommittee on Commerce, Transportation and Tourism

of the

Committee on Energy and Commerce

U.S. House of Representatives

April 10, 1986

Good Morning Mr. Chairman and Members of the Subcommittees. I am Mary Walker, the Assistant Secretary for Environment, Safety and Health at the Department of Energy.

I thank you for this opportunity to discuss Secretary Herrington's new initiatives in the environmental and safety area and to explain our current approach to mixed waste at the Department of Energy facilities.

As set forth in the Secretary's environmental policy statement of January 8, 1986, it is the policy of the Department to conduct its operations "in compliance with the letter and the spirit of applicable environmental statutes, regulations, and standards." This policy is, of course, fully applicable to mixed wastes.

I would like to provide some background information on the Department of Energy and the Resource Conservation and Recovery Act (RCRA) that is helpful in fully understanding the Department's current situation with respect to mixed waste. Section 1006(a) of RCRA provides that nothing in the Act applies to activities or

substances that are subject to the Atomic Energy Act of 1954 (AEA), except to the extent that RCRA's application would not be inconsistent with the Atomic Energy Act's requirements. On the basis of this provision in RCRA, the Department originally believed that the cumulative effect of differences between RCRA and the Atomic Energy Act resulted in certain of its facilities, that is, DOE's Atomic Energy Act defense facilities, remaining subject to regulation under the Atomic Energy Act. It was believed that the application of RCRA to these defense facilities would be inconsistent with the provision of the Atomic Energy Act that authorizes DOE to regulate its facilities so as to protect health and minimize danger to life or property. In addition, the Department believed that some aspects of the RCRA permitting program were inconsistent with its responsibility under the AEA to protect the integrity of classified information concerned with operations at these facilities, and with federal immunity from state regulation that was the prevailing rule when the Atomic Energy Act was adopted.

In 1984, in the case of L.E.A.F. or Legal Environmental Assistance Foundation v. Hodel, 586 F.Supp 1163 (E.D. Tenn. 1984), a United States District Court found that there is

no irreconcilable conflict between RCRA and the AEA, and that Section 1006(a) requires RCRA to give way only in specific instances in which DOE cannot comply with the requirements of both statutes.

The Department took no appeal from the District Court's judgment, but rather, adopted a policy of implementing the decision at its Atomic Energy Act defense facilities nationwide. Although the case did not involve, and the decision did not discuss mixed wastes as such, the Department felt that the dual character of mixed wastes warranted dual regulation: regulation under RCRA to guard against its chemical hazard, and regulation under AEA to guard against its radiological hazard. Where the application of a particular RCRA requirement is inconsistent with the AEA, as RCRA Section 1006(a) anticipates, adaptations may be required. This remains the Department's position today.

Two areas of potential inconsistencies have been identified: (1) national security, and (2) technical requirements. National security inconsistencies involve particular areas where the

regulatory process itself creates a potential for a breach of national security requirements through the unauthorized disclosure of classified or defense-related information. Again, these inconsistencies do not result in putting aside all RCRA requirements, but rather adapting those requirements to AEA requirements. Thus, the information is still available to the regulatory process, however, it is handled in a way that does not allow unauthorized disclosure. The other potential area of inconsistency, technical requirements, is similarly addressed.

Where a technical requirement of RCRA is inconsistent with AEA requirements, as for example, where compliance with RCRA would increase the radiation hazard, an alternate method of managing the waste would be developed so as to provide equivalent protection afforded by both statutory requirements or, if that were not possible in a particular instance, the RCRA requirement would be adapted to prevent an increased radiation hazard. In summary, the Department considers RCRA applicable to hazardous and mixed waste resulting from DOE operations. Consistent with this approach, DOE facilities were directed to apply for RCRA

permits for nonradioactive hazardous waste facilities and mixed waste facilities. In the case of the latter, the application was made to EPA, since no state has yet been delegated authority to regulate mixed waste under RCRA. In addition, my office has recently issued an interim policy concerning consultation and coordination with states regarding regulation of mixed waste under RCRA, pending EPA authorization of state programs. Under the interim policy, DOE will move forward to facilitate state participation in the regulation of mixed waste at DOE facilities, and will cooperate with the states and EPA, as necessary, to achieve a smooth transition of regulatory authority when authorization has been accomplished. We have already begun to implement this policy in a recent agreement reached among DOE, EPA, and the State of Colorado concerning DOE's Rocky Flats facility.

Now, if I may, I will turn to another subject that is routinely raised in the context of mixed waste. That subject is byproduct material.

RCRA provides an exclusion from the definition of solid waste, and thus, from hazardous waste, for "source, special nuclear, or byproduct material as defined by the Atomic Energy Act." However, at the time of RCRA's passage, the terms "source, special nuclear, and byproduct material" had not been previously used as waste-related terms, so there was no existing understanding of the meaning of these terms in the context of waste. As a practical matter, the AEA's definitions of "source material" and "special nuclear material" presented no difficulty in interpretation. The statutory definition of "byproduct material," however, does not identify specific substances and, thus, does present some difficulty in application in this context. For this reason, DOE has proposed an interpretative rule to clarify which DOE wastes are "byproduct material" and are therefore not subject to RCRA. That proposed rule was published in November 1985 (50 F.R. 45736, November 1, 1985). The Department is currently evaluating public comments on the proposed rule.

I do not feel it appropriate for me at this time to discuss the public comments, as such, because the Department, including my office, is now reviewing them in the context of the rulemaking. Moreover, my office is conducting a policy review of the byproduct issue. Because that review has just begun, I do not have any conclusions to share with you at this time.

Let me assure the Subcommittees, however, that no matter what regulatory program DOE's wastes fall under (AEA or RCRA), it shall be DOE's policy that its wastes will be treated in a way that protects the public health and the environment.

Secretary Herrington has responded to this and other environmental protection challenges that we face with a set of new initiatives. These new initiatives are the result of a thorough independent review of the Department's environment, safety, and health function conducted at Secretary Herrington's request.

- First, oversight responsibility for the environment, safety, and health function in the Department has been consolidated and upgraded under the new position of an Assistant Secretary for Environment, Safety and Health (ES&H).

- Second, ES&H will conduct a baseline Environmental Survey of all DOE facilities to identify Department-wide existing environmental problems and areas of potential risk and to prioritize corrective actions. The on-site Survey activities scheduled to begin in June 1986, are expected to be completed in 2 1/2 years, and will enable the Department to develop long-range planning for correcting environmental problems and reducing potential risks.

- Third, ES&H will conduct Technical Safety Appraisals of DOE's nuclear facilities to determine compliance with safety requirements, industry lessons learned, and licensed facility requirements. These will be on-site technical appraisals of all aspects of safety, including nuclear reactor safety,

nuclear process facility safety, health physics, training, emergency preparedness, occupational medicine, occupational safety, fire protection safety, and transportation and packaging safety. The Technical Safety Appraisals, begun in February 1986, will be completed in about 3 years. Recommended corrective actions requiring significant capital outlays will also be prioritized for long-range planning.

Other elements of the Department's strengthened Environment, Safety and Health program include regular field reporting and a Computer Assisted Tracking System, and a more aggressive ES&H role in the development and implementation of environmental and safety policies for the Department, including more detailed policy guidance concerning the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act.

We have also established a systematic process for coordinating and resolving the Department's environmental compliance issues. The process was established by the Secretary to ensure timely development and consistent application of Departmental environmental policy and guidance.

In addition, we are committed to enhancing our working relationships with the EPA and states. In that regard, we have had several working meetings with EPA headquarters' offices and are planning a series of similar meetings with EPA regional offices and state officials.

The initiatives represent Secretary Herrington's personal commitment to a quality environment and to the safety and health of DOE workers and the public. These initiatives assure that the Department has solid information upon which to base its clean-up and corrective actions, and strong oversight to ensure continued safe and environmentally sound operations. This concludes my prepared testimony. I will be glad to answer any questions you might have.

2.14

Statement of Virginia Aveni, Deputy Director of the Ohio Protection Agency, Before the House Subcommittee on Energy Conservation and Power

Virginia Aveni presents opposing testimony before the Subcommittee on Energy Conservation and Power.

Statement of Virginia Aveni

Deputy Director, Ohio Environmental Protection Agency

Before the

Subcommittee on Energy Conservation and Power

and the

Subcommittee on Commerce, Transportation, and Tourism

of the

Committee on Energy and Commerce

United States House of Representatives

April 10, 1986

Good morning Mr. Chairmen and members of the Subcommittees. I am Virginia Aveni, Deputy Director of the Ohio Environmental Protection Agency. As the person responsible for managing Ohio's air pollution control and solid and hazardous waste management programs, I appreciate the opportunity to appear before you to discuss our State's concerns with regard to the regulation of "mixed" waste.

The State of Ohio has three Department of Energy (DOE) facilities: the Mound research laboratory in Miamisburg, the Portsmouth nuclear enrichment facility in Piketon, and the Feed Materials Production Center in Fernald. Mixed waste is generated and stored at the Mound laboratory. Both the Piketon plant and the Fernald plant have on-site storage and disposal of mixed waste. To date, DOE has refused to acknowledge that state hazardous waste laws apply to these facilities. There are numerous environmental problems at both Fernald and Piketon, which I would like to summarize briefly for you.

Virtually all of the hazardous waste at the Fernald plant is "mixed" waste. The facility handles in excess of 38,000 pounds per year of mixed waste, approximately 95% of which is shipped there from DOE's contractor RMI in Ashtabula, Ohio.

Ohio EPA's initial inspection of the Fernald facility in March, 1984, revealed violations of 20 solid and hazardous waste requirements. Drums of waste solvents on the site were corroded

and leaking into a floor drain which led eventually to a creek known as Paddy's Run. The facility had no contingency plan, no personnel training program, no waste analysis plan, no operating record, and no closure plan for any of its hazardous waste facilities.

A major area of violation was an unlined excavation known as Waste Pit 4, which holds both radioactive waste and roughly 23,500 pounds of a mixed heavy metal/uranium contaminated sludge disposed of in the pit between 1981 and 1983. Waste Pit 4 is one of six pits into which low level radioactive wastes have been dumped on-site. DOE has only a general idea of the contents of these pits, and has commissioned a study to characterize the waste more fully.

Groundwater data collected by the plant operators indicates that these pits are causing ground water contamination through infiltration of contaminants into the aquifer or through overflows which result in discharges to Paddy's Run, or both. Because Paddy's Run recharges the aquifer, surface discharges are a potential source of groundwater contamination.

In addition to the contamination which is occurring from the mixed waste disposal areas, there is considerable environmental degradation at Fernald attributable to radioactive material and waste handling. While this waste is not specifically the subject of this hearing, Ohio EPA believes that the problems associated

with it are an indication of DOE's inability to regulate its own waste handling activities.

For example, DOE is under orders to construct a wastewater treatment system for this facility. The Department began construction without Ohio EPA approval of its plans, and consequently installed a settling pond that is too small to hold the stormwater runoff from the site. This run-off is another source of uranium contamination into Paddy's Run. Piles of uranium-contaminated debris are lying on the ground at the site, and may also contribute to the surface run-off problem. Three off-site wells near the Fernald plant are contaminated with uranium and have been abandoned by their owners.

You may be aware that there have been considerable releases of radioactive uranium dust at this facility. According to DOE figures, 96 tons of uranium dust have been released over the last 31 years. Another 337 tons of uranium is unaccounted for, and may have been released to the environment either through air emissions or water discharges.

Between October and December, 1984, 273 pounds of radioactive dust were released, despite the fact that an alarm system warned plant personnel that a leak was occurring. Rather than identify the source of the leak, NLO staff readjusted the alarm to make it less sensitive and prevent it from going off again. These air emissions have resulted in contamination of on-site soils, which

are being washed into Paddy's Run because of the inadequate containment of stormwater run-off from the site.

Because of the degree to which environmental problems at the Fernald facility are inter-related, the State of Ohio believes that a comprehensive study is needed to identify all possible radioactive and hazardous waste contamination sources and recommend clean-up alternatives.

Following the Ohio EPA inspection, DOE and its contractor, then NLO, corrected some but not all of the violations. In December, 1984, Ohio's Attorney General issued a notice of intent to sue DOE and its contractor for violations under RCRA. Ohio's position is that DOE facilities are subject to state and federal hazardous waste regulations.

The State subsequently entered into negotiations with DOE and NLO which resulted in partial resolution of the issues in question. Among the major points are DOE's agreement to:

--Stop burying mixed waste at the site. The waste is now stored in tanks or barrels.

--Install improved wastewater treatment, which will reduce uranium contamination of Paddy's Run.

--Correct the solvent storage deficiencies.

--Install pollution control devices on its smokestacks.

--Prepare an adequate personnel training program, closure plan, contingency plan, waste analysis plan, and operating record. On this last point, Ohio EPA is not confident that DOE would maintain these plans, which are RCRA requirements, if mixed waste is not subjected to RCRA jurisdiction.

Several critical issues remain unresolved, however, including DOE's refusal to accept either state or federal EPA jurisdiction over hazardous and mixed waste disposal at the site, and its refusal to do a comprehensive study of environmental problems at the site. Ohio EPA also wants additional ground water monitoring in order to more accurately assess the extent of ground water contamination, and expanson of the settling basin for stormwater runoff. Failure to resolve these issues in negotiation has resulted in the State Attorney General's filing suit against DOE.

Ohio EPA is currently preparing an enforcement case against DOE for violations at the Piketon facility. In many respects, the problems there are similar to those at the Fernald plant. For example, at the time of Ohio EPA's initial inspection, the Piketon plant had no closure plan, waste analysis plan, inspection log for storage impoundments, or annual personnel training program, and many of the plans that were subsequently developed remain inadequate. Groundwater monitoring at the facility is also inadequate.

Like Fernald, the Piketon facility has a number of unlined waste pits in which mixed waste has been disposed. In addition, there is an active and an inactive landfill on the site, both of which contain mixed waste. Radioactive-contaminated solid wastes are being disposed of in unapproved areas on the site. Ohio EPA only recently became aware of a mixed waste container storage area at the facility, and we have found it to be significantly out of compliance with hazardous waste Interim Status Standards.

Until September, 1983, DOE's contractor for the Piketon plant, Goodyear Atomic, disposed of 1,500 gallons per year of waste oil contaminated with radioactivity and solvents by land application on a .71 acre plot. DOE submitted a closure plan for the land application plot, but Ohio EPA has found it to be deficient and will require modifications in it. There are two additional land application plots on the property which have been abandoned but never properly closed.

There is evidence of groundwater contamination at the site, but the current monitoring program is insufficient to characterize it fully. Additional wells are being considered. Currently available data indicate that there is both radioactive and hazardous constituent contamination of groundwater near the low-level waste burial area and near the wastewater treatment pit. Interestingly, the radioactive contamination falls within acceptable federal levels, but the concentration of hazardous constituents, in particular trichloroethylene (TCE), far exceeds

acceptable standards, ranging as high as 790,000 parts per billion. One monitoring well at the site has a foot and a half of TCE in it. There is also evidence of PCB contamination of soil and possibly groundwater at the facility.

Like Fernald, this facility also has difficulties in its handling of radioactive materials and wastes. Ohio EPA inspectors noted broken 35 gallon drums from which lithium hydroxide had spilled, and the contractor has confirmed releases of lithium hydroxide to a drainage ditch. There is also a history of uranium hexaflouride spills at the plant.

Mr. Chairmen and members of the Subcommittees, the State of Ohio believes that we have authority under the Resource Conservation and Recovery Act to regulate solid, hazardous, and mixed waste disposal, as well as other hazardous waste management activities, at the DOE facilities in our state. We welcome the legislative initiatives before Congress to clarify this point. This is important not only to resolve the dispute between state and federal agencies which currently claim jurisdiction, but to ensure that the environment and the health of our citizens are properly protected. Given the gross negligence which has occurred in the operation of DOE facilities in Ohio, it is inappropriate and indeed dangerous to allow DOE to police itself in this matter.

As advocated by Ohio Governor Richard F. Celeste and adopted by the National Governor's Association, the regulation of mixed

hazardous and radioactive waste should be subject to RCRA. Because mixed waste has both radiocative and hazardous constituents, the public and the environment should be protected against both types of hazard. This is not currently the case. Rather, the hazardous waste component of the mixed waste is often ignored. However, in cases where the radioactivity of the waste is very low, the hazardous constituents may pose the greater hazard. Evidence of this fact lies in the groundwater results we are seeing at Piketon. Further, the radioactive materials in some mixed wastes may solubilize in a RCRA waste such as an organic solvent, which then serves as the vehicle by which the radioactive component can migrate through soils and contaminate surface and ground waters.

The State of Ohio opposes DOE's proposal to issue regulations expanding the definition of "byproduct material." We believe that the effect, and indeed the intent of this proposal is to exclude mixed waste from RCRA jurisdiction, and thereby circumvent state and federal attempts to properly regulate chemical wastes. We do not believe that the expanded definition is consistent with legislative intent in the Atomic Energy Act, either as originally adopted or as subsequetly modified in the Uranium Mine Tailings Radiation Control Act of 1978.

Nor do we believe that DOE's proposed definition of "direct" and "indirect" process wastes either clarifies the currently confusing situation or provides an acceptable means of determining

appropriate waste handling methods. In a sense, all byproduct materials are indirect, by virtue of the fact that they are, by definition, produced incidental to a primary production activity. DOE's distinction is arbitrary and at the same time ambiguous. Under this system, very similar or identical waste streams could be designated differently.

Ohio would far prefer to see the determination of whether a mixed waste is subject to the AEA or to RCRA made on the basis of the primary hazard associated with the waste. High-level radioactive wastes, from which the primary hazard would of course be radioactivity, could remain under the purview of the AEA. Low-level mixed wastes, which could well pose a greater hazard from their chemical constituents than from radioactivity, could be regulated under RCRA. Nothing in this system would preclude the application of AEA safeguards to guard against radiation hazard from low-level mixed waste.

In summary, Mr. Chairmen, the State of Ohio is adamant that the Department of Energy cannot be left to its own devices in regard to regulation of its mixed wastes. Our conviction is based upon first-hand, bitter experience with the DOE facilities within our borders. Ohio's environment has been damaged--perhaps irreparably--by careless and irresponsible operation at these sites. We believe that H.R. 2009 and H.R. 2593 are steps in the right direction for clarifying EPA's jurisdiction over chemical waste mixed with radioactive waste at DOE facilities.

We are committed to protecting Ohio's natural resources. We believe that they are a key component in our State's economic revitalization. We are committed to a strong, responsible hazardous waste management program. And we believe that we cannot have the control we need without RCRA regulation of DOE mixed waste.

Thank you, Mr. Chairmen.

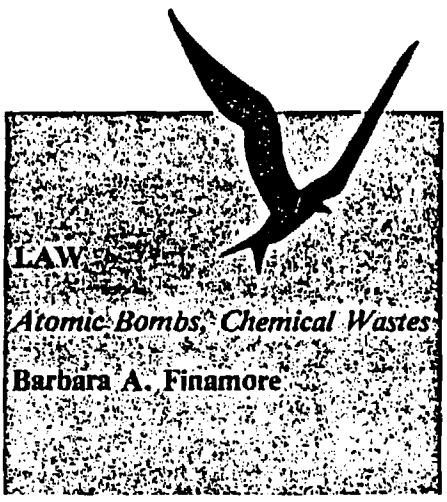
2.15

Overview of Oak Ridge Lawsuit Against DOE

An overview follows of the Oak Ridge lawsuit against DOE and judgment by one of the attorneys for the plaintiffs, Barbara A. Finamore. When governmental agencies disagree, they can seek clarification from Congress, do nothing, or be taken to court.

Environment, 26:6, 2-3. July/August. Reprinted with permission of the Helen Dwight Reid Educational Foundation. Published by Heldief Publications, 4000 Albemarle Street, N.W., Washington, D. C. 20016.

overview



Until recently, one of our nation's largest industrial enterprises had eluded compliance with the federal hazardous waste law. The Department of Energy (DOE) is America's sole source supplier of nuclear weapons; its nuclear weapons production complex would rank in size among the top quarter of the Fortune 500 corporations.[1] Each year DOE generates millions of gallons of chemical wastes. However, the department had adamantly refused to comply with the Resource Conservation and Recovery Act (RCRA), in part on "national security" grounds and in part because compliance with RCRA would conflict with certain provisions of the Atomic Energy Act. Additionally, the Environmental Protection Agency (EPA) had been unwilling to force its sister federal agency to obey the law.

Last September, two environmental organizations, later joined by the state of Tennessee, took DOE to court on the issue of RCRA compliance. The case[2] focused upon DOE's so-called "Y-12" plant in Oak Ridge, Tennessee—a 600-acre, 260-building facility that fabricates and assembles nuclear weapons components.

Controversy over waste disposal practices at Y-12 erupted in early 1983 when DOE revealed that over a period of two decades, 2.4 million pounds of mercury had been spilled, released, or otherwise lost there. A follow-up study by the Tennessee Valley Authority (TVA) showed that the plant was dumping some 140 different types of chemical wastes—including PCBs, cyanides, solvents, toxic metals, and acids—into nearby Clinch River. DOE admitted that the plant's disposal ponds were leaking wastes into the groundwater at a rate of 4.7 million gallons per year. At a congressional hearing held in Oak Ridge in July of 1983, one expert characterized the Y-12 plant's disposal techniques as "the best available technology for 1945," and charged that DOE was "destroying the groundwater resources of the state of Tennessee."[3]

In response to the lawsuit, DOE claimed that its nuclear weapons facilities are totally exempt from RCRA.[4] DOE chose to almost completely ignore Section 6001 of RCRA, which clearly requires all federal agencies to comply with all federal and state hazardous waste requirements to the same extent as any other industrial facility. Instead, DOE based its argument on RCRA subsection 1006(a), which exempts application of RCRA to nuclear facilities where it would be "inconsistent with the requirements" of the Atomic Energy Act of 1954, as amended.

DOE claimed three broad inconsistencies that, it argued, precluded *any* application of RCRA to its nuclear weapons plants. First, the department claimed that application of RCRA would conflict with its "national security" requirements, going so far as to argue that states would use RCRA to shut down DOE weapons plants or attempt to direct U.S. weapons production levels. Second, DOE argued that the Atomic Energy Act specifically prohibited any state regulation of DOE facilities, despite the fact that states around the country are currently regulating these plants under the Clean Water Act, the Clean Air Act, and other environmental laws. Third, DOE alleged that any application of RCRA would be "inconsistent" with DOE's general authority under the Atomic Energy Act to regulate health and safety matters at its own facilities.

The Department of Energy had been making these same arguments to EPA since 1980, when the RCRA regulations first became effective. But, although DOE's arguments had been repeatedly rejected by EPA's Office of General Counsel, EPA made no effort to require DOE to apply for RCRA permits or otherwise accede to the law. EPA's best ammunition came in February 1984, when the Justice

Department's Office of Legal Counsel, called in to resolve the interagency dispute, issued a lengthy opinion concluding that "EPA's interpretation of §1006(a) represents the sounder view of the law."[5] Yet, rather than pushing DOE to settle the ongoing lawsuit, EPA accepted an agreement by DOE to comply voluntarily with hazardous waste standards "comparable" to RCRA.

This agreement, which was contained in a memorandum of understanding, fell far short of actual RCRA compliance, since it omitted any state role in administering and enforcing the RCRA program, as well as any provision for citizen suits against violations.[7] EPA later claimed that the memorandum constituted an attempt to move forward on hazardous waste cleanup while the legal issue was being decided by the court. DOE, however, immediately characterized the memorandum as an agreement by the two agencies that DOE had no legal obligations under RCRA, and called for dismissal of the suit as moot.[8]

On April 13, 1984, Federal Judge Robert Taylor of the Eastern District of Tennessee ruled that DOE must comply fully with RCRA at its nuclear weapons facilities.[9] First, Judge Taylor found no evidence that RCRA conflicts with DOE's national security responsibilities. He pointed out that if such a conflict occurs, RCRA, like other environmental laws, provides for a presidential exemption on a case-by-case basis. He ruled that in cases such as this, where the agency has failed to request such an exemption, national security issues should play no part in the decision.

In addition, Judge Taylor ruled that DOE facilities are not immune from state regulation, as evidenced by their current regulation under several state environmental laws. Finally, he ruled that the Atomic Energy Act does not vest DOE with exclusive authority to regulate health and safety standards at its facilities, and that RCRA is not inconsistent with the Act in this regard. The court interpreted section 1006(a) as merely confirming congressional intent that RCRA not apply to radioactive wastes, a point not in dispute.

At a congressional hearing, one expert characterized the Y-12 plant's disposal techniques as "the best available technology for 1945."

This case is the first in the country to hold a DOE facility subject to RCRA, and sets a nationwide precedent for other DOE plants handling hazardous waste. At present, the department manufactures nuclear weapons at about a dozen major facilities around the country, including nuclear weapon material production reactors, fuel fabrication and reprocessing plants, and weapons assembly facilities. Nearly two dozen other DOE facilities are engaged in nuclear weapons research and testing.

The Department of Energy recently estimated that a comprehensive environmental management plan—including cleaning up waste dumps and instituting proper disposal techniques—for its Oak Ridge Reservation alone would cost at least $800 million.[10] DOE clearly has a high price to pay for its years of environmental neglect.

NOTES

1. Testimony of Major General William W. Hoover, U.S. Air Force, deputy assistant secretary for military applications, in *Energy and Water Development Appropriations for 1985: Hearings Before the Subcommittee on Energy and Water Development of the House Committee on Appropriations*, 98th Congress, Second Session, Part Six, March 13, 1984, page 28.

2. *Legal Environmental Assistance Foundation and Natural Resources Defense Council v. Hodel*, No. 3-83-562 (Eastern District of Tennessee, decided April 13, 1984).

3. Testimony of Frank M. D'Itri, professor of water chemistry, Institute of Water Research, Michigan State University, in *The Impacts of Mercury Release at the Oakridge Complex: Hearing Before the Subcommittee on Investigation and Oversight and the Subcommittee on Energy Research and Production of the House Committee on Science and Technology*, 98th Congress, First Session, July 11, 1983, pp. 165, 179.

4. U.S. DOE, "Memorandum in Support of Defendant's Motion for Summary Judgment and in Opposition to Plaintiffs' Motion for Summary Judgment," February 23, 1984.

5. Memorandum to F. Henry Habicht, III, assistant attorney general, Land and Resources Division, from Theodore B. Olson, assistant attorney general, U.S. Department of Justice, Office of Legal Counsel, re: "Application of Resource Conservation and Recovery Act to the Department of Energy's Atomic Energy Act Facilities," February 9, 1984, p. 2.

6. Memorandum of Understanding between the U.S. Department of Energy and the U.S. Environmental Protection Agency for Hazardous Waste and Radioactive Mixed Waste Management, February 22, 1984.

7. For further discussion of the states' role in administering and enforcing RCRA, see Thomas P. Fichler, "Overview - Hazardous Waste: The Status of RCRA in the Mid Atlantic States," *Environment*, June 1984, p. 2.

8. U.S. DOE, note 4 above, p. 4.

9. Memorandum and order in *Legal Environmental Assistance Foundation and Natural Resources Defense Council v. Hodel*, note 2 above, decided April 13, 1984.

10. U.S. DOE, *Department of Energy Management Plan for Oakridge Reserve*, February 29, 1984, pp. XIII, XIV.

BARBARA A. FINAMORE is a senior project attorney with the Natural Resources Defense Council in Washington, D.C., who works primarily on nuclear issues.

2.16

Summary Report of Nancy Smith, Staff Member, Subcommittee on Energy Conservation and Power, about Citizen Response to Environmental Issues

Nancy Smith, professional staff member of the Subcommittee on Energy Conservation and Power, provides a frame of reference for a citizen audience about the current legislative situation, shows what citizens can do, and suggests how legislation may resolve some of the issues in military nuclear waste management.

"What's in a name? that which we call a rose
By any other name would smell as sweet."
Romeo and Juliet

DEFINING OUR PROBLEMS AWAY

by

Nancy M. Smith
Professional Staff Member
U.S. House of Representatives

The temptation to solve problems by defining them into nonexistence, by merely putting a pen to paper, must be among the more irresistable temptations in the world of government. The Department of Energy, being a collection of humans afterall, is not above being seduced by such temptations, and in the case of the proposed byproduct rule, has demonstrated its ability to opt for the convenience of a paper solution. When the lawyers, rather than the scientists, end up doing all the talking and all the writing one can expect that much will turn on an artfully constructed phrase or paragraph. Although a solution which exists solely on paper is the easy way out, it is by no means easy for an outsider to discern the true motives underlying an agencies' actions or to prove that such motives are at work.

The beauty of this form of problem solving is that it is

often cloaked in the guise of good government. It all sounds well and good on paper, and sometimes purports to do one thing while it is actually up to quite another. This is a classic diversionary tactic. Let them think that you are solving one problem when in actuality you are solving quite another. One usually has to dig deep, through piles of documents, reading very carefully between the lines, to discover the true motives of a governmental agency which is intent on hiding its true purpose.

As a staff member of a Congressional subcommittee which is charged with evaluating and investigating the actions of the Department of Energy, I am constantly trying to understand what makes the Department tick. When facing an issue such as the proposed byproduct rule, I must first learn what the problems are that the Department is struggling to correct, and make recommendations to our representatives in Congress on why DOE's solution is either the correct or incorrect policy choice.

The problems on the nuclear waste front are inevitably technical in nature and I am not a scientist by training. The biggest challenge I face is boiling these issues down to their basics. This requires, more than anything else, asking endless questions, interviewing those with a handle on the subject matter and relying on a wide variety of governmental and nongovenmental sources to piece together the underlying reality. In most cases, asking dumb questions, those questions that are so self-evident that they hardly seem worth asking, are the ones that lead to the most illuminating answers. I have found that forcing the experts to explain issues in everyday English is the quickest way to

disrobe a cleverly cloaked purpose or motive. Exposing the underlying or hidden assumptions behind an agency's actions will often reveal the inanity or sensibility of any given policy. Inevitably, through this constant process of sifting information, the bottom line appears in all its simplicity. And often, the blander the words, the more colorful the policies.

There is probably nothing blander than the Federal Register, which is published every weekday for the purpose of informing the public of the latest in government regulations. The endless columns of small faded print and the turgid prose seem especially designed to tranquilize the reader into sleepy complacence. Armed with coffee and cynicism, one must read and weigh each and every word. When confronted with these pages, one must also guard against becoming lost in technicalities. The better course of action is to relentlessly ask why a course of action or inaction is being pursued: Why are they doing this? Does this make sense?

In the case of the byproduct material rule, on November 1, 1985, the Department of Energy published a notice of proposed rulemaking in the Federal Register. The purpose of publishing the proposed rule is to elicit comments from interested parties, so that the Department can get an idea of whether people agree with their rule or not, and why they have an opinion of it one way or another. This process is helpful because it usually brings to light some unanticipated results of the rule that slipped the minds of the people who created it.

At the beginning of this particular notice, the Department summarizes why it is seeking a new rule. The Department tells us

that its new regulation is "necessary to clarify which of these radioactive wastes shall continue to be regulated by DOE exclusively under the AEA [Atomic Energy Act] and which wastes shall be subject to regulation both under RCRA [Resource Conservation and Recovery Act] and the AEA." In other words, this proposed rule is designed to end a tug-of-war between two Federal agencies, the DOE and the Environmental Protection Agency (EPA), the agency which implements RCRA. The EPA oversees the disposal of hazardous materials and the DOE has the mission of overseeing the disposal of radioactive wastes at its facilities. Given the fact that the DOE has been historically hostile to the EPA's oversight of its activities, it is perfectly natural to wonder if some remnants of that hostility still remain and are at the root of this new rule.

Not surprisingly, the DOE would rather regulate itself than have some sister agency publicly pointing out its problems and demanding that DOE changes its ways. RCRA became law because Congress believed that a comprehensive regulatory scheme to govern the generation, transportation, treament, storage and disposal of hazardous waste was essential to protect the environment from dangerous contamination. In addition, RCRA set out a strict time schedule for compliance. The DOE, which is responsible for making nuclear weapons, produces both hazardous and radioactive wastes in vast quantities in its manufacturing processes. Unused to outside regulators, DOE initially claimed that they were totally exempted from RCRA. The courts disagreed.

In LEAF v. Hodel, the court held that RCRA does apply to

hazardous wastes at DOE facilities. The Department has not appealed that decision and now accepts the holding that RCRA does apply to its purely hazardous wastes; however, when it comes to wastes which are both hazardous and radioactive, "mixed wastes", DOE claims that RCRA does not apply. Seizing upon the fact that byproduct materials are excluded from regulation under RCRA, the DOE has decided to "clarify" the definition of byproduct materials so that it suddenly is a "substance containing radioactivity" in contrast to the old definition which states that byproduct material is "any radioactive material".

The new and old definitions contain several other twists and turns, but this one difference in particular is the key change which allows DOE to escape EPA regulation. By defining byproduct material as a substance "containing" radioactivity, the DOE has deftly enlarged the categories of substances which would be excluded from RCRA regulation under the byproduct material exclusion. The old definition clearly states that byproduct material is any radioactive material. But with the benefit of the new definition, DOE could claim that a hazardous material which is mixed with a radioactive material would be exempt from RCRA because of the presence of the byproduct material in the mixture. The old definition would only allow the radioactive component to be excluded. Under the old defintion, the hazardous materials mixed with the radioactive material would not automatically become byproduct material, and therefore, the EPA would have jurisdiction over the hazardous materials in a mixed waste.

The DOE then proceeds in the proposed rule to make something

of a compromise with EPA by splitting byproduct material into two categories. DOE splits distinguish these two categories by examining how a waste is produced, rather than what it is. According to DOE, one category will consist mostly of low-level radioactive wastes and the other will consist of the most dangerous of radioactive wastes, the high level wastes. The DOE explains the impact of the new improved definition in this regard in its Federal Register notice:

> "If the rule proposed here today is adopted by DOE, its application will have the effect of leaving under the exclusive AEA regulatory scheme all DOE radioactive wastes currently stored or in the future to be stored in High Level Waste Tanks at DOE facilities. These wastes are regulated under a system of DOE Orders which require the proper storage and treatment of these wastes....Other DOE radioactive hazardous wastes would either continue to be regulated under the exclusive AEA authority, if they are direct process wastes, or be regulated under both the AEA and RCRA authorities, if they are not."

Now everyone is thoroughly confused. A rule which attempted to "clarify" has thoroughly muddled our understanding of

byproduct. As a congressional staff member trying to understand why DOE is fiddling with the definition of byproduct to this extent, questions pop immediately to mind: Why does DOE only want to retain regulatory control of its high level wastes? Will the new definition of mixed waste really have the effect that DOE claims? Who will ultimately decide if these wastes are direct process wastes and under RCRA jurisdiction?

In particular, the question becomes, why should the waste contained in the High Level Waste Tanks at DOE facilities be treated differently from all other types of waste disposed of or stored at Federal facilities? The DOE has replied that the High Level Waste Tanks contain a mixture of hazardous and radioactive waste, but that the dangers posed by the radioactive elements are far greater than the dangers posed by the hazardous components. The DOE goes on to argue that their own requirements for ensuring that the radioactive elements do not leak from the tanks into the environment are so stringent that any hazardous component would be more than adequately covered. This prompts another question. Has the EPA, the agency which is responsible for protecting us from hazardous materials, had the opportunity to analyze these wastes and to make a determination that they are being regulated by DOE in a way that assures their isolation from the environment? The answer to that question, as far as anyone in Washington, D.C. can tell, is no. Shouldn't EPA take a hard look at those wastes before they are asked to surrender their ability to control the disposal of such wastes to the DOE? And what if these tanks do leak, should the EPA be on hand to supervise the clean-up?

All of these questions, in one form or another, were posed when the proposed rule was published. There was an avalanche of criticism from interested parties and other Federal agencies. In early April, 1986, the House Subcommittee on Energy Conservation and Power held a hearing to shed light on these questions and to examine legislative proposals offering their own interpretation of the byproduct material exclusion. Witnesses representing diverse points of view were called to testify.

The legislation, authored by members of Congress who have DOE facilities in their own backyards, called for EPA to regulate the hazardous components of mixed wastes. These DOE facilities pose a potentially significant hazard to the legislators' constituents and the legislators wanted to make sure, to the greatest extent possible, that DOE not be allowed to continue to self-regulate their own facilities. In addition, EPA has a program in which they delegate administration and enforcement of environmental regulations to state agencies. For the most part, state agencies have been far more aggressive in enforcing laws protecting their own citizens. It has been suggested by some observers that DOE resists total EPA regulation in order to keep the prying eyes and probing hands of the states from examining their facilities. DOE seems to have good reason to restrict EPA and state oversight of their facilities. At the Subcommittee's hearing, an administrator from EPA, Mr. Win Porter, replied when asked if DOE facilities could currently meet RCRA requirements, "I think it is fair to say they all have problems of various sorts...I think right now that none of them would meet the full requirements, and I think we have

a lot of work to do at all their sites."

At the end of March, 1986, DOE undertook a reevaluation of the proposed rule. As of this writing, no decision on the future of the proposed rule has been made by DOE. Once again, the ball is in the DOE's court and Congress will wait until DOE makes its next move. Meanwhile, as more and more environmental and management problems at DOE facilities are being made public, momentum is building to pass legislation which would require DOE to open their facilities to regulation by outside and impartial agencies.

2.17

Memorandum from Mary Walker, Assistant DOE Secretary, Environment, Safety and Health, entitled "Byproduct Rulemaking"

United States Government Department of Ene

memorandum

DATE: March 27, 1986

REPLY TO ATTN OF: EH-1

SUBJECT: Byproduct Rulemaking

TO: J. Michael Farrell
General Counsel
Office of General Counsel, GC-1

The purpose of this memorandum is to initiate a thorough policy review of the current status and future direction of the byproduct rulemaking.

BACKGROUND

- From 1980 through August 1984, the Department of Energy (DOE) took the position that the Resource Conservation and Recovery Act (RCRA) was not applicable to DOE's Atomic Energy Act (AEA) activities and facilities. That position was based on DOE's interpretation of two provisions in RCRA directly involving the AEA. One provision excludes from the definition of solid waste, and thus hazardous waste, source, special nuclear, or byproduct material as defined by the AEA. The other provision limits the application of RCRA to AEA activities "...except to the extent that such application (or regulation) is not inconsistent with the requirements..." of the AEA.

- In early 1984, after 3 years of negotiation on the issue, DOE and the Environmental Protection Agency (EPA) signed a Memorandum of Understanding that provided some RCRA coverage of DOE's AEA activities but no State jurisdiction and no permit requirements.

- In April 1984, a Federal District Court in Tennessee ruled, in a lawsuit against DOE, that RCRA was applicable to hazardous chemical wastes generated by DOE's AEA activities. However, the court decision did not address the applicability of RCRA to hazardous chemical wastes mixed with radioactive wastes.

- DOE decided not to appeal the court decision.

- DOE also decided to accede to some RCRA regulation of hazardous chemical wastes mixed with certain radioactive wastes. (It is important to note that a lot of DOE's radioactive wastes are mixed with chemical wastes, some of which are hazardous chemical wastes.) DOE's plan for deciding which of these wastes would be subject to RCRA regulation for the nonradioactive hazardous components was based on defining, through formal rulemaking, the term "byproduct material." Under the DOE plan, waste meeting the definition of byproduct material would be regulated exclusively by DOE under its AEA authorities even if the waste could qualify as hazardous waste

under RCRA; and, non-byproduct radioactive waste mixed with hazardous chemical waste would be called "mixed waste" and would be subject to RCRA for the chemical components and to AEA for the radioactive components. Inherent in the DOE plan, was a fundamental belief that the radioactive hazard of wastes determined to be byproduct material would greatly dominate any nonradioactive chemical waste hazard.

CURRENT STATUS

- On November 1, 1985, DOE published a proposed rule defining byproduct material as "...a waste substance containing radioactivity that is either directly yielded in the process of producing or utilizing Special Nuclear Material as that term is defined in the Atomic Energy Act of 1954, as amended, or its being made radioactive is a direct and necessary consequence of that process."

- The proposed rule has generated a significant amount of interest. Comments received were generally critical. Some questioned the need and authority for the proposed definition. Some alledged logical and technical deficiencies. Others suggested that DOE was again trying to use a loophole to get out of having to comply with RCRA. The Nuclear Regulatory Commission (NRC) expressed opposition because of its belief that the proposed rule would adversely impact NRC authorities, licensees, and low-level waste disposal programs.

- Senator Glenn has introduced a bill intended to nullify the effect of DOE's proposed byproduct definition by making all DOE radioactive waste, in a mixture with hazardous chemical waste, subject to RCRA.

- Congressional supporters of DOE have expressed concern with the effect of DOE's proposed definition of byproduct and strongly encouraged the Department to fix the problem "...or somebody else is going to do it for you."

NEXT STEP

- I have directed my staff, in coordination with the Office of General Counsel, the Office of the Assistant Secretary for Defense Programs, the Office of the Assistant Secretary for Nuclear Energy, the Office of Energy Research, and the Operations Offices, to throughly assess: (1) the consequences of proceeding with the byproduct rulemaking, (2) the consequences of not proceeding with the rulemaking, and (3) options to the rulemaking and their relative merits.

The purpose in directing this policy review is to assure that all aspects of the byproduct rulemaking are thoroughly assessed and that all related actions by the Department are consistent with the Secretary's Environmental Policy Statement of January 8, 1986. Please do not hesitate to call me directly if you have any questions or concerns related to this review.

Mary L. Walker
Assistant Secretary
Environment, Safety and Health

2.18

Section 2: Questions for Discussion

Section 2: Questions for Discussion

1. What are mixed wastes?

2. Explain the DOE byproduct rule, and provide arguments for and against the rule.

3. What is RCRA, and how is it related to the Oak Ridge lawsuit?

4. What is the Atomic Energy Act? What environmental responsibilities did the 1954 act provide to the Atomic Energy Commission (now the DOE)? Have these responsibilities been met by DOE?

5. How did the NRC, EPA, and DOE come into being?

6. Should wastes be regulated exclusively under hazardous or radioactive waste regulations? If nuclear waste is mixed, how should the waste be regulated?

7. In protecting the public, what part should economic factors play? When is the public fully protected?

8. Provide an analysis of John S. Herrington's statement and Mary Walker's statement and testimony. Compare these statements to the ENR article. What conclusions can be drawn? Support your arguments.

9. Compare the DOE response to Congressional Question 15 with Virginia Aveni's testimony.

10. Provide an analysis of the two proposed house bills. How can the bills be improved? Review your analysis with a state politician and compare your response with the politician's.

11. Interview a DOE official on radioactive and hazardous waste management. Also, interview an environmentalist. Write a comparison, and reach a conclusion.

12. What should citizens do about radioactive waste management?

13. How should citizens interact with scientists and engineers? How much free reign should be provided to scientists and engineers? Conduct an informal poll of engineering and non-engineering students and provide a summary with your conclusions.

14. Poll the Congressional legislators in your state on their reaction to the Wyden and Luken bills. Provide an analysis of their reactions and of how they feel the bills can be improved.

Section 2: Questions for Discussion

15. Poll the legislators in your city on local waste management. How do they feel about chemical waste management? Discuss waste management with your state environmental agency. Compare the responses from your legislators with those from your state regulatory agency.

Section 3:

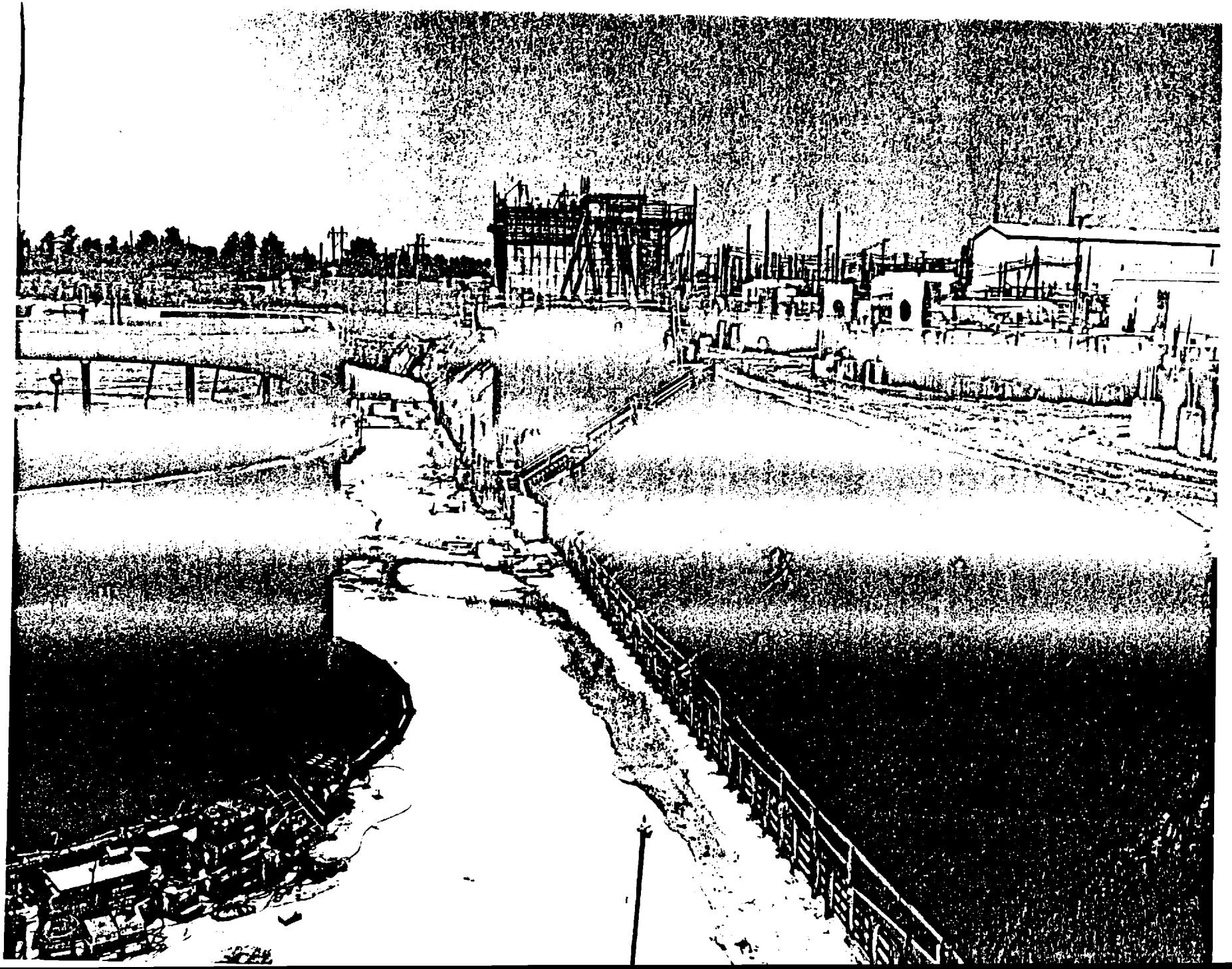
High-Level Radioactive Waste Tank Corrosion Pitting at the Savannah River Plant

On August 17, 1979, a federal court directed that an environmental impact statement (EIS) for a $200 million dollar Savannah River Plant high level radioactive waste tank construction project be published by DOE in conjunction with a similar EIS required for the tanks at DOE Hanford. The new EIS was published in March, 1980, and was distributed to the court and public. The new EIS stated that corrosion pitting in the new tanks theoretically could not happen. Six months later, after four new tanks became operational and internally became radioactive, extensive corrosion pitting was accidentally discovered before the remaining fourteen new tanks went into high level radioactive waste service. In a Department of Energy meeting at the Savannah River Plant on April 23, 1981, DOE staff proposed that the courts and the public be informed of the pitting problem through a formal news release. This request was denied. The staff proposal to go public with the pitting problem was made in writing to DOE management; again, management denied the request.

The pitting was subsequently corrected only in the fourteen tanks, and then these tanks were put into service. However, the federal courts were not informed, no research was allowed to be published on the corrosion pitting, and the only two corrosion pitting reports were neither published nor referenced in the scientific literature. The pitting incident then lay dormant until a different federal court request for information was filed against DOE in early 1983.

The request by a federal court in 1983 directed the DOE Savannah River Plant to identify all documents in its possession that provide information regarding the safety of the high-level radioactive waste tanks at SRP. The information provided to the courts by DOE specifically omitted any reference to the corrosion pitting at the Savannah River Plant. Titles of the corrosion pitting reports were read into the minutes during a public DOE hearing in November 1983.

High-Level Waste Tank



3.1

Excerpts from DOE Final Enviromental Impact Statement on New Waste Tanks at SRP

The Savannah River Plant Final EIS on the new high-level waste tanks was directed by a federal court. The new EIS noted that corrosion was not a problem and that a rigorous quality assurance program (p. G-9) would in any case prevent construction problems.

DOE/EIS 0062

FINAL
ENVIRONMENTAL IMPACT STATEMENT

(Supplement to ERDA-1537, September 1977)

Waste Management Operations

Savannah River Plant
Aiken, South Carolina

Double-Shell Tanks for Defense
High-Level Radioactive Waste Storage

April 1980

U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C. 20545

EXECUTIVE SUMMARY

FINAL ENVIRONMENTAL IMPACT STATEMENT
WASTE MANAGEMENT OPERATIONS
DOUBLE-SHELL TANKS FOR DEFENSE HIGH-LEVEL RADIOACTIVE WASTE STORAGE
SAVANNAH RIVER PLANT
DOE/EIS-0062
U.S. DEPARTMENT OF ENERGY
(SUPPLEMENT TO ERDA 1537, SEPTEMBER 1977)

1. This final environmental impact statement (EIS) has been prepared in compliance with the September 29, 1979, order of the Federal District Court for the District of Columbia (Natural Resources Defense Council, et al., v. Administrator ERDA/DOE, et al. (D.D.C. Civ. No. 76-1691). The statement analyzes the impacts of the various design alternatives for the construction of fourteen 1.3 million gallon high-activity radioactive waste tanks. The EIS evaluates the effects of these alternative designs on tank durability, on the ease of waste retrieval from such tanks, and the choice of technology and timing for long-term storage or disposal of the wastes.

2. The proposed action is to complete the construction of the 14 tanks as originally planned and use them to store waste. This action will facilitate the continued safe interim storage of waste from the SRP production of nuclear materials and make possible the retirement of 24 tanks of older designs beginning with nine tanks known to have leaks.

3. The design alternatives considered in the EIS are: thicker and more chemically resistant steel plates, an impressed-current, cathodic protection system to guard against stress corrosion cracking, better waste retrieval equipment, and enlarged tank openings to facilitate retrieval. The design alternatives are not proposed because no unique advantages are provided by the alternatives and because each of the alternatives possess definite disadvantages (cost, delays, or potential technical problems).

4. The environmental impacts of current waste management operations at SRP were assessed in ERDA-1537 (September 1977). ERDA-1537 covered interim storage of the high-activity wastes in subsurface tanks. SRP plans to continue existing operations and improve waste management practices in accordance with DOE policies and standards; this plan is Alternative 4 of ERDA-1537. It involves regular assessment of current waste management practices and continued improvement of volume reduction and storage equipment and techniques. Provision of these new tanks (and retirement of older ones) is a major step in the interim waste management program.

5. The U.S. Environmental Protection Agency published a notice of availability of a draft of the EIS (45 FR 4466) on January 22, 1980, and the comment period ended on March 3, 1980. Only four comment letters were received.

6. The EIS was forwarded to the U.S. Environmental Protection Agency on April 11, 1980, and an announcement of its availability will be submitted to the Federal Register.

7. Additional information regarding the EIS may be obtained from Dr. G. K. Oertel, M. S. B-107, U.S. Department of Energy, Washington, DC 20545, telephone (301) 353-3641.

FOREWORD

The Federal action under review is the continued construction and proposed operation of new tanks for high-level radioactive waste at the Savannah River Plant (SRP) near Aiken, South Carolina. The construction of these tanks, which has been substantially completed, was authorized in the FY-1976, 1977, and 1978 Congressional budgets. The Federal District Court for the District of Columbia (Natural Resources Defense Council [NRDC] v. Administrator, ERDA/DOE), directed that this supplemental environmental impact statement (EIS) be prepared to address the design and safety alternatives of the waste storage tanks in FY-1976 and -1977 projects at the Savannah River Plant.* Specifically, the court ordered on September 29, 1979, that:

"ORDERED, the defendents (Secretary, Department of Energy, et al.) will prepare with diligence and with all reasonable speed and file with the Court by no later than April 15, 1980, adequate final supplemental environmental impact statements to ERDA-1537, Final Environmental Impact Statement, Waste Management Operations, Savannah River Plant, Aiken, South Carolina, and ERDA-1538, Final Environmental Impact Statement, Waste Management Operations, Hanford Reservation, Richland, Washington, discussing the safety and design alternatives for the Fiscal Years 1976 and 1977 double-shell radioactive waste storage tanks at Hanford and Savannah River.

"FURTHER ORDERED, that the environmental impact statements shall discuss in detail at least those design and safety feature alternatives identified at note 19, page 13 of the Court of Appeals slip opinion, including the reasonably foreseeable environmental effects of these alternatives, their effect on the durability of the tanks or the ease of waste retrieval from such tanks, and the effect, if any, of these design and safety feature alternatives on the choices of a technology for long-term radioactive waste storage and final disposal, and on the timing of such choices."

This statement goes slightly beyond that court requirement in that four additional tanks authorized in a FY-1978 project are also included in the SRP EIS.

* A similar EIS has been prepared for the Hanford Site.

The base document, ERDA-1537, Final Environmental Impact Statement, Waste Management Operations, Savannah River Plant, September 1977, gives information on the current SRP waste management operations. This supplemental EIS summarizes, but does not repeat, the information given in ERDA-1537. The format of this supplemental EIS is changed somewhat from that of ERDA-1537 in accordance with recent Council on Environmental Quality (CEQ) Regulations for implementing the procedural provisions of the National Environmental Policy Act (40 CFR 1500-1508).

Two earlier environmental impact statements were issued to cover construction at SRP of specific additional waste handling and storage facilities. These statements are Future High-Level Waste Facilities, SRP, WASH-1528 in December 1972, and Additional High-Level Waste Facilities, SRP, WASH-1530 in August 1974. Originally each of these projects was expected to include both waste tanks and evaporator, but because of increased costs, they were revised to include three and four waste tanks, respectively, with no evaporators. The environmental impact of the new tanks under construction will be of the same nature and order as those for the previous tanks.

In the final EIS, significant changes from the draft EIS are indicated by a vertical line in the left margin of the page. Minor editorial and typographical corrections are not identified. If the change is the result of an error (typing error, etc.) in
C the draft EIS, it is identified with the letter "E." If the change is made to clarify or expand on the draft statement, it is
C identified with the letter "C." As an example, if this sentence were added to clarify a section, it would be identified with a vertical line and the letter "C" as shown to the left.

C Four comment leters were received; see Appendix G for DOE responses.

1.0 SUMMARY

This environmental impact statement was prepared as a supplement to The Final Environmental Impact Statement - Waste Management Operations, Savannah River Plant, Aiken, South Carolina, ERDA-1537, September 1977 as directed by the Federal District Court for the District of Columbia on September 29, 1979. This supplement covers construction and operation of 14 additional high-level waste storage tanks authorized for fiscal years 1976, 1977, and 1978 at the Savannah River Plant.

In the continuing production of nuclear material for national defense at the Savannah River Plant, highly radioactive waste by-products are generated. These defense wastes are being stored initially as liquids in underground, near-surface storage tanks. After suitable decay of short-lived radioactive isotopes, during which time insoluble constituents settle to the bottom as a sludge, the waste solution is then evaporated and returned to another waste tank where it partially crystallizes to form a soluble salt cake. This volume reduction program, which has been in operation for about 19 years, converts the waste to a form less mobile than the original liquid waste and reduces the number of storage tanks required. Storage of liquid wastes has been conducted safely during the 25 years of operation at the Savannah River Plant. These additional waste tanks are needed to meet forecast production of nuclear materials and to replace 24 older-design tanks which will
C | be removed from service. Nine of these older tanks have leaked.

The storage of liquid waste, salt cake, and sludge in near-surface storage tanks is considered as an interim plan for waste management. Long-term options for the Savannah River Plant wastes are also being investigated. The continuation of a research and development program on the immobilization of the waste for long-term management is considered in the Final Environmental Impact Statement, Long-Term Management of Defense High-Level Radioactive Waste (Research and Development Program for Immobilization), DOE/EIS-0023, November 1979.

The new facilities, now under construction, consist of fourteen 1.3-million-gallon high-activity waste tanks and associated auxiliaries; four tanks are in the F Area and ten in H Area on the basis of forecast production requirements and the need for tank replacement. Design of the tanks will be similar to that of the previous seven Savannah River Plant tanks authorized in fiscal

years 1974 and 1975.* The tanks will incorporate the latest technology in fabrication, stress relief, inspection, and acceptance testing. This concept is consistent with the base case in ERDA-1537, i.e., Alternative 4, "Improve Waste Management Practices in Accordance with ERDA Policies and Standards."

Ventilation air is the only normal effluent from the waste tanks. With this air approximately 650 Ci/year of tritium oxide will be released to the atmosphere from the waste tank vapor space. This tritium oxide will result in an average dose commitment to individuals at the plant perimeter of about 0.0009 mrem/year for each new tank. The population annual dose commitment within a 100-kilometer radius of the center of the Savannah River Plant will be about 0.18 man-rem for each new tank. However, since most of these tanks will replace older tanks, this exposure estimate is not an incremental increase in dose. The population dose from atmospheric release from 14 waste tanks is less than 0.5% of the total dose from SRP releases to the atmosphere (135.8 man-rem in 1978) and less than about 0.0001% of the dose received from natural sources by this population (5×10^5 man-rem).

Preferred Alternative

The preferred alternative is to complete construction and utilize in waste management operations the 14 tanks currently under construction. The 14 Type III** double-walled tanks covered in this EIS are in various stages of construction.

Construction of the Type III series of double-walled tanks began in FY-1966. The most important change in Type III tanks compared to those of previous designs is incorporation of a post-fabrication heat treatment of the primary tank to eliminate the high residual stresses induced by seam welding in the field of the many individual steel plates. This heat treatment is to help prevent stress corrosion cracking that has been experienced in nine
C | Type I and II tanks, which were not heat treated. No leaks have been discovered in any of nine Type III tanks that are now in service.

* Additional High-Level Waste Facilities, SRP, WASH-1530 (August 1974) (Tanks 25-28) and Future High-Level Waste Facilities, SRP, WASH-1528 (December 1972) (Tanks 35-37).

** Type III tanks are double-walled steel tanks with the secondary (outer) tank walls rising the full height of the primary tank and with both tanks contained in a cylindrical watertight reinforced concrete vault. Capacity is 1,300,000 gallons. The earlier Type I and II tanks hold about 750,000 and 1,000,000 gallons, respectively, and are of similar basic design except that their steel secondary tanks (or "pans") have walls only five feet high, and their roof supports differ.

Other major design improvements in the Type III tanks include:

C
- Full-height steel secondary vessels, rather than the 5-ft pans used in Types I and II
- A single roof support column mounted on the foundation pad rather than on the bottom of the primary tank
- Air-cooling of the center column and bottom of primary tank
- Bottom-supported distributed cooling coils

There are two basic needs for the new tanks. First, they will provide interim storage capacity and ensure containment of new high-level waste generated by continued operation of SRP. Second, they will provide improved reliability of storage of high-level waste already generated and in storage.

Significant engineered safety features in the new tanks include:

- Primary and secondary leak detection systems to allow prompt detection and containment of leaks through either barrier
- Ventilation systems to purge combustible gases and maintain vapor space negative with respect to atmospheric pressure
- Emergency power to maintain critical systems if normal power is lost
- SRP design basis earthquake protection to 20% of the acceleration of gravity (0.2 g) at zero period
- Tornado-resistant design greater than SRP design basis

Each waste tank has a capacity of 1,300,000 gallons and is 85 feet in diameter and 33 feet tall. The tank form is two concentric cylinders joined to washer-shaped top and bottom plates by curved knuckle plates. The primary tank sits on an 8-inch bed of insulating concrete within the secondary containment vessel. The concrete bed is grooved radially so that ventilating air can flow from the inner annulus to the outer annulus. Liquid would also flow through the slots, facilitating detection at the outer annulus, if any were to leak from the bottom of the primary tank.

The secondary vessel is 5 ft larger in diameter than the primary to provide an outer 2.5-ft-wide annulus. Its side wall rises to the full height of the primary tank. A channel grid system was installed in the concrete base slab under the secondary container to detect leakage from the secondary container. The grid system drains to a sump for collection and monitoring.

The nested two-vessel assembly is surrounded by a cylindrical reinforced-concrete wall 30-inches-thick.

The enclosure has a 48-inch-thick, flat, reinforced-concrete roof, which is supported by the concrete wall and the central column. The roof reduces the radiation field above the tank to less than the amount permissible for continuous occupancy by operating personnel; hence, no earth overburden is required.

Type III tanks under construction have permanently installed cooling coils. Vertical coils will be bottom-supported and on 3-ft triangular centers. No horizontal coils will be installed. In the nominal design, total heat removal capability is about 6,000,000 Btu/hr, but effectively reaches 10,000,000 Btu/hr for liquid waste in which convective circulation is effective. An example is "as received" waste service (liquid plus about 8% sludge). On the other hand, widely distributed cooling surfaces are necessary in tanks to be used for forming and storing crystallized salt, in which salt deposited on the coils restricts heat transfer.

All plate welds will be radiographically inspected as part of a rigorous Quality Assurance Program. All radiographs are permanently retained. The primary tank will be stress-relieved in place at 1100°F in accordance with the general requirements of the ASME Boiler and Pressure Vessel Code. A full hydrostatic test, consisting of filling each primary tank with water to a depth of 32 feet and allowing it to stand for 48 hours, is conducted after stress-relieving.

The top openings into the Type III tanks and annular spaces are closed with stepped concrete or lead plugs. These openings are used for instrumentation, cooling units, ventilation system connections, and waste transfer connections.

The tank ventilation system is a negative pressure system designed for purging the interior volume at a rate in excess of 100 ft^3/min. Air enters through a High Efficiency Particulate Air (HEPA) filter and is conducted by a 4-inch-diameter pipe through the roof into the waste storage space. Air leaves the storage space via a 12-inch-diameter pipe positioned across the tank from the inlet. The exhaust air passes through a condenser to extract potentially radioactive moisture and a HEPA filter to free it from solid particles; it is then discharged to the atmosphere through an exhaust blower.

The outer annulus between the primary and secondary containers of double-walled tanks is also ventilated. The Type III tanks have the added feature that in addition to the direct ventilation of the outer annulus by a warm air flow, 1000 to 4000 ft^3

of air per minute is drawn through the inner annulus, passes beneath the primary tank through the radial grooves in the concrete base slab, and exhausts into the outer annulus. The new tanks, the subjects of this EIS, have an annulus ventilation system with a capacity of about 8000 ft^3/min, up to about half of which can be passed through the inner annulus and beneath the primary tank, to aid in cooling the tank bottom.

Primary reliance for leak detection is placed on methods that automatically monitor areas into which waste will migrate, especially the collection sumps provided for this purpose inside the multiple containment barriers. Although rigorous inventory surveillance is practiced as a backup, this method is not as sensitive because waste inventories are too large for reliable measurement of small differences that would constitute significant leakage.

Techniques have been developed for remote inspection and evaluation of the condition of waste tanks. These include visual inspection by means of a periscope, photography, ultrasonic measurement of wall thickness, and corrosion specimens. Since 1959, the most frequent inspections have been visual surveys in the annular spaces, and, to a lesser extent, inside the primary tank. These are made by direct observations through opened access risers and/or inspection holes in the roof.

DOE plans to place the new tanks in service shortly after their completion. Several tanks will serve temporarily as receivers for unprocessed waste supernate currently stored in older-design tanks. This will allow earlier emptying of supernatant liquid and at least some solidified salt from many of the older-design tanks. The new tanks will also provide reliable isolation of the waste from the environment to allow adequate time for the implementation of the long-term waste management program for the SRP high-level waste.

Design Alternatives

The design and safety features advocated (for SRP) by NRDC are: thicker and more chemically resistant steel plates, an impressed current cathodic protection system to guard against stress corrosion cracking, better waste retrieval equipment, and enlarged tank openings to facilitate retrieval. Consideration of cooling coils is not applicable to the SRP because the SRP tanks already have cooling coils.

Thicker steel is not required because the thinning due to general corrosion is not a problem, and thicker steel would not prevent stress corrosion. The Type III tanks under construction are not expected to suffer stress corrosion because the improved steels used are normalized, stress-relieved, and stronger, and

because of improved operating controls on the composition of the wastes to minimize corrosion.

Cathodic protection was considered in 1972. The benefits of cathodic protection for waste tanks were judged to be small in comparison to the uncertainties and problems of installing such a
C | system in a tank with widely varying contents and that, while protection may be afforded in one part of the tank, there may be a deleterious phenomenon in another part of the tank. Reliance was continued on use of more-resistant steels and improved tank designs for long-term protection.

Although adequate waste removal techniques have been demonstrated, sludge removal and chemical cleaning tests in progress plus salt removal tests during 1980 will investigate improved methods and demonstrate performance of equipment for waste retrieval.

Enlarged tank openings are not included in these new Type III tanks. The long-shafted pumps that can be used to remove liquid waste, redissolve salt, or slurry sludge from SRP waste tanks are
C | designed to fit into any tank riser 2 feet or larger in diameter. The SRP tanks No. 38-51 contain nine access risers 3 feet or larger in diameter which can accommodate these pumps. Pumping of all three waste forms has been successfully demonstrated in existing SRP waste tanks and the equipment was safely retrieved.

In the preceeding paragraphs, the results of the examination of the three design alternatives were summarized. The design alternatives were rejected because no unique advantages were determined for the alternatives and because there are definite disadvantages (cost, delays, and potential problems) to the proposed design alternatives.

The "No Action" alternatives were discussed in ERDA-1537 and the alternatives were considered to be unacceptable. The "No Action" alternatives would preclude SRP from meeting its mission of producing special nuclear material for national defense and would violate the DOE waste management policies for existing wastes.

Site Characteristics

The Savannah River Plant site occupies a nearly circular area of about 300 square miles (192,000 acres) on the South Carolina side of the Savannah River and is about 100 air miles or 150 river miles from the river's mouth at Savannah, Georgia. Surface elevaE | tions range from about 90 to 360 ft above mean sea level. Surface streams drain to the Savannah River. About 70,000 people consume river water processed by two water treatment plants near the river mouth.

Natural background radiation (external and internal) is estimated to result in a dose of about 120 mrem/yr to individuals living in the vicinity of the SRP site. Within 100 km of the SRP perimeter, this background dose ranges from 60 to 450 mrem/yr. About another 100 mrem/yr is received from medical x-rays by the average individual in the general area population.

Environmental Impacts

Utilization of the new waste tanks covered by this Supplemental Environmental Impact Statement will allow the retirement of older-design tanks with a significant improvement in safety and reliability. Apart from the impacts of construction, which are minimal because construction is within areas dedicated to plant operations, the incremental consequences of this action include:

- Added risks of releases during waste transfer operations required to empty tanks to be retired
- Reduced risks of accidental releases from the waste operations because of the improved facilities
- Impacts associated with decontamination and decommissioning of the retired tanks

The waste management operating force will increase from about 50 to 120 people to accomplish the waste removal to new tanks and chemical cleaning of the older-design tanks. After the older-design tanks are retired from high-level waste service, the operating force will decrease to about 65 people. The extra 15 people are due to increased surveillance requirements. Adoption of the alternatives would not change, but would possibly delay the timing of the increased manpower.

Small amounts of radioactivity reach the environment from normal operation of the waste management system. Low concentrations of radioactive material, primarily tritium oxide, are carried by the tank ventilation air to the atmosphere. About 5500 Ci of tritium per year are released to the atmosphere during normal operation of the tank farm and tritium is the only radionuclide from waste tank systems perceptible off the plantsite. The whole body dose from atmospheric release to the population within a E | 150-km radius of SRP is calculated to be 1.3 man-rem/yr. Natural background and medical diagnostic radiation for the same population is 5×10^5 man-rem/yr. The maximum dose to an individual at the plant boundary from inhalation of tritium would be about 9×10^{-6} rem/yr.

Personnel operating the waste tank farms in 1978 averaged an exposure of 0.7 rem/year with a maximum of 2.5 rem/year. The total annual exposure averages about 50 man-rem to tank farm operations personnel.

The total exposure risk to the offsite population from potential accidents and normal operation is 16 man-rem/year with normal operation accounting for 3 man-rem/year.

The risk associated with earthquakes (10 man-rem/year) is the dominant risk. The major contribution to earthquake risk (about 70%) results from the pessimistic assumption of liquefaction of the soil around waste tanks built partially above the normal grade elevation in the waste tank farms. It is also assumed that leakage from damaged tanks could flow rapidly to Four Mile Creek, rather than being deposited in the soil beneath the tank. Most of this risk is attributable to hypothetical IX MM (or more severe) earthC | quakes which are unlikely to occur; the design basis earthquake based on extensive seismic analysis for SRP and other areas of the southC | east is between the VII and VIII MM values.

The offsite population risk (deaths/year) of tank farm operations is negligible when compared with other natural risks experienced by the population in the vicinity of SRP. Waste tank farm accidents and effluents might cause 0.003 latent cancer deaths per year compared to possibly 100 latent cancer deaths/year from natural background and medical diagnostic radiation or 2.4 sudden C | deaths/year from natural accidents, such as floods or lightning strikes.

The general consideration of the environmental effects of the proposed design alternatives resulted in the evaluation that the environmental effects would not be mitigated by adoption of any of the alternatives. The adoption of design alternatives would have severe effects because of the delay in removing waste from older design tanks, additional costs to implement the alternatives, and for the cathodic protection alternative requiring a total change in the SRP Waste Management program because the waste must be maintained in the liquid form. Additional waste tanks would be required to store this liquid waste.

C | Adequate methods for removing the wastes from tanks are available. However, tests of improved methods for sludge removal and chemical cleaning are in progress; decontamination factors in excess of 10^3 to 10^4 are expected. Decommissioning impacts cannot be quantified until decommissioning procedures are more completely defined.

There are no known conflicts with national, state, or local plans and programs in the operation of the waste tanks under construction. The plantsite is dedicated as a controlled area for the production of materials needed for national defense.

The only significant adverse effects caused by operation of the new tanks are the small offsite population dose commitment from the release of radionuclides and the commitment of about one acre C | of land for each waste tank. These effects would not be materially changed by adoption of any of the design alternatives.

2.0 PURPOSE OF AND NEED FOR ACTION

The Federal District Court for the District of Columbia (NRDC v. Administrator, ERDA/DOE), directed that this supplemental environmental impact statement (EIS) be prepared to address the design and safety alternative of the waste storage tanks authorized in FY-1976 and -1977 projects for storing high-level radioactive waste at the Savannah River Plant (SRP).* The pertinent part of the Court Order is reproduced in the Foreword of this Supplement.

At SRP ten tanks are involved in the Court action, four in the FY-1976 project and six in FY-1977. In addition, four tanks being provided in a FY-1978 project are also covered by the statement. These tanks are being built to continue the program begun in FY-1974 at SRP to provide additional waste tanks (1) to accommodate storage of fresh radioactive wastes as they are generated by production operations and (2) to replace with new Type III tanks all older-design tanks beginning with tanks with a history of leakage where practicable. This program was discussed as the base case (Alternative 4) in the Final EIS on Waste Management Operations, Savannah River Plant, Aiken, South Carolina, USDOE Report ERDA-1537 (September 1977). Alternative 4 of ERDA-1537, which is the present waste management plan, provides for continued improvement of waste management practices as improved technology can be developed and equipment can be procured.

This supplement to ERDA-1537, in addition to evaluating the environmental effects of the new waste tanks, specifically addresses the alternative design and safety features for the new tanks as they affect the durability and reliability of these tanks. It also considers any effects of these features on the ease of removal of the wastes from the tanks and on the choice of technology and timing for ultimately processing the wastes for long-term disposal.

* A similar EIS has been prepared for the Hanford Site.

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C. 20550

March 5, 1980

Mr. Sheldon Meyers
Acting Deputy Assistant Secretary
for Nuclear Waste Management
Department of Energy
Washington, DC 20585

Dear Mr. Meyers:

Several individuals at the National Science Foundation have reviewed the DEIS's on Double-Shell Tanks for Defense High-Level Radioactive Waste Storage at both the Hanford Site (DOE/EIS-0063-D) and the Savannah River Plant (DOE/EIS-0062-D). The reviewers felt the DEIS's were quite similar, so the following comments refer specifically to the Savannah River Plant site:

1. The present volume does not describe safeguard measures and procedures. (Perhaps the original document covers this point.) Physical protection of radioactive materials is necessary to minimize the possibility of saboteurs. The present double-shell tanks may have some advantages on this score, too. More information on this issue may be necessary.

2. A more comprehensive failure analysis could be helpful. The present description of potential failures (leaking is only one mode) and procedures to be taken during the failures is not comprehensive enough to assure confidence.

3. How do they assure the quality assurance of these tanks? Presumably, these tanks are field-erected. Are there any accepted initial and periodic inspection procedures during and after the construction?

RESPONSES

1. The safeguard measures for the waste tank farms are described on pages III-101 and 102, "Sabotage, Diversion of Fissionable Materials, and Acts of War" in ERDA-1537, Final Environmental Impact Statement, Waste Management Operations, Savannah River Plant, Aiken, S. C., September 1977.

   Revision of the document was not required.

2. A comprehensive analysis of all failure modes was performed for the waste storage system and is only summarized in Section 5.1.3, "Releases from Abnormal Operations or Accidents" (Tables 5.2, 5.3, and 5.4). Greater detail is presented in ERDA-1537, "Potential Effects of Abnormal Operation of Waste Storage and Handling Facilities" beginning on page III-82.

   Revision of the document was not required.

3. These waste tanks were designed and constructed under increasingly rigorous Quality Assurance plans. The SRP Quality Assurance Policy was developed and accepted by DNF based on the intent of 10 CFR 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants. Refer to page A-6 of this EIS for a summary of the inspection and testing during construction.

   Upon completion of construction, formal procedures are followed by the operating organization to inspect, check-out and run-in the equipment under expected operating loads, etc. before the equipment is accepted and placed in service. The post-operation inspection program is described in ERDA-1537 beginning on page II-102.

   Revision of the document was not required.

4. It could be helpful if the role of the proposed tanks in the overall nuclear waste management were described. This technology may be transferable to the management of civilian cases, if the future development allows some sort of chemical separation. Does the Savannah River Plant program incorporate some experimental or demonstrative tests?

4. The SRP waste management plan for high-level liquid waste is fully described in ERDA-1537 beginning on page II-64. As part of this plan, these new waste tanks will provide reliable, interim storage of the waste until a final decision is made for the permanent disposal of the waste. Appendix F in this document gives the specific schedule for use of the SRP waste tanks.

The new waste tanks were designed and are being built specifically for the SRP waste and waste management program and therefore have limited commercial applicability.

Appendix C of this document discusses the SRP demonstrations and tests currently underway or planned for waste removal and tank decommissioning which ultimately may be of value for civilian waste management programs.

Revision of the document was not required.

5. The old tanks do need to be replaced.

5. No response needed.

6. The new design is a significant improvement.

6. No response needed.

7. Operation of the old tank farm has been exemplary in terms of safety (if all the facts are known).

7. No response needed.

8. Backup volume ("spare volume," p. 21, 3.2, 2.2) seems to be skimpy. It should probably be increased to twice the maximum single tank storage volume.

8. The backup volume (minimum of one tank per area) is considered sufficient because of the flexibility of the operation. Spare volume in each area is equivalent to the largest volume of waste stored in any one tank. The inter-area waste transfer lines are available for transfer of waste between the tank farm areas so that all available spare tanks are available to either area as necessary. This spare volume requirement is covered in ERDA-1537 on page II-71.

Refer to the answer for comment 4 for the role of the new tanks in the SRP waste management program.

Revision of the document was not required.

One reviewer expressed the sincere desire that such temporary (semi-permanent) means of storing radioactive waste would eventually be superseded by a more satisfactory long-term method.

The program for the long-term management of waste is under active study and development. Refer to DOE/EIS-0023, Final Environmental Impact Statement, Long-Term Management of Defense High-Level Radioactive Wastes (Research and Development Program for Immobilization), Savannah River Plant, Aiken, S. C., November 1979. Also see Appendix J, Long-Range Waste Management Program in ERDA-1537.

Revision of the document was not required.

Sincerely yours,

Adair P. Montgomery
Chairman
Committee on Environmental Matters

3.2

Du Pont Report on Corrosion Pitting

Corrosion Pitting was discovered about six months after the final EIS was presented to the federal courts. Two 1981 reports were written on the corrosion pitting incident, one by Du Pont, the prime contractor responsible for the high level waste tanks, and one by Arthur D. Little, Inc., brought in by DOE to provide a technical check and balance to Du Pont's investigation. Neither report was distributed to the public until 1984, despite a 1983 court-directed search for documents on high-level waste tank safety.

INVESTIGATION OF PITTING IN PRIMARY BOTTOM PLATES OF TYPE III WASTE TANKS

SAVANNAH RIVER PLANT

ENGINEERING DEPARTMENT
E. I. DU PONT DE NEMOURS & COMPANY, INC.
DECEMBER 1981

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I. INTRODUCTION

On September 26, 1980 during final inspection for acceptance of Tank 40, H-Area, Project S-1618, FY '76, approximately 50 corrosion pits were discovered on the inner surface of the primary tank bottom. Subsequent inspection of Tank 40 bottom revealed a large number of additional pits. Later, all thirteen other tanks provided on Project S-1618, Project S-1747, FY '77 F-Area and Project S-1828, FY '78 H-Area were found to have inner surface bottom pitting.

Because of the critical nature of the tanks and the large investment involved, an exhaustive program was initiated to determine the cause of the pitting corrosion, the impact of the pitting on the integrity of each primary tank and what, if any, remedial action should be taken. This program involved application of new concepts for analytical modeling of pits and stress-corrosion cracks, finite element analysis of stresses, and supportive laboratory and field measurements and tests. Engineering Department Design, Construction and Engineering Service Divisions, Savannah River Plant, Savannah River Laboratory and outside consultants have participated in this investigation.

As an outgrowth of investigation into the pitting problem, a thorough re-evaluation of waste tank design and operation is underway. However, the purpose of this report is to present analytical support for Engineering Department's conclusion that the integrity of these fourteen waste tanks has not been impaired by pitting.

II. SUMMARY

A. General

This report presents an analysis of the problem of corrosive pitting of the primary tank bottoms and the corrective measures taken. The tanks involved are:

Project	Tank No.	No. of Pits >1/32 Inch	Deepest Pit(Inch)
S-1618	38	1,065	.061
H-Area	39	3,841	.097
	40	3,245	.170
	41	1,133	.135
	42	2,721	.079
	43	449	.106
S-1747	44	1,247	.095
F-Area	45	202	.079
	46	799	.109
	47	504	.070
S-1828	48	3	.052
H-Area	49	482	.071
	50	6,211	.078
	51	2,523	.081

Corrosion experts inside and outside the Engineering Department have examined the pitting, reviewed possible causes, conducted tests and reported their findings and opinions.

Dry abrasive blast cleaning was used to allow complete assessment of the extent of bottom plate pitting. The pits were sufficiently cleaned to remove all corrosion products and to quantitatively assess their extent and to permit their accurate measurement. A permanent record, DPE 3688 "Waste Tank Pitting Inspection Reports", was made of the depth and location of all pits deeper than 1/32 inch.

The structural integrity of the tanks with the pits was analyzed in two ways:

1) Design and operating stresses were evaluated against ASME Code criteria.

2) Possibility of initiation and propagation of nitrate stress-corrosion cracks was assessed. To make this assessment, evaluations were made of various criteria; a stress-concentration factor was established for use in assessment of crack initiation; and a model was selected for propagation of an assumed short crack at the base of a pit. The calculated stresses were then compared against the chosen criteria for initiation and propagation of cracks.

Another question in this investigation was the effectiveness of stress relieving in preventing nitrate-cracking in those Type III tanks already in operation. Therefore, a review was made of waste compositions fed to Type III stress relieved tanks to determine the value of stress relieving in preventing cracking from residual welding stresses.

B. Conclusions

1. The probable cause of pitting was oxygen concentration cells. The conditions that fostered this corrosion were the crevices created by the protective plywood placed on the floor of the tanks and rain water from leakage through risers and openings in the tank tops. The crevice between the plywood and tank bottom became saturated with moisture for long periods of time and created oxygen concentration cells that produced localized attack of the steel. Several intensification and aceleration factors may have been involved in causing the pits:

   - Biological organisms
   - Amino organic phosphate ions from the fire retardant treatment of the plywood.
   - Sulfate ions in the water

2. The integrity and reliability of these fourteen waste tanks have not been impaired by the pitting of the primary tank bottoms:

   a) These pitted tanks meet ASME Code criteria for static stresses and low-cycle fatigue.

b) The probability of initiation and propagation of stress-corrosion cracks from existing pits (3/16 inch deep or less) in the tank bottoms is virtually nil. This conclusion resulted from application of four separate criteria for initiation and propagation of nitrate stress-corrosion cracks to calculated values of maximum membrane and bending stresses in the tank bottoms.*

3. Conclusion 2b is strengthened by the high degree of conservatism both in the calculated values of maximum stresses and in the criteria used for stress-corrosion cracking.

4. The grit-blasting that was done to the tank bottoms will provide increased resistance to stress-corrosion cracking because: it cold-worked (strengthened) the surface layer, it distorted the grain structure (no discrete grain boundries**) in the surface, and it induced high compressive stresses in the surface layer.

5. The review of stress relieved Type III tanks already in service showed that stress relieving of these tanks combined with the control of waste composition (as indicated by limited waste analyses) has provided up to 7 1/2 years of leak free service following introduction of high heat waste. This performance contrasts with that of the original as-welded tanks where cracking and leaks occurred after only four months of service.

C. Recommendations

1. All tanks should be approved for service in operations up to 3,000,000 Btu/hr based on the model for thermal gradients (modified DPE 3516).

*For the purpose of this analysis, it was assumed that the waste composition could shift to where these cracks can occur. SRP has set up Technical Standards for control of waste composition to prevent the occurrence of nitrate stress-corrosion cracking.

**Nitrate stress-corrosion cracking is an intergranular process and requires discrete grain boundaries to occur.

II. SUMMARY (Continued)

2. Corollary recommendations are: a) continued emphasis on control of waste-solution chemistry for proper inhibition of nitrate stress-corrosion cracking and, b) monitoring of tank-bottom temperatures and accompanying operational controls to minimize thermal gradients in the tank bottoms.

3.3

Arthur D. Little, Inc. Report on Corrosion Pitting

THE EFFECT OF CORROSION PITTING ON THE INTEGRITY OF RADIOACTIVE WASTE STORAGE TANKS 38 TO 51 AT THE SAVANNAH RIVER OPERATIONS

Prepared for

SAVANNAH RIVER OPERATIONS OFFICE
Department of Energy

Under

Contract No. DE-AC09-78SR01065

December 1981

by

ARTHUR D. LITTLE, INC.
Cambridge, Massachusetts 02140
C-81923-25-27

I. SUMMARY

A. PURPOSE AND SCOPE

In September 1980, corrosion pits were found on the bottom of the primary liner of a radioactive-waste storage tank under construction at the Savannah River Plant. Subsequent inspections of several other tanks under construction also revealed the occurrence of pits.

These pits raised concerns that the tanks' integrity could be reduced through further corrosion pitting or stress-corrosion cracking while the tanks were in radioactive-waste service. Each of these occurrences could result in leakage of waste through the primary liner bottom into the secondary liner. Although the waste would be expected to be contained if this were to occur, the planned service life of the tank could be adversely affected. The Department of Energy therefore asked Arthur D. Little, Inc., to assess the influence of these pits on the long-term integrity of all 14 waste storage tanks under construction at SRP. These tanks are designated as Tanks 38 to 51.

To make this assessment, Arthur D. Little, Inc., investigated a number of issues related to corrosion in general and to stress corrosion in particular:

1. Corrosion

Corrosion allowances
Pit reinitiation
Galvanic corrosion

2. Stress Corrosion

Effect of waste chemistry
Effect of temperature
Effect of stress levels
Effect of pit geometry
Effect of bottom flatness

We reviewed the cause of pitting; however, the focus of our effort was on the effect of the pits on tank integrity.

Work was done in accordance with modifications A006, A008, and A010 to Contract DE-AC09-78SR01065. Prior to discovery of the corrosion pits we carried out an analysis of primary liner integrity under modification A004 to this contract.[1]

B. APPROACH

Arthur D. Little and E.I. du Pont de Nemours & Co., Inc. (Du Pont), the operating contractor of this plant, both acted as advisors to the Department of Energy on assessment of the storage tanks. Rather than have the two parties give separate advice, DOE requested that issues be discussed openly so that the opportunity would exist to resolve potential disagreements along the way. If disagreements remained after these discussions, DOE would take the advice of both organizations and make the final decisions.

A Pitting Task Force was set up with representatives from both Arthur D. Little and Du Pont. This Task Force met about every six weeks to discuss findings in depth. Prior to these meetings individuals from both companies met in small groups to discuss technical issues. The objective of the small technical meetings was to dispose of issues that could not be dealt with effectively in a large meeting.

At the request of DOE all laboratory studies were done at SRL. Arthur D. Little and Du Pont jointly worked out the test plans and Arthur D. Little personnel visited SRL to witness the testing. Stress analyses were performed by both organizations.*

In addition to its own staff, Arthur D. Little drew upon the knowledge and experience of:

Dr. John Hutchinson — Harvard University
Stress Analysis and Fracture Mechanics

Mr. Ronald Bradshaw — Independent Consultant
Numerical Stress Analysis

Dr. Robert Wei — Lehigh University
Fracture Mechanics

Dr. Robert Staehle — University of Minnesota
Corrosion and Stress Corrosion

Dr. Redvers Parkins — The University, New Castle Upon Tyne
Stress Corrosion of Mild Steel

The Arthur D. Little staff members were selected for their knowledge of and experience with stress analysis, fracture mechanics, numerical analysis, thermal analysis, corrosion and stress corrosion, metallurgy, chemistry and risk assessment. All these disciplines provided major inputs to this program.

*The Arthur D. Little, Inc., stress analysis is reported separately (2).

Progress reports and recommendations by Arthur D. Little and Du Pont were presented to DOE throughout the program.*

C. FINDINGS

1. Pitting appears to have resulted from the intrusion of water in the presence of plywood flooring. The plywood is treated with an organic amino phosphate and water leaches phosphate from the plywood. Phosphate, plus sulfates which may have been brought in from the air, provided an environment to cause pitting. Although the mechanism of pitting is not completely understood, it may involve the occurrence of oxygen depletion cells under the plywood flooring.

2. Further corrosion pitting of the waste storage tanks prior to service can be prevented by keeping the tank floor dry. If a long delay is expected before placing a tank in service, a heel of inhibited solution can be used.

3. Significant galvanic corrosion of the cleaned liner bottom will not occur in waste service.

4. The steel inner liner will not continue to corrosion pit in waste service provided the pits are cleaned of corrosion product.

5. A corrosion allowance for the pitted steel is not required. The steel liners are not likely to corrode appreciably in waste service.

6. The stress level at local imperfections and pits may cause stress corrosion cracks to initiate if waste chemistry is not controlled.

7. In tanks that meet the out-of-flatness specification, cracks which may initiate from pits will not propagate through the tank bottom under normal operating conditions.

8. If repair is required to remove the corrosion pits, the procedure must not cause surface tension residual stresses. A repair procedure that meets this criterion was developed by Du Pont.

9. Grit blasting to clean the tank floor results in a surface compression stress and localized plastic (irreversible) deformation which help prevent stress-corrosion cracking. These stresses were not quantitatively considered in our evaluation of the resistance to stress-corrosion cracking because they are not uniform over the tank bottom and cannot be quantified accurately.

*Du Pont will issue its final report separately on the tank integrity study.

D. CONCLUSIONS

1. Based on the data available from Du Pont, and provided that proper service conditions are maintained, the pits should not affect tank serviceability adversely.

   The important service conditions are temperature and waste chemistry. Temperature should be kept below the boiling point of the waste. The waste chemistry components must be maintained in the range known to inhibit stress-corrosion cracking. These limits are now specified but with allowance for modifications that may result from the current testing program at the Savannah River Laboratory.

2. While the pits themselves are not likely to affect tank integrity, three tanks do have potential problems. Tanks 43 and 50 have out-of-flatness bottoms that are outside specifications and could set up stresses severe enough to cause stress-corrosion cracking if the waste chemistry is not controlled. Tank 40 had the largest pits and as a precautionary measure, the large pits should be repaired to remove undercutting (re-entrant corners).

   Since Tank 43 is an evaporator feed tank, proper chemistry limits for control of stress-corrosion cracking should occur from the restricted operational service.

   Tank 50 does not have a restricted operational service. For this reason every effort must be made to control waste chemistry in this tank. If this is not done, stress-corrosion cracking is possible.

3.4

DOE Inspector General's Memorandum to Secretary of DOE

The corrosion pitting incident all but forgotten, a court-directed discovery requested pertinent documents from the Savannah River Plant on the safety of the high level waste tanks. Nothing was mentioned about the corrosion pitting incident in the DOE response to the court. This later became the subject of an investigation conducted by the DOE Inspector General's office. The IG report of the incident follows.

U.S. DEPARTMENT OF ENERGY

memorandum

DATE January 26, 1984

REPLY TO ATTN OF IG-1

SUBJECT INFORMATION: Report on Suppression of Information on Defects in Waste Storage Tanks at Savannah River

TO The Secretary

BACKGROUND:

This will supplement our Advance Report on Alleged Suppression of Information on Defects in Waste Storage Tanks at Savannah River which we submitted to you on November 18, 1983. A copy of that report is attached for your reference.

The purpose of our inquiry was to determine if two reports concerning corrosion pitting in radioactive waste storage tanks at Savannah River (SRO) were withheld from Departmental officials and attorneys in connection with a pending lawsuit and an Environmental Impact Statement (EIS) that is being prepared prior to the startup of the L-Reactor at SRO.

A former employee at SRO has alleged that the two reports have been suppressed by SRO officials.

DISCUSSION:

We found that the two reports in question had been withheld from Departmental attorneys handling the litigation and from other officials who were preparing the EIS on the startup of the L-Reactor. In our advance report mentioned above we recommended that the two reports immediately be made available to Departmental attorneys and appropriate officials so that judgments could be made as to whether such reports are material to either or both proceedings. We understand that this has now been accomplished.

James R. Richards
James R. Richards
Inspector General

Attachment

cc: Assistant Secretary for Defense Programs
Assistant Secretary for Policy, Safety and Environment
General Counsel
Acting Manager, Savannah River Operations Office

REPORT ON SUPPRESSION OF INFORMATION ON DEFECTS IN WASTE STORAGE TANKS AT SAVANNAH RIVER

BACKGROUND:

An Environmental Impact Statement (EIS) regarding the startup of the L-Reactor at the Department's Savannah River facility has been required by Congress and a Federal court. The EIS is being prepared at the Savannah River Operations Office (SRO). There is also litigation pending that involves the L-Reactor. It is being held in abeyance pending the completion of the EIS for a determination as to its sufficiency.

A former employee at the SRO has alleged that reports concerning corrosion pitting in radioactive waste storage tanks were withheld from the court in the context of discovery proceedings in the litigation. He has further alleged these reports were also withheld from the DOE Technical Information Center (TIC), and the professional engineering community as well as the general public.

Further, the former employee has requested at a recent public hearing that the reports be referenced in the EIS. The reports are the Arthur D. Little report of December 1982, "The Effect of Corrosion Pitting on the Integrity of Radioactive Waste Storage Tanks 38 to 51 at the Savannah River Operations," and the E.I duPont de Nemours Report, December 1981, "Investigation of Pitting in Primary Bottom Plates of Type II Waste Tanks."

We have concluded that these reports had been withheld from disclosure outside of the Department of Energy and from elements of the Office of General Counsel within the Department. We wrote an advance report concerning this matter to the Secretary of Energy and the Office of General Counsel. We also asked officials at Savannah River Operations Office what actions, if any, they were going to take to make these documents available to the public.

Although the Office of Inspector General takes no position as to whether the reports are responsive to the interrogatory or should be included in the Department's response thereto, we were concerned that the Department's attorneys may very well have been deprived of the opportunity to make the appropriate decisions with respect to these matters.

DISCUSSION:

The former employee informed us that there are defects in certain nuclear waste storage tanks that are now in use at SRO and will be used for waste from operation of the L-Reactor. He said that these defects were documented in two reports written for SRO. He

has alleged, in essence, that by failing to release these two reports, the Department has suppressed the fact that these defects exist. His evidence of this suppression is the reports themselves and documents showing that the reports were not turned over by the Department as part of a Federal court case in response to the plaintiff's interrogatory. In addition, the former employee presented us with documents that purportedly show that one of the reports was on a list identifying documents responsive to the interrogatory but was struck from the list at SRO.

We have learned that the reports were not submitted to the court as part of the discovery proceedings. We believe that the Department's attorneys handling this litigation at headquarters were not made aware of the existence of the reports. We have found that one of the reports was identified on a list initially prepared by SRO of documents responsive to the interrogatory; however, the report was "crossed off" that list at SRO and was not identified on the list sent by SRO to the General Counsel attorneys in Washington handling the litigation. We have been told that the former employee was assigned to prepare for his branch a list of documents that were responsive to the interrogatories. He wrote this list out in long-hand and gave a copy to the branch to be typed. This list was typed, but one of the reports was crossed off this typewritten list. We spoke with the branch chief about this, but he could not recall having crossed the report off the list. However, he did state to us that someone may have crossed off this particular report because SRO had a second opinion from another source which concluded that the pitting in the storage tanks was not a problem.

We spoke with the emoloyee to whom the list was submitted. He said that he received the typed list from the branch with one report crossed off and also a handwritten list from the former employee. He chose to follow the typed list from the branch.

We understand that the litigation referred to above is being held in abeyance pending the completion of the EIS and further that the time frame for projected completion of the EIS was December 1, 1983 -- January 1, 1984 and it is now overdue. So far, our focus on the EIS proceedings has been limited. However, it would appear that the only reference to the reports in the EIS proceedings has been introduced by the former employee himself at a recent public hearing on the matter. Without the benefit of these reports, attorneys and other appropriate officials in the Department would be deprived of the opportunity to make informed judgments concerning these reports.

In order to alert Department officials that there were some reports containing critical information of which they were not aware, we submitted an advance Report on Alleged Suporession of Information on Defects in Waste Storage Tanks at Savannah River. As a result

of this advance report, we understand that the Department's attorneys assigned to this litigation have been given access to the reports. We also understand that information on tank defects has been conveyed to appropriate Department officials who are responsible for consideration of these matters in the EIS process.

In response to the former employees's allegation that these reports were not conveyed to the DOE Technical Information Center, we inquired into the matter. We found that the reports had not been sent to the Technical Information Center. We then inquired of officials at SRO why this was not done pursuant to DOE Order 1430.1, "Managing the Department of Energy's Scientific and Technical Information," which states as the policy that:

> "Scientific and technical information developed during work supported by DOE shall be reported promptly and fully to the Department's Technical Information Center (TIC) located in Oak Ridge, Tennessee, for inclusion in DOE's information data base; and, as security, patent, and other DOE policy considerations permit, to be made available to the scientific, technical, and industrial communities, and to the public through approved channels. Because the scientific and technical information program is a basic and integral part of DOE's research and development program, research and development projects are not considered completed until the scientific and technical information (unlimited, limited, and classified) is recorded, documented, and provided to the Technical Information Center."

The order defines scientific and technical information as:

> Communicable knowledge or information (unlimited, limited, and classified) resulting from, or pertaining to, the conduct of research and development efforts. This information reports on progress or results of DOE-funded research and development or demonstration and usually is published as technical reports, journal articles, reprints, theses or dissertations, conference and symposium proceedings, or translations. This may include experimental data, theoretical data, analytical studies, and economic and energy use projections. This information is used by managers, scientists, researchers, and engineers engaged in scientific and technological efforts, and is the basic intellectual resource for and result of such effort."

A SRO official told us that only research and development (R&D) type reports had to be sent to the TIC and the contract for this report did not characterize this as an R&D type report. This official informed us that the A.D. Little report was an independent review of the structural integrity of the tanks. He distinguished this from an R&D report. We note that the end result is that the report was not disclosed to the TIC. The cost of pitting studies and pitting work was approximately $2.9 million. We inquired about disclosure under the Freedom of Information Act and were told there had been no requests for the report.

We have asked both the former employee and management at SRO the substantive question: Are the tanks safe? The former employee declined to answer this question yes or no. He was only willing to say that the tank safety issue should be judged by the engineering community after the community is presented all the information, including the allegedly suppressed reports concerning the tanks. At a recent public hearing in connection with preparation of the EIS, the former employee requested that the two reports be referenced in the EIS. Officials at SRO have told us that this will be done. The former employee has also sent to us a draft paper that he intends to publish in which he describes the reports and the controversy they engendered among DOE management and engineers, the Arthur D. Little consultants, and DuPont. It is our understanding that since our advance report he has submitted his paper for publication and testified as an expert witness at a trial of anti-nuclear protestors who had trespassed at the Savannah River Plant.

Management at SRO told us that the tanks are safe. They contend that another study of the issues raised in the Arthur D. Little report so indicates. They also pointed out that they do not believe that the tanks are leaking at the present time.

James R. Richards

James R. Richards
Inspector General

3.5

Atlanta Constitution Article on DOE Inspector General's Memorandum on Suppressed Information

The corrosion pitting reports and the IG report make the headlines in the Atlanta Constitution.

THE ATLANTA CONSTITUTION

★★★★ FRIDAY, FEBRUARY 3, 1984 25 CENTS

Feds at SRP withheld reports on tank safety

By John Lancaster
Staff Writer

Reports questioning the safety of radioactive waste storage tanks at the Savannah River Plant, where plutonium is produced for nuclear weapons, were deliberately kept secret by the Department of Energy office at the plant.

The documents, warning of potential leaks, were withheld from both an environmental group and the DOE's own environmental protection division, according to court records, internal Department of Energy memos and letters, and interviews with DOE officials.

Information about the safety of the storage facilities had been requested last year following a controversial proposal to restart the mothballed "L-reactor," which would increase the nation's weapons-grade plutonium output by a third. Much of the waste generated as a result would be stored in the recently constructed tanks.

In December 1981, a study by the Arthur D. Little consulting firm warned that cracks could develop in three of the tanks. It was not made public, however, until Jan. 10 of this year — the day after a former DOE engineer testified in court about its contents.

"When we found that our waste tanks were in fact all right and OK for use, we handled it just like our normal business," said Ed Goldberg, DOE assistant manager for operations at the facility, in an interview. "Thousands of people on the plant were aware of this problem so there was no attempt to hide it."

None of the new tanks at the Savannah River Plant has leaked, and there is no evidence to suggest any immediate threat to the environment.

DOE Inspector General James Richards, whose office has recently completed an investigation, said this week that he considered the withholding of the reports "a serious matter."

Richards said his investigation showed that information about potential problems in the tanks was deliberately kept from the environmental group, the Natural Resources Defense Council, when such material was requested in a court case last year. He said the report also was withheld

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SRP

Continued From Page 1-A

from the DOE's own environmental officials — both in Washington and at the Savannah River Plant itself.

The suppression, he said, "deprived officials in the department of critical information."

The inspector general said his investigation had not determined who was responsible. A report on the matter was forwarded last week to Department of Energy Secretary Donald Hodel.

The investigation began after William Lawless, an SRP engineer, filed five internal complaints about waste management at the South Carolina nuclear facility shortly before resigning last summer. Last month Lawless made public his allegations when he testified as a witness at the trial of 50 anti-nuclear protesters arrested in an October demonstration outside the facility.

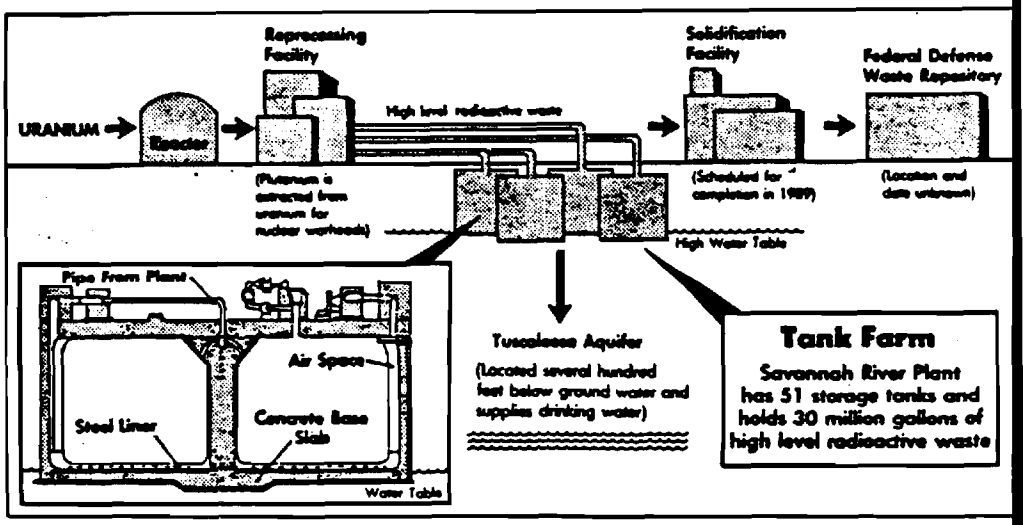
The Savannah River Plant is a heavily guarded 300-square mile facility along the north bank of the Savannah River in Aiken County, S.C., run by Du Pont under a government contract. It was built by the federal government 34 years ago.

Since then, nearly 30 million gallons of high-level radioactive waste has accumulated in two 10-acre tank farms, where 51 massive vessels of steel and reinforced concrete are buried. The thick brown liquid is piped into the tanks at scalding temperatures and will remain dangerously radioactive for 300 years. The DOE plans to solidify the waste into glasslike logs in a factory scheduled for completion by the end of the decade.

The tanks are buried within a few feet of the water table, and a critical consideration in their design was the risk of waste leaking into the soil. Several hundred feet below the water table is the Tuscaloosa aquifer, which supplies drinking water to parts of Georgia. Nine tanks have leaked over the years. In all but one case the waste was contained by an outer lining. In 1960, according to a DOE report, "a few tens of gallons" seeped into the soil around one tank. The report maintains the radioactivity has not spread more than a few feet since then.

The latest 14 tanks, built between 1976 and 1978 at a cost of $158 million and designed to hold 1.3 million gallons each, are supposed to be leakproof for at least 40 years.

In September 1980, an engineer making a routine inspection lifted a sheet of plywood and discovered corrosion pits in the bottom of one tank. Checks of the other new tanks revealed varying degrees of the same problem.



KATHY INSKEEP/Staff

Five months earlier, an environmental impact statement prepared by the DOE on the waste tanks had warned, "Pitting may cause very rapid penetration of the structure." The statement also reported that "pitting . . . has not appeared to be a problem in the waste tanks themselves."

The department hired Arthur D. Little Inc., one of the nation's largest consulting firms, to conduct a study of the corrosion. The firm's report, completed in Dec. 1981 at a cost of $426,000, concluded that the corrosion pits posed a risk of leakage in several cases.

Du Pont, responsible for building the tanks, carried out its own study. Company engineers decided the integrity of the tanks was not jeopardized in any way. The DOE agreed with Du Pont's assessment, and in

March 1982 the tanks were approved for "unrestricted radioactive waste service with no remedial repair."

Although the department was apparently satisfied that the tanks were in no danger of leaking, some DOE engineers felt that Du Pont deserved a stern warning in the aftermath of the affair, which cost the government a total of $3.3 million. Barbara M. Dodge, an engineer who served as a technical liaison between the DOE, Du Pont and Arthur D. Little, drafted a harshly worded letter to Du Pont headquarters in Wilmington, Del. Her superiors considered the criticism too strong, and a toned-down version was eventually sent.

Documents addressing waste management at the Savannah River Plant are usually released to the public through the DOE reading room in Aiken. In May 1981, Lawless sent a memo to his superiors suggesting they inform the public about the corrosion by filing a letter there describing the problem. The memo also suggested that reports on the corrosion be released to a DOE clearinghouse for technical documents in Oak Ridge, Tenn., called the Technical Information Center. His superiors declined both requests in a written response. The reports were not placed in the reading room until Jan. 10 of this year, the day after Lawless' testimony.

Last February, U.S. District Court in Washington, D.C., directed the DOE management at the Savannah River Plant to respond to a series of questions filed by an environmental group, the Natural Resources Defense Council, in connection with a lawsuit to prevent the restart of the L-reactor without an environmental impact study, which has since been ordered by Congress. The court specifically asked the DOE to provide a list of documents containing any information "regarding the safety" of the high-level waste tanks.

The question about tank safety was first routed to the waste management office at the plant, which chose to include the consulting firm's report in its reply. But before the response was sent from SRP to the DOE's legal branch in Washington, which was responsible for supplying it to the court, the reference to the report — "The Effect of Corrosion Pitting on the Integrity of Radioactive Waste Storage Tanks 38 to 51" — was deleted.

Inspector General Richards said that the abbreviated list was also supplied to DOE environmental officials looking at the effects of restarting the L-reactor.

"We were never under the impression there was any immediate danger," said Richards. "But there was written information that tanks built in the recent past were not what they should be. That is an important factor for anyone concerned with taking environmental aspects into account."

Richards said his investigation established that "someone on a middle level did cross it off the list." But he added, "We did not find a smoking gun as to who crossed it off."

Goldberg said there was no attempt at deception, and that the DOE's Washington headquarters was informed of the decison not to release the information.

According to Goldberg, the decision that the documents were not "pertinent" was made in the DOE operations office at the plant. Goldberg indicated that he felt the deletion was improper. "I don't know who knocked it off the list," he said. "If I had seen it on the list I would not have knocked it off."

Section 3: Questions for Discussion

Section 3: Questions for Discussion

1. What is a cover-up? Why are cover-ups socially disruptive? Should cover-ups be allowed to take place in our society? List five advantages to cover-ups and then five disadvantages? What conclusions can be reached on cover-ups?

2. Are scientists and engineers the best judges in a society of the social implications and applications of technology? Should any segment of society be allowed to determine what is best for the whole of that society? Is it important for non-technical individuals to understand the impact of technology in their society? Is it important for scientists and engineers to be educated in the humanities? Which is more important?

3. Does a federal agency have an obligation to obey the law? Why is it difficult, within large organizations, to see that those organizations obey the law? Why don't more insiders speak out when a large organizations, such as a federal agency or corporation, breaks the law?

4. Can you summarize the most important ideas presented in this section? What conclusions can you draw?

5. Should the DOE have informed the federal court and the public about the corrosion pitting in the Savannah River Plant high-level waste tanks?

6. Are scientists responsible to the public for the interaction of public welfare with their science? Should scientists consider the social consequences of their science?

7. What is a whistleblower? Are whistleblowers loyal individuals? What is their benefit to society? Should whistleblowers be protected and, if so, to what extent?

8. What is the benefit of having an inspector general organization within a federal agency? Is there a better way to review the problems within an organization? Explain.

Appendix A: Acronyms

Appendix A: Acronyms

Government Agencies

DOE - Department of Energy
DOT - Department of Transportation
EPA - Environmental Protection Agency
GAO - General Accounting Office
NRC - Nuclear Regulatory Commission
USGS - U.S. Geological Survey
NOAA - National Oceanic and Atmospheric Administration

Radioactive Wastes

HLW - High Level Waste (about 30 to 280 Ci/gal)
LLW - Low Level Waste (solids or liquids)
Mixed - Radioactive and Hazardous Chemicals
SF - Spent Fuel (Reactor)
TRU - Transuranic (usually plutonium)

Facilities

Hanford - Richland, WA
INEL - Idaho National Engineering Lab, ID
LANL - Los Alamos National Lab, NM
ORNL - Oak Ridge National Lab, TN
SRP - Savannah River Plant, SC
WIPP - Waste Isolation Pilot Plant, NM
RFP - Rocky Flats Plant, CO

Regulations or Orders

AEC 0511 - Manual chapter for Defense Radioactive Waste Management, 1973
DOE 5820.2 - Order Replacing AEC 0511, 1984
NRC 10 CFR Part 61 - Regulation for Commercial LLW

Units/Other

A-Area - Administration
cu m - Cubic Meters
EIS - Environmental Impact Statement
M-Area - Manufacturing
mg/L - milligrams/liter
nCi/g - nanocuries/gram
pCi/L - picocuries/liter

Appendix B: Glossary of Terms and Abbreviations

Glossary of Terms and Abbreviations

activity - Radioactivity or radioactive materials. A measure of the rate at which a material is emitting radiations; usually given in terms of the number of nuclear disintegrations occurring in a given quantity of material over a unit of time. The standard unit of activity is the curie (Ci).

AEC - Atomic Energy Commission (discontinued with formation of ERDA and NRC on January 19, 1975).

alpha particle (α) - A positively charged particle emitted by certain radioactive materials. It is made up of two neutrons and two protons; hence it is identical with the nucleus of a helium atom.

critical - The condition in which a material is undergoing nuclear fission at a self-sustaining rate.

curie - The basic unit used to describe the intensity of radioactivity in a sample of material. One curie (Ci) equals 37 billion disintegrations per second.

decay - The spontaneous radioactive transformation of one nuclide into a different nuclide or into a different energy state of the same nuclide. Every decay process has a definite half-life.

decontamination - The selective removal of radioactive material from the surface or from within another material.

depleted uranium - Uranium having a smaller percentage of uranium-235 than the 0.7% found in natural uranium.

dose - The energy imparted to matter by ionizing radiation per unit mass of irradiated material at a specific location. The unit of absorbed dose is the rad.

enriched uranium - Uranium in which the percentage of the fissionable isotope uranium-235 has been increased above the 0.7% contained in natural uranium.

fallout - Radioactive materials in the atmosphere and deposited on the earth's surface following the detonation of nuclear weapons.

fertile material - A material, for example, uranium-238, not itself a readily fissionable material, which can be converted into a fissionable material by irradiation in a reactor, e. g., plutonium-239.

Glossary of Terms and Abbreviations

fission - The splitting of a heavy nucleus into two roughly equal parts (which are nuclei of lighter elements), accompanied by the release of a relatively large amount of energy and frequently one or more neutrons.

fission products - Nuclei formed by the fission of heavy elements. Many are radioactive. Examples: strontium-90, cesium-137.

fissionable material - Any material readily fissioned by neutrons. Examples: uranium-235 and plutonium-239.

food chain - A linear sequence of successive utilizations of nutrient energy by a series of plant and animal species. Radioactive or hazardous chemicals can be passed through the food chain.

fuel assembly - An assembly of fuel elements.

fuel element - A tube, rod, or other form into which fissionable material is fabricated for use in a reactor.

gamma rays (γ) - High-energy, short-wavelength electromagnetic radiation emitted by a nucleus. Gamma radiation usually accompanies alpha and beta emissions and always accompanies fission.

GAO - General Accounting Office (under the Comptroller General of the United States).

glove box - A sealed box in which workers, using gloves attached to and passing through openings in the box, can handle certain radioactive materials safely.

ground water - Water in the zone of saturation beneath the land surface.

grout - Mortar or plaster that does not contain gravel or other reinforcing aggregate.

half-life, radiological - The time in which half the atoms in a radioactive substance disintegrate.

half-life, biological - The time required for a living organism to eliminate, by natural processes, half the amount of a substance that has entered it.

health physics - The profession which deals with the protection of humans and their environment from unwarranted exposure to ionizing radiation.

heavy water - Deuterium oxide, D_2O. Water in which normal hydrogen atoms have been replaced with deuterium atoms. D_2O has a low neutron absorption cross section; hence, it is used as a moderator in some nuclear reactors. In SRP reactors, it is used as the moderator and primary coolant.

high-level waste (HLW) - (a) high-level liquid waste, or (b) the products from solidification of high-level liquid waste, or (c) irradiated fuel elements if discarded without processing. HLW is generated by the reprocessing of either commercial spent fuel or defense production reactor fuel. It is the aqueous waste from the first-cycle extraction system (or equivalent high-activity waste from other processes) in a facility for processing irradiated reactor fuels. High-level waste may also be in the form of sludge, calcine, or other products generated in treating liquid HLW. This waste releases considerable decay energy and requires heavy shielding to control penetrating radiation as well as provisions for dissipation of the decay heat.

low-level waste (LLW) - Radioactive waste not classified as mill tailings, HLW, TRU waste, spent fuel, or by-product material as defined in Public Law 96-573. It is contaminated material that generally contains low, but potentially hazardous, amounts of radionuclides. The radiation level from this waste may sometimes be high enough to require shielding for handling and transport ("remote handled"). The NRC has recently defined four disposal categories of LLW that require differing degrees of confinement and/or monitoring.

milli - Prefix indicating one thousandth (1 milli = 1/1000 of a rem or 10^{-3} rem).

millirem - One thousandth of a rem.

moderator - A material, such as heavy water, used in a reactor to slow down high-velocity neutrons. In SRP reactors, heavy water is used as moderator and primary coolant.

MPC - Maximum permissible concentration. The average concentration of a radionuclide or chemical in air or water to which a worker or a member of the general population may be continuously exposed without exceeding an established standard.

natural (normal) uranium - Uranium as found in nature. It is a mixture of the fertile uranium-238 isotope (99.3%), the fissionable uranium-235 isotope (0.7%), and a minute percentage of uranium-234.

NRC - Nuclear Regulatory Commission (includes the regulatory branch of the former AEC).

Glossary of Terms and Abbreviations

nuclide - Any atomic nucleus specified by its atomic weight, atomic number, and energy state. A radionuclide is a radioactive nuclide.

plutonium - A radioactive element with atomic number 94. Its most important isotope is fissionable plutonium-239, produced by neutron irradiation of uranium-238. Another important isotope is plutonium-238, used in the space program as a heat source.

production reactor - A nuclear reactor designed primarily for large-scale production of plutonium, tritium, and other radionuclides by neutron irradiation.

Purex - A solvent extraction process in which uranium and plutonium are selectively separated from each other and from fission products by extraction from nitric acid solutions with tributylphosphate in a hydrocarbon diluent.

rad - Radiation absorbed dose. The basic unit of absorbed dose of ionizing radiation. One rad is equal to the absorption of 100 ergs of radiation energy per gram of matter.

radioactivity - The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

radionuclide - An unstable nuclide of an element that decays or disintegrates spontaneously, emitting radiation.

reactor - A device by means of which a fission chain reaction can be initiated, maintained, and controlled.

release guide - A control number which regulates the concentration or amount of a radioactive material or toxic chemical released to the environment.

rem - A quantity used in radiation protection to express the effective dose equivalent for all forms of ionizing radiation. It is the product of the absorbed dose in rads and factors related to relative biological effectiveness.

roentgen - A unit of exposure dose of ionizing radiation. It is that amount of gamma or x-rays required to produce ions carrying 1 electrostatic unit of electrical charge in 1 cubic centimeter of dry air under standard conditions.

seepage basin - An excavation in the ground to receive aqueous streams containing chemical and radioactive wastes. The water evaporates and seeps from the basin through the soil column to the ground water and ultimately to the streams that drain the plant site. Insoluble materials settle out on the floor of the basin. Soluble radioactive materials move with the water or are removed by ion exchange with the soil. Seepage basins are surrounded by earthen dikes to prevent the entrance of surface water, and levels are controlled to prevent overflow from the basin system.

separations - Chemical processes used to separate nuclear products from byproducts and from each other.

settling basin - An excavation in the ground similar to a seepage basin. Normally a settling basin overflows to a natural basin. In the settling basin, most of the solids settle out.

solvent extraction - A process in which materials are selectively removed from an aqueous solution by contact with an immiscible organic solvent.

spent fuel - Irradiated fuel discharged from a commercial reactor or special fuels from test or research reactors. The commercial fuel assemblies at DOE sites are now stored in pools at the reactor sites and other locations, and those special fuels which are not routinely reprocessed are stored at the Savannah River Plant (SRP) and the Idaho Chemical Processing Plant (ICPP).

tank farm - An installation of interconnected underground tanks at SRP for the storage of radioactive high-level liquid wastes.

target element - A tube, rod, or other form into which fertile or other materials are fabricated for irradiation in a reactor.

transuranic waste (TRU waste) - Solid radioactive waste containing primarily alpha emitters. TRU waste is defined as contaminated waste that, without regard to source or form, at the end of institutional control periods is contaminated with alpha-emitting radionuclides of atomic number greater than 92 and half-lives greater than 20 years in concentrations greater than 100 nanocuries per gram (nCi/g), or has smearable alpha contamination greater than 4000 dpm/cm^2 averaged over the accessible surface. This definition supercedes the previous one, which specified a concentration limit of 10 nCi/g. EPA draft criteria (which are the basis for NRC regulations and commercial activities) also define TRU waste as waste containing greater than 100 nanocuries per gram of transuranic elements. Transuranic waste results primarily from fuel reprocessing and from the fabrication of plutonium weapons and plutonium-bearing reactor fuel. Generally, little or no shielding is required ("contact handled"), but energetic gamma and neutron emissions from certain TRU nuclides and fission-product contaminants may require shielding or remote handling ("remote handled").

transuranium elements - Elements above uranium in the periodic table, that is, with an atomic number greater than 92. All 13 known transuranium elements are radioactive and are produced artificially. Examples: neptunium, plutonium, curium, californium.

trench - A long and narrow excavation in the ground for solid waste. Unless qualifying descriptions are given, a trench is unlined, and its walls are unsupported. After the solid wastes are placed in position, the trench is filled to grade level with some of the removed soil.

tritium - A radioactive isotope of hydrogen with two neutrons and one proton in the nucleus. It is heavier than deuterium (heavy hydrogen). Tritium (T or ^3H) is used in industrial thickness gages, as a lable in tracer experiments, in controlled nuclear fusion experiments, and in thermonuclear weapons. It is produced primarily by neutron irradiation of lithium-6.

uranium - A naturally radioactive element with the atomic number 92 and an atomic weight of approximately 238. The two principal naturally occurring isotopes are the fissionable uranium-235 (0.7% of natural uranium) and the fertile uranium-238 (99.3% of natural uranium).

uranium mill tailings - The earthen residues that remain after the extraction of uranium from ores. Tailings are generated in very large volumes and contain very low concentrations of naturally occurring radioactive materials. The isotopes of major concern are ^{226}Ra and its daughter, ^{222}Rn.

waste, radioactive - Equipment and materials (from nuclear operations) that are radioactive or have radioactive contamination and for which there is no recognized use or for which recovery is impractical.

Table of Radionuclides

Nuclides with Half-Lives Greater Than One Year

Element	Nuclide	Radiation Emitted	Half-life, yr[c]	Specific Activity, Ci/g
Ruthenium	^{106}Ru	β,γ	1.01	3.3×10^{3}
Cesium	^{134}Cs	β,γ	2.06	1.3×10^{3}
Promethium	^{147}Pm	β	2.62	930
Californium	^{252}Cf	α,n	2.63	540
Antimony	^{125}Sb	β,γ	2.73	1.1×10^{3}
Cobalt	^{60}Co	β,γ	5.27	1.1×10^{3}
Krypton	^{85}Kr	β,γ	10.73	390
Tritium	^{3}H	β	12.33	9.7×10^{3}
Plutonium	^{241}Pu	β	15	99
Curium	^{244}Cm	α	17.9	82
Curium	^{243}Cm	α	28	53
Strontium	^{90}Sr	β	29	140
Cesium	^{137}Cs	β,γ	30.1	87
Plutonium	^{238}Pu	α	87.8	17
Americium	^{241}Am	α	433	3.4
Carbon	^{14}C	β	5.73×10^{3}	4.4
Plutonium	^{240}Pu	α	6.5×10^{3}	0.2
Plutonium	^{239}Pu	α	2.44×10^{4}	0.062
Uranium	^{233}U	α	1.58×10^{5}	9.8×10^{-3}
Neptunium	^{237}Np	α	2.14×10^{6}	7.1×10^{-4}
Iodine	^{129}I	β,γ	1.59×10^{7}	1.8×10^{-4}
Uranium	^{236}U	α	2.34×10^{7}	6.5×10^{-5}
Uranium	^{235}U	α	7.04×10^{8}	2.2×10^{-6}
Uranium	^{238}U	α	4.47×10^{9}	3.4×10^{-7}
Uranium	^{Nat}U	α	4.47×10^{9}	7.0×10^{-7}
Thorium	^{232}Th	α	1.4×10^{10}	1.1×10^{-7}

Library Research Guide

by

James E. Ford

A LIBRARY RESEARCH GUIDE: Social and Legislative Responses to Nuclear Waste Disposal

This study guide is intended to lead you to sources which will assist you in writing a background study on your topic. When the background study is completed, you will be ready to write a paper dealing with a specific issue. As you begin, keep your subject general, but be alert to issues in the field. As you read for background information, keep these questions in mind: What seem to be the most important questions the people who write about this subject are asking? On what points do the scholars disagree? What issues seem to be unresolved? By following the procedure below you will be able to gather information for your background study.

I. FINDING BACKGROUND MATERIAL

As you read background material, look for the history of your topic, relationships between your topic and other topics, issues within the topic, authorities in the field, and special terminology and definitions.

A. Finding Related Terms for Your Topic

Go to the Library of Congress Subject Heading list and look up "Radioactive Waste Disposal." List related subject headings you could use in researching this topic. (Note, for instance, "Radioactive Waste Disposal--Law and Legislation." Add to this list whenever you see alternate subject headings in a new reference source.)

Related Subjects

_____ _____

_____ _____

_____ _____

_____ _____

B. Searching General Encyclopedias

You can use any general encyclopedia to get background information. But if it is available, choose the World Book Encylopedia and look up "Nuclear Energy" in the index. Note the Reading and Study Guide in the index, including the bibliography. Read the entire article in the "N" volume. Examine any other articles which might be of interest to you. These articles supply background information, names of authorities, (the author of the encylopedia articles and articles cited in the bibliographic references), and bibliographies. List bibliographic references you wish to consult.

Authorities in the Field

_____ _____

_____ _____

_____ _____

Bibliographic References from General Encyclopedias

_____

_____

_____

_____

C. Using Specialized Reference Books on Your Subject

You can find specialized reference materials covering your topic by browsing call numbers related to your subject in the general card catalog or the reference catalog, if available.

1. Go to the card catalog and look under the subject headings you listed in "I.A."

2. Notice the call numbers of books under these topics.

3. Look through the cards and get an idea of the kinds of materials that are available.

4. Go to the reference collection and browse the call numbers noted above. You will see reference books for your topic. Examine all books that may be relevant to your research. Notice particularly the McGraw-Hill Encyclopedia of Science and Technology. Check the index and the yearly supplements, under "Radioactive Waste Management." If this book is in use, consult the librarian at the desk to help you find other books which might be useful.

CONSULT THE TITLE IN #4 & OTHER REFERENCE BOOKS YOU HAVE LOCATED

Read for more detailed background information and to learn of more issues in the field. Also list titles and full bibliographic information from any of the bibliographies you consult.

Reference Books Consulted for Background

_____

_____

_____

_____

_____

_____

_____

_____

Titles From Bibliographies (From I B and I C)

_____

_____

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_____

Possible Issue Questions

_____

_____

_____

_____

II. FORMING AN ISSUE QUESTION

Your reading so far should give you a background of the history of your topic, the relationship of your topic to other topics, possible issues for research, terms, definitions, and authorities. From your reading, select any area you might be interested in researching and formulate an "issue question."

A SAMPLE ISSUE QUESTIONS:

"Nuclear power: do the advantages outweigh the disadvantages?" "Should states be able to regulate nuclear waste disposal within their boundaries? "Should military nuclear waste be subject to the same regulations as commercial nuclear waste?" "Are there gender differences in people's attitudes toward nuclear power?

Your Issue Question

_____

_____

_____

III. DOING THE RESEARCH

Now that you have gathered backgound information and formulated a tentative research question, you are ready to do research on your issue. Be open to the possibility that you may modify your issue as you proceed.

A. Using Periodical Indexes

Locate the indexes most appropriate for specific research on your subject by going to the periodical indexes. The most general periodical index is Reader's Guide (check "Radioactive Waste Disposal." More specialized indexes include General Science Index ("Radioactive Waste Disposal"), Applied Science and Technology Index ("Radioactive Waste Disposal") and Science Citation Index. ("Nuclear-waste" in the Permiterm Subject Index. Ask the library to show you how to use this index.) For articles on the political, and legal aspects of nuclear waste disposal, consult PALS (Public

Subject Headings

_____

_____

_____

Articles To Be Used

_____

_____

_____

_____

Affairs Information Service. Beginning with the most current and working background in time, examine several volumes to see the kinds of information you might locate. List the relevant subject headings (compare them with the list in I.A.). List three to five sample articles you will want to use to write a research paper on your issue. Include complete bibliographic information for each article.

B. Using the Card Catalog

With your specific issue in mind look up the subject headings you located in the Library of Congress Subject Headings list. (See Step I. A.) Find books which seem to be directly related to your issue. List the complete bibliographic information and call number for at least two books you will want to use in writing a research paper on your issue.

Books To Be Used

C. Using Bibliographies

In previous steps you consulted bibliographies related to your topic. It is particularly helpful to pay attention to bibliographies which are closely related to the actual subject you wish to write on since these can expand your research. If you have trouble finding books or articles on your subject you may wish to consult the Bibliographic Index.

Additional Bibliographies

IV. WRITING THE BACKGROUND STUDY

Now that you have completed this study guide you are ready to write the background study. Complete the following steps:

A. Sketch briefly the history and nature of your subject.

B. State the "Issue Question" you have chosen to research.

C. Indicate related subjects. These you will have discovered from your broad general reading. You will have used, first, the general and then more specific sources to get the needed background for your issue. These related subjects may suggest additional areas for productive research on your issue.

D. Mention some authorities in the field on your research. You should find some in the articles in the encyclopedias; others you will discover as you do more specific research.

E. Include a bibliography of the sources you used to obtain your background information. You should include in this bibliography a list of reference books used: general encyclopedias, specific encyclopedias, bibliographies, dictionaries, indexes etc.

F. Include a bibliography listing the articles and books you located by using periodical indexes and the card catalog. The sources you list should be directly related to your issue. You will use these sources as you write your final pro/con paper.

G. Document (footnote) the background study as needed.

H. Additional considerations
   1. The background study looks best when typed.
   2. Your background study could be rejected it if does not meet the above-mentioned criteria.

V. WRITING THE PAPER

Now that you have an understanding of the background of your subject and have located books and periodical articles on your specific issue, you are ready to write your paper. Use the material you have located through your background study as source material in writing your final paper.

APPENDIX 6: Module Field-testing Report

"Interfacing Mathematics and Technology with Design and Architecture," prepared at Morris Brown and field-tested at Clark and Spelman (Spring 1986). Report by Dr. Lee A. Ransaw, Project Director and Chairman, Fine Arts, Morris Brown.

"INTERFACING MATHEMATICS AND TECHNOLOGY WITH DESIGN AND ARCHITECTURE"

A RETLA MODULE

Field Tested at Clark College and Spelman College

Prepared by

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Submitted to

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May 15, 1986

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mathematics

Final Report

Statement of the Goal

The goal of these special workshops were to field test the module "Interfacing Mathematics and Technology with Design and Architecture" on two college campuses other than at Morris Brown College, and to determine how adaptable the module was to a new environmental setting. This module was field tested at Clark College on March 13,18,20,25,27 and April 3rd. The module was field tested at Spelman College on March 15,18,22, and 24.

The staff included Mr. Christopher Hickey, Assistant Professor of Art at Clark College, Ms. Akua McDaniel, Assistant Professor of Art at Spelman College, Mr. Abiola Lawal, Assistant Professor of Mathematics at Morris Brown College, Dr. Lee A. Ransaw, Project Director from Morris Brown College and Dr. Lee Payne, Consultant from the Georgia Institute of Technology.

The module presented problem solving tasks that focused on the Arch. Completion of a specific set of tasks requred the integration of knowledge derived from mathematics, technology and art. The four phases of the module included units on art history, mathematics 2-Dimensional design and finally a 3-Dimensional construction of an arch. Spelman College had 10 students to participate in the first three phases of module testing. These students, 2 male and 8 female, were enrolled in the art history class. Clark College had a variation of from 6-8 students to participate in all four phases of module testing. These students, enrolled in a Design class, included two engineering majors and four fine arts majors. There were six females and two males. It should be noted that Spelman chose not only to use two regular sessions for the workshop on Monday and Wednesday, but to come to two special Saturday morning sessions on March 15 and 21 from 9-12PM.

Overview of the Workshop

Dr. Ransaw introduced the staff and passed out student handbooks to both groups and followed with an overview of the activities. Dr. Payne started

the first session at both workshops with a slide lecture on the "Golden Triangle," how it was thought to be used by the Greeks in building Greek temples and the Parthenon, as well as how the"Golden Triangle" is presently used in product design and in Industry. The Art Instructors at Clark College and Spelman used the next two sessions to expand on the role of architecture in art history. The primary objective of these lectures were to demonstrate to the students knowledge of technical problems in mathematics that architects experienced not only during the Gothic and Renaissance Period, but in contemporary times.

Mr. Abiola Lawal followed with a 20 minute pre-test on problem solving and then with a 1½ hour session on how to calculate using enginneering calculators. A comprehensive Session #5 followed with the Math Instructor teaching the formula for strain, elasticity and scale. The classes discussed the yeild point and the British unit of Stress. Sessions #6 and 7 involved the introduction to graphical representations of an object, Graphs, 2-Dimensional plans and introduction to three-Dimensional shape and size by inthrographic and pictorial projections. The learning objectives were to develop a structural vocabulary in mathematics and to understand the technological process as it relates to art and mathematics ,Students spent several sessions in mathematics review to reestablish their contact with the geometry and algebra needed to construct an arch. This included things like being able to compute the area of a circle to the ability to construct angles at 30,45, and 60 degrees without the aid of a protractor.

The students at both workshops were then given the task of designing a structure incorporating the arch. They began making loose sketches of various ideas and then, after selecting the most promising direction, the Math and Art Instructors assisted the students in creating finished drawings to scale that would serve as a blue print for the actural building of the model structures. At this point Spelman College was unable to complete the last phase of the module, the acutual building of the arch. The Instructor has allocated six sessions to the project and was committed to return to the regular Art History curriculum. Students indicated that at a later date they would like to complete the construction phase of the project. The Clark College Design class however, was able to transfer the two-dimensional concepts into the 3-Dimensional model with different levels of success.

Project Analysis

The total number of participants in the two workshops were 18. The Spelman group included 8 females and two males while the Clark group included 6 females and two males. All participants were art majors, however Clark's group included two engineering students. The two engineering students did significantly better on all phases of the problem solving tasks than the Art History or Design students.

Adaptability of Module to New Setting

This module seemed adaptable to both colleges. However, both campuses presented different physical problems trying to set up the workshops. At Spelman College, the chair arrangement of the classroom was for history lectures, hence, we had only desk tops to work on. After completing the Art History and mathematics lectures and discussions, we moved to the Art library which had two large tables to work on. However, the work space was still very tight considering the number of participants that had to crowd around the tables. There was no display board or chalk board in the library for demonstration. At Clark College the Print room (Graphic Arts) was very bright through natural lighting, and we had to make special efforts to darken the room for the slide lectures. However, the drawing and construction facilities were very good. Both groups were able to move through the different phases of the module with varying amounts of success. The Art History majors at Spelman, probably due to their historical background, directed more challenging questions to Dr. Payne than the Clark College students. There seemed to be more of a fasination by Spelman students on the lecture on "The Golden Section" and its psychological limitations (related to vision) rather than mathematical logic.

Feasibility of Math in Art Course

A pre- test and an post-test were given in both workshops in mathematics. A summary of the results is as follows:

Clark College

ANALYSIS OF PRE-TEST

Scores

X	$X-\bar{X}$	$(X-\bar{X})^2$
60	-5.5	30.25
52	-13.5	182.25
71	5.5	30.25
93	27.5	756.25
48	-17.5	306.25
69	3.5	12.25
$\Sigma X=393$	0	1317.50

a. The mean $\bar{X} = \frac{\Sigma X}{N}$

$= \frac{393}{6} = 65.5$

$\bar{x} = 65.5$

b. Variance $= s^2 = \frac{\Sigma(x-\bar{x})^2}{n-1} = \frac{1317.50}{5} = 263.5$

c. The standard deviation $s = \sqrt{s^2} = \sqrt{203.5} = 16.23$

d. Range = UL - LL = 93 - 48 = 45

Spelman College

Analysis of Pre-Test

Scores

X	X - $\bar{X}$	$(X-\bar{X})$
72	-2.12	4.49
69	-0.88	0.77
80	10.12	102.41
94	24.12	581.77
49	-20.88	435.97
77	7.12	50.69
92	22.12	489.29
71	1.12	1.25
559	0	1666.64

n = total # of students = 8

(a) the mean = $\frac{\Sigma x}{n} = \frac{559}{8} = 69.88$

$\Rightarrow \boxed{\bar{x} = 69.88}$

(b) Variance = $s^2 = \frac{\Sigma(x-x)^2}{n-1} = \frac{1666.64}{7} = 238.09$

$\Rightarrow \boxed{s^2 = 238.9}$

(c) The Standard Deviation $s = \sqrt{s^2} = \sqrt{238.09} = 15.43$

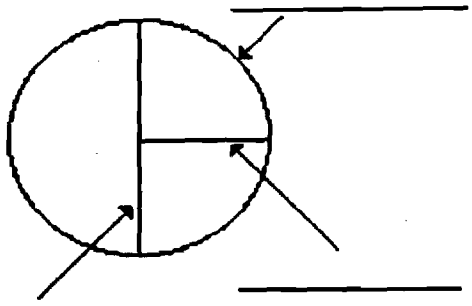
$+\boxed{s = 15.43}$

(d) Range = UL - LL = (94 - 49) = 45

TWO-DIMENSIONAL DESIGN: **Quiz!** Name _____

1. Identify the variable in the following problems
   $3(Y-1) - 2(Y+2) = 0$ $3x + 7 = 2x - 5$

2. Label the illustration



3. On a separate sheet construct angles (with only a ruler and compass) of 90 and 120 degrees

4. What is the difference between a circle and a sphere?

5. What following group was credited with the development of the arch as an architectural structure
   A. Greeks
   B. Egyptians
   C. Romans
   D. Indians

6. A structure supporting it's own weight is defined as
   A. Dead Load
   B. Live Load
   C. Dynamic Load
   D. Thermal Load

7. An unexpected force such as wind or falling objects on a structure is called
   A. Dead Load
   B. Live Load
   C. Dynamic Load
   D. Thermal Load

Findings

Comparing the Standard Deviation score of 16.23 at Clark College and the 15.43 score at Spelman, we can see that Spelman students were more mathematically inclined than the Clark College students. However, due to the limited time with Spelman students, we could not actually conclude that they are better in practical projects than the Clark College students.

The 2-Dimensional drawings produced by Clark students were superior in quality and in greater detail than the drawings produced st Spelman. Again, this may have been due to the urgency by the Instructors at Spelman to complete this phase of the project within the limited time. However, the technical abilities of the students from the Design classes at Clark were evident in all stages of planning and use of the technical drafting tools.

In all of the math and design activities at Clark College, the Art Instructor also functioned as a student. Mr. Hickey concluded that "Without becoming actively involved I would not have had a clear perception of what students were facing; being involved also helped in my ability to work with students on various levels of the project. In looking at the Instructor's Manual, I was reluctant to believe that the mathematics portion of the module could be handled in the small amount of time allocated, but in fact, Mr. Lawal was excellent in presenting the material in a clear and concise manner within the time limitations."

All of the Clark students, given the task of designing a structure incorporating the arch, made loose sketches of various ideas, and then after selecting the most promising direction, Mr. Lawal assisted the participants in creating finished drawings to scale which served for the actual blue print for the building of the structure. All participants were able to transfer 2-Dimensional concepts to the 3-Dimensional model at different levels of success.

The Art Instructors listed the following positive and negative aspects of the module:

Postive

1. Students were aware of the usefulness of mathematics in architecture. Although a number of participants had been away from algebra and geometry for several semesters, Mr. Lawal had excellent success in getting them on the correct track for problem solving activities.

2. The use of a variety of lecturers gave the students a wider range of information, and a broader body of knowledge than if the module were to be taught by one Instructor.

3. The increased awareness of the Clark College students to the conceptalization involved when shifting from 2D to 3D.

4. The introduction of a variety of new materials, tools and instruments were of value because it not only increased the students vocabulary, but built their confidence in a problem solving task.

5. The challenge of designing and constructing an architectural form with full knowledge that the end product may result it failure.

6. The Art Instructors found the module to be an excellent activity and hope that other opportunities to further test it will become available in other types of classes.

Negative

1. Time was perhaps the most noticable problem experienced by all. Mr. Lawal was very thorough and it took much longer to work through the math sections of the module. All of the math material could not be covered to art students in the three 50 minute class periods.

2. It also took students longer than expected to finish the drawings to scale. Some of the loose sketches were of little value in planning the final drawings and those students had to start over. The Art Instructor spent extra time helping those students develop their ideas.

3. The manual skills of some of the students were somewhat laxed (the classes were composed of both non-art and art majors) and for many, the combination of new materials, tools and mathematics instruments became somewhat complex.

4. Students did not have a clear idea of the eventual building materials so that they could design with the materials in mind. Although clay, balsa wook, cardboard, styrafoam, ect., were eventually available, they weren't there initially. The students tended to follow the lead of the Art Instructor in selecting materials. They seemed fearful of branching out on their own.

5. There was no contact or project interest between the Art Instructors at Clark and Spelman as to what the other groups were doing. Two Clark students who missed a lecture on "The Golden Section" were required to sit in at Spelman on the same lecture to make up that time. A joint evaluation could have been very valuable.

6. We were not able to take the class field trip due to limited time and budget.

Summary

Overall, the testing of the module was a success. The students gained knowledge derived from art, mathematics and technology, and were able to express an idea in 2D and 3D form with varying amounts of success. The important ingredient that this module brought to the Design Class and the Art History Class was mathematics. Students at Clark were more fearful

of mathematics than Spelman students, however, they were able to develop their ability to solve problems and apply abstract knowledge derived from mathematics at an acceptable rate to a project requiring a fair amount of technology.

The module, which was designed for three weeks, or 10 sessions, will need more time when tested again. It would be very difficult for an Art Instructor to teach the entire module unless he or she had a strong mathematics background, however the excitement and enthusiasm generated when the module is team taught, in my opinion makes this unit very special. Students were not able to meet the deadlines. The important question for us to consider as we prepare for another test with another class, it time more important than the product?

Budget Sheet

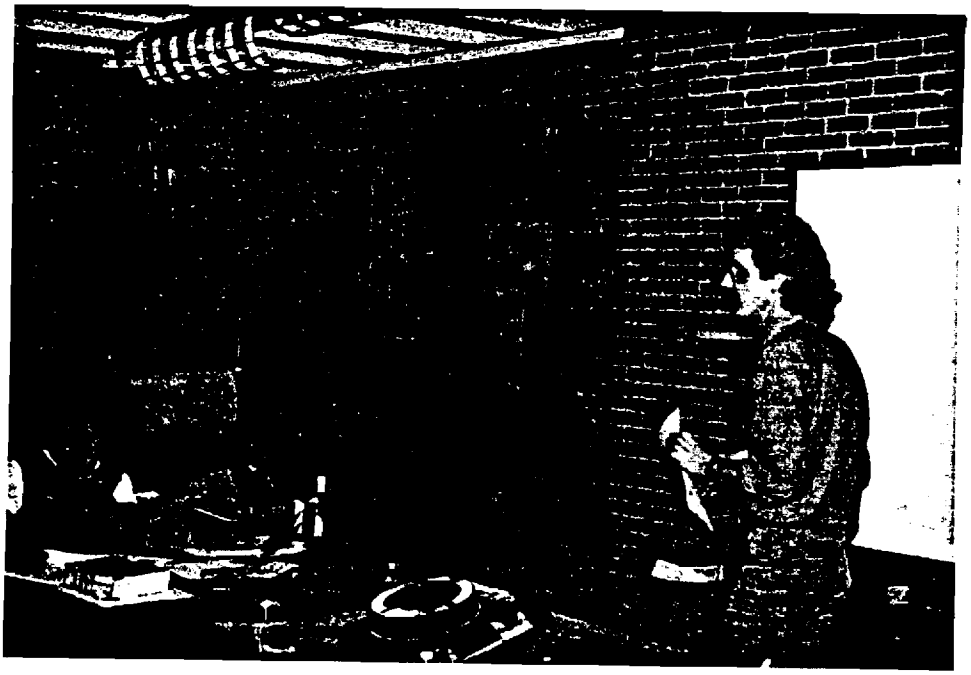
Stipends:

Project Director	@	$100 x 10 wks	$1,000.00
1 Math Instructor	@	100 x 6 Lecture	600.00
2 Art Instructors	@	100 x 4 Lectures ea.	800.00
Consultant N/C			
			$2,400.00

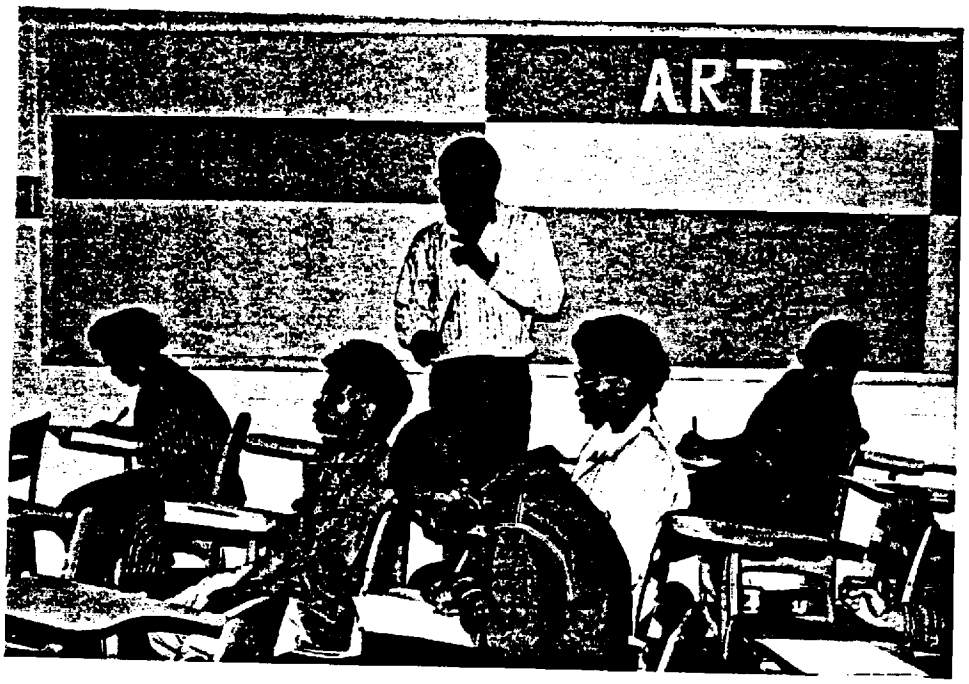
Materials & Supplies: 375.00

Travel: None

TOTAL $2,750.00



Chris Mickey —
Clark College



Abiola Lawal
Mathematics

POST-TEST FOR THE ART/TECHNOLOGY STUDENTS
FOR ART/TECHNOLOGY MODULE

NAME____________________________________

SCORE______________________

SOLVE THE FOLLOWING EQUATIONS. (10 points each)

1. $3x = -24$
2. $3d - 10 = 5(d-4)$
3. $3(y - 1) - 2(y + 2) = 0$
4. $7/8x - 1/4 + 3/4x = 1/16 + x$
5. $1/3(6x + 24) - 20 = -1/4(12x - 72)$
6. $3x + 7 = 2x - 5$
7. $1.7y + 8 - 1.62y = .4y + 7.68$
8. $(1/5 - 2x)(1/9 - 3x) = 0$
9. $5x(8x - 9) = 0$
10. $(.01 - .03)(.04x - 2) = 0$

!!!!!!!!!!BONUS!!!!!!!!!!BONUS!!!!!!!!!!BONUS!!!!!!!!!!BONUS!!!!!!!!!!BONUS

SOLVE ONLY ONE PROBLEM FOR 10 points:

1) $\frac{y - 2}{3} = \frac{2 - y}{5}$

2) $-2[3(x - 2) + 4] = 4(1 - x) + 8$

!!
PLEASE WRITE YOUR NAME ON ALL THE PAPERS YOU USE, THANK YOU

PRE-TEST FOR THE ART/TECHNOLOGY STUDENTS
FOR ART/TECHNOLOGY MODULE

1. The amount to which \$1000 will grow in 3 years, when interest is compounded annually, is given by the polynomial

$$1000r^3 + 3000r^2 + 3000r + 1000$$

Here, r is the rate of interest.

a), Find the amount to which \$1000 will grow in 3 years at 12%
b), Find the amount to which \$1000 will grow in 3 years at 15%

2. An open box is to be made from a square piece of material by cutting 2-inch squares from each corner and turning up the sides (see the figure below). If the box is to contain 200 cubic inches, find the size of the original piece of material.

3. One-eighth of what number is fifty-six?

4. The area of Lake Superior is four times the area of Lake Ontario. the area of Lake Superior is 78,114 km. What is the area of Lake Ontario?

5. $\frac{y - 2}{3} = \frac{2 - y}{5}$ Solve for y

6. $3x - 10 = 5(x - 4)$

7. $3y = 24$

8. $3z + 7 = 2z - 5$

APPENDIX 7: Computer Consulting Report

Proposals and Pre-Proposals Drafted and Reviewed

1. Distributed Microcomputer Lab for Humanities Students, drafted for Morehouse College Department of English.

2. Computer Art Laboratory: A RETLA Computer Initiative, 12 RETLA colleges.

3. Albany State Computer Art Proposal (Arthur Berry), reviewed October 1985.

4. Innovation in the Liberal Arts (John T. Hayes), Paine College, reviewed July 1985.

5. Embryonic General Microcomputer Labs for Several RETLA Colleges, submitted to Apple Computers, November 1985.

6. Rationale for Digital Equipment Acquisitions (Cynthia Duggar), Spelman College, reviewed October 1985.

7. General aid and consulting in preparation of computer-related proposals by Rust College, Paine College, Dillard University, Oakwood College, North Carolina A and T, and others.

Presentations

8. Computers and Liberal Education, South Carolina State students and faculty, February 1985.

Surveys Conducted

9. Computer Art, June-October 1985. 12 favorable responses. Questionnaire and typical response.

10. Capabilities and Needs at RETLA Colleges for Word Processing for English Composition. Analysis of results.

Technical Reviews

11. A Review of NSF's Program Announcement in "Materials Development and Research" in Relation to RETLA Program and Objectives, May 1985.

Project Initiative Material Distributed

12. Draft of Interest-Solicitation Letter to RETLA Colleges re: DEC Micro-VAX Discount Offer.

13. Ideas for Micro-VAX Projects, June 1985.

14. Evolutionary Trajectory Simulation, May 1985.

15. Checklist for Class-Support Software Initiation, Fall 1985.

16. Composition Work Analysis, Fall 1984.

(Draft of key elements of a prospective proposal from Morehouse College to the Sloan Foundation for computing equipment for word-processing and general use by humanities students)

Donovan Young

DISTRIBUTED MICROCOMPUTER LAB FOR HUMANITIES STUDENTS

Background

Morehouse College has a deep commitment to bringing the benefits of the computer to all its students. One evidence and result of this commitment is the establishment of a computer network by which terminals or micros at many places on campus can access several central computer systems and each other. (Perhaps include some detail — the name of the network, the machines, who funded it, who operates it, its purposes, etc.)

Access to the network is through network interface units (NIUs) that cost about $2000 each. Each NIU can serve up to 8 terminals or micros located in a 50-foot-radius cluster.

Internal funding has provided large computers, the networks, and a limited number of NIUs and terminals. It is not really practical, however, for humanities students to use the system very much. Their greatest need is for word processing, which is very inefficiently handled by a central system, and the terminals and NIUs are not in the proper locations, nor provided in sufficient numbers, for humanities students to compete with students in scientific and professional courses for access.

Morehouse, along with other colleges comprising RETLA, desires to send at least two faculty to the RETLA Word Processing Lab workshop if it is funded. The network is already in place. We are in a good position to move quickly. Suitable locations have already been established for the proposed equipment. A Writing Skills Lab already exists with a director, an associate

director, a secretary, and eight workstations suitable for word processors, to help students develop better composition skills. The workstations currently have audio cassette players for individual study, but no computers or terminals.

The Proposed Laboratory

We propose to acquire 14 IBM PC systems with associated NIUs, printers, and software to establish a Distributed Microcomputer Lab for Humanities Students (DMLHS) tied into the computing network. Each DMLHS station will normally operate in stand-alone mode when used as a word processor, except when the user wishes to store and manipulate large files on the central system. Six of the microcomputers will be located in Room 209 of the Sale Building, across the hall from the existing Writing Skills Lab; two of the microcomputers will be located in the Writing Skills Lab; and six will be located in Room 200B of Brawley Hall. Sale 209 is presently unused space; Brawley 200B is presently a classroom. As internal funding becomes available, Morehouse intends to add additional microcomputers and terminals at each of the three locations to bring the number of stations to eight at each location.

The main function of DMLHS is to give students access to word processing capabilities to support classwork in humanities courses, especially English composition. A secondary function of DMLHS is to encourage computer literacy among humanities students by giving them convenient access to the same central computing systems as are used by scientific and professional students, as well as access to microcomputers. In addition, DMLHS will bring to all students their first general access to microcomputers.

Draft
Distributed Microcomputer Lab for Humanities Students
Page 3

BUDGET

Equipment: 14 systems, including 14 IBM PC systems each with two diskette drives and 256K memory, 3 NIUs, 2 letter-quality printers, and 6 dot-matrix printers.	$ 50,000
Staff support to operate the distributed lab for one year.	20,000
Software	2,000
Maintenance for the first year	3,000
Supplies and materials for the first year	1,600
Subtotal	$ 76,600
Overhead at 15%	11,490
TOTAL	$ 88,090

Computer Art Laboratory:

A RETLA Computer Initiative

Donovan Young
April 1985

It has come within easy cost reach for an art class to include computer-art exercises and projects, with serious artistic intent, implemented in a way that provides valid hands-on computer experience as a side benefit, without either letting programming issues dominate or depending on an elaborate canned software package.

This paper outlines one way of setting up an inexpensive computer art lab and using it to provide an art medium with a fairly wide expressive range.

For sake of concreteness, we will draw examples from a particular system - a Chromatics CG system - which is probably both more expensive and less capable than what is available today, but has the advantage of having actually been used to create art works in the manner described here. These works, and the programs that were written to produce them stand as examples of what a computer lab can do.

Examples of Computer Art on a Chromatics CG System

In the accompanying materials or demonstration, you see geometric art created according to several simple principles. In works such as "Ribbon" and "Yegg" the artist creates an effect of curved intersecting surfaces by drawing closely spaced straight lines connecting points that revolve at various speeds on various elliptical or bits. Open surfaces, showing subtle textures, can be created by making a simple change to one parameter, causing successive lines to be more separated. In works such as "Figure" the artist creates patterns and textures resembling string or sculptures, using a similar technique. In works such as "Discs" the artist uses interference lines to create the effect of shimmering discs; constantly changing, this work is of the "moving wallpaper" genre (although the equipment lacks actual animation features). Gaudier possibilities abound (such as rectangles of random colors drawn in random places), as do instructive possibilities (such as "Spiral," in which an arithmetic spiral is expressed by notating a series of growing circles) and utilization ones (such as "Gin," which draws shadowed block letters).

For purposes of criticism of works of serious intent, the work itself may be considered to be the screen image, or a particular hard copy or projection of it. A medium that is particularly inexpensive, permanent, and effective is 35-mm color slides. Color printers are improving, but at present are still relatively expensive and of limited quality.

Methodology

Two general approaches are available for artistic expression on a microprocessor-based color graphics system: outline art and geometric art.

McPaint (on Apple's Macintosh) is an example of an outline art system, where the user draws or reproduces outlines, then fills outlined areas with various colors or patterns. Paint-by-numbers and cartoon connotations have perhaps unfairly created prejudice against the outline approach. Also, implementations have been aggressively "user-friendly," with menu-driven user interfaces that lead the first-time user by the hand at the expense of slowing down and unacceptably limiting the experienced user.

For more serious users, the implementation of outline art capabilities should be packaged not in canned software, but in firmware: outlines can be drawn or traced using a bitpad, mouse or other cursor-control device, or received as data from digitized maps or pictures. Filling is done by putting a cursor within an enclosed area and entering color and pattern codes on the keyboard. Generally, computers that can run outline art software packages can also directly execute outline art without software.

Geometric art is of greater pedagogic interest and does not depend critically on a student's representational drawing ability. The principles of ergodic reflection, interference and superposition allow simple forms to interact to create complex and subtle forms. For example, in "Iris" a system of interleaved logarithmic spirals is created as simply as this: draw a line segment of a certain length and direction in a certain color, then draw one the next color that is shorter or longer by a fixed ratio relative to the prior one at a fixed angle relative to the prior one, and continue.

The minimal skills that a student must learn to do geometric art on a color microcomputer are these:

1. Certain skills in the Basic language: constants, variables, loops, arithmetic operations, and entering, listing, editing and running a Basic program.
2. Some basic principles of analytic geometry: point, line segment, circular functions. As an example of the most complex operations needed, a student will need to learn that you can draw an arbitrary ellipse parametrically using $x = a\ cos\ (t+t_1)$, $y = b\ cos\ (t+t_2)$.
3. Codes for the machine's firmware functions: how to select colors, how to specify x and y coordinates, how to turn on the circle generator, etc. As an example on one machine, to have the same effect as pressing the "erase page" key a program must print the 12th character ("PRINT CHR$ (12);" is the Basic statement).

If a student has already learned to create simple geometric art, branching out to use a bitpad and learning the codes to specify fill patterns. The following section assumes the initial goal is to create simple geometric art.

Learning Goals

After about four hours of practice, a student given four hours of time at the machine should be able to produce a work worthy of the instructor's careful artistic cirticism. Three works, or sixteen total hours, should constitute a reasonable introduction to computer art. The student will also gain some computer insight, but will not become a programmer (tedious sorting, formatting, tricky logic, complex data structures and algorithmic are irrelevant in this work). Familiarization-level skills will be gained with a simple editor, a simple disk operating system, and Basic syntax.

Equipment, Resources, Structure and Costs

Hardware for this application must include at least medium-resolution graphics (560 x 288); only modest computing power (exclusive of graphics) is needed. An 8-bit Z-80 system with 48K of user memory is sufficient. Two systems costing less than $5000 per station are in service at the School of Industrial and Systems Engineering at Georgia Tech: Chromatics CG systems (stand-alone unit,

Z-80, 48K, 512 x 512, 6 colors), and Datavue multiprocessor systems with ISC terminals (shared hard disk, Z-80, 64K, 580 x 288, 16 colors). A large screen size is not necessary; 13" screens are sufficient.

For hard copy, a 35-mm camera with a zoom lens on a tripod can make good 35-mm slides at a cost of less than 75¢ each for film and processing. Hard copy is not necessary for the learning experience, but students should want to keep pictures of their best works for their personal portfolios. Schools should already own or be able to borrow camera equipment when needed (at most twice per term).

Sixteen hours per student is half of the total lab time for a 3-credit quarter course with a weekly 2 hours of lecture and 3 hours of lab. On the other hand, it is only a quarter of a 5-credit semester course that is all lab. This sixteen hours would be the minimum work for a meaningful computer art experience. The maximum would be about twice that amount; a computer art lab could be the entire lab for a 3-credit introductory course with a history or appreciation focus, or one-third of an introductory lab course. Regardless of the precise structure, one station operating 40 hours per week for a 10-week quarter, with appropriate time scheduling, can service 25 students per quarter or 75 per year. The sophomore level could be appropriate, but level is not crucial.

For RETLA schools that could include computer art as part of an established course, with 25 or fewer students in any one term, a manufacturer (Chromatics, Intelligent Systems Corporation, Hewlett-Packard, DEC) could be asked to donate a unit and its maintenance. Supervisory labor would be no more than that already devoted to a lab, and would be covered by the college's instructional funds. Release time equivalent to one course should be given to faculty who would train on the machine for one term. The same amount of release time would be required for one trainer, who would work personally with each faculty member until able to solo, then continue with correspondence, exchange of disks, and informal development of course materials. Perhaps a foundation would be willing to fund the release time for one faculty member per college and the trainer, and travels for training.

Colleges would provide floor space, utilities, security, administrative oversight, normal laboratory supervision and hard copy costs.

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

October 28, 1985

Prof. Arthur Berry
Department of Art
Albany State College
Albany, GA 31705

Dear Prof. Berry:

Thank you for your call.

I have looked over your June 5 proposal, and it appears that you hve a very viable strategy for incorporating the computer into the ART 201 course: to extend the course outline for this 11-week course from 6 units to 7, with the computer experience as the second unit.

At the time I sent materials to you, it appeared that a stand-alone unit such as the Chromatics CG or the ISC, based on a Z-80 central processing unit, would be the best option. Now, however, it appears that we are on the verge of seeing inexpensive high-resolution color graphics systems become available for the IBM PC family of computers, based on much more powerful central processing units. This would be much better all around.

However, at the moment, the best relatively inexpensive resolution available is the IBM "enhanced graphics" system's 640 x 350 resolution. This resolution - only 350 vertical pixels - is just too coarse for art work.

I have been working with the well known artist Lev Mills, who is on the Spelman College faculty and who has been following personal computer graphics closely. He has identified one board in particular, the Number Nine board, that is very powerful. IBM also has a Professional Color board. Either of these boards can convert an IBM PC to a very capable graphics machine.

The trouble is, the prices are much higher than I think they will be in a year or so. In the case of the IBM Professional Color board, there is currently no good "graphics driver" language to make it easy to program graphics; the manufacturer of HALO, the de-facto standard graphics drives software, claims the IBM system is so overpriced that they will not bother to implement a version of HALO for it. There is already a HALO version for the Number Nine board.

I have an ongoing non-art project that demands high resolution graphics for the PC, and our current plans on that project are to wait until March 1986, and if nothing better coemes along by then, we will buy the Number Nine system at whatever its price will be.

Based on all the above-described developments, I believe there are just three options for an art system: (1) Go with the older Z-80 technology, (2) Go with the IBM PC with a Number Nine board and HALO, or (3) For now, wait.

With the first option, the price is fairly cheap, and the resolution (512 × 512) is good, but the color flexibility is poor and the programming is awkward and non-standard. With the second option the price is high. With the third option, in my opinion, we can have our cake and eat it too. By April or May 1986, I'm sure we can issue a reasonably-priced proposal that would provide high resolution, good flexibility, convenient programming, and the use of standard graphics language that the students can contrive to use after graduation. Therefore, I would like to wait for the next round of new-product announcements and price reductions, which I predict will occur by February.

Sincerely,

Donovan Young
Associate Professor

DY/bp

cc: Jeffrey Plank
Lev Mills

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

July 26, 1985

To: Dr. John T. Hayes
Department of Biology
Paine College
Augusta, GA 30910-2799

From: Donovan Young
School of Industrial and Systems Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0205

Subject: Review and Followup on "Innovation in the Liberal Arts"

I very much enjoyed our meeting last week. You asked me (1) to review your 7-17-85 proposal draft "Innovation in the Liberal Arts", (2) to explore possible avenues for sponsorship, and (3) to provide specific project ideas that you might use either to flesh out your proposal or to give your colleagues examples within the framework you have proposed so that they can more easily contribute specific project proposals of their own.

1. Review of "Innovation in the Liberal Arts"

A marked copy of your draft is enclosed with comments written thereon.

As it stands now, before the detailed project descriptions have been submitted by your colleagues, the draft is more a framework than a proposal.

As we discussed, the introductory sections are valuable to you and me as documentation about how you became interested in certain subjects, but an actual proposal would not necessarily include this. An introduction to an actual proposal would basically review available technology, Paine College's strengths and needs, and the reasons why what you are about to propose seems to mesh well with Paine's needs and strengths, available technology, and the prospective sponsor's announced or implied goals.

You mention three primary catalysts: Hofstadter's book Gödel, Escher, Bach (GED), CAD/CAM technology as taught and as practiced, and the computer language LOGO. The link among these three things is more obvious perhaps to a non-technical person than to a technical one. I have finally realized that you have been thinking of GEB as a literature source for the ideas behind such computer-science concepts as modularity (Hofstadter calls this "chunking"); of CAD/CAM technology as concrete working examples of such ideas put to use; and of LOGO as an accessible language in which students could practice using such ideas. In a real project, of course, one would use a more direct literature source and a more directly-applicable language.

However, the idea of courses or course modules for liberal arts students based on hands-on experience with CAD/CAM systems, backed by appropriate literature and an appropriate computer language — such a proposal seems potentially quite attractive.

The remainder of the draft gives lists of areas of possible activity and lists of possible participants. An actual proposal, of course, would need to describe specific activities in enough detail so that the sponsor could see clearly what was going to be done, what resources would be needed to do it properly, and what the prospective benefits would be. A particular sponsor's goals would also need to be taken specifically into account; especially in recounting benefits.

2. Possible Avenues for Sponsorship

It appears that you are hoping for the actual activities to be innovative and to result in concrete module materials. Deliverables — not simply learning experiences — are a necessary part of any proposal. It appears that you will need not only faculty release time but also equipment for students and faculty to use in these activities.

I would suggest seeking co-sponsorship by three parties: NSF, under the program called "Materials Development and Research," to support the development of innovative curriculum materials that could be used at other schools as well as at Paine; DEC, under their offer entitled "New Liberal Arts Program," in which they offer a 45% discount on 16-user MICROVAX systems for schools that will use them to develop and pilot-test innovative applications that (again) can be used at other campuses; and the Sloan Foundation, to pick up part of the remaining 55% of equipment costs. Following the usual strategy in cost-sharing projects, Paine College would also incur costs. NSF would be told that you hope to get the necessary equipment from DEC, Sloan, and internal funds; DEC would be told you hope to get the necessary release time for module preparation and testing from NSF, and other costs (maintenance, for example) internally; and Sloan would be told of the others' participation as well. It is necessary in such cost-sharing projects to get all parties together and be completely above-board. Sponsors <u>favor</u> this sort of arrangement; the only negative factor is that one sponsor's backing out can spoil the whole thing.

I enclose ("A") a confidential analysis of what I personally think NSF's goals are, and how I see prospects for NSF funding; ("B") a confidential analysis of what I think might fly under the DEC offer; ("C") slides from DEC's presentation of its offer at a recent NLA conference; and ("D") a letter from John Truxal giving the official line on DEC's offer.

3. Specific Project Ideas

I enclose ("E") a confidential list of preliminary project ideas — really a list of areas in which projects could be devised. We have been specifically told <u>not</u> to broadcast this list; it is viewed as having the potential to discourage the kind of innovation that Sloan and DEC would like to see. However, it is my personal opinion that such a viewpoint may be based on cursory reading or on a possible overemphasis on innovation for innovation's sake. When it gets down to concrete specifics, I think anything much "further out" than the

listed ideas would have little chance for real success in the long run. The history of computer use in education is littered with corpses of projects whose only virtue was glamour.

Finally, I enclose ("F") a white paper on a more specific project idea titled "Evolutionary Trajectory Simulation." This has not yet been reviewed in detail by anyone connected with NLA or RETLA.

I hope you find these materials and comments useful. I will be happy to participate further in your proposal development and to travel to Paine at an appropriate time if desirable. Sloan has provided travel funds for such a purpose.

Georgia Institute of Technology
Atlanta, Georgia 30332

College of Sciences and Liberal Studies
Department of English
(404) 894-2730

Mr. John (Bud) Colligan
University Marketing Manager
Apple Computers
20525 Mariani Avenue
Cupertino, CA 95014

19 November 1985

Dear Bud:

Enclosed please find three sets of documents pertinent to our lunch meeting concerning RETLA college microcomputer labs at the Reed College conference:

--Embryonic General Microcomputer Labs for Several RETLA Colleges (15 November 1984): This draft proposal, originally submitted to Apple, includes all costs from all sources. RETLA asked Apple to participate by providing machines and software through gifts or deep discounts. You will see that we originally thought the Apple II to be the most cost-effective micromcomputer for RETLA needs.

--Microcomputer Proposal Allocation Policy (14 February 1985): Presidents of eleven of the twelve active RETLA colleges endorsed this policy statement, which clearly delineates the amount of institutional support required for the microcomputer lab proposal.

--RETLA Newsletter Back Issues (March, May 1985)

I was glad to have the opportunity to meet you and to renew RETLA's contact with Apple. The RETLA network is a distinctive one; its institutions present a special set of needs which, as yet, have not been addressed by computer vendors. I look forward to hearing from you.

With best regards,

Jeffrey Plank
Coordinator, RETLA

cc: Mr. Lloyd Mahaffey
Ms. Lucy Carter
Mr. Chuck Polosky
Ms. Cynthia Davidson
Dr. Donovan Young

Table 1: LABORATORY SIZING

Key Number of Students	Number of Stations	Number of Assistants on Duty	Hours Open Weekly
10	7	1	10
20	7	1	14
30	9	1	23
40	11	1	25
50	12	1	29
60	13	1	32
70	14	1	35
80	15	1	37
90	16	1	39
100	17	1	41
110	17	1	45
120	17	1	49
130	18	1	51
140	18	1	54
150	18	1	58
160	30	2	37
170	31	2	38
180	32	2	39
190	33	2	40
200	33	2	42
210	34	2	43
220	34	2	45
230	34	2	47
240	34	2	49
250	34	2	51
260	35	2	52
270	35	2	54
280	36	2	54
290	36	2	56
300	36	2	58
310	36	2	60
320	54	3	41
330	54	3	43
340	54	3	44
350	54	3	45
360	54	3	47
370	54	3	48
380	54	3	49
390	54	3	51
400	54	3	52
410	54	3	53
420	54	3	54
430	54	3	56
440	54	3	57
450	54	3	58

DRAFT

EMBRYONIC GENERAL MICROCOMPUTER LABS FOR SEVERAL RETLA COLLEGES

A Joint Proposal

Executive Summary

Donovan Young
November 15, 1984

This is a proposal to establish, operate, maintain and evaluate microcomputer laboratories for undergraduate students at twenty-one Black liberal arts colleges in the Southeast, with initial concentration on word processing support of freshman English composition courses.

Background — Goals, Activities, Needs

The Alfred P. Sloan Foundation began a program called "The New Liberal Arts" in 1982, having found in a two-year dialog with educators that "a new obligation lies before colleges and universities: to prepare students for life in a society saturated with technology and technological issues." [James D. Koerner, "The New Liberal Arts Program: A Status Report," April, 1984] Through faculty workshops, seminars, planning efforts and needs assessments, the concept was fleshed out. Primary goals are to introduce all students to technological concepts, artifacts and issues, including some familiarity with computers, to help them to take up quantitative modeling and use it in its proper place as one set of intellectual tools among others, and in general to lead students to appreciate scientific and technical aspects of knowledge alongside art, language literature, history, philosophy, religion and other areas. Secondary goals include faculty development in the same directions as a prerequisite for significant change in the education process, and preparation of teachable materials and techniques that can be shared among colleges. Activities have so far included, besides inquiry and planning, such concrete

things as computer familiarity sessions and workshops to prepare learning modules for small-scale infusion of appropriately related scientific and technological material into courses traditionally aloof from such concerns.

We, the traditionally Black colleges in the Southeast, along with a major technological university, Georgia Tech, formed in 1983 an association called RETLA (Resourceful Exchange: Technology and the Liberal Arts), which received funding to carry out a needs assessment that asked what we could do for ourselves and what help we might need in order to achieve, for our own students, the goals of the New Liberal Arts program. The heart of our reported findings was this:

> The most critical activities for both faculty development and curriculum development are
>
> —the preparation of technology modules for existing liberal arts courses
>
> —the updating of required service courses in mathematics
>
> —the updating of composition courses by word processing on microcomputers.
>
> ["Resourceful Exchange: Technology and the Liberal Arts — Final Report," 9 April 1984, Page 4]

Funding obtained so far has been concentrated in the first two areas, although the Sloan Foundation has made a modest attempt to help certain colleges in the third area through $50,000 equipment grants and by funding a computer consulting activity to help RETLA colleges continue jointly to plan, assess needs, seek funding, and improve the computer situation on each RETLA campus.

Rationale — Why Word Processing?

The versatile information machines that are rapidly becoming cheaper and more powerful can be turned to many tasks. Several of us have already attempted to make small computers available to students. Such microcomputer laboratories as already exist among us are used, in roughly equal proportions, for computer-aided

instruction (CAI), to support computer programming courses, and as word processors. CAI, in which the computer is used as a teaching machine to drill various subjects, has little relevance to New Liberal Arts goals (however, students do learn, besides whatever explicit subject matter is treated by the CAI lessons, some important concepts about computers generally — their rigidity, inflexibility, and general unsuitability for judgemental tasks and insightful interaction; when you dance with a robot, the robot leads). Computer programming courses are relevant to whatever small extent they are taken by those students whom the New Liberal Arts program hopes to reach, and to whatever extent they contribute to communication skills and to a larger understanding (just as auto mechanics contributes to driving and to understanding the role of motor vehicles in society, computer programming can contribute to a person's ability to function in today's information-driven world). Computer support of mathematics coursework is an often-mentioned use, but one with which we have no direct experience and which, like programming per se, preaches to the converted. The other widespread uses of small computers, such as spread-sheeting, database management, project management and the like, are more professional than liberal.

Except for word processing. Here we have an application that is probably the only application of microcomputers to which <u>all</u> students and faculty can readily relate. It is certainly the only application that can directly support low-level courses (English composition) taken by all students. It is probably the only available way to put computers into the hands of all students early in their college careers, doing work that is useful, that would be done anyway, and is done more easily and effectively by letting the computer take the drudgery out of it, and without having the computer take over and control the process (as in CAI). Word processing is also a throroughly modern use of computers that uses them in the new way — through pre-programmed software packages — that has only very recently replaced the older way of first programming, then using (analagous

to building an automobile before driving it).

Word processing is the easiest way to get to know and use a computer; it contributes directly to one of the most fundamental courses without requiring the course to be radically changed; and it allows the student a sufficient distance from the bits and bytes to gain a perspective on how computers are going to take their niche in society.

Computer support of English composition is often discussed in connection with more sophisticated uses that go far beyond simple word processing. However, as is shown in a review of the field by Lynn Sadler, these applications are still in the future ("The problem is that practically all of these are under development. The two or so available...have not yet received major testing." ["The Computers-and-Effective-Writing Movement: Computer-Assisted Composition," presented at The Future of Educational Technology: An Invitational Conference, Aetna Institute, Hartford, Connecticut, October 19, 1984].)

Collectively, our twenty-one schools each have from about 60 to about 450 freshman students taking English composition courses during the heaviest times of the year; there is an estimated total of 3150 such students in all 21 schools, or an average of about 150 per school. We have estimated that each student needs about six hours at a $1300 workstation each week to produce a 750-word paper, saving nearly half an hour per draft, producing many more drafts than would have been done with pen or typewriter, and writing substantially better-organized and longer themes. This can be accomplished at remarkably low costs: about 44¢ per hour per station for equipment, software, paper and maintenance, plus about an equal amount of money for staff and supervision. Teachers will also save time and effort. More total learning and skill development will take place.

In summary, word processing is an inexpensive and effective way to introduce computing to all students, and is probably the only way.

Investigations and Results

A survey was made to assess the capabilities and perceived needs at RETLA schools for word processing for English composition. It was found that over half the schools had already developed an interest and had previously sought funding. Only about five of the twenty-one schools have any appreciable access of all students to computing, even though all schools have computing facilities open to certain groups.

A study was made to identify the basics of undergraduate computer access. It was found that at any college campus there must be a good balance among computer hardware, software, peripherals and administration, and that access is only as good as the worst of its components. It was found that basic access, by itself, provides most of the benefits of computing; it is almost true that you can simply field the access components and let the students go, provided they have actual work to do with which the computer can help. You cannot, however, simply field the hardware and software without the maintenance and staff support, computer aides, supervision, etc. that are also necessary; several RETLA schools have had bad experiences of getting hardware support without support for other components of access — and, naturally, failing to have real access. Structured attempts to control exactly how students use computers, attempts to supervise them directly (as by having the English teacher on duty in the lab), or attempts to buy or develop software not already widely available are expensive and have never been effective at any school inside or outside RETLA.

We investigated the hardware, software, peripherals and administration (maintenance, supervision, computer-aide assistance, security, etc.) that would be appropriate for a lab meant to support English composition. On the basis of these investigations, we prepared a composition work analysis that revealed what the task times and effectiveness might be with various arrangements. Fast printers were found to be cost effective, and the extra cost of IBM-PC or similar

computers compared to Apple IIe or similar computers was found not to be justifiable.

It was estimated that to prepare a 1000-word paper with three drafts before the final copy (something rarely done by pen or typewriter because of the tedium of recopying unchanged material) would take an average of 9 hours 18 minutes by pen or typewriter, compared to 7 hours 52 minutes by using an Apple-type station with a shared fast printer. It is clear that word processing does, in fact, save time and tedium for students and does encourage more extensive revision. Ignoring the enhanced learning, the time savings alone will be cost-effective; a student's time would need to be worth less than $2.40 per hour before it would be economical to fail to provide Apple-type stations.

Since the number of students varies from school to school, a cost analysis was performed to determine the best mix of components of computer access to provide in various situations for the average task envisioned by RETLA English composition teachers (one 750-word theme per week, with 2 to 3 drafts). For example, 450 students can be supported by 54 stations open 58 hours a week with 3 student assistants on duty, at an estimated cost of $4.72 per student per week, while for only 60 students the most economical way to provide the same access is to have 15 stations open 28 hours a week with one student assistant on duty, at a higher estimated cost of $6.76 per student per week.

On the basis of these investigations and their results, the following detailed proposal is made.

Proposed Support

The twenty-one RETLA colleges propose to obtain a total of about 380 Apple IIe or similar workstations at a cost of about $1300 per station including printers and furniture; to provide maintenance at a cost of $160 per year per station; to operate laboratories for 30 weeks per year up to 60 hours per week; to provide staffing including faculty supervision and student assistants on duty at a total

funded level of $6 per operating hour; and to provide operating costs (chiefly paper) at a level of $50 per year per station. Support is sought for the initial costs and for the first two years of the continuing costs.

Each RETLA school is to receive a share of the support in strict accordance with the true population of its freshman English composition student body during the highest-enrollment quarter or semester, without regard to existing equipment and other computer support that may be available from other sources. Each school will be required to use the laboratories as envisioned, to keep the open hours specified, to have assistants on duty as specified, and to require 750-word themes with two to three drafts from every student of the affected courses for at least 30 weeks during the academic year.

We propose to open the laboratories to other students and at other hours at our own expense, and to pay all continuing expenses after the two years are up.

We propose, at our own expense, to undertake comparative evaluations at each school, involving running freshman English composition classes with and without word processing support. A small amount of money is included in this proposal to coordinate these efforts among the schools and to prepare the final report within six months of the end of the first year of operation.

Projected Budget

380 Apple IIe or similar stations, including printers, software, and furniture, @$1300 per station		$494,000
Maintenance, 2 years @$160 per year per station		121,600
Staffing, 2 years, 60 hours per week per 18 stations, 30 weeks per year, @$6 per hour		456,000
Supplies, 2 years, $50 per year per station		38,000
Planning, coordination and production of evaluation		10,000
	SUBTOTAL	1,119,600
Overhead @15%		167,940
	TOTAL	$1,287,540

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

October 3, 1985

Dr. Cynthia Duggar
Department of Mathematics
Spelman College
Atlanta, GA 30314

Dear Dr. Duggar:

Relative to the proposal entitled RATIONALE FOR DIGITAL EQUIPMENT ACQUISITION, I would like to summarize the discussions from our October 3 meeting and confirm our plans to proceed further.

As we agreed, the immediate need is for detailed conceptual design of a few specific software packages. These preliminary designs can be used as the basis for two actions:

1. Preparation and submission of a proposal to NSF for development support.

2. Preparation and submission of an addendum to the DEC preproposal to reach John Truxal before the DEC preproposals from all colleges are screened.

The preliminary concept of a software package should consist of a relevant subset of the following:

1. A brief but description title. Ideally, a good title should pretty well imply what the package will do and who might want to use it and why.

2. A brief (catalog-level) description of the course in which the package would be used.

3. The learning goals for the particular topic within the course, the learning goals for student interaction with the software package, and the relationship between the two sets of learning goals. Also, if not obvious, the relationship between the topic and the course as a whole.

4. If the topic is already taught, a statement about how and why the software package will enhance learning or make it easier. If the topic is not already taught, a justification for teaching it and a statement of what will be removed from the course to make room for it.

5. Level of student effort - how many connect hours and how many explanation and discussion hours, per student.

6. Level of instructor effort - preparation time, operation time, explanation time. List of source material for instructor.

7. A brief description of all the key concepts, skills, system behavior characteristics, functions, algorithms, heuristics, or relationships, that the software package will demonstrate, implement, or drill. This is the heart of the program - what it actually does - and an experienced engineer such as John Truxal can judge the potential viability of a software package on this point alone.

8. A list of existing software packages that perform the same or similar functions to that of the proposed package. A discussion of how these can be used or why it cannot be used.

9. A list of inputs that the user would provide.

10. A list of outputs that the computer would provide - if part of the output is to be graphical, what items will be displayed on the screen, and how, what text items will be displayed, and what kinds of hardcopy charts, graphs or reports will be given?

11. A brief description of the user interface protocol. How will the user know what input is expected, when to type and when to use the mouse, whether to end inputs by depressing the RETURN key, whether the basic arrangement is of the menu-driven or command type, what windowing architecture will be used if any, whether or not online HELP is to be provided, etc. Will the user refer to paper documentation while running?

12. An estimate of program architecture, size and structure. Will the program be modular in design, with each function isolated and parametized, so that, for example, all user inputs will be

routed through a single interpretive routine? (If not, debugging and improvement may prove impossible.) What will be the major subroutines, and how will they be interconnected? Give an estimate of the total number of lines of source code and the central memory requirements for the executable program, for the data, for resident utility software, and for screen refresh memory.

13. A list of equipment, peripherals and utility software estimated to be required to run the software. A separate list, if needed, of that needed to develop the software. Will there be disk operations during running? What compilers or interpreters will be needed? Will there be a database manager running concurrently?

14. A list of deliverables, including, if applicable, such things as source code (in what form, tape, disk, diskette?), user manual, teacher manual, internal program documentation, student exercise manual, etc.

15. An estimate of development effort, including design, specification, programming, verification of individual subroutines, debugging, program documentation, online HELP documentation, user documentation, demonstration, and initial tutorials for instructors. Estimated person-hours for each part should be given.

16. An estimate of testing and evaluation effort. Will there be a person (or committee) outside the development team who exercises each subroutine and approves each subroutine and major design decision as the development progresses? Will there be a classroom test bed for the final product, with provision for revision and refinement according to test experience? Estimated person-hours for each part should be given.

17. An estimate of maintenance effort. After delivery, will the developer have responsibility for collection of bug reports, removal of bugs, and enhancement?

18. An estimate of faculty-development impact. Will the experience of using the software help instructors professionally (in addition to helping students learn)? Will the experience of developing the software help in professional development and/or recognition of the involved faculty members? Will the software be attractive to other campuses?

For any one software package, fortunately, not all of the above points are relevant.

You, I and Sylvia Bozeman should meet early next week on your campus to plan how to develop software descriptions, how many packages to try for, and how to approach Sloan, DEC, NSF and others for support.

We have agreed that the next step after that is to get together in two-hour meetings with proponent faculty members. Each meeting should include me, you and/or Sylvia Bozeman, and members. If two or more proponents attend any one meeting, they should all be interested in exploring the same software package or at least the same topic area. A "checklist for Class-Support Software Initiation" is enclosed and should be distributed before these meetings.

My aim at each of these meetings will be to prepare a draft of a software package description. I will do this essentially by interviewing the proponent and making suggestions. If the proponent already has a good idea for a package, this process ought to result in something that will fly with DEC and NSF. If not, perhaps I can make some specific technical suggestions that may result in a viable idea for a package.

Within two weeks after these meetings, we should be able to send a proposal to NSF and send an addendum to John Truxal.

I very much enjoyed meeting you, and I look forward to working with you, Sylvia, and other Spelman faculty.

Best regards,

Donovan Young
Associate Professor

cc: Sylvia Bozeman
A. D. Van Nostrand
Jeffrey Plank

DY/nt

Enclosure

RUST COLLEGE
DIVISION OF HUMANITIES
DEVELOPING TECHNOLOGY IN THE HUMANITIES PROGRAM
TENTATIVE SCHEDULE
FOR
DR. DONOVAN YOUNG, RETLA CONSULTANT
WEDNESDAY, NOVEMBER 13, 1985

8:55 a.m.	Arrival in Memphis
10:00 a.m.	Arrival in Holly Springs, MS., Rust College
10:15 a.m. - 12:00 Noon	Conference with Freshman Studies Faculty
12:00 Noon	LUNCH with Dr. O.P. Lowe, Chairman, Freshman Studies Program, Mr. Sylvester W. Oliver, Acting Chairman of Humanities and Dr. Paul Lampley, Academic Dean
1:00 p.m. - 2:00 p.m.	Conference with Mrs. Helen Oliver, Humanities Seminar
2:00 p.m. - 3:00 p.m.	Conference with Music Faculty Dr. Norman Chapman, Mr. Yogi Hawkins and Mr. Henry Loyzelle
3:00 p.m. - 4:00 p.m.	Attend General Faculty and Staff Meeting
4:00 p.m. - 4:30 p.m.	Conference with English Faculty- Dr. Ila Wells, Dr. B.C. Njoku and Mr. Joseph Njoku
4:30 p.m.	Depart for Memphis
5:44 p.m.	Depart for Atlanta

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

October 24, 1985

Professor Sylvester Oliver
Chairman, Division of Humanities
Rust College
Holly Springs, Mississippi 38635

Dear Professor Oliver:

This is to confirm our plans for me to visit Rust College on Wednesday, November 13 to help generate proposals for software development under Rust's program Integrating Technology Into Humanities.

With reference to "New Liberal Arts" aims of Paine and other RETLA colleges under Sloan support, we would primarily be looking for opportunities to provide a computer exercise as a natural part of any course taken by non-technical students, or by all students.

I believe that when a proposal for a software package is truly viable, it should be possible to obtain outside support for its development. A reviewer of a proposal asks:

1. Is this proposal responsive to the announced intents and requirements of the support program? In our case, a proposal should fall within RETLA goals and also meet the special requirements of potential sponsors such as DEC or NSF.

2. Are the claimed potential benefits viable? In our case, we can ask whether the software will really help the instructor do a better job under the course's present aims and intents. It should not be a matter of an instructor's setting aside time for insertion of RETLA material. If the topic supported by the software is not already in the course, there must be a real faculty desire to include the topic, including a specific desire to remove something else to make room for it.

3. Is the conceptual design complete enough? Many people actually ask for support to develop software when they have done little more conceptual design than merely thinking about a topical area.

4. Does the proposer know what is involved in developing and documenting an error-free, user-friendly software package?

5. Can the proposer do the job? Will the proposed support, plus existing resources and support from other sponsors, allow a prognosis of success?

In my opinion, the right way to proceed in initiating a class-support software idea is to start with the instructor's needs and aspirations. If an instructor can tell me what he or she is trying to accomplish in a given course, then I can scan my experience to identify ways that computers are capable of helping. If I find a synergistic matchup of something a computer can do that needs doing in this course, I will make a specific suggestion to the instructor, and an idea may be born.

Enclosed is a "Checklist for Class-Support Software Initiation." The first page reviews the kinds of class-support software and gives some background material. The second page outlines a 6-step way of trying to generate a good software idea, and then lists 18 things to consider in preliminary planning and proposal preparation once a basic idea is adopted. It would be helpful if you would distribute copies to the instructors I will be meeting.

My travel plans for November 13 are to fly to Memphis on Delta Flight #409, to arrive at 8:55 a.m.; and to leave at 5:45 p.m. the same day from the Memphis airport. I will accept your offer of a ride to the campus and back.

If there are pairs or groups of instructors teaching a single course or sequence, I could meet with them together. If an instructor already has a concrete idea for a package, we can simply jump to step 7 and develop the idea. If there is a resource person such as a math or computer science instructor who is already identified, he or she should be included.

Expenses for the trip will be covered by Georgia Tech. I look forward to visiting the Rust campus for the first time. Please let me know the names of the people I will be meeting. Perhaps three meetings would be appropriate, the middle one to include lunch.

Sincerely,

Donovan Young
Associate Professor

cc: Jeffrey Plank

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

October 24, 1985

Professor Carol Rychly
Mary Helm 316
Paine College
1235 15th Street (10)
Augusta, GA 30910-2799

Dear Carol:

This is to confirm our plans for me to visit Paine College on November 14 to help generate proposals for software development to bring appropriate technology topics into non-technical courses at Paine.

With reference to "New Liberal Arts" aims of Paine and other RETLA colleges under Sloan support, we would primarily be looking for opportunities to provide a computer exercise as a natural part of any course taken by non-technical students, or by all students.

I believe that when a proposal for a software package is truly viable, it should be possible to obtain outside support for its development. A reviewer of a proposal asks:

1. Is this proposal responsive to the announced intents and requirements of the support program? In our case, a proposal should fall within RETLA goals and also meet the special requirements of potential sponsors such as DEC or NSF.

2. Are the claimed potential benefits viable? In our case, we can ask whether the software will really help the instructor do a better job under the course's present aims and intents. It should not be a matter of an instructor's setting aside time for insertion of RETLA material. If the topic supported by the software is not already in the course, there must be a real faculty desire to include the topic, including a specific desire to remove something else to make room for it.

3. Is the conceptual design complete enough? Many people actually ask for support to develop software when they have done little more conceptual design than merely thinking about a topical area.

4. Does the proposer know what is involved in developing and documenting an error-free, user-friendly software package?

5. Can the proposer do the job? Will the proposed support, plus existing resources and support from other sponsors, allow a prognosis of success?

In my opinion, the right way to proceed in initiating a class-support software idea is to start with the instructor's needs and aspirations. If an instructor can tell me what he or she is trying to accomplish in a given course, then I can scan my experience to identify ways that computers are capable of helping. If I find a synergistic matchup of something a computer can do that needs doing in this course, I will make a specific suggestion to the instructor, and an idea may be born.

Enclosed is a "Checklist for Class-Support Software Initiation." The first page reviews the kinds of class-support software and gives some background material. The second page outlines a 6-step way of trying to generate a good software idea, and then lists 18 things to consider in preliminary planning and proposal preparation once a basic idea is adopted. It would be helpful if you would distribute copies to the instructors I will be meeting.

My travel plans are simply to drive to Paine College. I could leave about 6:00 am and be ready for my first meeting at 9:00. I could meet with three or four instructors, two in the morning and one or two in the afternoon.

If there are pairs or groups of instructors teaching a single course or sequence, I could meet with them together. If an instructor already has a concrete idea for a package, we can simply jump to step 7 and develop the idea. If there is a resource person such as a math or computer science instructor who is already identified, he or she should be included.

Expenses for the trip will be covered by Georgia Tech. I look forward to visiting the Paine campus for the first time. Please let me know at your convenience where and when I should report for duty and whom I will be seeing.

Cordially,

Donovan Young

Donovan Young
Associate Professor

cc: Jeffrey Plank

Carol: Since I've already worked with Jackie Hill and Jack Hayes, it would be better to work with others. Of course, I can make a courtesy call on each of them or have lunch with them. Don

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DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

October 23, 1985

Gilbert L. Rochon
Director, Urban Studies
Dillard University
2601 Gentilly Blvd.
New Orleans, LA 70122

Dear Gil:

I am glad to have met you and to have learned about your DOT research.

To summarize our conversation about how to seek further equipment support and further development funds...

Since your wish is to upgrade software that runs on an IBM PC/AT to something that would run on a Micro-VAX, it is very probable that DEC would be interested. It is my guess that DEC would grant a 45% discount to any university proposing to create software that would be of interest to other schools having Micro-VAX systems.

Enclosed is a packet of information about the Micro-VAX offer. The September 20 deadline is not important, and I would even advise going directly to DEC with your rather specialized proposal rather than going through John Truxal's screening and the Sloan Foundation's ranking.

Since the aim of the discount is to encourage software to make the Micro-VAX more attractive to other schools, attractiveness to DEC will be largely based on portability of the resulting software. This means we must be careful not to specify a graphics system that is so fancy that other schools will be excluded. One would think that a 1024x1024 color screen would not be excessive, but we should check with DEC. We should also check whether the graphics terminals can be DEC-supplied and hence subject to the discount. The discount otherwise attainable, by the way, is 26% on DEC equipment, and approximately the same on other equipment.

You mentioned a program by NSF under which minority institutions can request equipment. It appears that the "Minority Institutions Science Improvement Program" (guide enclosed) is suitable for this purpose, and is probably the one you had in mind.

Please develop your needs in a little more detail, or let me help you do that (by phone). Then I will help you word the proposals and coordinate them with each other.

I do not have a good idea at this time about where you might seek support for programming effort. Let us return to this as soon as we get the equipment money requests tied down.

Sincerely,

Donovan Young

Donovan Young
Associate Professor

cc: Jeffrey Plank

GEORGIA TECH 1885-1985
DESIGNING TOMORROW TODAY

Georgia Institute of Technology
School of Industrial and Systems Engineering
Atlanta, Georgia 30332-0205
(404) 894-2300

August 30, 1985

Professor Frances Bliss
Department of Education
Oakwood College
Huntsville, AL 35896

Dear Professor Bliss:

Thank you for your call, and I look forward to helping Oakwood College prepare a proposal to get a Micro-VAX and develop courseware.

The key to a proposal would have to be the specific courseware that you would propose to develop. I do not think you should try to develop CAI (computer-aided-instruction) modules such as for drill and testing of mathematics concepts, because Sloan, DEC, and NSF have little interest in CAI.

To illustrate one kind of software module that might be of interest, I am enclosing a working paper titled "Evolutionary Trajectory Simulation" (marked "F"). This exemplifies the level of development and detail that would be appropriate. Note that it proposes a very specific module in terms of its characteristics and behavior, which is much more specific than just talking about a potential audience and its needs.

Some areas in which a software module might be developed are listed in the paper "Ideas for Micro-VAX Projects," (marked "E").

As we discussed, I believe you would not want to go into buying a Micro-VAX system at a 45% discount unless you can also get support both for the remaining costs associated with the hardware (the 55% after-discount capital cost plus maintenance, furniture, printers, staffing, etc.) and for the costs of developing the software the DEC would expect to be developed to enhance the availability of Micro-VAX software. The Sloan Foundation, in my opinion, would be likely to come up with about $20,000.

I previously sent you my analysis of the NSF Materials Development and Research program. Their Program Announcement is enclosed in full. Under this program, you could get perhaps $20,000 to $40,000 to pay for faculty release time and other costs associated with preparing the software.

In order to get joint sponsorship, one essential thing is to avoid the Catch-22 situation in which each sponsor wants the others to say yes before giving serious consideration. One good way to get things rolling is first to prepare an overall project description which would be attached to each of the proposals. The project description would state how the pieces all fit together, but the proposals would otherwise be entirely separate.

The proposal to NSF would describe the module you propose to develop, with no reference to the DEC equipment except a statement that you expect to acquire the necessary hardware on which to develop the module, and a reference to the attachment. The proposal to DEC could also focus on the proposed module, with reference to NSF as the source of the development funds. The proposal to the Sloan Foundation would be prepared at the same time and would simply state what costs would still remain if the other two proposals (which would be attached) were funded.

Please call me again as soon as you have adopted a specific module idea. I have travel funds for the purpose of helping RETLA schools prepare proposals, and we can get together at your convenience. If you feel it would be better to get your people together and come here, that would save me a little time and stretch my travel funds further, but either way is fine.

I look forward to meeting you and working with you.

Sincerely,

Donovan Young

Donovan Young
Associate Professor

DY/nt

Enclosures

"COMPUTERS AND LIBERAL EDUCATION"

Presentation and demonstration for
S.C. State students and faculty,
Tuesday, February 12, 1985

Donovan Young, Ph.D., P.E.
Georgia Institute of Technology

Computers today — an overview

- types of system
  - mainframe
  - supermini
  - mini
  - micro
  - onboard
- types of human interaction
  - programming
    - systems programming
    - applications programming
    - scientific programming
  - application running
    - dynamic — games, piloting
    - interactive — transactions
    - decision support
    - office work
  - design
  - control
- I/O means
  - input
    - keyboards — QWERTY, keypad, synthesizer
    - voice

location specification – mouse, light pen, screen touch

output

alphanumerics

display

printing

voice synthesis

graphics

display

printing – raster

plotting – vector

mechanical actuation

transactions

Industrial applications of computers

electronic data processing

control applications

(12.5-minute film "IEs On The Job")

robotics controllers – spot welding (GM)

numerically controlled lathe (Scientific Atlanta)

computer-assisted order picking (Avon)

ISyE Materials Handling Laboratory

automated warehouse storage and retrieval

numerically controlled drill

process control

feedback control – on/off, proportional, reset, rate

level, pressure, flow, temperature controllers – pneumatic, electronic, digital

cockpit controls – human/machine dynamic interfaces (ISyE Man-Machine Laboratory)

a superminicomputer system (VAX 11/780)

Office Automation

- functions in an office
  - communications – text, data, voice, graphics
  - LAN
  - (color) graphics – raster, vector
  - presentation graphics
  - word processing
    - production of semi-automated documents
    - authorship, publishing
  - filing and retrieval – DBMS
  - decision support, expert systems
    - spreadsheets
    - project management
- office workstations
  - CAD
  - sedentary work, layout, ergonomics
  - modern concepts
- microcomputers in office work
  - types
  - functions performed
  - operating systems – DOS, UNIX
  - integrated software

Approaches to computer literacy

- programming in BASIC
- graphics programming
- assembly language
- computer science
  - linguistics
  - data management

PC applications – word processing, spreadsheets, DBMS

CAI

statistics packages

Appendix 7, Exhibit 9, p. 1 of 2

QUESTIONS TO ASK IN PHONE SURVEY OF RETLA FACULTY INTERESTED IN WORD PROCESSING FOR ENGLISH COMPOSITION

Do you have word processing workstations available to English composition students to help them organize, write and revise papers? YES

If not, go to Needs 2

How many workstations? 10 (Student Body Size - 600)

Hardware specifics? IBM PC's

Software specifics?

Requirements for students to use? -

Standards for submission?

organization as a separate requirement (outlining)?

submission as diskette or hardcopy?

standards for spelling, grammar, punctuation, style?

Costs

hardware $340 ($150 for recommended)

software

operation -

maintenance -

security -

Benefits

to students

organization?

enhanced overal composition skills?

better papers?

more revision?

to instructor

easier to read?

easier to grade?

effects on instructor workload -

add-on software use by instructor?

Describe the word-processing software package as to features used, details of problems with operation, documentation, etc. Easy Writer-only 3 classes to learn - cannot underline easily. Also cannot do Super & Subscripts.

General impressions of effectiveness change after lab established Better than hoped

Formal evaluation study? No- AT&T has developed a test analyzing soft. (not ready for IBM PCs as of yet) called "Writer's Workbench" It can tell how many weak verbs are used, etc. She would use this software Needs 1

Additional workstations? on a student test & last needs more data. Papers submitted to

Different software features? Submit a study.

yes

More speed

word processor outlining tasks

text entry tasks

revision tasks

Needs 2

Composition course data

number of students, level, major - English comp. stude

how many papers, length? - depending on instructor

baseline of skills expected before and after course

Hopes or wishes for support - funded course by Title 3

Needs 3

Plans for word processing at this school

Capabilities and Needs at RETLA Schools for Word Processing for English Composition

A survey was made in the weeks of October 15 and 22 to find out which RETLA schools have faculty interested in word processing support for English composition classes, how many of what kinds of workstations and software packages are available to undergraduates, how the existing computer resources of all kinds are being utilized, and what is each school's computer access plan for undergraduates.

The survey revealed that a dozen RETLA schools had already developed an interest in small computer laboratories. Here is a brief school-by-school synopsis:

Albany State College, according to James Hill, would like to use word processing for its 450 students per year in freshman English courses, with one paper required per week. Digital Equipment has offered the school a VAX computer with 10 to 15 stations for only $50,000. A proposal was sent on this basis to the Sloan Foundation but was rejected; another source of funds has reportedly been found.

Bennett College, with a total student body of 600, has been a leader in the type of word processing support we envision. According to Wendy Greene (who replaces Mary Lynn Sadler as our RETLA contact), Title 3 grants have given Bennett 10 IBM PCs for use mainly in support of English composition. The stations, with Easy Writer, Word Star and PFS Write Display II software, are used by classes 20 hours per week and are open for free time an additional 20 hours per week. Faculty and students are very happy with the stations. They feel a need for more stations and better

software, but have not yet sought additional outside support. Students of English composition are required to use the stations at least one hour per week. Effectiveness of the stations is "better than hoped"; no formal evaluation has yet been made, but when AT&T's "Writers Workbench" program becomes available on IBM PCs, instructors will run students' first and last papers through it to measure objective indicators of style improvement - decreased use of weak verbs, etc.

Dillard University, with a student body of 1200, has already obtained with private funds a laboratory with 30 Apple IIe workstations. The lab is used for multiple purposes, including non-required use by English composition students. Instructors informally report better organization of papers and enhanced composition skills for those students who use word processing.

Fort Valley State's English department head, Dr. Alma Bryant, has completed most of a proposal to Apple under the "Wheels for the Mind" program. (The portion not completed is tie-in to a local high school as required by Apple.) She will ask for 20 to 25 Apple IIe computers which freshman English composition students will use in structured, supervised lab sessions with Apple Writer Software. Dr. Bryant also sees a need to open the lab in the evenings for unstructured use with a student assistant in charge, but no potential sources of support for this have yet been identified. The lab sessions will serve 8 classes, each with 20 to 25 students, who will prepare one paper per week of 350 to 500 words at the beginning level and 1500-word research papers every three weeks in the second and third courses. Plans for the first year call for concentrating on the organized lab sessions and discouraging non-word-processing use.

Similar lab sessions for mass communications, journalism, and technical writing courses are envisioned.

At Jackson State, according to Dr. Robert Toler, there is a strong interest in word processing for freshman English composition, but the English department needs further time to articulate their needs.

North Carolina A&T's Dr. Jimmy Williams, chairman of the English department, has focused on the need for word-processing support of twelve courses connected with professional writing, and is planning to ask the State to buy 20 personal computers for courses taken by English and journalism majors. No decisions have been made on hardware or software. Supporting freshman English composition with word processing has not yet been discussed in detail at North Carolina A&T.

According to Eugene Eaves, North Carolina Central has tentative plans for a Learning Center supported by microcomputers. No support has been sought nor decisions made; the school hopes to use the guidelines coming out of this current joint proposal effort to clarify its needs.

Paine College has a Learning Resource Center equipped with 20 Apple IIe systems used for programming courses, computer-aided-instruction, and word processing. An additional 12 Apples, 9 IBM PCs, 3 IBM XTs and two small Texas Instrument computers are also managed by the Center and have varying degress of availability to undergraduates. Dr. Susan Greenstein now uses the stations on a required basis for 15 students in the freshman honors course in English composition, requiring 9 papers per semester of 500-750 words each, with 4 rewrites per paper. There are plans to include word processing requirements in the freshman study skills course. Depending on results in the current semester, other English composition courses may begin using the stations.

Savannah State College wants 25 to 30 workstations but does not contemplate required use of them by freshman English composition classes. A proposal for workstations was submitted to the Sloan Foundation but not funded.

Dr. Lewis Roache at South Carolina State reports an interest in 20 to 25 microcomputers to accommodate English composition courses. The school has not articulated any specific plans.

Spelman College and Morris Brown college have some workstations available to students, but details have not yet been reported.

Tuskegee Institute is technically oriented. According to Dr. Francis Taylor, they will shortly use their equipment grant from the Sloan Foundation to buy 20 IBM PC's. These will be used as Plato terminals and for many other purposes including word processing. Dr. Taylor hopes to require freshman English composition students to spend up to three hours weekly at the stations. The stations will be open days and evenings.

A REVIEW OF NSF's PROGRAM ANNOUNCEMENT IN "MATERIALS DEVELOPMENT AND RESEARCH" IN RELATION TO RETLA PROGRAMS AND OBJECTIVES

Donovan Young
May 11, 1985

General Objectives of NSF's Materials Development and Research Program

NSF justifies the program on the basis that "a firm grounding in science and mathematics" for all students is the only way to achieve "a broad understanding of science and technology on the part of the American citizenry" which is "essential to the strength of our scientific enterprise and to the security and economic vitality of our nation."

"Beginning in 1985, the Foundation is focusing especially on... the middle/junior high and elementary school level."

The program's objectives are identified as (1) preparing all students for living in a high technology society (greatly relevant to New Liberal Arts goals), and (2) increasing the number of students adequately prepared to pursue higher education in mathematics, science, and technical fields (not relevant). A concern is mentioned for under-representation of minorities, but in relation to careers, not in general: "increasing the numbers of qualified young people in these groups who are encouraged to choose careers...."

There are four specific programs announced:

Instructional Materials Development

Six kinds of materials for precollege classrooms are sought, including five kinds whose main characteristics are innovation, and one that is directly related to remediation needs of RETLA colleges:

> "materials tailored to the special needs of particular groups of students, such as women, minorities, physically handicapped students, college bound students, those entering the work force immediately following high school graduation, and the gifted and talented."

If we proposed an innovative way of teaching some aspect of math or science, and if our proposed materials seemed to be the best way to deliver that innovative way of teaching, and if there were some natural relevance to blacks or to remedial students, then there would be no question as to suitability, and the proposal would be judged mainly on the basis of the technical merit of the proposed innovation. Barring some eureka, the way to be innovative is to bring to our context something that has succeeded recently in a different context. Computers are doing new things all the time, constantly refreshing the temptation to undertake yet another "survey of available software" — surely one of the saddest activities one can undertake, but I think a well-conceived survey of the possible educational value of recent applications of personal computers would certainly be worth our (my) time.

Applications of Advanced Technologies

This program would support "development of innovative computer applications that offer exceptional promise of educational effectivness and efficiency," or systems or delivery mechanisms based on them. Thus anything that we would develop that met the criteria I outlined in the previous paragraph would also be relevant under these criteria, were it

not for the following terribly restrictive caveat: "This program is concerned only with issues at the forefront of technology applications to science and mathematics education." I think that the most useful and effective ways to use computers in education are such things as word processing in English composition, color graphics as an art medium, and x-y graphics to show functions in mathematics, but the glamour is associated with more esoteric (and, in my opinion, less potentially useful) applications.

Research in Teaching and Learning

This program supports research as such, mostly in psychology and computer linguistics, or in education. It is not relevant to RETLA.

Materials and Methods for Teacher Preparation

This program supports innovations in the training of precollege teachers and is not relevant to RETLA.

In conclusion, it appears that we could get NSF support for our computer initiatives under both the Instructional Materials Development and Applications of Advanced Technologies programs (or under the former with added strength coming from matching all except the glamour goals of the latter) if we could identify some way to use computers that would be similarly esoteric and similarly fresh to the Computer Art initiativ except with more quantitative relevance.

RETLA is a set of needs in search of resources. NSF looks at matters from the other end, funding resources that are in search of applications. That is, NSF funding normally depends more on the technic quality of a proposal than on who would benefit and how much. Therefore we must try to look at the supply side rather than the demand side. The richest ground to prospect would seem to be this: What have computers recently succeeded in doing (for scientists, engineers, businessmen, anyone) that has potentially great educational side-benefits?

If I had an answer to that question already, I would have suggested a project based on it. However, I can think of some possibilitie that might constitute some close also-rans. For example, some very simple computer programs have been of great help to astrophysicists in verifying notions about coalescence of galaxies, formations of planets, etc. In some cases the programs have literally done no more than start with a collection of pieces of matter, move each piece according to gravity toward the center of mass of all the other pieces, advance to the next time, and repeat. This can even be done two-dimensionally instead of three-dimensionally. Could any of these programs operate on a PC and let students watch as it develops? (I don't know; the number crunching is huge, and PC's are poor number crunchers.) The programs used by the weather service for forecasting are exactly the same sort of thing (and the number crunching sorely taxes the biggest supercomputers). Could a meaningful cut-down version be useful educationally? The recent applications of computer graphics to give "movies" of droplet formation, heat flow, traffic flow, queueing congestion, inventory-system evolution, etc. are of a similar nature and may be useful educationally. Perhaps thermodynamics could be taught early by showing graphically how the macro properties of pressure and temperature are collctives of Brownian motion. I will search in these directions.

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DRAFT of Interest-Solicitation Letter to RETLA Schools Re DEC MicroVAX Discount Offer

At *occasion* on *date* , Ms. Niccolé Hartlett of Digital Equipment Corporation (DEC) announced DEC's willingness to sell at a 45% discount up to ten MicroVAX computer systems to schools participating in the Alfred P. Sloan Foundation's New Liberal Arts (NLA) program. Assuming similar-quality proposals from all participants, it would be expected that from one to three RETLA schools would be among the ten.

The MicroVAX is a new product with approximately the computing power of a VAX 11/750, but with I/O handled by a Q-bus rather than the VAX's faster Unibus. Each school would configure its own system, but a system typical of the ones envisioned by DEC in their invitation would consist of a table-top-sized central unit, disk and tape drives, a VMS operating system, from 8 to 16 medium-resolution color graphics terminals, and other hardware and software appropriate to the particular school's requirements.

Data sheets and list prices are enclosed to help you evaluate various possibilities. Further information on the hardware and software obtainable from DEC can be obtained from your local DEC representative.

The discount is very substantial (industrial and educational customers would normally get not more than a 15% to 20% discount), and DEC would insist that each system have

high visibility as "the NLA machine" on its campus and be available to a wide spectrum of students. It could not be under the control of any single department, nor could it be used merely as another system available as part of the general computing resources operated by a campus computer center. Preference would be given to interdepartmental, interdisciplinary or multidisciplinary proposals that would use the machine for innovative developmental purposes in line with NLA goals.

Preliminary guidance from the Sloan Foundation indicates that some support may be available not only to help pay for the equipment and software but to help cover other costs as well. Substantial cost sharing will be required from the proposing college: as a rule of thumb, proposals should anticipate that at least one-third of the total cost would be paid by the proposing college.

Here are some approximate cost guidance figures. For concreteness, assume a school's proposal calls for a system whose list prise is $75,000 and includes software development and pilot teaching effort consuming release-time salaries and benefits of $80,000. Some of the additional costs in the initial year would include a one-third time system manager whose salary and benefits might cost about $10,000; maintenance and supplies at perhaps $4000 (more in subsequent years); software (say two major packages such as a compiler and an office automation package) at perhaps $2800 total after the discount; office furniture at perhaps $3000; and remodeling, power supply for installation, building space rent or equivalent, and utilities, at costs determined by

the local situation.

Before planning a proposal, a college should also bear in mind that maintenance and operating costs of perhaps 10% of the list (not discounted) prices will continue after initial sponsors drop out. Colleges already owing VAXes should check with DEC before assuming compatibility of hardware or software.

RETLA's computer consulting office (Dr. Donovan Young, Georgia Tech ISyE, Atlanta, GA 30307, 404/894-2321) stands ready to provide detailed help to any RETLA school contemplating or preparing a proposal.

For planning purposes, we would appreciate your contacting either Dr. Young or Dr. Plank by *date* with the following information:

Would you be interested in preparing a proposal or examining the matter further?

If so, please give the name, address and telephone number of the person who will be in charge of proposal preparation or further study.

If already known, what campus departments or units would be cooperating in this effort? (Give specific persons if known.)

Two enclosures should go with this letter: One would be a set of data sheets and list prices from DEC. The other would be a non-exhaustive list of possible MicroVAX applications having NLA and RETLA relevance, to help schools generate proposal ideas.

Not approved for general distribution.

Ideas for Micro VAX Projects

Donovan Young
June 20, 1985

This is a list of preliminary project ideas for a hypothetical RETLA school to use a MicroVAX to achieve NLA goals in a way that might be expected to meet the criteria of the DEC MicroVAX discount offer.

For each of these, let us assume the MicroVAX would have 16 terminals, 14 of which would go in a laboratory, with 2 deployed in adjacent offices. Each proposal would propose a combination of development work by faculty, to be done mostly in those offices, and student exercises in the laboratory. Of the student exercises, a portion would constitute testing of the development work, while the remainder would apply completed and pre-existing software and modules as an integral part of the students' coursework.

The list to follow simply gives a variety of RETLA-related subprojects for which the MicroVAX would be an appropriate tool. A real proposal would use only a selected few of these, each probably altered substantially to meet the particular school's needs. A creative challenge that would be faced by the proposer would be to tie together the disparate parts: for example, if a school wanted to use the MicroVAX for support of English courses, math courses and nursing courses, it might be difficult to find an appropriate common thread.

1. Mathematics Support

Many, if not all, weekly topics in mathematics courses can be made more clear by computer exercises. As early as 1976, computer exercises were sprinkled throughout a ninth-grade algebra textbook [Dolciani, et. al., Algebra: Structure and Method, Houghton Mifflin Company]. Graphing of functions, functional evaluations, drill of basic skills, searches for integer solutions or prime numbers, compound interest calculations, statistical computations, etc. can be accomplished better with a computer than without, and computations can be done with realistic volumes of data demonstrating overall patterns that would otherwise be difficult to appreciate without voluminous calculations.

The Educational Software Directory [Personal Computer Institute, IBM, Winter/Spring 1985] and the Tech-Lines Buyers Guide/Catalog [Antech, Inc., 1985] list software packages appropriate for use in support of mathematics learning at several levels. Availability of mathematics-learning software on the MicroVAX has not been ascertained, but many existing packages are in BASIC or other open source code and could easily be converted. A number of universities, including Georgia Tech, have developed home-grown software for support is open for sharing.

A RETLA school could propose support for a specific mathematics course, or for more than one course, as part of their MicroVAX proposal. Students might use the MicroVAX for a given number of laboratory hours,

and one or more faculty might seek release time to gather and/or develop additional materials.

2. Word Processing Support of English Composition

A RETLA school could propose word processing support on the MicroVAX for English composition students in honors sections. If the 14-station laboratory were reserved 9 hours weekly for such work, 42 students could each use a terminal for 3 hours each or 21 students for 6 hours each. Benefits of such use, and RETLA English instructor's interest in such a project, are already documented in previous RETLA joint proposals to Apple and IBM for microcomputers for similar purposes. The MicroVAX is also capable of running text analysis programs much faster than microcomputers could, if such programs were proposed to be converted or developed for the MicroVAX.

If word processing is proposed, the system should be configured with adequate printing capacity. However, the MicroVAX system would also allow experimentation with paper-free all-electronic production and scoring of papers if an English instructor were to develop such a scheme.

3. Computer Art Support

The MicroVAX system could handle a more intensive version of the computer art laboratory described in the paper "Computer Art Laboratory: A RETLA Computer Initiative" distributed to art instructors at RETLA schools (additional copies available).

If a software graphics driver such as DI-3000 or HALO is available on the MicroVAX, the possibilities are greatly enhanced.

With the MicroVAX, a RETLA school could propose to have two or three 3-hour lab sessions of a design or studio art course in the MicroVAX lab, where the instructor could work with a group of 14 students, giving them real-time coaching in the manner traditional for instruction in other art media.

Lev Mills, a well-known artist of the constructionist school and an art instructor at Spelman College, is currently making a survey of computer-support possibilities for art instruction, and his advice could be valuable for preparation of a proposal along these lines.

4. Office Automation Support

A complete line of Office Automation software is available with the MicroVAX. Many RETLA school have large professional degree programs in Criminal Justice, Business, or Nursing, all of which require some exposure of students to the extensive automated environments they will encounter on the job in performing data retrieval, communications and accounting tasks. It probably would not stretch NLA goals to include a profession-specific sub-project as one of several MicroVAX subprojects,

or to include several of them, particularly if they could partially overlap (say nursing or business students studying the same accounting procedures) or if several profession-specific subprojects would collectively reach a majority of all students.

A RETLA school could propose, for example, for an accounting professor to develop accounting exercises using the MicroVAX. These would be implemented on existing Office Automation software and be used by students in a variety of majors.

5. Support for History of Technology

Courses in the history of technology often suffer from the impracticality of reproducing early technology in the laboratory. Such progressions as that from Leeuwenhoek's lenses and Tycho Brahe's lensless instruments to Galileo's telescope, or from Newcomen's steam engine to Watts', convey important intuitive principles not readily learned from words and pictures alone. Although lab devices may often be impractical, it ought to be possible to devise simple simulations of them with a MicroVAX color screen.

This is but one of many possible examples of CAI (Computer Aided Instruction), which is discussed more generally in the next two items.

6. CAI Conversion

Computer aided instruction modules have been written for many courses on many different systems. With the lack of an ad hoc standard CAI language, the field is in a relatively chaotic state. There are islands of order such as Control Data Corporation's PLATO system. Also, CAI authoring systems have been developed for several systems (probably not yet for the MicroVAX), which make it relatively easy for instructors to write new CAI applications.

A RETLA school could propose to convert a group of appropriate existing CAI programs to the MicroVAX system and test and exploit the results in courses. If these were basic courses taken by a variety of students, this subproject would be particularly relevant to RETLA and NLA goals. It would probably be viewed favorably by DEC, since the results could be used elsewhere.

7. CAI in Education

Many RETLA schools have large numbers of education majors. These students should be prepared to use CAI, yet it is probably rare for them to be able to study CAI usage or authorship in college.

On the same campuses are students who could benefit from the results of CAI authorship. (Although education graduates will teach at K-12 levels, they could author college-level materials for practice; alternatively, they could author high-school materials suitable for use in practice teaching or for use in remedial courses.)

A RETLA school could propose a multidisciplinary project in which CAI applications were developed by cross-discipline teams and tested by education faculty and students. If a sufficient number of different disciplines was involved, this activity could constitute the entire MicroVAX project. Conversion of existing CAI applications could be done where appropriate.

If there is no CAI authorship package available for the MicroVAX, this item may not be practical. However, in such a case, if the school has a strong Computer Science faculty, it would probably be possible to propose a project of potentially even greater interest to DEC: that of writing or converting a MicroVAX CAI authorship utility that could later be marketed by DEC.

8. Evolutionary Trajectory Simulation

A working paper on "Evolutionary Trajectory Simulation," (Donovan Young, May 27, 1985) has been circulated to certain people in RETLA schools and is available upon request. This documents a specific CAI-related area of possible interest to the National Science Foundation under its "Materials Development and Research" program (a program to fund development of instructional materials for use in non-technical high school and college freshman classrooms). The software described in the paper would aid instructors in presenting hands-on exercises in planning and exercising time-step simulations such as are used in weather prediction, astrophysics modeling, queueing simulations, feedback systems dynamics models, etc.

If a RETLA school or group of schools wanted to ask for NSF support for the Evolutionary Trajectory Simulation project, and it wanted to use a MicroVAX (which would greatly outperform the contemplated PC's in this application), it would perhaps make sense to predicate the NSF proposal on getting a MicroVAX, and use the NSF proposal as the justification to DEC for the MicroVAX.

The preceding eight applications are intended to be a non-exhaustive sampling of some kinds of proposals that might be appropriate in responding to the DEC MicroVAX discount offer. They are not the result of any systematic survey, and they have not been screened either by DEC or by the Sloan Foundation.

EVOLUTIONARY TRAJECTORY SIMULATION

Donovan Young May 27, 1985

This is a working paper for a possible proposal under the NSF "Materials Development and Research" program to develop instructional materials for use in non-technical high school and college freshman classrooms that would aid instructors in presenting hands-on exercises in planning and executing time-step simulations.

Needs Background

There is a well-documented need in high-school and college freshman classrooms for hands-on computer experience that can lead naturally to familiarity with computers and appreciation of some basic capabilities and limitations of computer applications, especially for non-technical students [ ]. This need is particularly severe for liberal arts students, especially those at minority liberal arts colleges [ ], and it is aggravated by the fact that the number of successful existing computer applications in non-technical fields is quite small. Word processing for use in English composition courses is a promising area [ ]; substitution of personal computers and word processing software for the typewriter in typing courses is a fast-growing practice in high schools [ ]; computer graphics as a new medium for visual art, already accepted in commercial art pedagogy, promises to become a viable tool for art survey and studio courses in fine arts for art majors and non-majors [ ]; and automated graphing of functions is an inexpensive, effective, easily-used learning aid in math courses at practically any level [ ].

These few areas are singled out for mention because they share some desirable characteristics: they require only inexpensive personal computers, they allow hands-on manipulation in a way that neither is technically overly demanding nor hides the computer's role behind an opaque interface, and they entail the computer's doing jobs that are of intrinsic interest beyond their computer-relatedness.

Most other existing or feasible general classroom uses of computers are deficient in one or more of the above areas - they fail to be inexpensive, or they operate in a black-box or misleading manner, or they have a hobbyist slant, involving computers mainly for their own sake. For example, while one might well argue that every liberal arts student should take a basic computer programming course, the issues (data structures, algorithms, formats) are strictly computerish, and the application examples (business, formula evaluation, list processing) are largely foreign to liberal-arts concerns. Tutorial CAI (computer-aided instruction) programs have their niche, but are more misleading than informative in indicating how computers work. The same can be said for trick artificial-intelligence (AI) programs such as ELIZA (the computer "psychiatrist"). In such programs the computer's non-trivial role is limited to outputting the best-matching response from a library of stock responses, on the basis of a shallow analysis of user input, ignoring semantics and nearly ignoring syntax: thus a CAI program can output a phrase of praise if the user's answer to a

question matches its stored answer, or ELIZA can output "Why do you resent your mother?" if the user's input contained the character strings "resent" and "mother" in the right order. With such application programs, the user cannot alter any meaningful aspect of the computer's behavior, and is merely interacting with the program author's predictions of what the user might input; the only fundamental concept about computers that one gains as a side benefit is an idea of their inflexibility. 'Overall, from a computer-literacy point of view, CAI and AI applications are misleading to the non-technical novice.

The same can be said for computer games of nearly all types. Pilgram in a Microworld [David Sudnow, Warner Books, 1983] is a good example not only of the strange mystical vision of computers shared by the seeming majority of the computer-naive legions, but also of how experience with computer games can reinforce rather than cure what one might call computer paranoia. (The author, an urbane man of letters and accomplished pianist, tells of a thousand-hour struggle to become adept at a game easily mastered by children in a few hours, and even after having gone to the length of interviewing the game's creator, who gives straightforward answers to his questions, he ends up expounding a labyrinthine theory of impossible machinations and unheard-of computer capabilities.)

The Alfred P. Sloan Foundation began looking into the problem of technological literacy for liberal arts students in 1980. A set of essays by educators on the subject was published

under the title of "The New Liberal Arts" [Alfred P. Sloan Foundation, 630 Fifth Avenue, New York, NY 10111; available free on request]. Grants were solicited and awarded, and progress was reported in 1984 in a booklet by James D. Koerner entitled "The New Liberal Arts Program: A Status Report" [ibid.].

One result of this work was the formation of an association of Georgia Tech and several Southeastern colleges with predominantly black enrollments, dubbed RETLA ("Resourceful Exchange: Technology and the Liberal Arts"). Prominent among needs identified by RETLA were needs for educational materials that would support appropriate hands-on computer experience for non-technical students.

Resource Background

Personal computers have already become widely available on college campuses, even for the relatively underfunded Southeastern black colleges in RETLA [ ]. Computer power per dollar has risen dramatically. Graphics capabilities, in particular, have recently become more powerful, less expensive, and, with the advent of generic graphics drivers such as HALO and DI-3000, easier to incorporate into software. New software has been published at an unprecedented rate. There has been a powerful recent trend towards integrated software, whereby separate modules can run in conjunction, the output of one module feeding the input of another, or controlling its actions, in ways that the user can specify and change non-procedurally.

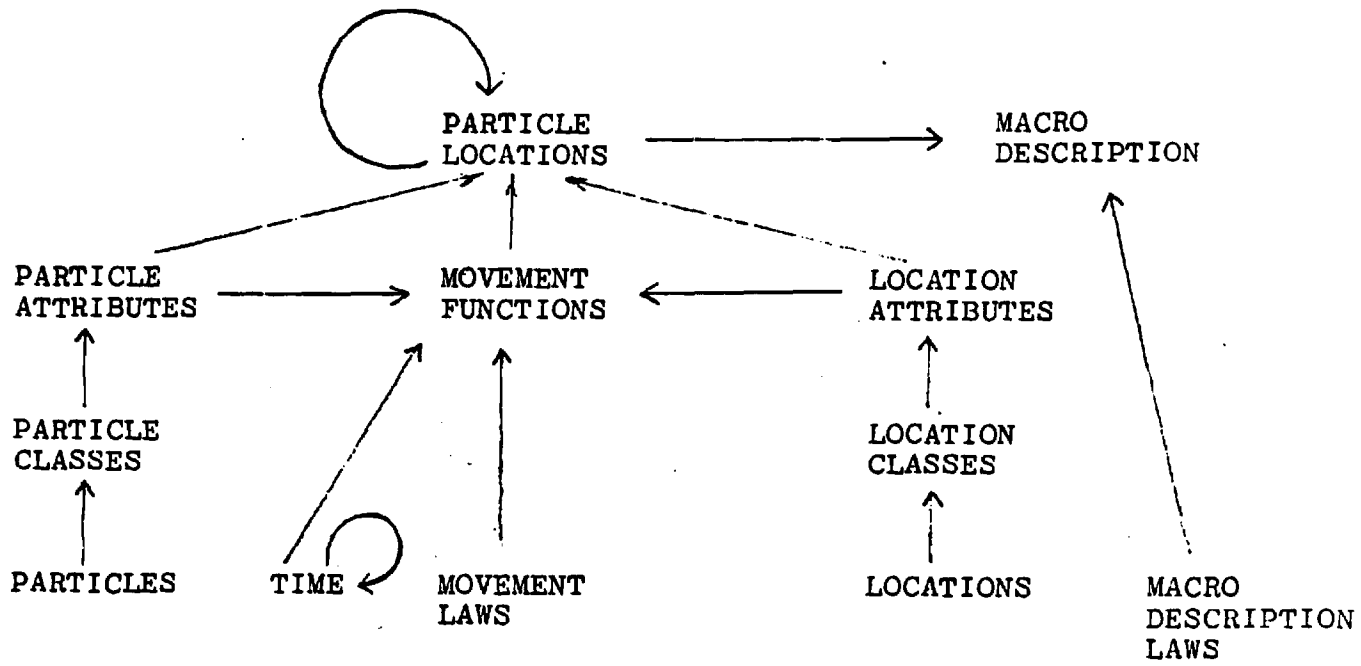
As part of RETLA computer initiatives supported by the Sloan Foundation, a systematic survey was made to discover opportunities created by these developments. That is, a search was made for new applications of computers for liberal-arts learning at RETLA schools that would meet the criteria mentioned earlier — economy, functional clarity, application relevance — yet would have been ruled out prior to recent advances.

Four such applications were identified. On the basis of three of them, RETLA has already undertaken computer initiatives in the areas of word processing in support of English composition, computer graphics in support of studio art courses, and evaluation and plotting of functions in support of mathematics courses. It was possible to undertake these initiatives immediately using resources already available.

The fourth identified area, evolutionary trajectory simulation, requires some software development work which, while relatively straightforward, has never been undertaken.

Trajectory Simulation as A Class of Structured Models

We define trajectory simulation as a class of time-step structured models in which there exist primitive entities that we may call "particles"; permanent and temporary attributes that we may call the set of "locations" of the particles; movement laws having the characteristic that after each time step the new locations (and other attributes) of each particle can be computed as a function of only (1) absolute time, (2) time-step size, and (3) particle attributes including current locations; and a macro description of particle locations that



Data Flow and Structure for Evolutionary Trajectory Simulation

serves as the primary output. The trajectory of such a system is its history of (macro descriptions of) particle locations over time, starting from an initial set of locations and other attrubutes.

We choose a data structure that assumes that neither individual particles nor individual locations require unique internal representation, so that movement laws and data storage can treat particles and locations in (a small number of) groups called particle classes and location classes.

These definitions and relationships are diagrammed according to Geoffrion's structured modeling concepts [

] at the top of this page.

For our purposes, the key characteristic of evolutionary trajectory simulation models is the simple, straightforward logic of time-step computations.

Examples of Evolutionary Trajectory Simulation

There are many superficially unrelated models that already exist which either already meet the above definitions or can easily be modified to do so.

Astrophysics simulations of many types have been used to study at various levels of aggregation, the formation of stars, of planets, of solar systems, of galaxies and of clusters of galaxies. These programs in many cases literally do no more than start with a collection of pieces of matter, move each piece according to gravitational and/or other laws, advance to the next time and repeat, outputting a macro description at each step.

Weather models in use by the U.S. Weather Service on supercomputers do straightforward trajectory simulation with parcels of air as the particles.

Discrete-event queueing models that are handled by languages such as SIMSCRIPT, GPSS, and SLAM perform the equivalent of trajectory simulation (where the particles are customers and the locations are servers), except that completely different data structures are used (next-event structures) because zero or one or a small number of movements can occur at each time step rather than movements of every particle. Efficiency dictates this; it remains true that these models can be programmed more easily as time-step simulations [ ].

Feedback dynamics models that are handled by the DYNAMO language are time-step trajectory simulations identical to those of our definition except that the focus is on abstract attributes rather than on locations of particles.

As an example of an application suitable for classroom use at RETLA schools, students in an Urban Engineering course at Georgia Tech were required in a weekly assignment to demonstrate, by writing their own program in a general-purpose language, that housing segregation would automatically result from geographic differentiation of such location-specific attributes as housing cost or pollution, together with social-class-specific differentiation of such attributes as income available for housing or pollution tolerance. Students set up a two-dimensional set of locations with areas of higher and lower housing cost or pollution; they defined classes of people with lower and higher incomes or pollution tolerance; at each time step, they had each person consider a move to a place that better matched his or her income or tolerance; and at the end the people's locations had classified themselves.

The commonality of such diverse applications as described above has not heretofore been exploited.

Proposed Work

We propose developing a simple evolutionary trajectory simulation language that would enable users interactively (1) to define data on particle classes and location classes, (2) to specify initial conditions and time-step size, (3) to specify movement laws, and (4) to control aggregations of particles; and would output a two-dimensional picture of particle locations under user control of scale and aggregation.

We further propose to implement and test the language on a suitable small computer system (such as the IBM PC-AT with monochrome graphics and co-processor), and to prepare three sample drafts of course modules, in three widely divergent areas

that would constitute a sample of in-class hands-on exercises that would use the language to good advantage.

The proposed work would prepare RETLA for the further step of preparing course modules, each of which would have dual learning goals of gaining insight into the system being modeled and gaining hands-on experience in programming computers and interpreting computer output.

CHECKLIST FOR CLASS-SUPPORT SOFTWARE INITIATION

Class-support software can be of three basic types:
1. Simple CAI (computer-aided instruction) software tries to automate teaching and can be useful for automated drill and practice.
2. Demonstration software provides a simulation of the behavior of some system. The student can exercise the simulated system behavior interactively so as to learn about the system. CAI features may be added; the best CAI packages have some sort of demonstration simulation at their core. 3. Utilitarian software performs some function that supports class activities but does not of itself teach or demonstrate. Tools such as word processing are in this category.

Given the list of topics taught in a particular course, the instructor can ask, for each topic, "Is there anything the student does or should do in learning this topic that could better be done with computer support?"

Such a supportable activity would be one that is at least partially automatable. If the student must do something that is well defined, repetitious, tedious, and not directly valuable, a computer might be helpful. For example, in chemistry there are tedious computations associated with problems in, say, stochiometry, reaction kinetics, rarefied gas dynamics, etc. Pick any one particular type of problem: Would the instructor like the student to set up the solutions to 20 different exercises rather than set up and solve only 5 in the same amount of time? If so, a software package that cranks out the solution from the setup might be useful.

The computer is not a device that you can ask questions of and get answers. Such a device is an expert system, which is just now beginning to appear in advanced applications costing hundreds of thousands of dollars to develop. Instead, the computer is a device that can do any perfectly-well-defined information-processing task rapidly.

The computer is no good at providing reading material; use textbooks or handouts instead. The computer is good at showing a result graphically; for example, a program that simply graphs the time trajectory of an algebraic function was exercised to show the path of the centerline of an ideal coin spinning on a flat surface, and by seeing the patterns (as the coin wanders, then falters, etc.) a student was led to propose a theorem that was later stated and proved.

Here are some recommended steps in initiating a class-support idea:

1. For each topic, consider what the student actually does, or would do if time and support were less limited.

2. For each such student activity, examine it further if it is tedious, boring, expensive or otherwise unsatisfactory.

3. For a tedious or boring activity, consider whether it is automatable.

4. For an expansive activity, consider whether it could be replaced by a computer simulation.

5. Generate a brief description of the most promising idea from Steps 3 and 4.

6. Consult someone to see if what you have conceived has already been done. If so, see if a package exists, and perhaps either plan to use it or plan to modify it. If not, perhaps plan to create a package.

7. To plan to create or modify a package, go through the 18-step preliminary planning procedure:

    1. Title of package
    2. Description of course
    3. Learning goals for package
    4. Learning enchancement expected
    5. Level of student effort
    6. Level of instructor effort
    7. Key concepts, skills, behavior, algorithms, etc.
    8. Existing packages
    9. List of inputs
    10. List of outputs
    11. User interface protocol
    12. Program architecture, size and structure
    13. Equipment and utility software needed
    14. List of deliverables
    15. Estimate of development effort
    16. Estimate of testing and evaluation effort
    17. Estimate of maintenance and enhancement effort
    18. Faculty-development impact

Composition Work Analysis

It is well established that people act approximately as "bother minimizers" in performing work via tools and machines. Bother is effort, as measured by number of keystrokes, etc., modified to include bothersome but not necessarily time-consuming factors such as glare, noise, physical discomfort, and (especially) requirements to have one's attention diverted from the job to the tools or machines themselves, as when a writer about the price of tea in China must temporarily pay attention to a totally unrelated matter such as tab setting. A support system is said to be "transparent" to the extent it allows its user to keep focusing on the ultimate job instead of procedures. Transparency increases with practice; an expert user becomes an effort minimizer when everything that bothers novices has been practiced into transparency.

In research on tasks closely related to those faced by students composing papers, researchers at Xerox Office Systems, Stanford University, and Georgia Tech have studied text editors used by programmers to input and revise computer programs (see, for example, "The Evaluation of Text Editors" by Teresa L. Roberts and Thomas P. Moran, Communications of the AACM, Vol. 26, No. 4, April 1983, pp. 265-283). It is now possible to come close to being able to evaluate a text editor from its specifications or user manual, before it has actually been implemented. Thus it is not farfetched to do a work analysis to select appropriate word processing facilities for English composition students without sitting down statistically significant numbers of actual students at various machines with various software packages and analyzing their performance.

Benchmark Population and Tasks

Although Sadler and others claim that students who can't type can "learn word processing well enough to compose without difficulty" relatively soon, inability to type is a huge barrier. Let us assume moderate typing skills - say 33 words per minute - for our benchmark composition students. Text can be neatly handwritten at about the same rate. (An expert typist works about twice as fast.)

Creative writing can be done at an overall rate of about 200 words per hour. At this rate a novelist could write two books a year with no time out for research or promotion. The quality may vary, but students from grade school to graduate school write at roughly the same overall rate. (Most of the time is spent thinking and organizing. A stream-of-consciousness writer typing at 33 words per minute continuously would create text about 10 times faster).

Let us assume that our benchmark student has a 1000-word paper to prepare and has already done the research and rough planning. Let the student have actually written or typed about 1200 words in the first draft, the extra words having been replaced or discarded in the process.

Assumptions must be made about revisions. Let us assume that there will be two more drafts and a final version; let the first draft be incomplete, requiring newly-created passages totalling 250 words for the second draft, 150 for the third, and 90 for the final. Assume the student is an averagely skilled reader who can proofread, correct, and improve text at a rate of about 9000 words per hour (exclusive of writing new material).

The final 1000-word paper is to be submitted in hardcopy form, not on a diskette or in a computer file.

With these assumptions about the student and the assignment, we are ready to evaluate alternative ways of performing the tasks.

Work Analysis for Various Alternative Systems

Let us analyze the work necessary to produce a 1000-word paper by using various systems for support. Since the students are assumed to be able to type, and since handwritten copy is hard to read, we will not consider an alternative in which the final copy is handwritten. Here are the basic alternatives:

1. Handwritten drafts, typed final copy.
2. Apple IIe or similar microcomputer using Apple Writer II or similar software.
3. IBM-PC or similar microcomputer using ProofWriter or similar software.

-- Within the second and third basic alternatives, we will separately consider printer speeds of 160 characters per second (typical for ink-jet printers and dot-matrix printers) and 12 characters per second (typical for daisy-wheel printers). With a short allowance for printer setup and waiting for other students, the fast printer will be assumed to produce the 1000 word document in 1.0 minutes, the slow printer in 8.7 minutes.

Due to slightly faster response times to all commands, the IBM-PC or similar computers will give slight advantages in the time to enter text, and very slight advantages in the time to enter corrections. The following table gives the estimated times for a student to produce a 1000-word theme using the various alternative systems:

Estimated Times to Produce 1000-word Paper
(times in hours and minutes)

Task	Hand/ typed	Apple with slow/fast printer		IBM-PC with slow/fast printer	
Initial draft					
Create	5:00	5:00	5:00	5:00	5:00
Clean hardcopy	(included)	:09	:01	:09	:01
Second draft					
Create	1:15	1:15	1:15	1:10	1:10
Proof and correct	:07	:07	:07	:07	:07
Clean hardcopy	:30	:09	:01	:09	:01
Third draft					
Create	:45	:45	:45	:42	:42
Proof and correct	:07	:07	:07	:06	:06
Clean hardcopy	:30	:09	:01	:09	:01
Final draft					
Create	:27	:27	:27	:25	:25
Proof and correct	:07	:07	:07	:07	:07
Clean hardcopy	:30	:09	:01	:09	:01
TOTALS	9:18	8:24	7:52	8:13	7:41

The work analysis shows that nearly all the time to be saved is due to using a printer or a faster printer for making the final copy and clean intermediate copies.

It should be noted that if the IBM-PC were used for certain sophisticated tasks, or if the themes were much longer or were to be partially automatically proofread by running them through analysis programs, the very modest advantage would become greater. However, for this kind of work, an IBM-PC station would save only perhaps 20 hours per year compared to an Apple station, so the savings would be totally inadequate to justify the more expensive stations.

The fast printers, on the other hand, are obviously justified. Ink-jet printers having speeds of 150 characters per second have recently been advertised for $400; not only would they save large amounts of student time, but they could even be made the cheaper overall alternative by purchasing fewer of them and sharing them among stations.

The main question then, is whether the Apple stations save enough time compared to hand/type methods to make pedagogically sound the argument that they truly make revision easier. First, let us analyze whether word processing really makes revision easier, and then see how much the advantage costs per student per year.

The student is estimated to save 29 minutes on every draft (except the first) using word processing with a fast printer. Note that if the paper is produced in one effort with no preliminary drafts, the computer saves no time, and is even estimated to be a minute slower, because with the computer the entered text is not in hardcopy form until printed out. But the student can save nearly half an hour per draft after the first draft. After about three drafts, the student will be spending about about half an hour retyping - or one minute running off a clean copy. Thus it is clear that word processing would, in the assumed situation, definitely encourage extensive revision. A total of 1 hour 26 minutes is estimated to be saved on each 1000-word theme. If a station produces 3.5 themes per week in a 30-week academic year, the station saves over 150 hours of student time, or changes over 150 hours of student time from unproductive to productive each year. One way to compare this with the $1300 cost of a station is to note that if the students were being hired to write themes, their salary would need to be less than about $2.40 per hour before it would be economical to fail to rent or buy stations for them.

The economic analysis, then, clearly favors using Apple stations with fast printers for word processing, and the time savings definitely would promote extensive revision of compositions.

APPENDIX 8: RETLA Advisory Board Minutes

Georgia Institute of Technology
Atlanta, Georgia 30332

MEMORANDUM

Date: 31 July 1984

To: Members, RETLA Advisory Board

From: Jeffrey Plank, Coordinator, RETLA

Subject: Minutes, 30 July Meeting

1. Calendar: The Board set 11 September as the date for its next meeting. The Board will also meet in mid-October to draft the Interim Report which Sloan must have by 1 November.

The Module Development Workshop schedule will be as follows: the first workshop will take place at Georgia Tech, 27-28 September, as will the second, on 6-7 December. There will also be workshops held in February or March and in May. The modules selected for immediate production are: Mathematical Applications, Technology Assessment, and Engineering. These will be advertised to RETLA colleges during August.

2. Workshop Structure and Rationale: Van Nostrand reviewed the constraints resulting from the Sloan Foundation's funding decision:

(a) Sloan subtracted the $65,000 in the RETLA proposal budget set aside for liberal arts college faculty travel, per diem, and stipends and divided that money among the individual RETLA colleges. But the Foundation's letter of award did not stipulate how much of the discretionary grant should be spent on workshop activities.

(b) Consequently, we cannot predict the level (or intensity) of faculty participation. We have designed each workshop so that it can accommodate a variable number of module teams (user/supplier teams) in any of four phases in each of the three fields.

3. Advisory Board Response to Constraints: In addition to endorsing the workshop structure, the Board took these positions:

(a) The discretionary grants are too small for significant participation by liberal arts faculty in the RETLA workshops over a period of two years. Moreover, such participation depends on the accident of geographical location because the method of funding penalizes colleges

that are further from Georgia Tech.

(b) In order to demonstrate to the Sloan Foundation that funding is not adequate and to monitor local administration of faculty development funds, the Board agreed to recommend that each RETLA coordinator should have the autonomy required to prepare programmatic and fiscal reports on a quarterly schedule. These reports should include the following categories:

(1) goals for the quarter,
(2) status of programs at the end of the reporting period,
(3) unfinished business for the next reporting period, and
(4) fiscal report of expenditures during this quarter.

(c) The Board should make these recommendations to the RETLA college presidents and to the Sloan Foundation (perhaps at the Fall meeting in NY).

(d) The Board will take a position on RETLA funding of faculty participation in the Interim Report. At this point, the position seems to be that funding for faculty participation should be handled by the RETLA Board as opposed to the individual colleges.

4. Advisory Board Position on Faculty Reimbursement for FY 85 Workshops: Board reached impasse here. Board noted that funds have already been budgeted (especially in the case of the $150,000 award winners), that none of the liberal arts colleges ordinarily pay stipends to faculty (because over 100% time), that release time does not work to the advantage of the faculty member. See 3(d) above.

5. Computer Consulting: Don Young reviewed the activities he will undertake with regard to needs assessment and proposal writing for computer hardware and software.

6. Miscellaneous: Plank reported that Sloan encourages grantsmanship among RETLA colleges and Georgia Tech based on the New Liberal Arts initiative. Firest Newsletter will appear during Fall 1984. Lynn Sadler has raised to Jim Koerner the question of how Sloan plans to treat membership applications to RETLA or the Sloan NLA program from new colleges; the Board will want to take a position on this matter before 1 November.

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RETLA COMPUTER CONSULTING

Donovan Young (Georgia Tech)	(O) (404) 894-2321 (H) (404) 378-6192

Georgia Institute of Technology
Atlanta, Georgia 30332

MEMORANDUM

Date: 1 October 1984

To: Members, RETLA Advisory Board

From: Jeffrey Plank, RETLA Coordinator

Subject: Minutes, 11 September Meeting

1. Calendar: The Board set 17 October for its next meeting. This meeting will begin at 10:00 a.m. and end at 3:30 p.m.

2. Advisory Board Response to Constraints: The Board continued its consideration of the constraints resulting from the Foundation's funding decision. At its first meeting, the Board had taken the position that the discretionary grants are too small for significant RETLA participation and that the grants discriminate against colleges in relation to their distance from Atlanta. The Board also decided, at its first meeting, to detail these responses and communicate them to the Foundation through these minutes.

The Board reviewed responses to initial RETLA Workshop planning. In addition, each individual Board member reported the consequences of funding policy on his or her own campus. The discussion was, at times, intense. The Board sought both to record problems and consider solutions to these problems.

There are five kinds of problems:

(1) The discretionary grants do not provide adequate funds for participation in RETLA workshops over a two-year period. Indeed, the $65,000 subtracted from the proposed RETLA budget and divided among the individual colleges had been specified in the proposal to cover merely one year of workshop participation.

(2) The discretionary grants of $15,000 do not provide adequate funds for two years because the entire $15,000 is not available for workshop participation. The Foundation indicated that these funds could be used for various projects.

(3) Large grant winners have already committed their funds to the

projects originally described in their proposals.

(4) These liberal arts colleges do not or cannot pay stipends to faculty. In many cases, colleges do not pay stipends to faculty because there is simply no faculty development going on; there is no precedent. In other cases, state regulations prohibit colleges from paying stipends to faculty.

(5) The discretionary grants favor colleges closer to Atlanta and cause a hardship to those more distant.

The Board proposed:

(1) That the Foundation make a supplemental grant for 1985-86 Workshop participation.

(2) That this supplemental grant be sufficient to cover the cost of two workshop teams from each RETLA college.

(3) That these funds be awarded to the RETLA Advisory Board for payment to workshop participants.

(4) That the RETLA Advisory Board spell out the responsibilities of workshop participants and award stipends to participants.

3. Module Development Workshop: The Board reviewed plans for the Module Development Workshop, 27-28 September, discussed the agenda, and urged the project team to present a complete overview of the project to all participants. Board discussed the problematic size of Workshop and drew attention to the variables that might affect attendance.

4. Board Elections: The Board agreed to elect six (6) members from RETLA colleges, with two (2) additional Board positions for Georgia Tech, and one (1) for the Southern Region Education Board, for a total of nine (9) Board members. The Board agreed that there should be at least one member from each of the three "geographical areas" in the RETLA region:

(1) Area A: Rust, Dillard, Tuskegee (and later, possibly Xavier, Jackson State, and Oakwood)

(2) Area B: Morris Brown, Savannah State, Albany State, Spelman (and later, possibly Fort Valley State and Morehouse)

(3) Area C: North Carolina Central, North Carolina A and T, South Carolina State, Bennett (and later, possibly Benedict)

Nominations will be restricted to RETLA faculty representatives. Each representative will have six votes. Three of the new board members must come from the current Board; these members will have one-year terms. Three

new Board members will have two-year terms.

N.B. Advisory Board meeting scheduled for 17 October will take place, as usual, in 327 Skiles Building, Georgia Tech.

cc: Dr. James D. Koerner, Sloan Foundation

Georgia Institute of Technology
Atlanta, Georgia 30332

MEMORANDUM

Date: 19 October 1984

To: Members, RETLA Advisory Board

From: Jeffrey Plank, Secretary, RETLA Advisory Board

Subject: Minutes, 17 October Meeting

1. Module Workshop Report: The Board reviewed the Workshop Report sent by the Georgia Tech Project Team to workshop participants. The Board agreed that the Project team needs more control. In considering the apparent shifts in module topic interests between April and September 1984, the Board pointed to several explanations: (1) such shifts can be attributed to the changing political climates at some colleges, and (2) the absence of stipends could explain why some faculty were chosen at the last minute to participate. In either case, the prospect of getting involved in a year-long project, in addition to covering his/her classes and performing other faculty duties, might be considered a burden, rather than an opportunity, by some faculty members. The Board pointed out that a nominal stipend would provide to both the faculty member and the institution a symbolic message that the RETLA workshop activities are important.

The Board also noted that their colleagues remained confused about the products that would emerge from the workshop. Here, the Board and the Project Team did not disagree about the nature of the products. Rather, the new faculty participants seemed unable to absorb, tha the short workshop period, background information and perform workshop tasks. The purpose of the modules, the Board agreed, is to engage the liberal arts student in activities which include quantitative reasoning and which are made relevant to the course in which the module is used. The products of the workshop are: a student syllabus and a faculty handbook (which may include AV materials, cassettes, etc.). At the next workshop, the Project Team will provide participants with much more orientation.

The Board discussed workshop schedules, noting that early May might be the last time during the academic year when colleges on the semester system could afford to release faculty for extra-curricular activities.

2. Funding Report: The Board ratified minutes of the 11 September meeting

detailing the Board's response to funding and directed the AB secretary to forward these minutes to Dr. James Koerner.

The Board discussed the growth of the RETLA group and the scope of RETLA activities, expressing great concern about the implications of uncontrolled growth within fixed funding levels. We do not want the growth of the RETLA group to undermine an orderly progress toward completion of projects now under way.

The AB secretary will prepare budget forecasts by activity (including a second-track workshop series for colleges not participating in current series) for an Interim Report to Sloan due 1 November.

3. Computer Consulting Report: The Board welcomed a report of the computer consulting project for word-processing laboratories. At some colleges this kind of activity is already consuming funds from the RETLA discretionary grants. Some outside funding for the word-processing/computing initiative should help restore college committments to RETLA workshops.

4. Elections: The AB secretary will prepare a ballot for AB elections, first by contacting college presidents and RETLA faculty representatives for nominees by the regions identified in the 11 Sept. meeting minutes. Elections will take place after the 28 November AB meeting.

5. Next Meeting: 28 November 1984, 10:00 a.m. to 3:30 p.m., 327 Skiles Classroom Building, Georgia Tech. At this meeting, the Board will review data and proposals prepared by Don Young and discuss vendor proposals with James Koerner.

Georgia Institute of Technology
Atlanta, Georgia 30332

MEMORANDUM

Date: 4 February 1985

To: Members, RETLA Advisory Board

From: Jeffrey Plank, RETLA Advisory Board Secretary

Subject: Minutes, 22 January 1985 Meeting

1. New RETLA Colleges: Van Nostrand briefed the Board on the status of Jackson State and Oakwood. Both colleges contacted James Koerner who directed them to contact the Georgia Tech project team about RETLA activities. The Board approved the Georgia Tech project team decision to postpone entry of new colleges into workshop series until the first cycle of module development is complete. Other RETLA colleges will be invited to participate when a new cycle begins, either in May or September.

2. Elections: The Board decided to go through with election procedures during Spring, 1985. These procedures include:

(a) asking college presidents to name RETLA project directors for their colleges; and
(b) preparing a ballot listing each of these RETLA college project directors as nominees, by region (west, central, east); and
(c) distributing ballots to each RETLA college project director.

The Board secretary will prepare the ballot for approval at the next Board meeting.

3. Module Workshop Report: Plank briefed the Board on the status of module workshops. The three module topic groups will meet as follows:

(a) Art and Technology: 7-8 February
(b) Math for Social Sciences: 7-8 February
(c) Engineering/Technology Assessment: 28 February-1 March

The aim of each workshop is to convert information gathered on the December 1984 workshop worksheet into a student syllabus (inclusing sequential lesson plans), for possible field-testing in Spring, 1985.

Van Nostrand reported that the Georgia Tech project team had invited several module workshop teams to work on student syllabi with their faculty consultants in advance of the third workshop. These sessions have resulted in at least one "demonstration" module for use by the Art and Technology group.

4. Access Policy for Computer Proposal: The Board reviewed Don Young's access policy draft (14 December 1985) and introduced several new variables. The Board questioned that college presidents would commit to microcomputer labs dedicated exclusively to word-processing for English classes. The Board asked the Georgia Tech project team to revise Young's draft so as to clarify the responsibilities of the college within the program.

5. NLA Newsletter: Van Nostrand asked the Board to examine the NLA Newsletter, edited by John Truxal (SUNY-Stony Brook), in particular the notices in the Newlsetter about seminars and workshops for NLA college faculty. Truxal had asked Van Nostrand to supply a mailing list for the NLA Newsletter so that RETLA faculty might apply for the advertised activities. The Board felt, initially, that it might be better for RETLA faculty to apply through the RETLA Advisory Board. Were the Board to make recommendations to the seminar leaders, it was argued, RETLA faculty would have a better chance at being included in the seminars. After studying the Newsletter more carefully, the Board decided not to ask that RETLA faculty apply through the Board simply because the seminar deadlines would pass before any other Newsletters were distributed anyway. The Board also decided the NLA Newsletter did not clearly state eligibility requirements and asked Van Nostrand to have Truxal clarify eligibility requirements in future issues.

6. Next meeting: The Board decided to meet two weeks after receipt of the word-processing lab proposal from Apple Computers. The Board secretary will distribute Apple's proposal as soon as it arrives and set the meeting date.

14 May 1985

TO: Members, RETLA Advisory Board
Faculty Representatives, RETLA Colleges

FROM: Jeffrey Plank, RETLA Advisory Board Secretary

RE: Minutes, 30 April Meeting

1. Orientation: Van Nostrand (1) briefed new Advisory Board members on 1984-85 RETLA activities and funding arrangements and (2) reported award of renewal grant (effective 1 July through 31 December 1985).

--All 1984-85 RETLA activities (module development, computer initiatives, advisory board, production of project deliverables, newsletter, project administration) will continue with the renewal grant.

--Some changes in the underwriting of module development will make possible a fairer allocation of resources. With the renewal grant, RETLA faculty participants will be reimbursed for travel and per diem expenses (up to four trips) and receive stipends for completing Student and Faculty Handbooks. There will also be "materials and supplies" sub-budgets set aside for module teams as needed.

2. Computer Initiatives: Don Young (Industrial and Systems Engineering, Georgia Tech) reported on the word-processing microcomputer proposal and two new proposals in art and math.

--Word-processing labs: Apple computers decided not to fund the RETLA proposal, citing microcomputer market conditions. Jim Koerner plans to pursue this same proposal with IBM and other vendors in May and June.

--Computer Art Labs: Young outlined a proposal for computer art labs (see attached draft); Board endorsed proposal and agreed that Young should (1) distribute the proposal draft and illustrative materials to RETLA college art teachers and (2) prepare a revised proposal to send to vendors during the summer.

--Computer Labs for Math: Young also outlined a proposal for computer labs for math courses, modelled on the word-processing lab proposal. The Board agreed that Young should poll RETLA college math teachers to identify specific needs and resources and prepare a proposal for

review by the end of the summer.

Young also proposed that these initiatives be combined into a broad proposal to establish central microcomputer labs at each RETLA college, incorporating these three applications as well as others.

The Board also discussed the need to designate uses for equipment in proposals to vendors. Young noted that vendors usually dismiss proposals for equipment that do not include commitments for specific uses. Young and the Board agreed that the word-processing lab proposal (endorsed by 11 of 12 presidents of active RETLA colleges) required commitments to broader equipment use than would the art or math lab proposals. The Board also noted that the umbrella microcomputer proposal would permit colleges to designate equipment use in accordance with institutional needs and priorities.

3. Module Reports: The Georgia Tech Project Team joined the Board at lunch to discuss modules now in progress and to forecast procedures for new module teams in the fall. The Board asked the Project Team to draft "operational guidelines" to detail responsibilities, obligations, financial support, and deadlines for review at next Board meeting.

4. Sloan Foundation Meeting for RETLA College Presidents: In a March site visit to Georgia Tech, Jim Koerner and John Truxal (Sloan Foundation New Liberal Arts Advisory Board member) suggested that the Foundation convene a meeeting for RETLA college presidents in Atlanta in December or January. The purpose of this meeting would be (1) to demonstrate the instructional materials deveoped by RETLA faculty and (2) to provide an occasion for the discussion of opportunities presented by the RETLA network. The Board endorsed this meeting.

5. Next Meeting: Board selected Monday, 29 July, 10:00 a.m.-3:30 p.m. for next meeting.

Georgia Institute of Technology
Atlanta, Georgia 30332

College of Sciences and Liberal Studies
Department of English
(404) 894-2730

30 July 1985

MEMORANDUM

TO: RETLA Advisory Board

FROM: Jeffrey Plank, Secretary, RETLA Advisory Board

RE: Minutes, 29 July Meeting

1. Georgia Tech OCA Accounting Procedures: The Office of Contract Administration now requires contracts between the Institute and participants in sponsored-research projects to cover payment and reimbursement for services and expenditures. Van Nostrand reviewed Advisory Board contracts and distributed invoices for Board members to sign.

2. DEC MicroVax Competition: Van Nostrand briefed Board on evolution of DEC's offer to make 10 MicroVax systems available (at a discount of 45%) to Sloan's New Liberal Arts colleges. The Sloan Foundation will administer a competition among the all NLA colleges; letters announcing details of the competition will be sent to RETLA colleges before 7 August.

The Board expressed concern about the lack of information regarding proposal specifications. In particular, the Board's consensus was that without some financial commitment from a third party for the remainder of the hardware costs not covered by the DEC discount, most RETLA colleges would not develop proposals. Also, the Board agreed that RETLA colleges would not submit proposals unless the concept of "innovative" equipment use includes innovative approaches to basic RETLA college needs--instruction in the fundamentals.

3. In-progress Module Evaluation: Van Nostrand reported on the progress of the 20 technology module teams. Of these 20 teams, eight have submitted Student Handbooks; the Georiga Tech project team is now editing these handbooks and suggesting revisions. Four teams have not submitted Student Handbooks, but will be invited to continue on the basis of progress to date. For various reasons, the remaining eight teams have not made progress and will not be asked to continue in this phase.

4. New Module Team Selection: Eight new teams will be selected to begin work with Georgia Tech engineering consultants in the Fall. Applications from prospective teams will provide the basis for selection. The Board reviewed, amended, and endorsed an application form and contract sheet prepared by the Georgia Tech Principal Investigators and Project Group. Application forms will be sent to each RETLA faculty representative; deadline for applications is 10 September.

5. RETLA Membership: During consideration of new team selection, the Board discussed RETLA membership. The Board advised the Georgia Tech Project Team to ask presidents of the six inactive RETLA colleges (Oakwood, Jackson St., Benedict, Ft. Valley, Xavier, and Morehouse) to confirm intention (if they do so intend) to participate in RETLA by naming faculty representatives.

6. Project Group Report: Mayer reported that the Georgia Tech Project Team is preparing several video presentations (about 20 min. each) about engineering procedures to be used during new module team orientation. These projects include: water resource management (Mayer, Civil Engineering), leg brace design (Vito, Engineering Science and Mechanics), textile machinery and switching systems (Lundberg, Textiles), and modeling in engineering (Rossini, Philosophy of Science).

7. 1985-86 Plans: The Board was briefed on Sloan Foundation timetable for proposal renewal, on plans for inviting Sam Goldberg to visit RETLA colleges, and on the presidents' meeting (originally suggested for December by Jim Koerner in his April visit). The Board will review a renewal proposal draft/outline at its next meeting; other plans will be developed after Goldberg takes over the NLA program after Labor Day.

8. The next RETLA Advisory Board meeting will take place on 17 September, 10:00 a.m.-3:30 p.m..

cc: RETLA Faculty Representatives

18 October 1985

MEMORANDUM

TO: RETLA Advisory Board Members

FROM: Jeffrey Plank, RETLA Advisory Board Secretary

RE: Minutes, 17 September Meeting

1. The 17 September meeting took place at Georgia Tech. Board members attending were: Sylvia Bozeman (Spelman), W. C. Brown (SREB), James Hill (Albany State), Jeffrey Plank (Georgia Tech), Lee Ponting (Bennett), Carol Richly (Paine), Francis Taylor (Tuskegee), A. D. Van Nostrand (Georgia Tech); Board members absent: Sara Kirk (NCATSU).

2. The agenda followed the Draft Proposal for CY86. The Board reviewed the status of current activities in its discussion of the "Continuing Activities" section of the proposal. The Board suggested modifications of several activities proposed the "New Activities" section, including the project grants, computer consulting activities, and on-site orientation seminars.

The revised Draft Proposal which includes the Board's suggestions is attached.

3. Don Young (ISYE, Georgia Tech) reported on computer consulting activities, including the DEC and NSF opportunities. Young's report is summarized in the October RETLA Newsletter (enclosed).

4. The Board considered Sara Kirk's status as a Board member; she has not attended the Board's first three meetings. Lee Ponting volunteered to ask Kirk if she intends to participate.

5. Next meeting: The next Board meeting will take place at Paine College in Augusta, GA on Monday, 2 December. The location is the President's Office, Second Floor Conference Room, Haygood-Halsey Hall. The meeting time is 10:00 a.m.-3:30 p.m. Carol Richly will send campus maps to all Board members.

DATE: 3 January 1986

TO: RETLA Advisory Board Members

FROM: Jeffrey Plank, RETLA Advisory Board Secretary

SUBJECT: Minutes, 13 December Meeting

1. The Board reviewed Van Nostrand's report of Sloan Foundation Program Officer Dr. Sam Goldberg's November site visit and his decision to discontinue the RETLA program. Goldberg gave four reasons for his decision:

--The module program is not having sufficient impact on students at RETLA colleges.

--RETLA college presidents are not sufficiently committed to the program.

--The present funding arrangement is patronizing toward RETLA colleges.

--The Foundation now defines the New Liberal Arts more narrowly, excluding technology and engineering and focusing instead on quantitative methodologies and computers.

The Foundation has directed Georgia Tech to phase out all current activities by 30 June. Funds from the current grant will support current activities until that time. In order to meet current commitments with remaining funds, Georgia Tech will not award Project Grants.

2. Board members from RETLA colleges agreed to respond in writing to the Sloan Foundation before the next Board meeting. Francis Taylor is coordinating this response.

3. The Board agreed to pursue funding from other sources. Van Nostrand will contact Jim Koerner and Dwight Lahr for suggestions.

4. John Lundberg reported for the Georgia Tech Project Team on module development activities. In order to provide sufficient time for editing and revision of module materials, the Project Team has had to accelerate deadlines. Guidelines for module documentation will be distributed to teams during the first week of January.

Of the 1984-85 teams, four (Bennett/Art and Technology, Dillard/Technology Assessment, Morris Brown/Art and Technology, South Carolina/Industrial Revolution) have revised their Student

Handbooks and three of these are preparing Faculty Handbooks. Three teams (Albany State/Statistics, Savannah St./Statistics, Tuskegee/Microscope) which have made some progress on the Student Handbooks will be given another deadline; four other teams (Albany St./Textiles, South Carolina St./Birth Control, Spelman/Birth Control, Spelman/Statistics) will not.

Of the 1985-86 teams, five (Bennett/Decision Making, Dillard/Hazardous Chemicals, Paine/Augusta Canal, Paine/Savannah River Plant, Tuskegee/Computer Logic) are making satisfactory progess; one (Savannah St./Food Technology) is not.

5. The next Board meeting is scheduled for Monday, 3 February, 10:00 a.m. to 3:30 p.m. in the Skiles Classroom Building, Room 308.

4 February 1986

MEMO TO: Members, RETLA Advisory Board

FROM: Jeffrey Plank, RETLA Secretary

SUBJECT: Minutes, RETLA Advisory Board Meeting, 3 February

1. The elected members of the Board drafted a response (copy attached) to the Sloan Foundation's decision to discontinue RETLA funding. These Board members also agreed that Jim Hill would have the letter typed, sign it for the Board, and mail it so that it would reach the Foundation by 7 February. Board members will send copies of the draft to their college presidents in advance of the 7 February meeting in New York with Foundation representatives.

2. A. D. Van Nostrand reported that Dwight Lahr had no suggestions for alternative funding sources for RETLA. Jim Koerner suggested Ford, Carnegie, and the "old" Mott Foundation (in Grand Rapids, MI) as possible sources. Koerner expressed reluctance about following up personally on these suggestions because he was cautious about his own consulting arrangements in the foundation community. Van Nostrand indicated that he did not think Board efforts at securing funds from those sources would succeed without more vigorous support from Koerner.

3. Donovan Young briefed the Board on computer consulting activities.

--Despite demonstrations of renewed interest in November, Apple representatives have not responded to the RETLA word-processing lab proposal. Plank will follow-up with Apple; Young will contact Zenith.

--Since the DEC-Sloan competition has apparently been cancelled, Young will submit the proposals developed by Dillard, NC A and T, and SCSC directly to DEC.

--Three colleges (Paine, Rust, Spelman) are currently developing proposals for NSF support. These proposals will be completed by 1 May.

--After Young reviews hardware prices, he will review the art proposals developed last fall and ask art teachers if they are interested in pursuing the proposals further.

4. John Lurdberg reported on the progress of module teams.

--The five 1985-86 teams expect to submit Student Handbook drafts by 21 February.

--Five 1984-85 teams are currently revising Student and Faculty Handbooks on schedules that have evolved from last year.

--Four additional 1984-85 teams have been given a 7 February deadline to submit Student Handbook drafts.

5. The next Board meeting is scheduled for 1 April, 308 Skiles Classroom Building, 10 a.m. - 3:30 p.m. At this meeting, the Board will draft a statement for the final RETLA Newsletter and review RETLA activities.

3 February 1986

Dr. Samuel Goldberg
Program Officer
Alfred P. Sloan Foundation
630 Fifth Avenue
New York, NY 10111

Dear Dr. Goldberg:

The RETLA Advisory Board would like to express its appreciation to the Alfred P. Sloan Foundation for its support of the New Liberal Arts activities based at the Georgia Institute of Technology. As the Foundation discontinues its support of the consulting arrangements between Georgia Tech and some of the traditionally Black schools of the Southeast, we feel the need to bring to your attention some of the accomplishments of the program with which you may not be familiar.

*The consortium arrangement between Georgia Tech and the participating institutions has provided access to resources that traditionally have not been available on these campuses. For example, schools have secured seminar leaders and consultants in specialized areas such as computing, biotechnology, energy, and engineering methodology.

*On many member campuses it was the RETLA activities which first stimulated faculty interest in exploring the integration of technology into the traditional liberal arts curriculum. This in itself was a significant accomplishment because before meaningful curriculum changes could be designed and implemented, faculty had to be convinced that such a development was both feasible and important in the education of their students.

*The RETLA project not only provided the participating institutions the benefits of networking with Georgia Tech but also provided for new avenues of exchange between the Black institutions. Given the special mission of the historically Black colleges in higher education, it has been both necessary and useful for us to exchange ideas and resources and arrive at a consensus on the appropriate methodology for integrating technology into a curriculum that serves underprepared students as well as high achievers.

Since both the NLA and RETLA activities at these institutions were experimental, the Board feels that the accomplishments of the program are yet to be determined. We strongly recommend that the Sloan Foundation continue to support: (1) a formal network among the historically Black institutions, and (2) the completion

of the module development initiative at Georgia Tech through field testing. We also recommend vigorous support of NLA initiatives on historically Black campuses.

Sincerely yours,

RETLA Advisory Board

2 April 1986

MEMO TO: Members, RETLA Advisory Board

FROM: Jeffrey Plank, RETLA Secretary

SUBJECT: Minutes, RETLA Advisory Board Meeting, 1 April

1. Current Modules: Status Report and Distribution Policy

The Board reviewed the current status of the technology modules:

--Three module teams have completed both Student Handbook and Faculty Handbook and have field-tested these materials.

--Two module teams have completed the Student Handbook and have field-tested it.

--Two teams have submitted draft Student Handbooks; another team expects to submit a draft Student Handbook next week. (For a complete list, see attached sheet.)

The Board also decided on a distribution policy for completed module materials:

--Each author will receive ten copies of his or her own materials.

--Either the final RETLA Newsletter or a separate catalogue will include a list of all completed module materials, along with a brief abstract and the authors' names and addresses. Until 30 June, the RETLA office will send copies of modules to anyone who requests them free of charge. After 30 June, those interested in obtaining modules will write directly to the module authors.

2. Computer Consulting Report

Donovan Young reported on current computer consulting activities; these include: Paine (music), Apple (word-processing labs), various art proposals, and Spelman (math). He reported that none of these activities are likely to result in fundable projects.

Young summarized his efforts at faculty development in computing by pointing out that the two ingredients essential for proposal development--hardware and release time--are not available to RETLA faculty. Without hardware and release time,

RETLA faculty members find themselves drafting proposals without having had the opportunity to familiarize themselves with a range of possible computer applications.

3. Final Report

The Board made the following suggestions for the Final Report:

--Stress the evolutionary nature of the project: what the Foundation has meant by the term "new liberal arts" has never been fixed; rather, it has evolved significantly during the project activities.

--Stress the boldness of the project: the team approach (in which RETLA faculty and Georgia Tech faculty collaborated as peers) and the network approach (in which all participating institutions pooled resources) is unprecedented.

--Stress the significance of the Advisory Board: faculty development projects need faculty administration.

9 April 1986

RETLA Technology Modules: Status Report

College	Topic	SH	FH	Field-test
Albany St.	Statistics	x		x
Bennett	Art-Math	x	x	x
Dillard	Lit-TA	x		x
Morris Brown	Art-Math	x	x	x
SCSC	Ind. Rev.	x	x	x
SCSC	Pill	(x)		
Bennett	Decision-Making	(x)		
Dillard	Hazardous Chemicals			
Paine	Augusta Canal	(x)		
Paine	Savannah R. Plant	(x)		
Tuskegee	Computer Logic	(x)		

APPENDIX 9: RETLA Newsletters

1. March 1985
2. May 1985
3. October 1985
4. May 1986

RESOURCEFUL EXCHANGE:
TECHNOLOGY AND THE LIBERAL ARTS
NEWSLETTER

RETLA

March 1985

A STATUS REPORT

The acronym RETLA (Resourceful Exchange: Technology and the Liberal Arts) denotes a group of eighteen historically black colleges in the Southeast that have been funded by the Alfred P. Sloan Foundation to participate in its New Liberal Arts program. RETLA also denotes an informal association of a majority of these colleges, with its own advisory board, which has evolved during the past ten months.

Current RETLA activities include a sustained series of workshops, and a computer consulting service. These activities evolved from a one-year assessment of needs undertaken by the colleges with Georgia Tech during 1983-84. The assessment procedure also established a representative advisory board.

During that first year of organization, with the help of the Southern Regional Education Board, the Georgia Tech project team (Mel Kranzberg, History; Paul Mayer, Civil Engineering; A. D. Van Nostrand, English; and Donovan Young, Industrial and Systems Engineering) invited faculty from groups of colleges to two preliminary workshops that modeled ways of interpolating technology and quantitative reasoning into liberal arts curricula. Then at an editorial workshop these faculty representatives categorized project ideas and explored the possibilities of networking and/or forming an association.

An elected committee then met with Georgia Tech project members three times during Spring 1984 to draft and revise the needs assessment report and proposal. In July 1984 the Sloan Foundation awarded grants to Georgia Tech and to fifteen colleges: Albany State College (Albany, GA), Bennett College (Greensboro, NC), Dillard University (New Orleans, LA), Jackson State University (Jackson, MS), Morehouse College (Atlanta, GA), Morris Brown College (Atlanta, GA), North Carolina Agricultural and Technical State University (Greensboro, NC), North Carolina Central University (Durham, NC), Oakwood College (Huntsville, AL), Paine College (Augusta, GA), Rust College (Holly Springs, MS), Savannah State College (Savannah, GA), South Carolina State College (Orangeburg, SC), Spelman College (Atlanta, GA), and Tuskegee Institute (Tuskegee Institute, AL). Four of these institutions received major grants: North Carolina A and T, Rust, Spelman, and Tuskegee.

Now in the program phase of instructional activities, forty-two faculty from fourteen RETLA colleges are meeting with Georgia Tech consultants in bi-monthly, two-day workshops to develop instructional modules for use in liberal arts courses. Each module falls within one of three categories: Art and Technology, Math for Social Sciences, and Engineering/Technology Assessment. The subject areas for which these modules are being prepared include mathematics, political science, sociology, studio art, history, and English literature.

During earlier workshops in September and December 1984, participants developed specifications for their respective modules. They are now drafting student handbooks and instructors' guidelines for field-testing in the Spring and Fall 1985 terms. We expect to have five modules completed by June 1985. Documentation for each module will consist of a Student Handbook and Faculty Handbook, and a brief introductory reference.

RETLA college faculty participants work in teams of two: one faculty member — typically from the humanities — who currently teaches the course for which the technology module is being prepared, and one member — typically from math or the sciences — who serves as a resource for quantitative methodology. In short, one faculty member uses the resources that his or her colleague supplies.

A third, part-time, member of each team is a consultant from the Georgia Tech faculty. As field specialists, the consultants facilitate the dialogue between humanist and scientist/mathematician. Their fields include Civil Engineering, Engineering Science and Mechanics, Industrial Engineering, Industrial and Systems Engineering, Industrial Design, Mathematics, Sociology, and English. This faculty group of fifteen members has articulated a description of engineering procedures which the RETLA college teams are now using in their instructional designs.

The technology modules, of one to three weeks' length for a quarter or semester class, are designed to engage students in engineering concepts and procedures. All modules include problem definition, mathematical or mechanical modeling, and optimization, and some address the assessment of typical engineering solutions. The Georgia Tech project team is designing a standard documentation so that the modules can be shared by all participating colleges.

Among the other current RETLA activities, a Georgia Tech team has surveyed the computer resources and needs at RETLA colleges and is now preparing proposals to foundations and to vendors for microprocessor labs. The advisory board, consisting of five faculty elected by RETLA college representatives, two Georgia Tech representatives, and one representative from the Southern Regional Education Board, has so far met seven times during the 1984-85 academic year to review the RETLA program.

The RETLA Newsletter, to appear four times each academic year, will report on project activities and review pertinent publications; later issues will feature short articles by

participating faculty and survey related programs throughout the country.

MODULE WORKSHOPS

Forty-two faculty from fourteen RETLA colleges have been participating in a series of two-day workshops at Georgia Tech to develop technology modules for use in liberal arts courses. Each module falls within one of three categories: Art and Technology, Math for Social Sciences, and Engineering/Technology Assessment. Participants work in teams of two; one from the humanities and one from the sciences or mathematics. A third member of the team is a Georgia Tech faculty consultant who facilitates the dialogue.

Workshop sessions have typically included presentations by the Georgia Tech project team, engineering laboratory and computer demonstrations, and tutorial sessions. At the September workshop, Prof. Wolfgang Bürger (Institute for Theoretical Mechanics, University of Karlstruhe) lectured on "Toys and Engineering," using numerous examples to illustrate the role of mathematics and mechanics in simple toys. At the December workshop, Georgia Tech professors John Lundberg (Textile Engineering), Paul Mayer (Civil Engineering), and Ray Vito (Engineering Science and Mechanics) reported on their work as engineers, detailing the role of mathematics and mechanical modeling in the solution of social problems. Each presentation has been video-taped for use by workshop participants.

Participating RETLA college faculty and their module topics include:

(1) Art and Technology:

—Bennett College (Alma Adams, Art; Lee Ponting, Mathematics): "Artistic and Mathematical Components in Visual Communications"

—Morris Brown College (Lee Ransaw, Art; Abiola Lawal, Mathematics): "Interfacing Mathematics and Technology with Design and Architecture: The Arch"

—North Carolina Central University (Mel Carver, Art; Kinney Kim, Physics): "Art and Technology"

The "Art and Technology" teams have been assisted by Georgia Tech consultant Lee Payne (Industrial Design).

(2) Math for Social Sciences:

—Albany State College (Veula Rhodes, History; Don Williams, Math/Computer Science): "Quantitative and Analytical Concepts for the Social Sciences"

—Dillard University (Carrol Wiltz, Social Sciences; Robert Johnson, Math): "Statistics for Social Sciences"

—North Carolina A and T State University (Bob Davis, Sociology; Hsin-Yi Lau, Mathematics): (1) "Life Expectancy," (2) "County Data Profile," (3) "Socio-economic Well-being of North Carolina Counties"

—Rust College (Paul Lampley and Pat Hennington, Social Sciences; William Scott and Felix Osuja, Mathematics): "Math Models for Interpreting Social Data"

—Savannah State College (Ella Sims, Sociology; Dorothy Murchison, Mathematics): "Social Stratification: Race, Sex, and Age"

—Spelman College (Nagambal Shah, Mathematics; Marilyn Davis, Political Science): "Statistics by Example: Registration and Voting"

The "Math for Social Sciences" module teams have been assisted by Georgia Tech consultants Kevin Phelps (Mathematics), Alan Porter (Industrial and Systems Engineering), and Fred Rossini (Social Sciences).

(3) Engineering/Technology Assessment:

—Albany State College (Leonard Minter, English; George Hill, Chemistry): "The Impact of Textile Production Machinery on Early 19th-century England"

—Dillard University (Violet Bryan, English; Kathryn Aultman, Chemistry): "The Development of Technology and Big Business between the Wars"

—Morris Brown College (Tyrone Price, Criminal Justice; Fred Okoh, Mathematics): "Computer Applications in Criminal Justice Management"

—North Carolina A and T State University (Donna Benson, History; Elvira Williams, Physics): "Industrialization and Urbanization: A Case History in Greensboro, NC"

—Rust College (Helen Oliver, Humanities; Marjorie Marshall, Freshman Studies): "An Analysis of the Social and Psychological Impacts of Technology on the Black Individual"

—Savannah State College (Obi Emeh, Biology; Jeffrey James, Chemistry): "Technology as Cause and Effect of Social Change"

—South Carolina State College (Stan Harrold, History; Tom Whitney, Engineering): "The Beginnings of the Industrial Revolution in the 18th-century: Steam Power and the Mines"

—South Carolina State College (Maria Ricks and Johnnie Sharpe, Humanities; John McLeod, Chemistry): "The Pill: Oral Contraceptive Technology"

—Spelman College (Haywood Farrar, History; Lura Allheimer, Biology): "Contraceptive Technology"

—Tuskegee Institute (John Kitchens, History): "Irrigation and Water Resource Management"

—Tuskegee Institute: Ben Benford, History; Ollie Williamson, Biology): "The Microscope and the Consequences for the Emergence of Modern Biology"

The "Engineering/Technology Assessment" module teams have been assisted by Georgia Tech consultants Wayne Book (Mechanical Engineering), Marshall Leach (Electrical Engineering), John Lundberg (Textile Engineering), Paul Mayer (Civil Engineering), Alan Porter (Industrial and Systems Engineering), Fred Rossini (Technology Assessment), Bill Sayle (Electrical Engineering), Ray Vito (Engineering Science and Mechanics), and Ed Yeargers (Biology).

Before the end of June 1985, the Georgia Tech project team expects to

RETLA (Resourceful Exchange: Technology and the Liberal Arts) denotes a group of eighteen historically black colleges in the Southeast that have been funded by the Alfred P. Sloan Foundation to participate in its New Liberal Arts program. Georgia Tech serves as RETLA's principal resource institution. The RETLA Newsletter is edited by Dr. Jeffrey Plank, Department of English, Georgia Institute of Technology, Atlanta, GA 30332.

complete the initial documentation and revision of five to seven modules and bring to completion another seven to ten now in progress. Georgia Tech consultants A. D. Van Nostrand (English) and Jeffrey Plank (English) have designed a standard documentation for all modules so that they can be shared by all RETLA faculty. Standard documentation for each module will include a Student Handbook and Faculty Handbook, and an introductory reference indicating the range of course applications. After these documented modules have been field-tested and revised by their authors, the Georgia Tech project team will distribute revised versions for use throughout the RETLA community.

RETLA FACULTY REPRESENTATIVES

RETLA college presidents have named the following representatives for a term ending 30 June 1986:

Albany State: James Hill, English
Bennett: Lee Ponting, Mathematics
Dillard: Boake Plessy, Chemistry
Morris Brown: Beulah Farmer, English
North Carolina A and T: Sara Kirk and Peter Meyers, History
North Carolina Central: Eugene Eaves, Romance Languages
Paine: Carol Rychly, Mathematics
Rust: Leroy Frazier, Chemistry
Savannah State: Obi Emeh, Biology
South Carolina State: Johnnie Sharpe, Humanities
Spelman: Sylvia Bozeman, Mathematics
Tuskegee: Francis Taylor, Social Work

ADVISORY BOARD

The 1984-85 Advisory Board evolved from the Ad Hoc Editorial Committee, elected at the December 1983 needs assessment meeting to participate in the drafting of the April 1984 needs assessment and proposal. Members of the 1984-85 Board are: Sylvia Bozeman (Spelman), Obi Emeh (Savannah State), Eugene Eaves (North Carolina Central), Johnnie Sharpe (South Carolina State), W. C. Brown (Southern Regional Education Board), Jeffrey Plank (Georgia Tech), and A. D. Van Nostrand (Georgia Tech). The Board will meet seven times during 1984-85.

Since July 1984, the Board has served as the faculty voice in the RETLA project and its advisory role has expanded. The Board has advised the Georgia Tech project team on the design of activities and on the fiscal underwriting of workshops and participant expenses. The Board has met with computer vendors and representatives of other foundations. It has drafted policy guidelines for the allocation of hardware pending proposals from computer vendors. The Board has also designed election procedures which will be implemented in April 1985.

ADVISORY BOARD ELECTIONS

Six RETLA college representatives will be elected to a new Advisory Board in April. The current board has restricted the election procedures to faculty representatives from RETLA colleges actively participating in RETLA activities. The name of each faculty representative appointed by his or her college president will be placed on a ballot divided into three geographical regions: west (Albany State, Dillard, Rust, Tuskegee), central (Morris Brown, Paine, Savannah State, Spelman), and east (Bennett, North Carolina A and T, North Carolina Central, South Carolina State). Two Board members will be elected from each region; the two current Board members receiving the highest number of votes will retain their positions on the board for an additional year. In addition, Bill Brown (Senior Program Officer, Southern Regional Education Board) and Paul Mayer, Jeffrey Plank, and A. D. Van Nostrand (Georgia Tech project team representatives) will also retain Board positions.

RETLA COMPUTER SURVEY AND ALLOCATION POLICY

The RETLA Computer Consulting team surveyed computer needs and resources at RETLA colleges in October 1984 to develop baseline information for proposals to computer vendors and foundations. The team found that the preferred and most cost-effective way to bring computer experience to all students was through microcomputer-equipped word-processing labs for freshman composition courses.

After its November meeting with representatives from Apple Computers, the Advisory Board asked the team to prepare guidelines for the fair and simple allocation of hardware in its proposals to vendors. The Board has edited these guidelines; its "Allocation by Need and Commitment" policy statement now incudes a rationale for equipment allocation and formulas for sizing word-processing labs. The policy statement also specifies the in-kind support participating institutions would be expected to provide and the financial support the Board will seek from foundations.

The following paragraphs summarize the "Allocation by Need and Commitment" policy draft to be circulated for ratification by college presidents in March 1985.

Rationale: The intent of the policy is to provide word-processing access to allow each bona fide English composition course to be supported. Fair allocation requires each institution to make verifiable commitments and to be held accountable for them.

Laboratory Sizing: The RETLA Advisory Board agreed in its November 1984 meeting to size each lab according to the amount of English composition work required in the heaviest academic period at each campus. Given the number of students enrolled in composition courses during the peak quarter or semester of enrollment, each college would receive a corresponding number of microprocessors.

The institution would agree to keep the lab open for the prescribed number of hours, with the prescribed number of assistants on

duty, for two years, during the heaviest 10 weeks of each year.

The RETLA Advisory Board will seek outside financial support for maintenance, supplies, assistants' labor, and direct supervision for 30 weeks of each of the first two years, and for printers and computer tables.

Each institution would agree to provide the unsupported facilities (space, utilities, desks and file cabinet for the assistants, and any other personnel services needed beyond those supported) for the first two years. In addition, each institution would agree to continue the laboratory beyond the two-year supported figure.

The Advisory Board expects to receive a proposal for word-processing labs from Apple Computers in March and will continue to solicit proposals from other vendors to meet other shared computer needs. —*Donovan Young (Industrial and Systems Engineering, Georgia Tech)*

RETLA FORECAST

The Sloan Foundation has funded RETLA colleges and Georgia Tech for the period 1 July 1984 through 30 June 1985. The Georgia Tech project team has requested that the Sloan Foundation extend funding for at least another six months, through 31 December 1985. The Foundation will take action on this extension proposal at its April Trustees' meeting.

The Georgia Tech project team has made this request with advice from the RETLA Advisory Board. The request for extension entails several modifications of current RETLA activities.

Workshops: The Georgia Tech project team will work with participants in the completion and field-testing of some 14 modules now in progress. (Five to eight of these will be completed before the end of June 1985.) The new series of workshops for new teams will begin in Fall 1985. Subsequent workshops will be conducted as tutorials, with one Tech faculty consultant assigned to each RETLA college team. To channel the flow of workshop participants into tutorial sessions and to award modest stipends to participants, we have proposed that the Foundation subsidize participant travel expenses and stipends.

Computer Consulting: The project team will continue to survey computer needs and resources at RETLA colleges and to prepare proposals to vendors and third party funding sources.

Advisory Board: We propose that the new Advisory Board, elected in 1985, have a broader advisory role in the selection of workshop participants, in the selection of new colleges, and in program assessment. The board will continue to make proposals for new grants from computer vendors and foundations.

Workshop products: We propose to continue the standard documentation of workshop worksheets and of student and faculty handbooks. We will begin a module "bank" and disseminate completed modules.

Newsletter: We will continue this newsletter, with project reports, reviews, articles by participating faculty, and reports from other New Liberal Arts Activities.

Project Administration: We have recruited a broadly representative team of faculty consultants from Georgia Tech's engineering and engineering-related departments. We have devised a cooperative and flexible process for developing modules. These faculty will engage in more directive consulting to emphasize (1) engineering concepts and problem definition, (2) engineering and public policy, and (3) the evolution of engineering procedures. We plan to add consultants as needed to the present project team.

Given the proposed funding arrangements, we look forward to a productive extension of this unprecedented collaboration in faculty development. —*A. D. Van Nostrand (English, Georgia Tech)*

RETLA NEWSLETTER
Department of English, Georgia Institute of Technology,
Atlanta, GA 30332

RESOURCEFUL EXCHANGE:
TECHNOLOGY AND THE LIBERAL ARTS
NEWSLETTER

RETLA

May 1985

GLAD TIDINGS

The Alfred P. Sloan Foundation has awarded up to $245,000 to Georgia Tech to continue the RETLA project through 31 December. It is a variable amount depending on the number of colleges participating. The Foundation has authorized the Georgia Tech project team to support a range of activities. By percentage of total direct costs, the expenditures for each activity are as follows:

— module workshops/tutorials (60%)
— computer consulting (8%)
— advisory board (14%)
— project deliverables (8%)
— newsletter (6%)
— project administration (4%)

The new grant also makes new provisions for underwriting module workshops and tutorials; it includes money for RETLA college faculty travel and per diem expenses and honoraria. We anticipate that honoraria for new module teams will be awarded upon completion of modules. In addition, we anticipate that funds will be set aside for "materials and supplies" sub-budgets for each module team and that RETLA college faculty who complete modules during the 1984-85 grant period will be awarded appropriate honoraria.

NEW MODULE TEAMS: GUIDELINES AND DEADLINES

Through 31 December, the Georgia Tech project team can support up to eighteen module teams. At least 6-8 teams have yet to finish modules begun during the 1984-85 grant period. We expect openings for 10-12 new teams in the early fall. We anticipate that new teams can be added when funding is continued in 1986.

As in the past, RETLA college faculty will work in teams of two: one faculty member — typically from the humanities — who currently teaches the course for which the module is being prepared, and one member — typically from math or the sciences — who serves as a resource for quantitative methodology. In short, one faculty member uses the resources that his or her colleague supplies.

A third, part-time member of each team is a consultant from the Georgia Tech faculty. As field specialists, the eleven consultants facilitate the dialogue between humanist and scientist/mathematician. Their fields include Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering Science and Mechanics, Industrial and Systems Engineering, Textile Engineering, Industrial Design, Mathematics, Sociology, and English.

The technology modules, of one to three weeks' length for a quarter or semester class, are designed to engage students in engineering concepts and procedures. In 1985-86, modules will emphase (1) engineering concepts and problem definition, (2) engineering and public policy, and (3) the evolution of engineering procedures. Completed modules will consist of a Student Handbook and a Faculty Handbook (from 15-25 pages each).

Each team member will receive $200 upon completion of the Student Handbook and another $300 upon completion of the Faculty Handbook. Team members will be reimbursed for up to three trips to Georgia Tech (based on receipts). Each team will be assigned a "materials and supplies" account for up to $250 (based on receipts) to cover module research and preparation costs (no equipment).

Prospective module teams will be asked to apply for participation in the new cycle so that we can plan resources to meet needs. The project team expects to distribute application forms to all RETLA college faculty representatives in early August; the deadline for module team applications will be 10 September.

After an orientation meeting for all new teams in late September, participants will return to Georgia Tech as needed (up to three trips) to meet with their engineering consultant. The deadline for Student and Faculty Handbooks now in progress is 13 December 1985; the deadline for Student and Faculty Handbooks in new modules is 16 April 1986.

COMPLETED MODULES

By 30 April, four module teams had revised and completed Student Handbooks. The project team has authorized honoraria of $200 to each of these module team members:

— Albany State: Veula Rhodes (History), Don Williams (Math): "Quantitative and Analytical Concepts for the Social Sciences"
— Dillard: Violet Bryan (English), Kathryn Aultman (Chemistry): "Literature as a Form of Technology Assessment"
— Morris Brown: Lee Ransaw (Art), Abiola Lawal (Mathematics): "Interfacing Mathematics and Technology with Design and Architecture: The Arch"
— Savannah State: Ella Sims (Sociology), Dorothy Murchison (Math): "Social Stratification: Race, Sex, and Age"

At least part of each module has been field-tested; in one case, the module has been prepared for use in both the humanities and math or science course. As teams revise Student Handbooks and complete Faculty Handbooks during the fall quarter/semester, the Georgia Tech project team will prepare materials for distribution throughout RETLA colleges.

ADVISORY BOARD ELECTION RESULTS

RETLA college faculty representatives have elected six Board members, two from each of three geographical regions:

— West: James Hill (English, Albany State), Francis Taylor (Social Work, Tuskegee Institute)

— Central: Sylvia Bozeman (Mathematics, Spelman), Carol Rychly (Mathematics, Paine)

— East: Sylvia Kirk (Sociology, North Carolina A and T), Lee Ponting (Mathematics, Bennett)

Sylvia Bozeman and Francis Taylor, two current Board members, were elected for one-year terms; the new members will retain their Board positions for two-year terms.

In addition, Bill Brown (Senior Program Officer, Southern Regional Education Board) and Paul Mayer, Jeffrey Plank, and A. D. Van Nostrand (Georgia Tech project team representatives) retain Board positions.

COMPUTER INITIATIVES

In February, the RETLA Advisory Board sent to Apple Computers a proposal for word-processing laboratories for English composition courses at RETLA colleges. In surveying RETLA college computer needs and resources, the Computer Consulting team found that the preferred and most cost-effective way to bring computer experience to all students was through microcomputer-equipped word-processing labs for freshman composition courses.

The Advisory Board drafted policy guidelines for the fair and simple allocation of equipment in proposals to vendors. Presidents of eleven RETLA colleges endorsed the Board's guidelines. Apple Computers did not fund the proposal, however, citing microcomputer market conditions. The Sloan Foundation is now assisting the Board in presenting the word-processing lab proposal to other potential sponsors.

As the next RETLA computer initiative, a proposal is being coordinated now among studio art teachers at various RETLA colleges to obtain a high-resolution color graphics microcomputer for each 25 studio art students to work under a trained teacher in producing small, geometric art works.

In such a program, the instructor would be given release time to learn the equipment and plan the studio use of it. Each student would spend a total of about sixteen hours and produce about three different works. In the process of producing these works, the student would absorb some analytic geometry and be introduced to programming in BASIC; the student would also connect abstract mathematical statements with their visual representations.

Some samples of computer-aided geometric art have been sent to instructors at several RETLA colleges to see if they would be interested in devoting studio time to computer-aided geometric art if equipment and maintenance were donated.

Following closely behind this studio art proposal will be a survey of math teachers in RETLA colleges to determine their needs and wants for microcomputer support in the computation of functions and in the display and graphs of functions. This survey could lead to a proposal for microcomputers, software, and release time for support of math courses.

Once all three proposals — for labs for word-processing, computer art, and math support — have been presented to potential sponsors, their responses will be valuable in guiding plans for the culminating proposal in the RETLA computer initiative area: a proposal to establish microcomputer laboratories at each college, incorporating not only these three applications but others as well.

— Donovan Young (Industrial and Systems Engineering, Georgia Tech)

MEETING FOR RETLA COLLEGE PRESIDENTS

In a 28 March meeting with the Georgia Tech project team, Dr. James Koerner (Vice President, Sloan Foundation) and Dr. John Truxal (Sloan Foundation New Liberal Arts Advisory Board) suggested that the Foundation convene a meeting for RETLA college presidents in Atlanta. The purpose of this meeting, now planned for December 1985 or January 1986, would be twofold: (1) to demonstrate to the college presidents instructional materials developed by RETLA faculty, and (2) to allow the college presidents to discuss opportunities provided by the RETLA network.

The Georgia Tech project team endorsed the suggestion and will prepare presentations for the occasion.

At its 30 April meeting, the Advisory Board also endorsed the idea of a meeting for RETLA college presidents, pointing to the need for a close relation between administrative commitment and faculty initiative in the RETLA project.

The Foundation will coordinate this meeting.

NUCLEAR ARMS CONTROL CONFERENCE PLANNED

The Center for Theoretical Studies at the University of Miami (Florida) is planning an intensive one-week training workshop (5-11 January 1986), "Enlightenment: The Best Security in a Nuclear-Armed World." Participation is limited to 25 workshop participants and 7 consultants; funding will be available to support the workshop participants. Candidacy for participation is open to RETLA college faculty.

The workshop will address as topics a brief history of the Manhattan Project, existing nuclear weapons technology on both sides of

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the Iron Curtain, and currently prevailing strategic doctrines as they pertain to the offense-dominated world through Mutually Assured Destruction (MAD) and to a defense-dominated world through Mutually Assured Survival (MAS). Workshop presentations will also cover European security, arms control negotiations, and nuclear proliferation and its possible impact on the vertical nuclear arms proliferation.

The aim of the workshop is to help participants structure and teach their own courses on these nuclear arms issues in their own colleges. This is an interdisciplinary workshop and will include representatives from the technical, scientific, and political communities. RETLA college faculty are encouraged to apply. For further information and application materials, contact Behram N. Kursunoglu, Director, Center for Theoretical Studies, University of Miami, P.O. Box 249055, Coral Gables, FL 33124. — *Behram Kursunoglu (Theoretical Physics, University of Miami)*

BOOKS AND ARTICLES RECEIVED

A selective list of books and articles pertinent to RETLA activities:

Bernstein, Jeremy. *Three Degrees above Zero: Bell Labs in the Information Age*. Scribner, 1984. $17.95.

Billington, David. *The Tower and the Bridge: The New Art of Structural Engineering*. Basic. $24.95.

Landes, David S. *Revolution in Time: Clocks and the Making of the Modern World*. Harvard U. Press, Cambridge. 1985. paper.

Morison, Elting. "What Went Wrong with Disney's World's Fair," *American Heritage* (Dec. 1984), 71-79.

Technological Innovation and the Decorative Arts, ed. Ian M. G. Quimby. University Press of Virginia, Charlottesville. 1985. $14.95 paper.

"Technology," an occasional column, written by Eric Berg, Stuart Diamond, David Sanger, and others, in *The New York Times*, daily edn., Business section.

Tufte, Edward. *The Visual Display of Quantitative Information*. Graphics Press, 1985. $34.00

TUSKEGEE INSTITUTE MODULE REPORT: THE MICROSCOPE AND THE EMERGENCE OF MODERN BIOLOGY

At Tuskegee Institute, Benjamin Benford (History) and Ollie Williamson (Biology) are near completion of a teaching module designed to explain the role played by early microscopes in the emergence of the modern science of biology.

This material will supplement a unit on the Scientific Revolution in a basic World Civilization survey course.

The module will be introduced by two lectures. The first will be a standard review of the Scientific Revolution; the second, supplemented by slides, will focus on the history of lens use and the origin, development, and implications of 17th-century microscopy. This second lecture will also introduce such basic engineering concepts as optimization, trade-offs, simulation, and sampling, as well as simple issues related to geometric optics.

Material covered in these lectures will be reinforced by two out-of-class exercises. The first lecture will require students to plot a curve based on copies of micrographs taken of the growth in a medium of a microorganism which could have been observed under 17th-century conditions. Students are then asked to compare this real curve with a model curve produced mathematically and account for observed discrepancies. The second exercise will require students to operate a computer program written to run on an Apple IIe or IBM PC designed to teach basic optics by means of an optical model of a Robert Hooke compound microscope. Students will manipulate lens configurations and attempt solutions to optical problems faced by Hooke. — *Benjamin Benford (History, Tuskegee Institute)*

CENTER FOR THE NEW LIBERAL ARTS AT SUNY-STONY BROOK

Under the New Liberal Arts Program, the Alfred P. Sloan Foundation has made grants to more than 50 colleges and universities. Major grants have gone to 17 of the original 30 liberal arts colleges and to four traditionally black institutions in the southeast. During the summer of 1985, the Foundation will be supporting workshops at Wellesley, Princeton, M.I.T., and Harvard, and (outside the NLA Program) two workshops on arms control. By fall, over 200 faculty members will have participated in one of the NLA workshops; additional faculty are active in the Program at their own institutions.

In February 1985, the Foundation made a grant to the Department of Technology and Society of the State University of New York at Stony Brook to establish there a center to focus on communication among the faculty at the various colleges and universities, and to provide support services as particular needs arise. The Stony Brook activity will attempt initially the following:

(1) Distribution of a monthly newsletter (NLA News) including brief reports on specific course and program innovations. The newsletter, currently with a mailing list of 400, also will serve as a report on the Program to interest individuals at other institutions. Success of the newsletter as a communication medium clearly depends on the voluntary submission of reports and informational items by faculty at all the participating colleges.

(2) Operation of the Wellesley Workshop schedules this coming August, and coordination of the announcements of the various summer programs.

(3) Administration of a special-grant program, offering four grants in 1985-86 for faculty members anxious to take a leave of absence for intensive study and curriculum development in an area of special importance to the New Liberal Arts Program. On an experimental basis this year, the announcement attracted 14 applications.

(4) Stimulation of small

conferences of faculty members with similar disciplinary interests. There are tentative plans for two such experiments in the fall of 1985 — one in philosophy, the other in physics.

(5) Distribution of notes and teaching modules resulting from curriculum development under the NLA Program to bring this work to a broader audience when commercial publication is not feasible.

(6) Provision of information on human and material resources for program and curriculum change within the New Liberal Arts Program.

Items (1) through (6) are already underway under the guidance of a steering committee consisting of: Dan Bauer (Anthropology, Lafayette), Sylvia Bozeman (Mathematics, Spelman), Owen Flanagan (Philosophy, Wellesley), Patricia Johnson (Biology, Vassar), Robert Palter (History, Trinity), and Leon Trilling (Engineering, MIT). The second meeting of this group (13-14 May) will include consideration of desirable approaches to items (5) and (6).

Our hope is to enhance communication and inter-institutional support among faculty active in the NLA Program. In this mission, we want very much to act as a service group, responsive to the needs perceived at other colleges; hence we solicit your suggestions, thoughts, or questions, which can be addressed to either of the co-directors: Dr. John G. Truxal or Dr. Marian Visich, Jr., Dept. of Technology and Society, State University of New York, Stony Brook, NY 11794 (516) 246-8424.
— John Truxal (Technology and Society, SUNY-Stony Brook)

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Department of English, Georgia Institute of Technology,
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RESOURCEFUL EXCHANGE:
TECHNOLOGY AND THE LIBERAL ARTS
NEWSLETTER

RETLA

October 1985

PROJECT GRANTS NOW AVAILABLE TO RETLA COLLEGE FACULTY

The Georgia Tech project team has established a new RETLA activity: grants-in-aid to RETLA college faculty. Up to $16,000 (the cost equivalent of developing two modules) has been set aside from the CY85 budget for 4 to 5 project grants to be awarded on 15 December.

To date, RETLA activities have been based exclusively on mutual needs of participating colleges. These activities were developed according to common denominators that emerged during the original needs assessment process. Now, after RETLA's first year of program organization, the Georgia Tech project team is prepared to develop additional kinds of activity and to encourage incentives among RETLA colleges.

Each RETLA Project Grant will entail faculty development through a project-oriented activity. Each activity should have some connection with teaching, and each is intended to result in some deliverable product.

Projects may include (but are not limited to):

—release time for curricular experimentation (team teaching, or course development as distinct from the present module development program);

—faculty seminars (faculty groups commited to meeting regularly to develop some report or other construct or investigate some issue relevant to teaching technology in the liberal arts);

—module testing (testing a present module in another subject or at another college).

Applicants might be interdisciplinary groups at one college or single-discipline groups from one or a subset of RETLA colleges. Project grants will be awarded directly to project directors unless release time for faculty is involved.

Project Grant application forms have been distributed to all RETLA faculty representatives. The deadline for applications is 2 December; awards will be announced on 15 December. For further information, contact Dr. Jeffrey Plank (English, Georgia Tech), (404) 894-6816 or 894-2731.

NEW TECHNOLOGY MODULE TEAMS SELECTED

Six new teams will begin preparation of technology modules in October. The new teams and their module topics are:

—Bennett: Helen Trobian (Religion and Philosophy), Ray Treadway (Mathematics): "Ethical Problem Solving and Decision Making"

—Dillard: Kathryn Aultman (Chemistry), Gil Rochan (Urban Affairs and Public Policy): "Hazardous Chemicals, Computer Technology, and Public Policy"

—Paine: Marva Stewart (English), Jacquelyn Hill (Educational Media): "Five Miles on the Augusta Canal"

—Paine: Ephraim Williams (English), W. F. Lawless (Mathematics): "Moral Choices in an Advanced Technological Society: The Savannah River Plant"

—Savannah State: Obi Emeh (Biology), Ella Sims (Sociology): "Food, Energy, and Overpopulation: The Consequences of Irresponsible Stewardship"

—Tuskegee: Maurice Graney (Philosophy), Hira Narang (Computer Science): "Computers and Circuit Logic Design"

As in the past, RETLA college faculty will work in teams of two: one faculty from the humanities and one from the sciences. A third, part-time, member of each team is a consultant from the Georgia Tech engineering faculty. Module teams will develop instructional materials (including a Student Handbook and Faculty Handbook).

Each team member will receive a stipend of $500 ($200 upon completion of the Student Handbook, $300 upon completion of the Faculty Handbook). Team members will be reimbursed for up to three trips to Georgia Tech. In addition, each team is assigned a "materials and supplies" account of up to $250 to cover module research and preparation costs.

New module teams will meet at Georgia Tech on 17-18 October for orientation sessions on engineering procedures and concepts and on module documentation.

1984–85 MODULE TEAMS: A STATUS REPORT

Seven module teams have completed and revised Student Handbooks for their modules.

—Albany State: Veula Rhodes (History), Don Williams (Math): "Quantitative and Analytical Concepts for the Social Sciences"

—Bennett: Alma Adams (Art), Lee Ponting (Math): "Artistic and Mathematical Components in Visual Composition"

—Dillard: Violet Bryan (English), Kathryn Aultman (Chemistry): "Literature as a Form of Technology Assessment"

—Morris Brown: Lee Ransaw (Art), Abiola Lawal (Mathematics): "Interfacing Mathematics and Technology with Design and Architecture: The Arch"

—Savannah State: Ella Sims (Sociology), Dorothy Murchison (Math): "Social Stratification: Race, Sex, and Age"

—South Carolina State: Stan Harrold (History), Tom Whitney (Engineering Technology): "The Beginnings of the Industrial Revolution in the Eighteenth Century"

—Tuskegee Institute: Ben Benford (History), Ollie Williamson (Biology): "The Microscope and the Emergence of Modern Biology"

Four other teams did not complete Student Handbooks during the first module cycle but plan to resume work during the fall:

—Albany State: Leonard Minter (English), George Hill (Chemistry): "The Impact of Textile Production Machinery on the General Society of the Romantic Period"

—South Carolina State: Maria Ricks (Humanities), Judith Salley (Natural Sciences): "The Pill: Oral Contraceptive Technology"

—Spelman: Haywood Farrar (History), Albert Thompson, Jr. (Chemistry): "The Birth Control Pill and its Effect on Modern American Society"

—Spelman: Nagambal Shah (Math), Marilyn Davis (Political Science): "Statistics by Example: Registration and Voting"

DOCUMENTATION AND EDITING OF INSTRUCTIONAL MODULES

One purpose of the module project is to enable exchanges of modules among teams or colleges, so establishing a uniform sequence, scope, and density of information in all module documentation in all module documents is paramount.

To help achieve document uniformity, the Communication Research Group at Georgia Tech plays a consulting role to the RETLA teams preparing modules. Dr. Joan Pettigrew, Director of the CRG, coordinates this activity with the authors developing the two principal documents of each module: the Student Handbook and the Faculty Handbook.

Based on information in the 1984-85 module documents, CRG has issued guidelines for documenting both handbooks for each module. These guidelines establish categories for information and present questions in each category for the authors to address. The guidelines will be reviewed with each team prior to its presenting its next draft.

ON-SITE ORIENTATION SEMINARS

In order to extend faculty participation in RETLA activities, the Georgia Tech project team proposes to conduct orientation seminars at RETLA colleges. These half-day seminars will be coordinated by RETLA faculty representatives. They will feature video presentations on engineering procedures and commentary by a member of the Georgia Tech project team. For more information, please contact Jeffrey Plank (English, Georgia Tech), (404) 894-2731 or 894-6816.

MICROVAX DISCOUNT OFFER FROM DIGITAL EQUIPMENT CORPORATION

Nicole Hartnett, Marketing Manager for Academic Computing for the Digital Equipment Corporation (DEC), recently made an offer to various NLA colleges and groups of colleges to sell DEC's new MicroVAX computer systems at a 45% discount to colleges willing to make innovative, transferrable use of them. DEC's aim in this offer is to get MicroVAXes placed at key academic locations and to encourage the quick development of academic software for these machines.

The MicroVAX is a desktop-sized version of the popular VAX supercomputer. It has approximately the computing power of a VAX 11/750, but the computer's input/output (I/O) operations are handled by a Q-bus rather than the VAX's faster Unibus.

Each college would configure its own system, but a suggested system that would be useful for a 16-station computing lab would be a 3-megabyte MicroVAX computer with three fixed desk drives of 210 megabytes capacity each, a 95-megabyte cartridge tape drive, 16 color graphics terminals, the VMS operating system, and selected software such as a Pascal compiler, a BASIC interpreter, graphics software, and an office automation package including word-processing and electronic mail.

A college that did not already have adequate computing hardware for its students and faculty might find a MicroVAX system very attractive. With the 45% discount, the capital cost of the system would be about $40,000 to $50,000; equipment for a 16-station personal computer lab costing about the same amount of money would be less powerful and flexible in almost every way—central memory, mass storage, speed, networking—except in variety of available software.

Need for software is the underlying rationale for DEC's offer. With the discount, a college will save about $20,000 compared to the best price it would ordinarily pay for comparable equipment, and the offer is DEC's way of subsidizing software development. A college that is already planning to develop and distribute a software package that would be of interest to other campuses would be a perfect candidate, especially if financial support for the development is already in hand. DEC's interest is that the software be developed on time, be of high quality, have good documentation, and be of interest to other colleges—and run on MicroVAX equipment.

How would a liberal arts college use a MicroVAX? Here are some ideas. Mathematics learning modules are blossoming on many campuses. These are not computer-aided-instruction lesson modules, but something more elegant. A typical module is a program that makes it easy for the user to see graphic representations of the trajectory of solutions of a given class of mathematical functions, so that one can study, for example, the path of the tip of a spinning top on an ideal planar surface for various initial conditions. Experimenting with the behavior of mathematical functions in this way has led researchers to

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pose significant theorems that they later were able to prove. With its excellent graphics capabilities, the MicroVAX would be a good tool for such work.

One college has reportedly contracted with DEC to develop a program that will analyze student-generated verse for meter and form. The system uses an existing DEC program to convert the verse also into spoken form via a computer-generated voice, so the student can hear how the rhythm falters in a line that fails to scan.

With the color-graphics capabilities of a MicroVAX, one could develop modules to assist users in generating computer art.

Fred Hofstetter (Univ. of Delaware), who currently has a major software-development contract with DEC, contends that computer-aided-instruction (CAI) has entered a new era with the suddenly inexpensive graphics and interactive capabilities whose cost crippled CAI in the past. Now might be the time to dust off some good CAI ideas that failed the first time around because of prohibitively high hardware and software costs.

For a liberal arts college interested in innovative computer applications, and willing and able to develop software, the MicroVAX discount offer may be just the thing. There is an acid test: Do you have a specific idea for a software package and a burning desire to bring it to reality? If the idea is relevant to liberal arts education and would be of interest to other campuses, chances are that your idea might be the kind of thing DEC is looking for. Why not bounce the idea off the RETLA computer initiatives consultant, Donovan Young (Industrial and Systems Engineering, Georgia Tech) at (404) 894-2321?

PROPOSAL PLANNING FOR CLASSROOM COMPUTER-SUPPORT

Donovan Young is available to make proposal planning trips to each RETLA campus where there is interest in preparing specific software modules for support of New Liberal Arts learning in existing courses. He would like to meet with the faculty member in whose course the module would be used, or with this individual and another faculty member, if appropriate, who would serve as a resource person for the technological and/or programming aspects of the proposed module.

A typical classroom computer-support module would consist of a computer program, program documentation, a teacher manual, and a student exercise manual. There would be three basic types: CAI modules, simulation modules, and tool modules. The CAI (computer-aided instruction) would provide drill and practice, and perhaps evaluation of student progress; the simulation type would provide interactive simulation of the behavior of a system, so that students could learn about the system by exercising the program; the tool type would provide a technical tool as an adjunct to classroom activities (e.g., a word-processor for composition courses, or an analysis program).

To initiate planning for modules, Dr. Young would travel to your campus for an afternoon and the following morning, to discuss two to three proposed modules with their proponents. He would attempt, on site, to determine what equipment would be needed and/or available, what technological content the module would have, how many class periods would be used in exercising it, what sponsors should be approached to support module development, and how much effort would be required to develop and test the module. For further information, contact Donovan Young (Industrial and Systems Engineering, Georgia Tech), (404) 894-2321.

WINTER WORKSHOP: ENLIGHTENMENT, THE BEST SECURITY IN A NUCLEAR-ARMED WORLD

A one-week winter training workshop for college professors from the Southeast will take place at the University of Miami (FL) Center for Theoretical Studies, 6-10 January 1986. Participation is limited to 25 working participants and 7 visiting professors. The workshop is being supported by the Alfred P. Sloan Foundation, and funding will be available to support workshop participants and professors. Applications are being accepted now; the selection process occurs during October. Selections will be announced in November.

The workshop will address as topics a brief history of the Manhattan District Project, existing nuclear weapons technology, and currently prevailing strategic doctrines as they pertain to the offense-dominated world through Mutually Assured Destruction (MAD) and to a defense-dominated world through Mutually Assured Survival (MAS). Workshop presentations will also cover European security, arms control negotiations, and nuclear proliferation and its possible impact on vertical nuclear arms proliferation.

The aim of the workshop is to help participants structure and teach courses in their own colleges on these nuclear arms issues.

Workshop professors will be: Dr. Austin David (Archdiocese of New York), Dr. Leon Goure (Science Applications, Inc.), Dr. Behram N. Kursunoglu (U. of Miami), Dr. Franklin A. Long (Cornell U.), Dr. Jack Ruina (MIT), Mr. Paul Warnke (Clifford and Warnke), Dr. Alvin M. Weinberg (Oak Ridge Associated Universities), Dr. Eugene P. Wigner (Princeton U.).

For further information and application materials, contact Linda Scott, Workshop Coordinator, Center for Theoretical Studies, University of Miami, P.O. Box 249055, Coral Gables, FL 33124-9055 (tel. [305] 284-4455).

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IN MEMORIAM, PAUL MAYER

Paul Gustav Wilhelm Mayer died on 13 September of a heart attack following surgery. He was sixty-one years old. A civil engineer, Dr. Mayer was a Regents' Professor at Georgia Tech and a co-principal investigator of the RETLA project.

Born in Frankfurt, Germany, he apprenticed himself as a locksmith while attending school, and during World War II he was interned in a Nazi labor camp. He immigrated to the United States in 1947 to resume his education, earning a bachelor's degree in civil engineering at the University of Cincinnati and then a master's degree and a doctorate in hydraulic engineering at Cornell University.

Dr. Mayer joined the faculty at Georgia Tech in 1959 and became a Regents' professor in 1974. During his twenty-six years at Tech he received such formal awards as Outstanding Teacher, Outstanding International Person, and Outstanding Faculty Member; he consulted extensively with government agencies and private corporations; and he published some ninety-five journal articles and reports.

One of the founders of the RETLA program, Dr. Mayer had been at work, when he died, on a video presentation of hydraulic engineering concepts and procedures for RETLA participants. Those in the early phases of this program will remember his hosting our informal suppers as mentor, colleague, and friend.

He served many communities. Speaking at Dr. Mayer's memorial service, Dr. John Palms, Vice President of Academic Affairs at Emory University, summed up a lifetime of service, saying "Every friend of Paul's thought their relationship was special."

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Department of English, Georgia Institute of Technology,
Atlanta, GA 30332

RESOURCEFUL EXCHANGE: TECHNOLOGY AND THE LIBERAL ARTS NEWSLETTER

RETLA

May 1986

A MESSAGE FROM THE SLOAN FOUNDATION

As many of you already know, the Foundation has decided not to renew the grant to the Georgia Institute of Technology under which the RETLA consortium was developed and its activities carried out. We will be replacing the current arrangement by a new direct relationship between the Foundation and some of the colleges active in RETLA.

Let me first acknowledge the important service Georgia Tech has rendered in this aspect of the New Liberal Arts Program. Professor Van Nostrand's efforts in working with the RETLA colleges, in enlisting the services of his Georgia Tech colleagues, and in making so many in the region aware of the NLA Program are most appreciated. To him and his associates go our thanks, not only for their contributions to RETLA over the years, but also for their cooperation in the orderly phasing out of ongoing activities, thereby permitting a smooth transition to the new program.

Our first step was to explain the new program of direct grants to the historically black colleges and to solicit advice on its development. This we did at a meeting of college presidents held in New York City on 7-8 February. The colleges invited were Albany State, Bennett, Dillard, Morehouse, Morris Brown, Paine, Savannah State, and South Carolina State, each an active participant in RETLA activities. Our second step will be a week-long intensive workshop for 24 faculty members, three from each of the eight colleges, to be held 15-21 June at Dartmouth College. The workshop will concentrate on teaching materials for introductory courses in mathematics and quantitatively oriented social sciences, and on the effective uses of computers throughout the curriculum.

Following the workshop, the Foundation expects to invite four of the colleges to submit proposals for grants of up to $75,000 over a three-year period. We will continue to work with the remaining colleges and hope to invite them to submit proposals during 1987. We are prepared to make as many as eight grants of $75,000 each, provided we receive eight strong proposals outlining feasible, well-thought-out projects within the guidelines for this program. Under the New Liberal Arts Program, major grants have already been made to four historically black colleges: North Carolina A and T, Rust, Spelman, and Tuskegee. Smaller but still substantial direct grants to eight additional RETLA colleges will give them significantly greater resources than they receive under the present arrangement and should enable them to pursue NLA initiatives with a greater intensity than heretofore.

Resourceful exchange for technology and the liberal arts must continue. We will encourage cooperation among the historically black colleges and among these colleges and the others participating in the NLA Program. The Stony Brook Resource Center, under the direction of Professor John G. Truxal, can assist in many ways. Reports of activities are always welcome for publication in the *NLA News*. I want to thank all the members of the RETLA Advisory Board and everyone involved in the RETLA project for their efforts on behalf of the New Liberal Arts Program. We hope you will continue these efforts in your own work, on your own campuses and elsewhere. There is a substantial distance yet to travel before reaching our NLA goals for undergraduate education.

As we look forward to a new program, it is important to learn from what has gone before. Please do not hesitate to write or call me with ideas for moving more quickly and more surely toward the improved curriculum and teaching we seek for our students. Your comments and suggestions are always welcome. — *Samuel Goldberg (Program Officer, Alfred P. Sloan Foundation)*

TECHNOLOGY MODULES: STATUS REPORT AND DISTRIBUTION POLICY

Five of the six new module teams which began preparation of technology modules in October have submitted drafts of Student Handbooks for editorial and engineering review by the Georgia Tech project team. These five teams and their topics are:

—Bennett: Helen Trobian (Religion and Philosophy), Ray Treadway (Mathematics): "Ethical Problem-Solving and Decision-Making"

—Dillard: Kathryn Aultman (Chemistry), Gil Rochon (Urban Affairs and Public Policy): "Hazardous Chemicals, Computer Technology, and Public Policy"

—Paine: Marva Stewart (English), Jacquelyn Hill (Educational Media): "Five Miles on the Augusta Canal"

—Paine: Ephraim Williams (English), William Lawless (Mathematics): "Moral Choices in an Advanced Technological Society: The Savannah River Plant"

—Tuskegee: Marc Graney (Philosophy), Hira Narang (Computer Science): "Computers and Circuit Logic Design"

These teams plan to complete their Student Handbooks by 31 May; two teams (from Bennett and Dillard) have already field-tested their preliminary materials in philosophy and chemistry classes respectively, totalling 175 students.

Six 1984-85 module teams also have revised, field-tested, and completed their module materials:

—Albany State: Veula Rhodes (History), Don Williams (Math): "Quantitative and Analytical Concepts for the Social Sciences" (Student Handbook only)

—Bennett: Alma Adams (Art), Lee Ponting (Math): "Artistic and Mathematical Components in Visual Composition"

—Dillard: Violet Bryan (English), Kathryn Aultman (Chemistry): "Literature as a Form of Technology Assessment" (Student Handbook only)

—Morris Brown: Lee Ransaw (Art), Abiola Lawal (Math): "Interfacing Mathematics and Technology with Design and Architecture: the Arch"

—South Carolina State: Stan Harrold (History), Tom Whitney (Engineering Technology): "The Beginnings of the Industrial Revolution in the Eighteenth Century"

—South Carolina State: Maria Ricks (Humanities), Judith Salley (Natural Sciences): "The Pill: Oral Contraceptive Technology"

These six modules have been variously field-tested in American literature, art, mathematics, sociology, and western civilization survey courses totalling some 375 students.

Modules have also been demonstrated at faculty retreats (Bennett) and field-tested at other institutions. During the Spring, 1986 semester, the Morris Brown module has been field-tested in art classes at Clark and Spelman.

Completed RETLA technology modules which have been fully documented for distribution to faculty at other institutions will be listed, along with an abstract and the names and addresses of the module authors, in a supplemental number of the RETLA *Newsletter*.

Until 15 July, completed modules will be available, free of charge, from the RETLA Office (English Department, Georgia Institute of Technology, Atlanta, GA 30332). After 15 July, completed modules will be available from individual module authors.

RETLA ADVISORY BOARD

The RETLA Advisory Board held its final meeting on 1 April in Atlanta. The 1985-86 Board included five members elected by faculty representatives from each of the twelve participating RETLA colleges, one member from the Southern Regional Education Board, and three members from the Georgia Tech project team:

—Sylvia Bozeman (Mathematics, Spelman)

—James Hill (English, Albany State)

—Lee Ponting (Mathematics, Bennett)

—Carole Rychly (Mathematics, Paine)

—Francis Taylor (Social Work, Tuskegee)

—William C. Brown (Senior Program Officer, SREB)

—John Lundberg (Textile Engineering, Georgia Tech)

—Jeffrey Plank (English, Georgia Tech)

—A. D. Van Nostrand (English, Geogia Tech).

During 1985-86, Board responsibilities increased in direct relation to RETLA activities; as a result, the RETLA faculty voice in the project management increased, and networking among RETLA colleges expanded.

The Board monitored the evolving nature of the project and recommended modifications in project activities. The Board also monitored the selection of module topics and the progress of module teams.

Networking among colleges was consolidated through the Board's planning and drafting of joint proposals (including some or all RETLA colleges) for computer applications in art, composition, and mathematics and for distribution policies (for RETLA resources and products). Some of these joint proposals required substantial institutional commitments of resources on the part of RETLA colleges.

In its final meeting, the Board identified two aspects of the innovative and experimental RETLA project which it considered worth continuing:

—the team approach (in which RETLA faculty and Georgia Tech faculty collaborate as peers)

—the network approach (in which all participating institutions pool their resources).

THE GEORGIA TECH PROJECT TEAM: ENGINEERING AND EDITORIAL CONSULTANTS

RETLA college faculty have worked on technology modules in teams of two: one from the humanities and one from the sciences or mathematics. A third, part-time member of each team has been a consultant from the Georgia Tech engineering faculty. Each team, in turn, has been assisted in the documentation of its materials by an editorial consultant from the Communications Research Group at Georgia Tech.

Engineering consultants have helped RETLA faculty members identify the technology, engineering concepts, and mathematical and symbolic representations appropriate for each module.

For the 1985-86 module teams, Georgia Tech engineering consultants have included: Stan Carpenter (Philosophy), Bernd Kahn (Nuclear Engineering), John Lundberg (Textile Engineering), Lee Payne (Industrial Design), Luther Roland (Geophysical Sciences), Fred Rossini (Technology Assessment), Bill Sayle (Electrical Engineering), Terry Sturm (Civil Engineering), Ray Vito (Engineering Science and Mechanics), and Don Young (Industrial and Systems Engineering).

Editorial consultants have assisted RETLA faculty members in establishing a uniform sequence, scope, and density of information in their module documents. With document uniformity, the exchange of modules among colleges or teams is made easier. Joan Pettigrew (Director, Communication Research Group) has coordinated RETLA editorial activities with the module authors, developing the two principal documents of each module: the Student Handbook and the Faculty Handbook. These editorial activities have included the design of module guidelines, copy-editing of draft Handbooks, conferences with module authors and engineering consultants, and the editing and copy-editing of successive revisions of module materials.

RETLA (Resourceful Exchange: Technology and the Liberal Arts) denotes a group of eighteen historically black colleges in the Southeast that have been funded by the Alfred P. Sloan Foundation to participate in its New Liberal Arts program. Georgia Tech serves as RETLA's principal resource institution. The RETLA Newsletter is edited by Dr. Jeffrey Plank, Department of English, Georgia Institute of Technology, Atlanta, GA 30332.

RETLA COMPUTER CONSULTING

As my computer consulting activities to RETLA colleges draw to a close, I would like to review them. Much of my work was ordinary consulting — answering questions, reviewing planning documents, helping design labs, and making recommendations on such things as computer purchases, maintenance, and software. But the most significant things I was involved in, from a long-range perspective, formed a sustained inquiry into how computers can best be used in liberal arts classrooms and how the results of that inquiry can be used in the writing, editing, and reviewing computer-related proposals for RETLA colleges and for RETLA as a group.

The Computer as an Incidental Tool: At the outset of NLA discussions the sponsors and consultants emphasized that support of computer-aided instruction (CAI) was not the intent of computer-related NLA and RETLA activity. Another prohibition, implicit but unanimous, was that learning about computers per se, desireable as that might be in a liberal arts curriculum, was to be considered at most a side benefit. There were to be no RETLA "computer camps" or programming courses. I agreed whole-heartedly with both ideas. I have seen little but naive expectations and broken promises from the CAI field since 1960, and there are plenty of computer introductory experiences available in RETLA colleges for exactly the sort of computer-naive person at whom we would aim any special NLA computer introduction. A third restriction, this a self-imposed one, was that I felt neither the competence nor the mandate to encourage the study of the computer as a technological artifact from a societal, historical, humanistic, or philosophical point of view.

But if not CAI, nor computing, nor the computer's relation to society, then what? How could computers be used in liberal arts classrooms to true advantage?

The answer is to use the computer as an incidental tool, using its capabilities where appropriate to do work that is already being done awkwardly or tediously or to do work of undoubted potential benefit that is impossible without the computer.

There are plenty of opportunities, and they can be divided into two broad categories: use of the computer as a *task engine* or as a *model exerciser.* Word processing is a good example of using the computer as a task engine; document preparation with extensive revision — the specific aim of English composition pedagogy — can benefit greatly from electronic editing, cutting, pasting, revising, rearranging, and so forth, avoiding the time-wasting and error-introducing process of retyping adequate passages. Another example of the computer as a task engine is the proposal by Henry Loyzelle (Rust) to enhance a foreign-language drill facility by letting a microcomputer control a cassette tape machine so that students recieve questions orally.

The whole CAI field is an example of using computers as task engines, but the emphasis here has been on automating the process of test administration, question presentation, and grading rather than on doing things that help students learn. Semiautomated computation is a better example; whenever students are presented with the necessity for performing large volumes of computation only part of which is valuable for learning, it is usually possible to arrange for the computer to do the learning-irrelevant part while the student does only the meaningful part.

Model exercise is probably the richest potential use of computers in the humanities. If a student is to learn about a system that is difficult to demonstrate or exercise directly, a computer program that simulates its behavior can be quite useful. Of course model exercising can be carried to extremes, as at a Northwestern college where a physics lab has no Bunsen burners, magnets, inclined planes, and so on — just personal computers.

A year ago I prepared and distributed to the Foundation a paper entitled "Evolutionary Trajectory Simulation," detailing how the ability to demonstrate and exercise a broad class of time-step structured models could be provided in a simple programming language that would bring to the classroom a facility for modeling such things as weather prediction, astrophysical processes, prey-preditor situations, queueing systems, consumer choice, and traffic.

A seven-session technology module on decision analysis designed and taught by Helen Trobian and Ray treadway of Bennett College illustrates how computers can be used as an incidental tool in two of the ways mentioned above: model exercise and semiautomated computation.

RETLA Computer Proposals: Given that computers could contribute significantly to liberal arts classwork in the many ways outlined above, the challenge to me was to help RETLA colleges identify and develop particularly attractive projects within NLA and RETLA guidelines. A successful proposal for outside support requires a good basic premise, a viable plan for developing it, and a sponsor who shares the aspirations of the applicant.

(1) The first proposal developed in detail was one for word processing for English composition courses. Here the benefits were very clear, the costs were relatively low, and no software development was required. At current prices it would take less than $50,000 for a college to start up a word processing lab. We have not been challenged on the point that this is the most cost effective way to bring basic computer experience to every liberal arts student, and the most cost effective way to provide for extensive revision of a student's papers. Many affluent universities and colleges, in fact, are moving rapidly toward assuming or requiring that freshman students will have their own microcomputers with word processing software.

It is disappointing that a sponsor for this proposal has not been found. People unacquainted with the special needs of RETLA colleges evidently find it difficult to see that there is indeed a need — word processing power joins the growing list of skills that students are assumed to get at home or in high school.

(2) Twelve RETLA colleges joined in endorsing a joint proposal for computer art facilities — a high-resolution color graphics machine in each freshman design class. Here again, software development would not be required, and costs are rapidly declining. Costs for high-resolution graphics are expected to come down within a year from the current $4,000 per station to $2,000 or less. Potential

sponsors were contacted, but without sponsorship, RETLA colleges have not submitted any formal proposals.

(3) RETLA was invited by Digital Equipment Corporation to submit proposals for acquiring Micro-VAX computers at a deep discount, with the proposals to result in development of software that could be used at other colleges. The vendor's main aim was to bolster the catalogue of academic software that would run on the Micro-VAX, a new machine. With faculty at North Carolina A and T, I drafted a proposal for a 16-station Micro-VAX system. Detailed discussions were held with ten other RETLA college faculty groups, but in these cases we declined to submit proposals because of the potential sponsor's reluctance to support any faculty who did not have a proven track record in software development. The potential sponsor subsequently withdrew entirely.

(4) In consulting with many individuals and groups at RETLA colleges, I developed a pattern for a class of proposals that would involve software development that could be accomplished by small teams without previous software development experience. The proposals would be limited to those that would provide a definite capability in support of a specific need in an identified course. In the paper, "Checklist for Class-Support Software Initiation," I outlined the process of seeking a viable opportunity for beneficial use of a computer. I also listed steps in initiating a class-support idea, and a 18-point preliminary planning procedure that would provide the core of a proposal.

It has not been definitely established whether there are any potential sponsors for NLA-type software development, beyond those who normally fund educational activities at the colleges. The National Science Foundation has one program, "Materials Development and Research," whose main aim is materials development (including software) for science courses at high school senior and college freshman levels, with a minority sidebar and a secondary aim of increasing the understanding of science among non-science students. No formal proposals have been directed through this channel as yet.

(5) An important part of my computer consulting work was to review proposal drafts prepared by RETLA faculty. I worked on eight such proposals. In the process, I prepared a package of materials for John Hayes (Paine) consisting of reviews of the NSF program, the Micro-VAX discount program, an "Ideas for Micro-VAX Projects" paper, and the "Evolutionary Trajectory Simulation" paper. I would be happy to supply these or other materials to the RETLA colleges who have not already received them, and to continue to review any computer-related proposal drafts that RETLA faculty would care to have me review.
— Donovan Young (Industrial and Systems Engineering, Georgia Tech)

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