

Science, Technology



& Society

Curriculum Newsletter of the Lehigh University STS Program
& Technology Studies Resource Center

Editor:
Stephen H. Cutcliffe

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TECHNOLOGY AND THE HUMANITIES

Many generations and many cultures have sought to define those distinctive qualities that make a human being unique. Some would argue that humans alone possess an immortal and rational soul; others point to the apparently uniquely human capacity for self-awareness or self-consciousness; still others insist that it is man (and woman) alone who are the tool-makers, who fashion and use tools to manipulate and ameliorate the environment. Each of these positions has been challenged, and counter examples from the animal world, even the insect world, have suggested that human beings may be unusual in the degree to which they imagine and create, design and build, but they are not unique in these capacities. What is perhaps less subject to dispute is that wherever and whenever human beings have existed, they have gone beyond instinctual behavior and exercised their imagination to create a world better than the one in which they live. What they have imagined, they have tried to create, whether in pictorial art, the poetry of language, or the artifacts that ameliorate human existence.

These creations comprise the humanities and, in a larger sense, civilization. It would appear that, that which we call civilization emerges from the gap between our perception of an event or object and our reaction to that occurrence, a reaction that is not merely instinctive or reflexive, but active and appropriating. The pause between the action and our response may be brief and scarcely perceptible, but in that pause lies the act of imagination which makes free creation possible.

It is in this world that humans have most truly expressed themselves, for it is in our history and in our art that we are free to create, to move unfettered by physical need or control from others. We are also free to create useful objects, objects which make life easier, more pleasant, and more conducive to further creativity since they free us from the hard physical labor necessary for mere subsistence. Since our humanity has historically been magnified and liberated by the artifacts of technology, it is somewhat odd that post-industrial men and women tend to

denigrate, if not disdain, the contributions of technological society to their well-being and their freedom. Precisely because technology has reduced so much of the drudgery of human existence, we are free to expend energy on art, literature, and other creations of the human spirit.

This fundamental ambivalence towards those creations of the imagination which result in useful tangible objects is not exclusively a product of the modern period. It goes back at least as far as the ancient Greeks. Even in Homer, Hephaistos, the god of goldsmiths, blacksmiths, masons, and carpenters, was deformed and the object of the other gods' mirth as he clumsily hobbled about. And yet his wondrous creations were almost magical: a throne that could move under its own power, self-propelled tripods, impenetrable armour --all tributes to his marvelous craftsmanship. Son of Zeus and Hera, he was a divine smith, but the only divinity misshapen and subject to ridicule. Plato and Aristotle share this same mistrust of the marriage between creative imagination and manual labor; although there are important differences in their reasons, they would agree that those who work with their hands are not truly free men. This disdain for technological achievement, so characteristic of Greek civilization, persisted in successive generations. It is only in the 16th and 17th centuries that a new respect for technological achievement appeared, apparently as a result of the con-

fluence of economic, scientific, and social factors. Since that time, technological development has occurred rapidly and ubiquitously, so much so that our own generation now feels threatened by its latent power and frequently dehumanized by its pervasive ethos of efficiency, effectiveness, and economy. For many, it is above all the humanity of men and women that is threatened by technology --the space for spontaneity, for playfulness, for the human pace, for impulse and reflectivity, the logic of association, and the language of feelings. There is real fear that the scientific-technological system is becoming increasingly autonomous, that it is a creation of man, but a creation that is no longer dependent upon nor subservient to the needs and wishes of its creator. Characterized by Edmund Husserl as a crisis in Western thought and values, our technological world is the product of the Western humanist tradition, but it is rapidly negating that tradition and affirming instead a value-system of efficiency, control, and usefulness.

This substitution of the efficacy of modern decision-making techniques like system analysis and operations research, successful and helpful as they have been in certain kinds of problem solving, for the traditional humanistic reliance on experience, sensitivity to human considerations, and complex differentiated thinking has produced the contemporary form of our wariness about the technological system. If we are to escape from its hold, we will first need to become aware of the conceptual system in which we are ensnared and then devise ways of adapting its strengths to our visions of what humanity could be. But the point of departure for a reconciliation between the aspirations

Science, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An "Open Forum" section exists for readers with questions, comments or announcements regarding STS activities or needs. Our goal is to help generate new courses, and to provide an information exchange, in the STS field.

Subscriptions, covering six issues, are available for \$6.00 per year. Please address all materials for publication and correspondence to: Dr. Stephen Cutcliffe, Editor, 216 Maginness Hall 19 Lehigh University, Bethlehem, PA 18015

of humanity and the tools and systems generated by technology must be an understanding of the etiology of our dilemma.

In order to apprehend and explain the peculiarly Western genesis of modern technology, our conviction that scientific knowledge should lead to technological power over nature, it may be useful to refer once again to our history. Its immediate roots as a controlling idea, we have suggested, may be traced back to the 17th century where Descartes, anxious to provide the philosophical foundations of the "new science" envisaged a new method which would enable humans to be "masters and possessors of nature;" and Bacon dreamed of science as the tool by which humans would "establish and extend the power and domain of the human race itself over the universe." But the work of Joseph Needham in his monumental study, Science and Civilization in China, is convincing in its argument that the roots of Western technology, with its pervasive ethos of control, go back to the Judaic-Christian heritage in which the earth and all its creatures were created for the benefit of man who is to have dominion over them. By way of contrast, Chinese civilization, which is notable for the relative early invention of the mechanical clock, the reciprocating steam engine, moveable type-printing, gun powder, and the magnetic compass, had a totally different value system which never equated knowledge with natural science nor dominance over nature as an especial divine dispensation of human beings. For the Chinese, humans are a part of nature, and the world is seen holistically, not as an object of exploitation but as a matrix for

harmonious adaptation. Harmony, not dominion, is the controlling Chinese idea. The Chinese tradition, according to Needham, has always perceived force as the wrong way of doing things. Indeed, an ancient Chinese parable makes fun of the peasant-farmer who was discontented with the growth rate of his plants and started to pull at them in order to facilitate their growth.

There was a time when we in the West also knew that the application of force is not what ultimately moves men, nature, or events. As Henry Adams reflected in his autobiographical reminiscence about his own education, "All the steam in the world could not, like the Virgin, build Chartres." That energy has always come from the imagination, from that sphere of psychic space where the human race has created its symbols, its ideals, and its hopes for the good life. Ultimately, it must be our hope that the encounter between our imagination and the technological system, which is sometimes abrasive, sometimes in harmony, will foster, not fetter, our aspirations for a better world.

--Maud Chaplin
Department of Philosophy
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Wellesley, Massachusetts

[This article originally appeared in slightly different form in the Spring 1987 edition of the Weaver, a publication of the Council for the Understanding of Technology in Human Affairs, and is reprinted herein with permission of the author and CUTHA.] Editor.

COURSE SYLLABUS

HISTORY OF SCIENCE AND TECHNOLOGY - I

History 219S

Professors Seymour Mauskopf
and Alex Roland, Duke University

COURSE OVERVIEW:

History of science and history of technology have each developed into vigorous disciplines in recent decades. Inevitably, specialized development has resulted in divergence of interest, viewpoint, and approach between the two fields. Yet, living in an age where science and technology are intimately linked in the most pervasive and dramatic ways, historians of science and historians of technology cannot escape considering how these two activities have been related to and have influenced each other in past ages and different cultures. Indeed, historians of science and technology cannot avoid considering how their very conception of "science" and "technology" is defined by the interaction between them.

In this course, we plan to examine the relationship between science and technology in Western civilization, as that is traditionally defined. During the first semester, we shall cover the period between the earliest manifestations of organized social life and the inception of the Industrial Revolution in 18th-century Britain. The second semester will focus on science and technology in the industrializing society of the 19th and 20th centuries.

The course is structured to accomplish two broad goals. The first is the presentation by each of us of the lineaments of our own field, through an examination of selected topics in the history of science and in the history of technology for each era we cover. By this means, you will be able to gain insight into the subject matter, viewpoint, and approach of each field. Secondly, we plan to examine what sorts of interrelations and interactions there have been between science and technology in the course of Western history. Has the contemporary intimate linkage (itself an object of analysis) been general throughout this history? Is this a development which has taken place only recently? Or have there always been linkages but of a sort different from what we are accustomed to expect today because of the differing natures of science and technology in earlier eras and other cultures?

For anyone expecting non-controversial answers to these questions, we would add some final cautionary words. Historical discussion of great issues (such as these) rarely leads to the kind of clear-cut consensus which, occasionally at least, marks the outcome of scientific research and discussion. You will note in your readings that historians have taken and continue to take different stances on the question of the nature of science, technology, and the factors which cause either or both to prosper. This course is itself something of a joint pioneer effort on our parts to survey the literature of our fields and to try to achieve our own understanding of the historical relationship between science and technology. We hope that you, too, will find the fluid and often controversial state of the analysis of this relationship an exciting challenge to develop your own insights into these fascinating and important issues.

READINGS:

Please purchase the following books, all of which are available in paperback:

- J.D. Bernal, Science in History, vol. 1: The Emergence of Science. Cambridge, Mass.: MIT Press, 1971.
- Daniel Boorstin, The Discoverers. New York: Random House, Vintage, 1985.
- A. Rupert Hall, The Revolution in Science. White Plains, N.Y.: Longman, 1983.
- J.G. Landels, Engineering in the Ancient World. Berkeley: Univ. of Calif. Press, 1978.
- G.E.R. Lloyd, Early Greek Science. London: Chatto and Windus, 1970.
- Robert K. Merton, Science, Technology, and Society in 17th Century England. Atlantic Highlands, N.J.: Humanities Press, 1978.
- Arnold Pacey, The Maze of Ingenuity. New York: Holmes and Meier, 1975.
- Lynn White, jr., Medieval Technology and Social Change. Oxford: Oxford Univ. Press, 1962, 1966.

CLASS SCHEDULE: (Two 1:15 hour meetings per week).

<u>Week</u>	<u>Date</u>	<u>Topic/Assignment</u>
1	27 August	Introduction. Bernal, 27-57.
2	3 September	The Neolithic Revolution. Bernal, 61-101.
3	10 September	The Urban Revolution. Bernal, 102-44.
4	17 September	Hellenic Civilization. Bernal, 145-208. Lloyd, complete. Landels, 9-57.
5	24 September	Hellenistic Civilization. Bernal, 208-23. Landels, 58-132.
6	1 October	Rome. Bernal, 223-37. Landels, 133-98.
7	8 October	Dark Ages. Bernal, 247-84. White, 1-78.
8	17 October	12th Century Renaissance. Pacey, 25-55.
9	22 October	Late Middle Ages. Pacey, 56-86. Bernal, 285-339. White, 79-134.

10	29 October	Renaissance. Hall, Chaps. 1-3. Pacey, 87-115.
11	5 November	Sixteenth Century. Hall, Chaps. 4-6. Pacey, 116-173.
12	12 November	Institutions. Hall, Chaps. 7-10. Pacey, 174-203. Merton, 3-136.
13	19 November	Scientific Revolution in England. Hall, Chaps. 11-14. Merton, 137-238.
14	3 December	Industrial Revolution in England. Pacey, 204-61.

All reading is to be completed before the class meeting. Intelligent questions and informed discussion in class will help determine the class participation component of your final grade. Additional reading will be handed out the week before it is due.

RESEARCH PAPER:

Each student will prepare a term research paper on a topic that reveals the interrelationship between science and technology in the Western world before the Industrial Revolution. The main focus of the paper may be either science or technology, but the case study selected must have at least some bearing on the other field. Those students intending to take the second semester of this course (History 220S) may select topics like astronomy or steel production that can be carried into the second half of the course.

The papers are to be prepared according to the following schedule. On or before 24 September, submit your topic and a preliminary bibliography for approval. On or before 24 October, submit a conceptual outline and a full bibliography. The papers are due on or before 22 November. They should be 20 to 30 pages in length and include a critical bibliography.

EXAMINATIONS:

There will be two examinations. A take-home, mid-term examination to be distributed on 3 October and due on 8 October, will cover all reading and class discussion through Roman civilization. The final examination, to be scheduled, will cover all reading and class discussion; approximately 1/3 of the exam will focus on the first half of the course, 2/3 on the second half.

GRADING:

Mid-Term Exam	- 20%
Term Paper	- 30%
Final Exam	- 30%
Class Participation	- 20%

COURSE SYLLABUS

HISTORY OF SCIENCE AND TECHNOLOGY - II

History 220S

Professors Seymour Mauskopf
and Alex Roland, Duke University

COURSE OVERVIEW:

This course is a sequel to History 219S, in which we examined the history of Western science, Western technology, and the relation between the two activities up through the Industrial Revolution of 18th-century Britain. Now we shall continue our historical examination in the 19th and 20th centuries.

In one respect, our pedagogical and analytical tasks become easier. Namely, "science" and "technology" are increasingly recognizable as such (at least in their popular image) as we move towards modern time. But it must be cautioned that similarities can be deceiving in historical study, especially since we tend naturally to simplify and flatten out our historical model into stereotypes whose characteristics we appropriate from our own time.

But even granting that our tasks are easier in one respect, in others they are made more difficult and complex. Science explodes in size and scope in the 19th and 20th centuries, all the while fragmenting into distinct specialities. The rapidly industrializing world witnesses the transforming power of technology. It remains to be explored how exactly technology changes in terms of its social and institutional context and its relationship with science. But clearly it is in the modern period that "applied science" becomes synonymous with some aspects of technology.

At any rate, the rapid growth of science and technology presents us with an embarrassment of riches. No longer will it be possible to provide the systematic if sketchy overview of the development of "science and technology" in each epoch; indeed, it becomes increasingly hard to speak unequivocally of "science" and "technology." Rather, we shall be both more selective and integrative this semester; while trying to maintain a narrative, we shall focus on cases where the development of science and technology intersect.

COURSE READING:

Please purchase the following paperback books, which have been ordered through the Duke Bookstore:

- Hugh G.J. Aitkens, Syntony and Spark: The Origins of Radio. New York: John Wiley, 1976; Princeton, N.J.: Princeton Univ. Press, 1985.
- Daniel J. Kevles, The Physicists: The History of a Scientific Community in Modern America. New York: Knopf, 1978; Random House, Vintage, 1979.
- John Marks, Science and the Making of the Modern World. London: Heinemann, 1983.
- Carroll W. Pursell, ed., Technology in America: A History of Individuals and Ideas. Cambridge, Mass.: MIT Press, 1981.
- Nathan Rosenberg, Technology and American Economic Growth. New York: Harper, 1972.

We shall try to maintain the seminar ambiance of last semester. Therefore, it is imperative that class readings be done on time to facilitate informed discussion. From time to time we will ask for short papers on questions related to the reading for the week. Even when we do not, we expect that you will remain up to date on the reading and ready to join in class discussion.

CLASS SCHEDULE: (Two 1:15 hour meetings per week).

<u>Week</u>	<u>Date</u>	<u>Topic/Assignment</u>
1	9 January	Introduction (no reading).
2	14 January	Thermodynamics in France. * D.S.L. Cardwell, "Science, Technology, and Industry," in <u>The Ferment of Knowledge: Studies in the Historiography of Eighteenth-Century Science</u> , ed. by G. S. Rousseau and Roy Porter (Cambridge: Cambridge Univ. Press, 1980). Marks, Chap. 4.7. * Sadi Carnot, "Reflections on the Motive Power of Fire, and on Machines Fitted To Develop That Power," ed. by E. Mendoza (New York: Dover, 1960).
3	21 January	Chemistry in Germany. Marks, Chap. 4.5. * Karl-Heinz Manegold, "Technology Academized," in <u>The Dynamics of Science and Technology</u> , ed. by Wolfgang Krohn, Edwin T. Layton, Jr., and Peter Weingart (Dordrecht, Holland: D. Reidel, 1978), pp. 137-58. * Georg-Meyer Thurow, "The Industrialization of Invention: A Case Study from the German Chemical Industry," <u>Isis</u> 73 (September 1982): 363-81.
4	28 January	Electromagnetism in England. Marks, Chap. 4.9. * Harold I. Sharlin, "From Faraday to the Dynamo," in <u>Scientific Technology and Social Change</u> , ed. by Gene I. Rochlin (San Francisco: W.H. Freeman, 1974), pp. 83-89. * David F. Channell, "The Harmony of Theory and Practice: The Engineering Science of W.J.M. Rankine," <u>Technology and Culture</u> 23 (January 1982): 39-52. * R.A. Buchanan, "The Rise of Scientific Engineering in Britain," <u>British Journal of the History of Science</u> 18 (1985): 218-31.
5	4 February	Radio. Aitken, complete.
6	11 February	Technology in Early America. Pursell, Chaps. 1-6, 8-11. Rosenberg, Chaps. 1-4.
7	18 February	Science in Early America. Kevles, Chaps. 1-7. * Edwin T. Layton, <u>The Revolt of the Engineers: Social Responsibility and the American Engineering Profession</u> (Baltimore: Johns Hopkins Univ. Press, [1971] 1986), pp. 25-69. * Monte Calvert, <u>The Mechanical Engineer in America, 1830-1910: Professional Cultures in Conflict</u> (Baltimore: Johns Hopkins Univ. Press, 1967), pp. 277-81.
8	25 February	Science and Technology in World War I. Kevles, Chaps. 8-10.
9	11 March	American Agriculture and Genetics. Pursell, Chaps. 7, 14. Rosenberg, Chap. 5.

- * Wayne D. Rasmussen, "Advances in American Agriculture: The Mechanical Harvester as a Case Study," in Technology and Culture: An Anthology, ed. by Melvin Kranzberg and William H. Davenport (New York: New American Library, 1972), pp. 255-68.
- * Daniel J. Kevles, "Genetics in the United States and Great Britain, 1890-1930: A Review with Speculation," Isis 71 (1980): 441-55.
- 10 18 March **Science and Technology of Flight.**
Pursell, Chap. 16, 20.
* John D. Anderson, Jr., Introduction to Flight: Its Engineering and History (New York: McGraw-Hill, 1978), pp. 19-31.
- 11 25 March **Research Institutions.**
Pursell, Chap. 12.
Kevles, Chaps. 11-14.
Rosenberg, Chap. 6.
* George Wise, "A New Role for Professional Scientists in Industry: Industrial Research at General Electric, 1900-1916," Technology and Culture 21 (July 1980): 408-29.
- 12 1 April **Nuclear Energy.**
Pursell, Chap. 19.
Kevles, Chaps. 15-21.
Marks, Chaps. 6.3, 6.6, 8.2.
- 13 8 April **Molecular Biology and Genetic Engineering.**
Marks, Chaps. 6.4, 8.4.
- 14 15 April **Solid State Physics and Microelectronics.**
Marks, Chap. 8.3.

*Additional reading; available in photocopied form. Some readings beyond these will also be assigned as the course proceeds.

PAPERS:

Three papers are required in the course. At a minimum, they should draw together the material presented so far in the course to present a coherent synthesis. Graduate students and those desiring additional credit will be expected to supplement the course materials with outside reading, to be integrated in these essays.

<u>Paper</u>	<u>Date Due</u>	<u>Topic</u>
1	11 February	Science and Technology in 19th-Century Europe.
2	11 March	Science and Technology in 19th-Century America.
3	17 April	Science and Technology in the 20th Century.

Papers 1 and 2 should be 5-10 typed pages. Paper 3 should be 10-15 typed pages and should include a section of summary thoughts on science and technology since the Industrial Revolution: i.e., on the topics of this semester's work.

EXAMINATIONS:

There will be only one examination in the course, a final on a date to be scheduled. Dependent on enrollment and scheduling, this may be an oral exam.

GRADING:

Grades will be determined according to the following formula:

Paper #1	-	10%	Final Examination	-	30%
Paper #2	-	20%	Class Participation	-	10%
Paper #3	-	30%			

BOOK REVIEW

Cecelia Tichi, Shifting Gears: Technology, Literature, Culture In Modernist America. (Chapel Hill, N.C.: University of North Carolina Press, 1987). xvii + 310 P. Illus.; Bibliog. Hardcover, \$35.00; Paperback, \$14.95.

The late-19th century witnessed the triumph of standardized, systemic technologies over an earlier American technological style. The old order, rooted in the task of constructing the national terrain, depended on continual negotiation between skilled artisans, local entrepreneurs, and the wilderness itself. Cecelia Tichi rightly observes that the new era was dominated by a "gear-and-girder" mentality that fostered "a conception of the human being as a machine . . . and it defined nature similarly as a congeries of machines and structures comprised of interworking component parts . . ." (p. xii). How, she asks, did American writers respond to the new mechanical consciousness?

After an opening chapter exemplifying a newly commonplace language linking "trees, animals, and engines" as mechanistically-kindred realities, Tichi defines the challenge facing her authors as a tension between pervasive fear of instability and the more manageable linked concepts of waste and efficiency. Instability, in nature or society, terrifies because it opens out into the chaotic void. The concept of waste--popularized by Progressive Era reformers and proponents of F. W. Taylor's Scientific Management--domesticates instability by defining it as a problem that can be solved by efficiency experts. The storyteller of the now-obsolete romantic era must be replaced by the engineer. The resulting engineer-artists see novel or poem as a "machine made of words." Tichi portrays their attempts--particularly as embodied in John Dos Passos, Ernest Hemingway, and William Carlos Williams--as an artistry that celebrates form over content, motion over story, and speed over locality. Indeed, one might aptly subtitle Shifting Gears "The Assault on Narrative."

Edward Bellamy's Looking Backward presages the new style with its vision of an America rescued from the chaos of industrial violence through efficient rationalization of the social order. Thorstein Veblen articulates its philosophical underpinnings and Ezra Pound enunciates its central literary maxims. Tichi's primary heroes, however, remain Dos Passos, Hemingway, and Williams. The politically leftist Dos Passos rejects "the established fictional tradition in which characters' relationships are based on lineage, ancestry, kinship patterns, or the common culture of a region" (p. 200). Hemingway is "full of nostalgia for a preindustrial 'natural' environment but his sentences are irrevocably of another, a gear-and-girder, world" (p. 229). Williams, while satirizing the hectic pace of modern life, nevertheless creates a poetic style based on it. "Writing," says Williams, "is an action, a moving process" (p. 284). Chapter 5's treatment of Williams is particularly masterful, demonstrating as it does the linguistic and conceptual links between his medical education in the new mechanistic style found in the 1910 Flexner report, his growing appreciation for the efficiency ideals of Taylorism,

and his commitment to poetry, not as an escape from the modern pace of life but as its embodiment.

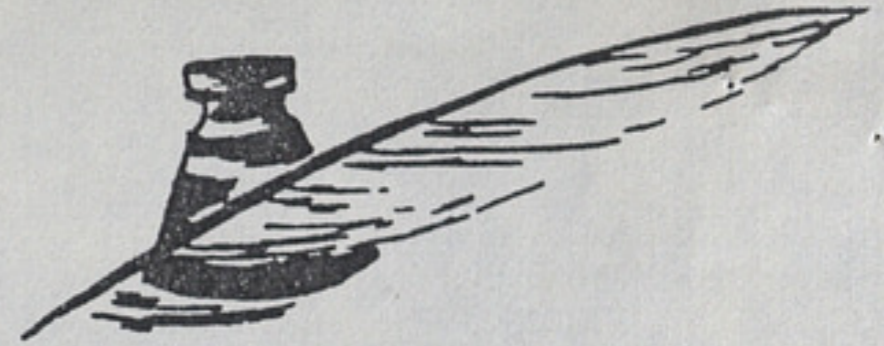
The book is studded with extraordinary texts from these and other period authors and marvelously enhanced by myriad reproductions (not always of satisfying photographic quality) of advertisements, paintings, and photographs embodying her analysis. We are, in short, indebted to her work for its detailed analysis of a compelling link between technological and linguistic style.

As satisfying as this is, however, Tichi's approach is seriously flawed. I found myself asking, "What of those who refuse to conform to the new era's norms or who mount a direct attack on storyless kinesis?" Tichi disposes of the most resonant voice, Faulkner, in a single paragraph as one of "those clinging to the romantic perception of an earlier age" (p. 37). She aims her weapons more directly at Willa Cather and Sherwood Anderson. Both commit, for Tichi, the unforgivable sin of challenging the engineering mentality head-on in their stories of a fatally flawed bridge and an equally failed machine-designer. Cather is "committed to the values of the waning Romantic era;" she "typifies those others who felt threatened by the engineering power from which they felt excluded" (p. 173, my italics). Anderson is "anxious," "trapped between sentimentality and rage" (pp. 184, 192). All this, alas, exemplifies the simplistic rhetoric of autonomous and inevitable technological progress. Those who, unlike Dos Passos, Hemingway, and Williams, reject the canons of the dominant new ideology are defined out of contention in the struggle to interpret its values. Here we see Tichi's key flaw. She does not situate her cluster of "up-to-date" authors within the larger literary context. Were she to see Hemingway, Dos Passos, and Williams as representing one voice in a tumultuous debate about the artistic endeavor and about 20th-century technological style, she would sharpen the issues at stake. Suppose Cather's Alexander's Bridge and Anderson's machine-building Hugh McVey (Poor White) represent, not a clinging to a waning romantic past, but a radical critique of the technological and social style which has achieved dominance in the land? Suppose their dissent reveals the very flaw lines of the gear-and-girder mentality?

Were their voices given equal weight we would witness a clash worthy of both. Imagine, from this perspective, a chapter on Faulkner's commitment to narrative intimacy over against her superb study of Williams' poetry-without-story. I am reminded, for example, of Faulkner's Nobel Prize acceptance speech in which he mourns recent authors who write of "battles in which nothing of consequence is either won or lost." Tichi fails us, finally, by making things too easy for her modernists. Like other significant artists of this century, but also in company with those others, they wrestle with the challenge posed by big-system technological style. By excusing them from answering the challenge posed by alternative artistic voices, Tichi deprives the reader of some of the passion and human drama of their struggle while encouraging an overly simple interpretation of technological change.

John Staudenmaier, S.J.
Department of History
The University of Detroit

OPEN FORUM



CALL FOR PAPERS

Ferris State College

Humanities, Science and Technology Conference

Ferris State College welcomes proposals for papers or entire sessions for its first annual conference on Humanities, Science, and Technology to be held March 11-12, 1988. The conference will provide a unique forum emphasizing concerns that transcend traditional disciplinary boundaries. This will include such sessions as medical ethics, the politics of scientific research, history of science and technology, art and technical innovation, etc. Proposals should include a 300 word abstract and the participant's vitae. All proposals are due December 1, 1987. Please indicate if you are interested in serving as a session chair or commentator. Proposals should be submitted to: Coordinating/Program Committee, Department of Humanities, Ferris State College, Big Rapids, MI 49307: phone: [616] 592-2758 or [616] 592-2771.

CUTHA COMES TO FLORIDA

The Council for the Understanding of Technology in Human Affairs (CUTHA) announces its first conference in the southeastern U.S. on "Technology and the Liberal Arts." The conference will be held January 21-22, 1988 at Rollins College in Winter Park, Florida. Financial support is from the Exxon Foundation.

Speakers will discuss aspects of technology as part of a contemporary liberal education and describe a variety of courses and programs throughout the United States. In addition, there will be presentations dealing with the New Liberal Arts program sponsored by the Sloan Foundation and technological literacy courses sponsored by the Council of Independent Colleges.

Presentors and resource people will come from a variety of academic disciplines and institutions and will provide a stimulating conference atmosphere.

Program mailing will be done in October 1987, and people wishing to be on the specific mailing for the conference should contact: Dr. Joseph V. Siry, Department of Environmental Studies, Rollins College, Winter Park, FL 32789: phone: [305] 646-2648, or Dr. J. Paul Hartman, P.E., CUTHA Program Director, College of Engineering, University of Central Florida, Orlando, FL 32816-0450: phone: [305] 275-2455.

THE THIRD NATIONAL
SCIENCE, TECHNOLOGY, SOCIETY (STS) CONFERENCE
on
TECHNOLOGICAL LITERACY

February 5-7, 1988
Crystal Gateway Marriott Hotel, Arlington, Virginia

Conference Theme: Technology, Democracy and Development

Call for Papers and Workshops

Submit proposals (250 words maximum) by November 15, 1987 to: Leonard Waks,
TLC Program Chair, The Pennsylvania State University, 128 Willard Building,
University Park, PA 16802.

and

Inaugural Meeting of the Society for STS

A new step for Science, Technology and Society (STS)

In response to the needs of professionals from a wide spectrum of disciplines and livelihoods, who share a concern for reflection, education or action in any of the myriad areas where technology and science affect our society, a new society for STS is being inaugurated. All conference attendees will be invited to become founding members and participate vigorously in shaping its future.

For further information and registration form, write to: STS Program, The Pennsylvania State University, 128 Willard Building, University Park, PA 16802; phone: [814] 865-9951.

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THE STUDY OF SCIENCE AND TECHNOLOGY IN THE 1990S
A JOINT 4S/EASST MEETING

Amsterdam
November 16-19, 1988

sponsored by
The Society for Social Studies of Science (4S)
and the European Association for the Study of Science and Technology (EASST)

For further information or to suggest session proposals, write to: 4S/EASST Joint Meeting, c/o Science Dynamics UvA, Nieuwe Achtergracht 166, 1018 WV Amsterdam, The Netherlands.

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ENGINES OF CHANGE VIDEOTAPES

Due to extraordinary demand, the videodisc of machine tools in operation and of images from the Smithsonian Institution's Engines of Change exhibit (see STS Newsletter 60 [Sept. 1987]: 19-20) is no longer available. However, VHS format videotapes containing the same material are now available for \$29.95. Order from: Department of Public Programs, Room BB 051, National Museum of American History, Smithsonian Institution, Washington, DC 20560.

**ANNOUNCING A CONFERENCE
ON SCIENCE, TECHNOLOGY, AND SOCIETY STUDIES**

November 18-20, 1987 at the Marriott Hotel, Worcester, MA
Sponsored by Worcester Polytechnic Institute (WPI)
and the Society for Social Studies of Science

The current status of Science, Technology, and Society (STS) studies in North America, Western Europe and Australia is largely the result of many local actions in a variety of academic and cultural settings. The purpose of the November STS conference is to draw together representatives of diverse STS academic programs with different organizational histories so that they can share their experiences. The timing of the conference has been arranged so that it overlaps the beginning of the 12th Annual Meeting of the Society for Social Studies of Science (4S), being held in Worcester, MA on November 19 through 22.

The STS conference will focus on fifteen case study presentations, each based on the experience of a particular STS academic program. General discussions of common interest issues have also been scheduled. These issues will include the recruitment of students to STS and the establishment of career placement mechanisms, assessing the role of foundations, corporate sponsors, and professional societies for STS, and devising mechanisms to facilitate faculty exchange.

Support from the GTE lecture series has made it possible to schedule a formal presentation that will be open to the public, but still part of the conference. Rustum Roy has graciously agreed to speak on the implications of the Technological Literacy Movement for STS. He will also bring us up to date on the drive to create a new society in this field; which would be devoted to outreach activities designed to increase the public's understanding of science, technology and their social implications.

Those considering attending the conference should send for a package of conference information and registration materials. Address all inquiries to: Prof. John M. Wilkes, STS Conference Local Arrangements Committee, Dept. of Social Science and Policy Studies, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609: phone [617] 793-5578.

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CONFERENCE ON:

**ETHICAL ISSUES IN MILITARY RESEARCH:
WHAT ARE THE ISSUES? HOW CAN THEY BE HANDLED?**

The New York Academy of Sciences, New York, NY - May 18-20, 1988

Sponsored by
The New York Academy of Sciences
and the Philosophy and Technology Studies Center,
Polytechnic University, Brooklyn, NY

The purpose of this conference is not to take a partisan stand or to debate once again the pros and cons of specific weapons research projects, e.g., the Strategic Defense Initiative (SDI). Instead, the goal is to bring scientists and engineers representing both sides of the political-moral spectrum in the SDI and related debates together with philosophers and others who can help place such debates within a larger context. To be considered are: * conceptual distinctions between pure and mission-oriented research, * the historical and sociological background of current debates, * the kinds of ethical arguments employed in the articulations of different positions, and * the moral options open to persons on various sides of the issues.

Conference Chairs: Carl Mitcham, Director, Philosophy and Technology Studies Center, Polytechnic University, Brooklyn, NY, and Philip Siekevitz, Ph.D., Program in Cell Biology, Rockefeller University, New York, NY. For further information and registration form (available February 1988) write to: Public Relations Department, The New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021; phone [212] 838-0230.

LITERATURE AND SCIENCE

16th Annual 20th-Century Literature Conference
University of Louisville
February 25-27, 1988

CALL FOR PAPERS AND FOR SUBMISSIONS OF POETRY AND FICTION
Deadline: October 15, 1987

Submissions must: pertain to the theme; be appropriate for a conference on "literature of the 20th century"; be a complete paper/work; be structured for a presentation time of 20 minutes (about ten typed, double-spaced pages), and omit submitter's name from all pages except cover sheet.

Include a cover sheet with the following items: a) submitter's name; b) submitter's academic affiliation (if any); c) submitter's mailing address; d) submitter's telephone number(s); and e) title of paper in caps and lower case. If a **critical** submission: include a **250 word, carefully formulated abstract**, identify the national origin(s) and genre(s) of work(s) discussed. **Critical** papers previously read at other conferences or previously published cannot be accepted; **creative** submissions may come from published or unpublished works. Manuscripts will not be returned. Papers will not be read in absentia.

Contact: Send submissions and correspondence to: Harriette Seiler, Conference Chair, Dept. of Classical and Modern Languages, University of Louisville, Bingham Humanities, 332, Louisville, KY 40292: phone [502] 588-6683.

* * * * *

RESEARCH FELLOWSHIPS

The Hagley Museum and Library announces the availability of research fellowships for 1988-1989.

Advanced research fellowships, funded by the National Endowment for the Humanities and the Andrew W. Mellon Foundation, support independent study in Hagley's fields of interest at its Center for the History of Business, Technology, and Society. Scholars working in the humanities or in those aspects of the social sciences that employ historical or philosophical approaches are encouraged to apply. Fellowships are offered for six to twelve months work with a maximum stipend of \$27,500.

These fellowships are restricted to individuals pursuing advanced research; awards will not be made to degree candidates or to persons seeking support for work leading to a degree. Endowment guidelines specify that applicants must be American citizens or have been residing in the United States for three years immediately preceding the term of fellowship. Completed applications must be received by February 15, 1988; awards will be announced by April 1, 1988.

Short-term grants-in-aid are also offered for the calendar year 1988. These grants support short-term (two to eight weeks) research in Hagley's imprint, manuscript, pictorial, and artifact collections. They are available to both degree candidates and advanced scholars. Applications will be accepted throughout the year; awards in 1988 will not exceed \$750 per month of study.

For additional information please write Elizabeth Gray Kogen; Center for the History of Business, Technology, and Society; Hagley Museum and Library; P. O. Box 3630; Wilmington, Delaware 19807.

M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BERNARD, H. RUSSELL AND PERTTI PELTO, EDs. TECHNOLOGY AND SOCIAL CHANGE. 2ND ED. PROSPECT HEIGHTS, ILL.: WAVELAND PRESS, 1987. 393 P. ILLUS.; BIBLIOG. PAPER: \$10.95.

An updated edition of the editors' original 1972 collection of anthropological studies analyzing the impact of technological innovation on society and cultural systems. A revised introduction and concluding essay on anthropological theory along with three new essays treating agricultural modernization in Mexico, human views of automated machinery, and office automation complement eight of the original case studies. Papers include studies of both macrotechnological change--large scale technical projects such as hydroelectric dams involving government policymaking -- and microtechnological change -- tools, weapons, vehicles, etc. Specific case studies include: "Ciudad Industrial: A New City in Rural Mexico," by John J. Poggie, Jr.; "The Kariba Dam Project: Resettlement and Local Initiative," by Thayer Schudder and Elizabeth F. Colson; "Relocation and Technological Change in Micronesia," by Robert Kiste; "Engineers and Energy in the Andes," by Paul L. Dougherty; "Seeds of Change: The Effects of Hybrid Sorghum and Agricultural Modernization in Mexico," by Billie R. DeWalt and David Barkin; "Sponge Fishing and Technological Change in Greece," by H. Russell Bernard; "Snowmobiles: Technological Revolution in the Arctic," by Pertti J. Pelto and Ludger Müller-Wille; "Microtechnology in Rural Buganda," by Michael C. Robbins and Philip L. Kilbride; "Controlling Population Growth in Mauritius," by Burton Benedict; "Human Views of Machines: Expression and Machine Shop Syncretism," by John M. Roberts and Garry E. Chick; and "Word Processing, Office Drudgery, and the Microcomputer Revolution," by Michael Evans and H. Russell Bernard. This new edition, which is available in paper at a relatively inexpensive price, would serve as a good supplementary text for many STS courses, especially those with an anthropological bent.

CORTADA, JAMES W. HISTORICAL DICTIONARY OF DATA PROCESSING: TECHNOLOGY. WESTPORT, CONN.: GREENWOOD PRESS, 1987. 415 PP. \$55.00.

Over 150 entries cover a wide range of topics on data processing technology including historical computer developments, programming languages, and software. Entries range in length from a few paragraphs to several pages and conclude with bibliographic references to additional material. A useful chronology from the development of the abacus to IBM's 1985 announcement of the 3090 large MVS/XA computer is appended. This dictionary on technology is one of three companion volumes --the other two cover biographies and organizations.

FARKAS, JANOS AND DHIRENDRA SHARMA. "SOCIAL PROBLEMS OF SCIENTIFIC KNOWLEDGE," PHILOSOPHY AND SOCIAL ACTION 13 (1987): 1-170.

A special issue containing primarily a selection of papers originally presented at the 11th World Congress of Sociology in New Delhi, August 18-22, 1986. Contents includes: CENTERS-PERIPHERY ANALYSIS OF SCIENCE-- "Transfer Systems in Science and Technology and Indigenous Intellectual Initiative," by Susantha Goonatilake; "Some Conceptual Problems of the Center-Periphery Relationship in the History of Science," by Gabor Pallo; and "Science, Society and the Indian Transformation," by Kamini Adhikari. THE SOCIAL RECONSTRUCTION OF SCIENCE -- "Classifying Rule-Based Expert Systems," by H.M. Collins; "Models In/Of Scientific Practice," by Andy Pickering; "Precambrian Studies as Interdisciplinary Science," by Steven Yearley; "The Reconstruction of Scientific Knowledge," by Thomas Nickles; and "Selection of Research Problems in Agricultural Sciences: An Organizational Context," by Hemchandra Gajbhiye. HISTORICAL AND POLITICAL ASPECTS OF SCIENCE -- "Lagging and Development of the Sociology of Science: The Hungarian Case," by Janos Farkas; "Uses of Science and the Structures of Political Decision-Making," by Marja Alestalo; "Sociology of Science and Science Policy," by Vojin Milic; "Ethics and Rationality of Technology," by Ron Levy; and "Weapons and World Welfare," by J.K. Galbraith.

"THE FARM CRISIS: STRUCTURAL DEFECT OR SIMPLE ADJUSTMENT," AGRICULTURE AND HUMAN VALUES 3 (FALL 1986): 1-107.

This special issue includes: "Agricultural Structure and Economic Adjustment," by E. Wesley F. Peterson; "Values and the Agricultural Crisis: Differential Problems, Solutions, and Value Constraints," by Cornelia Butler Flora; "Crisis in Swedish Farmland Preservation Strategy," by David Vail; "The Social Goals of Agriculture," by Paul B. Thompson; "Constructing Rural Culture: Family and Land in Iowa," by Deborah Fink; "Farming, Rationality, and Craftship: Beyond X-Efficiency," by Patrick H. Mooney; "The U.S. Farm Crisis: Program Responses and Alternatives to Them-The Case of Michigan," by Laura D. DeLind; "Farm Financial Trend in Missouri and Its Future Implications," by Ejigou Demissie; "The Rural Crisis in Minnesota: Identifying Social and Economic Vulnerability and New Directions for the Future," by George Boody and Michael Rivard; "Agricultural Research and Farm Structural Change: Bovine Growth Hormone and Beyond," by Frederick H. Buttle; and "The Politics of Agricultural Abundance," by Don F. Hadwiger.

"FOOD PRODUCTION, AGRICULTURAL RESEARCH AND TECHNOLOGY ASSESSMENT," AGRICULTURE AND HUMAN VALUES 3 (SUMMER 1986): 1-40.

This special issue includes: "Accelerating Agricultural Research and Production in the Third World," by Norman E. Borlaug, "Food for Everyone? Yes...From Trees," by Edward Passerini; "Mechanized Agriculture and Social Welfare: The Tomato Harvester in Ohio," by John H. Vandermeer; "The Confrontation Between Processors and Farm Workers in the Midwest Tomato Industry and the Role of the Agricultural Research Extension Establishment," by Peter M. Rosset and John H. Vandermeer; and "Values and Making Decisions about Agricultural Research," by Rachelle D. Hollander.

GOLDBERG, STEVEN E. AND CHARLES R. STRAIN, EDs. TECHNOLOGICAL CHANGE AND THE TRANSFORMATION OF AMERICA. CARBONDALE/EDWARDSVILLE: SOUTHERN ILLINOIS UNIV. PRESS, 1987. X, 204 P. HARDCOVER, \$19.95.

Most of the 13 essays in this volume were originally presented at a 1984 conference entitled "The Human Side of High Tech," sponsored by the DePaul University Institute for Business Ethics and the Department of Educational Relations at Illinois Bell. Although, as with many conference proceedings, this is a somewhat diverse set of papers, they are held together by the recognition that at root technical choices "spring from cultural traditions and social beliefs" and that "political choice and moral commitment permeate all human enterprise" (pp. 5-6). It is the editors' hope that "reasoned discourse about the ends of society can make a material difference in public policy decisions" (p. vii). The book is divided into four somewhat overlapping sections and includes the following essays: CONSCIOUSNESS -- "Does Improved Technology Mean Progress?" by Leo Marx; "The Invention of the Past: Technology, History, and Nostalgia," by John F. Kasson; "Artificial Intelligence: Its Accomplishments and Prospects," by Martin G. Kalin; and "Conflicting Models of Rights: The Case of Technical Obsolescence," by Robert Allan Cooke. WORK -- "Technology and Its Critics: The Degradation of the Practical Arts," by Christopher Lasch; "The Challenge of Economic Transformation: Forerunner of Democracy," by Brian G. Sullivan; and "Industrial Technology and Collective Bargaining," by Irving Bluestone. COMMUNITY -- "Medical Technologies and Communities of Moral Value," by Paul F. Camenisch; "Community, Time, and the Technical Order," by Robert Rotenberg; and "Community Planning for Technological Development: A New Bargaining Process," by Marc A. Weiss and John T. Metzger. POLITICS -- "Republican Virtue in a Technological Society," by Albert Borgmann; "Brandeis v. Nineteen Eighty-Four: Computer Technology and the Right of Privacy," by Senator Charles McC. Mathias, Jr.; and "High Technology and Higher Education," by James W. Carey. Together this collection of essays is suggestive of the current breadth of STS studies.

JACKSON, DOUGLAS N. AND J. PHILIPPE RUSHTON, EDS. SCIENTIFIC EXCELLENCE: ORIGINS AND ASSESSMENT. BEVERLY HILLS, CALIF.: SAGE, 1987. 381 P. \$28.00.

A specially commissioned collection of essays, all but one of which were originally presented at a conference at the University of Western Ontario in April 1985, that examine and assess the notion of scientific excellence from a variety of behavioral science perspectives. Contents include: Part I: ASSESSMENT-- "Mapping the World of Science: Is Citation Analysis a Legitimate Evaluation Tool?" by Eugene Garfield. Part II: PERSONOLOGICAL ORIGINS -- "Historical Overview of Research on Scientific Abilities," by Philip E. Vernon; "The Possible Different Personality Dispositions of Scientists and Nonscientists," by Robert S. Albert and Mark A. Runco; "Multiples, Chance, Genius, Creativity, and Zeitgeist," by Dean Keith Simonton; "Personality Characteristics Associated with High Research Productivity," by J. Philippe Rushton, Harry G. Murray, and Sampo V. Paunonen; "Scientific and Technological Innovation: Its Personological and Motivational Context," by Douglas N. Jackson; "The Scholarly Impact of Psychologists," by Norman S. Endler; and "Evolution and Creativity: Some Playful Musings," by Pierre L. van den Berghe. Part III: SOCIOCULTURAL ORIGINS -- "The Wisdom of Solomon: Avoiding Bias in the Publication Review Process," by Daniel Perlman and Elizabeth Dean; "The Role of Journal Editors in the Scientific Process," by Henry L. Roediger III; "Approaches to Ensuring Quality of Data and Performance: Lessons for Science?" by Lee B. Sechrest; "Melding Capitalist Versus Socialist Models of Fostering Scientific Excellence," by John J. Furedy; "Permitting Creativity in Science," by Janet Beavin Bavelas; "Development of Scientific Productivity: Impact of Graduate Teaching and Thesis Supervision," by Harry G. Murray; "The Psychology of Women and Scientific Research," by Esther R. Greenglass; and "Women in Science," by Jonathan R. Cole.

PELTO, PERTTI J. THE SNOWMOBILE REVOLUTION: TECHNOLOGY AND SOCIAL CHANGE IN THE ARCTIC. REV. ED. PROSPECT HEIGHTS, ILL.: WAVELAND PRESS, 1987. 234 P. ILLUS.; MAPS; BIBLIOG. PAPERBACK, \$8.95.

A somewhat revised reissuing of Pelto's original 1973 study of the impact of snowmobiles on the reindeer herding practices of the Skolt Lapps of northeastern Finland. In a new Preface and Postscript Pelto alludes not only to the continuing changes effected by the snowmobile but also the impact of television, roads and automobiles, and new housing with electricity, modern baths, and central heating. This study would make an excellent supplementary reading in a variety of STS courses.

SANDERS, RALPH. "PENETRATING THE FOG OF TECHNOLOGY'S SOCIAL DIMENSIONS," TECHNOLOGY IN SOCIETY 9 (1987): 163-80.

"This study offers a straightforward message: To gain a meaningful understanding of technology's societal connection, one must first dismantle the intricate complexity that often envelops today's technological enterprises. [S-growth-curve] analysis represents a heuristic device, suitable for setting aside the peripheral and enabling the analyst to focus on key points. In effect, growth analysis sees beyond complexity to grasp the essential points and, in the process, makes the subject under investigation simpler and, therefore, more manageable" (author's abstract).

WEBB, GEORGE G., ED. HUMANITIES AND TECHNOLOGY ASSOCIATION NEWSLETTER 6 (FALL 1987): 1-37.

This issue contains several articles on curricular topics that will be of interest to readers of this newsletter, including: "The S&TS Program at Lyman Briggs School," by David E. Wright; "To Teach and To Learn Together: A Science and Technology Program for Faculty," by James J. Murphy; "A Strategy for Bridging the Gap: A Program in the History of Science, Technology and Medicine," by Jeffrey C. Brautigam; "Bridging Gaps at Wentworth," by Amos St. Germain; and "Knowledge and its Applications: The Effectiveness of Integrative Efforts," by Thomas Matro. There is also a 20-page listing of "Recent Books of Interest." Anyone interested in joining the HTA should send a check for their \$6.00 dues to: Dr. James Gray, Department of Technology, Northern Kentucky University, Highland Heights, Kentucky 41076.

WEINGARDEN, LAUREN S. "NATURALIZED TECHNOLOGY: LOUIS H. SULLIVAN'S WHITMANESQUE SKYSCRAPERS," CENTENNIAL REVIEW 30 (FALL 1986): 480-95.

Whitman's literary language of naturalized technology, a convergence of apparently contradictory images of rural and urban, organic and mechanical, was translated by Sullivan into architecture which in itself stands as a form of poetic discourse. Weingarden provides an analysis of the literary means employed by Whitman to "organicize" the industrialized city, such as juxtaposition, parallelism, repetition, creation then dissolution of oppositions and tensions, the pairing of technological and spiritual images. Then Sullivan's translation of the poetic into skyscraper construction is detailed. In his writings, such as Kindergarten Chats and "The Tall Office Building Artistically Considered," Sullivan provides theoretical analyses of the extra-architectural meanings of his skyscraper "compositions." It becomes evident that Sullivan's dictum, "Form follows Function," was intended to have a two-fold meaning: a rationalist mediation between the real and the ideal, and a spiritual convergence of form as a manifestation of the primal "Infinite Creative Spirit or God." Sullivan also poeticized buildings by emphasizing verticality as an emotional element, equating ornament and poetry, and by illustrating the synthesis between the "objective-geometric and the subjective-organic components of his designs."

OTHER BOOKS RECEIVED

DRAGGON, SIDNEY; JOHN J. COHRSSSEN; AND RICHARD MORRISON, EDS. ENVIRONMENTAL MONITORING, ASSESSMENT, AND MANAGEMENT; PRESERVING ECOLOGICAL SYSTEMS; ENVIRONMENTAL IMPACTS ON HUMAN HEALTH; GEOCHEMICAL AND HYDROLOGIC PROCESSES AND THEIR PROTECTION. 4 VOLS. NY: PRAEGER, 1987. 168; 232; 272; 248 P. ILLUS. \$39.95 EACH.

A set of four related reports resulting from a Council on Environmental Quality (CEQ)-commissioned study of the current state of long-term environmental research and development with the hope of developing guiding principles and priorities.

GOLDSTEIN, STANLEY H. REACHING FOR THE STARS: THE STORY OF ASTRONAUT TRAINING AND THE LUNAR LANDING. NY: PRAEGER, 1987. IX, 193 P. ILLUS; BIBLIOG. \$35.95.

GOLLEY, JOHN. WHITTLE: THE TRUE STORY. WASHINGTON, DC.: SMITHSONIAN INSTITUTION PRESS, 1987. 272 P. ILLUS; BIBLIOG. \$24.95.

Frank Whittle, a British engineer, conceived of and developed the turbo jet engine, which was first tested on April 12, 1937.

World Resources Institute Reports

DOVER, MICHAEL AND LEE M. TALBOT. TO FEED THE EARTH: AGRO-ECOLOGY FOR SUSTAINABLE DEVELOPMENT. 1987. 88 P. \$10.00.

EL-ASHRY, MOHAMED T. AND DIANA C. GIBBONS, TROUBLED WATERS: NEW POLICIES FOR MANAGING WATER IN THE AMERICAN WEST. 1986. 89 P. \$7.50.

ELKINGTON, JOHN. DOUBLE DIVIDENDS? U.S. BIOTECHNOLOGY AND THIRD WORLD DEVELOPMENT. 1986. 50 P. \$7.50.

MILLER, ALAN S. AND IRVING M. MINTZER. THE SKY IS THE LIMIT: STRATEGIES FOR PROTECTING THE OZONE LAYER. 1986. 38 P. \$7.50.

MYERS, NORMAN. NOT FAR AFIELD: U.S. INTERESTS AND THE GLOBAL ENVIRONMENT. 1987. 73 P. \$10.00.

REPETTO, ROBERT. SKIMMING THE WATER: RENT-SEEKING AND THE PERFORMANCE OF PUBLIC IRRIGATION SYSTEMS. 1986. 47 P. \$7.50.

Available from World Resources Institute, 1735 New York Avenue, NW, Washington, DC 20006.

Judith Adams
Auburn University
Auburn, Alabama

Christine Roysdon
Lehigh University Libraries
Bethlehem, Pennsylvania



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