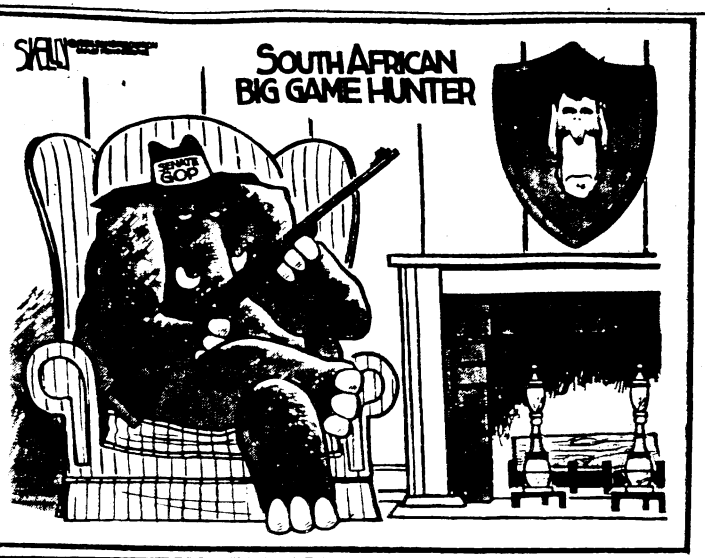
opinion



The Tech

Volume 106, Number 42 Tuesday, October 7, 1986

Chairman ..... Ronald E. Becker '87
Editor in Chief ..... Harold A. Stern '87
Managing Editor ..... Mark Kantrowitz '89
Business Manager ..... Eric N. Starkman '87
Executive Editor ..... Michael J. Garrison '88

News Editors ..... Earl C. Yen '88
Andrew L. Fish '89
Opinion Editor ..... Edward E. Whang '87
Night Editors ..... Halvard K. Birkeland '89
Ezra Peisach '89
Arts Editor ..... Michiel Bos G
Photography Editor ..... Stephen P. Berczuk '87
Advertising Manager ..... Shari A. Berkenblit '88
Contributing Editors ..... V. Michael Bove G
Bill Coderre G
Julian West G
Carl A. LaCombe '86
Steven Wheatman '86
Sidhu Banerjee '87
Simson L. Garfinkel '87
Andrew S. Gerber '87
Ben Z. Stanger '88
Senior Editor ..... Jonathan Richmond G

Column/Simson L. Garfinkel

Athena faces identity crisis

Project Athena has been in the midst of an identity crisis ever since March 1985.

At that time, Project Athena "opened up" the Student Center cluster to the MIT undergraduate student body. Since then, any undergraduate who has wanted an account on Project Athena has been able to get one.

The Student Center cluster is the only exposure many students get to Project Athena. For these undergraduates, the Student Center's overburdened timesharing computers, unreliable printers and meager file space allocations are defining characteristics of the Project. It is no wonder that Project Athena slides at Lecture Series Committee movies are accompanied by hissing.

Many people within Athena view the Student Center as an anomaly. The role of the Project, these people maintain, is to experiment with the role of computers in education, not to provide word processors to the MIT undergraduate community. Few people within the Project expected undergraduates to flock to Project Athena for word processing services. Athena's technical support and equipment resources were ill-prepared to satisfy the unexpected demands placed on the Student Center cluster.

This conflict between "Athena as a service" and "Athena as an experiment" is at the heart of the Project's identity crisis. The conflict is also at the center of student dissatisfaction with the Project.

Attempts to publicly address this conflict have failed. A recent article in the Information Services newsletter protesting that "Project Athena is *not* a service" misses the point: Project Athena is both an experiment and a service.

For a faculty member developing and testing educational software on Athena equipment, it is essential that the Project provide a stable and reliable service. The faculty member's experiment depends on the Athena service.

In order for students to trust the system sufficiently to use it outside of an "Athena course," the hardware must provide responsive and reliable service. Athena's experiment of watching what happens when undergraduates are provided with unrestricted computing power depends upon students' acceptance of the system. At the present time, many students view Project Athena as the last choice when looking for computer resources on campus.

Until Project Athena realizes that it has become a *de facto* service and budgets for operations and consulting accordingly, student and faculty dissatisfaction will continue to rise.

Editorials, marked as such and printed in a distinctive format, are the official opinion of **The Tech**. They are written by the editorial board, which consists of the chairman, editor in chief, managing editor, executive editor, news editors and opinion editors.

Dissents, marked as such and printed in a distinctive format, are the opinions of the undersigned members of the editorial board choosing to publish their disagreement with the editorial.

Columns and *editorial cartoons* are written by individuals and represent the opinion of the author, not necessarily that of the newspaper.

Letters to the Editor are welcome. They should be typed and addressed to **The Tech**, PO Box 29, MIT Branch, Cambridge MA 02139, or by interdepartmental mail to Room W20-483.

Letters and cartoons must bear the authors' signatures, addresses, and phone numbers. Unsigned letters will not be accepted. No letter or cartoon will be printed anonymously without express prior approval of **The Tech**. **The Tech** reserves the right to edit or condense letters. We regret we cannot publish all of the letters we receive.

feedback

Anti-abortion is not "anti-choice"

To the Editor:

I am writing in response to the recent letter in *The Tech* referring to people who are opposed to abortion as "anti-choice" ["Pro-life poster misleading," Sept. 30]. I feel that the use of this term in those involved in the majority of abortion decisions.

Therefore, I shall examine the case of a healthy woman who finds herself pregnant. It is my position that this woman has *al-*

If one is pro-choice, one must also be in favor of accepting the consequences of one's choices, since any choice is a choice between different sets of possible consequences. In

opinion

Guest Column/Arthur P. Mattuck

Evidence of faculty racism questionable

The wide circulation of the Black Alumni Survey and the national attention being given to it have caused concern to me and some of my faculty colleagues. I refer to those quotations from alumni which accuse the faculty of racist behavior.

Dean For Student Affairs Shirley M. McBay urges the faculty to get beyond the "denial" stage and address the issue. I don't think we're denying the possibility of faculty racism, but I for one am unhappy with the evidence for it that was presented in the report.

When the report on sexual harassment came out, it struck resonant chords; we all knew faculty with sexist attitudes, and we had heard stories. By contrast, the minority report caught me and many of those to whom I have spoken by surprise; I don't know of any racist mathematics faculty, and have heard no stories.

It is against this no-rumor background that the report deserves some scrutiny. The comments are undated, and it is at least possible that some of the most inflammatory faculty behavior reported no longer reflects the current situation.

Are comments accurately remembered? If "you" is heard or remembered as "you people," a statement not intended as racist becomes so. The alumni comments are presented in a context which implies that they are accurate, with no apparent attempt to check on their validity; isn't the faculty entitled to its day in court?

For me, at least, this is not idle carping; such carping would be petty, directed at a report which obviously represents a sizable effort and whose topic is so serious. I offer three anecdotes from my own experience to illustrate why I am hesitant to accept the report at face value.

Several years ago the same Differential Equations (18.03) exam was given in two successive hours in Walker and it was necessary to clear the earlier students out before letting the new ones in. An Asian-American was slow in leaving, and we exchanged some harsh, but non-ethnic, words. Two years later I was startled to hear that his whole fraternity "knew" that I had a strong prejudice against Japanese students.

Many years ago, the mathematics department held up the graduation of a student; he felt this was unjust. A year later the case was discussed again in an Institute committee, and I was urged to give him his degree with "Look, you've already gotten your pound of flesh."

As it happens, I am Jewish and the student was obviously not. I was sure then and now that the faculty member who made the comment was and is not anti-Semitic, but after 15 years the memory is still fresh.

And, finally, in a recent meeting I remarked about certain difficulties that occur in running a recitation; several minority attendees heard me say that I and my colleagues "ask minority students easy questions," and were justifiably upset at what this implied about the faculty having low expectations of minority students. It isn't what I said and I don't have low expectations of any group or class of students.

The point of all this is the obvious one: whether we like it or not, in an emotionally charged situation there is difficulty communicating across ethnic or racial lines. What is said may not be what is meant, and it may be still different from what is heard. Care is needed in assessing reports of such situations, and some independent verification is called for.

As a faculty member, I certainly would like to know what the situation today is. If there are people who can give fair evidence, I'd like to hear it. Minority students should speak up if they feel faculty members are showing prejudice, and give everyone a chance to clear the air. Such speaking up can be to existing Institute offices, or to new ones if the administration feels they are needed.

Our department reaches all students, especially in their first year; I certainly hope and think that there are no difficulties of this sort in any mathematics classes, but if there are, I would like to hear about it.

(Editor's note: Arthur P. Mattuck is head of the department of mathematics.)

Column/Simson L. Garfinkel

Athena alternatives explored

Education, the final frontier. These are the voyages of Project Athena; its five year mission: to explore new networks and new configurations for high performance graphics workstations; to fund and to develop a new generation of educational software; to boldly go where no university has gone before! [music]

Not quite. If the goal of Project Athena was solely to integrate computers into the undergraduate curriculum, there were many other strategies that could have been adopted besides the one Athena chose.

If the goal of Athena was to get vendors to contribute large amounts of money and equipment to MIT, there were more efficient ways by which that goal might be been accomplished. If the sole objective was the development of courseware, that goal could have been achieved without involving the entire student body.

Still another option for the Institute in 1982 was to resist embarking on a campus-wide project under the grounds that the technology was not ready for such an project. This column attempts to explore each of these options. This column is not intended as a criticism of Project Athena; instead, it is simply an exploration of what MIT could have done in Athena's place.

Option 1: campus-wide timesharing computers

Project Athena was divided into two "phases." The first phase was the creation of a campus-wide network and the installation of approximately 50 VAX 11/750s. Each 11/750 operates as a timesharing computer using UNIX.

Phase II, which is just now starting, is the deployment of "workstations" around campus and the migration of user accounts from the timesharing computers to the workstations. Each workstation has nearly twice the computation power of a single 11/750.

The goal of using workstations has dictated the form and intensity of Athena's system development. Much effort was required in order to make workstations usable. From the beginning, faculty and students have been told to view their accounts on the timesharing systems as transitionary.

As an alternative, Project Athena could have chosen to remain with timesharing systems. The approach might have locked IBM out of a substantial part of the project, since IBM did not, until very recently, sell a computer similar to Digital's VAXes.

IBM's problems aside, Project Athena could have upgraded or replaced its 11/750s with Digital's newest VAXes (the 8600 and 8800 series). These computers can support between four and ten times as many users; they would have solved Athena's overcrowding and performance problems. The conversion would not have otherwise changed the way in which users relate to their machines.

With a stable and powerful computing base, the Project could have spent more effort responding to student and faculty criticisms. Instead of asking users to put up with poor services in the short term, using the excuse that workstations would be coming in a year or two, the Project

(Please turn to page 5)

The Tech

Volume 106, Number 54 Tuesday, November 25, 1986

Chairman ..... Ronald E. Becker '87
Editor in Chief ..... Harold A. Stern '87
Managing Editor ..... Mark Kantrowitz '89
Business Manager ..... Eric N. Starkman '87
Executive Editor ..... Michael J. Garrison '88

FEATURES STAFF

Cartoonists: V. Michael Bove G, Kevin J. Burns '79, Jim Bredt '82.

ARTS STAFF

Associate Arts Editor: Peter E. Dunn G; **Staff**: Allison J. Davis G

feedback

Doubts insufficient to denounce SDI

To the Editor:

In a column appearing in *The New York Times* on Nov. 11 and reprinted in *Tech Talk* on Nov. 19 ["Need seen for 'Star Wars' advisory panel"], President Emeritus Jerome B. Wiesner and Kosta Tsipis categorically attacked all pro-Strategic Defense Initiative scientists by referring to their support for SDI as a "syndrome."

Their argument against these scientists consisted of singling out one of them, Edward Teller, and attributing to him two errors in technical judgment made in the 1940s and 1950s. The implication was that past flawed judgment of one supporter of a cause discredited all who support the cause.

This is a very weak argument: certainly any worthwhile technological proposal will win the support of some people with poor technical judgment

of the many possible systems with which this policy could be implemented. In other words, support for defending the United States from ballistic missiles is not equilavent to support for building a satellite-based laser system.

Denunciation of one of the more exotic proposals for an SDI system should not be accepted as a valid substitute for a critique of the SDI policy. Nevertheless, Wiesner and Tsipis' acceptance of the popular, derogatory label "Star Wars" for all of SDI facilitates this substitution by making mention of the policy call to mind one particular vision which is then dismissed as "folly and foolishness." Other present and future missile defense technologies make doubts about satellite and laser techology insufficient cause to denounce the SDI policy.

Wiesner and Tsipis concluded Soviet Premier Mikhail Gorbachev's insistence that SDI must be written off before any treaty is signed, while they criticize Reagan's insistence on keeping SDI. Why not accept Reagan's insistence on preserving the option to defend the United States, and criticize Gorbachev for insisting that the United States give up its right to defend itself from missiles?

Wiesner and Tsipis were correct that the president must "seek serious, responsible and uncensored technical and scientific advice from a panel of the nation's most distinguished and trusted citizens, including scientists." Hopefully he will find people who will give due consideration to all technological implementations of the SDI policy, and hopefully such consideration will be based on evaluation of the ac-

opinion

Column/Simson L. Garfinkel

Athena system is too limited

A few weeks ago, a slide at an Lecture Series Committee (LSC) movie advertised a Project Athena minicourse. The audience hissed and shouted, "Project Athena sucks!" Obviously, students attending the movie did not have a very high opinion of Athena.

And how could they? When most MIT students think of Athena, images of the vastly overcrowded Student Center Athena cluster come to mind: a place where terminals are only available after 4 am, where printers rarely print and where the amount of file storage allocated to each student is less than the amount of space on an IBM PC floppy disk.

The Student Center Athena cluster is substantially overcrowded because it is the only cluster where accounts are open to all undergraduates. Accounts is in other clusters are available only to students enrolled in special subjects.

When the Student Center cluster was opened last year, Steven R. Lerman '71, director of Project Athena, expressed a hope that students would use their Student Center accounts to write educational software, called "courseware," and games. Unfortunately, the Student Center accounts do not provide users with enough file space for writing programs.

The goals of Project Athena were to investigate the ways in which computers could be integrated into the undergraduate curriculum, to write "courseware," and to construct a campus-wide computational facility.

Project Athena will not be able to realize these goals until it has provided students with adequate word processing facilities. "Adequate word processing facilities" include unlimited file storage, fast response time and easy access to equipment. Athena currently has the equipment to provide such services to its users, but has not done so.

If Athena provided all students with adequate word processing facilities, more students would obtain a familiarity and competence with the equipment. These students would then be more inclined to explore the courseware Athena hopes to offer.

Project Athena believes that students will explore the computer and use the courseware without the incentives of wordprocessing. To a large extent, this has not happened. Most students are shying away from Project Athena. This circumstance arises because most students don't believe the Athena ideology.

Students feel that they need to use computers for word processing. Students want to send electronic mail and play games. Some students want to write programs. Most students haven't given much consideration to the possibility of using the kind of "courseware" which the Project likes to think it is developing.

Most students I have spoken to do not welcome the intrusion of Athena into their subjects. Learning to use the "courseware" has not been germane to learning the subject, only to solving the particular problem set that was designed to be solved with the computer.

Athena's success will be measured by student use of the system in the years to come. If students use the courseware and the computers when given the option, the Project will have succeeded. At the present time, the only students who are using Athena freely are students who are writing papers. These students are being hampered, rather than helped, in their attempts to do so.

Project Athena should offer support to those who are using the system as was originally envisioned. Athena should make a substantial effort to support student word processing. Athena must open more clusters for general student use.

(Editor's note: Simson L. Garfinkel is a member of the Student Information Processing Board.)

.....Thomas I. Huang '86

.....Katie Schwarz '86
David P. Hamilton '88
Ben Z. Stanger '88
Earl C. Yen '88
.....Edward E. Whang '87
Mathews M. Cherian '88
.....Robert E. Malchman '85
Mark Kantrowitz '88
.....Jonathan Richmond G
.....Stephen P. Berczuk '87
.....Craig Jungwirth '88
.....V. Michael Bove G
Bill Coderre '85
Simson L. Garfinkel '86
Carl A. LaCombe '86
Sidhu Banerjee '87
Andrew S. Gerber '87
Michael J. Garrison '88
.....Ellen L. Spero '86
Steven Wheatman '86
.....Robert E. Malchman '85
ative .....Carl A. LaCombe '86

EWS STAFF
ndrew L. Fish '89; **Staff:** Joseph J. harles R. Jankowski '88, Robie Silber- '89, Dorit S. Brenner '89, Derek T. '89, Jeffrey C. Gealow '89, David C. Pao '89, Irene E. Skricki '89, Sally a '89, Anuradha Vedantham '89, Anh andor W '88. **Meteorologists:** Robert organ '88.

X. Black G, Michael ...

OPINION STAFF
Columnists: Scott Saleska '86, Randy Hertzman '88, Mark McDowell '88, Daniel W. Pugh '88, Alan Szarawarski '88, Elliot Marx '89

...will bring that to the district, as we will ...e district. ...eople who ...utton was ...n College, ...lered how ...His point ...the small

...at he was

...at the people in the district would ...fact that I was the most experience ...t the issues that I was working on we ...ople in the district. What he was sa... going to look at race and not be res... ...e issues and the experience. I would ...elieve and have faith that people wo... ...he basis of my expertise.

...[would my election] do on a nation... ...be of real significance when the De... ...ngress and the country see that this ...rson who is black. That is going to s... Democratic Party, which has been m... ...ey, they've elected a black person, a ...n Massachusetts." That ought to sa... ...what is possible to happen, so that's ...ct in terms of the party and the Con... ...sis.

...led for protests against Gramm-I... ...pell out your opposition to that?

...been happening under this admin... ...ot faze the team, ...ueled them on. Craig Gilchrist

...other colleges, ... gress to get the South Africa th... to understand ... United States f...

Q: *How about ... should we be d...*

A: Obviously, th... porting the *cont...* be willing to sit ... als; the Nicarag... relate to them.

And thirdly, ... President José N... to bomb the peo... people in the Uni... cumstances in So... there can be som... kets, the issues a... really not the fe... themselves: why i... order to change t... is: because of the ... tion that have gor...

Q: *The United St... control proposals ... ing the other's. Do ... been made are c... theirs?*

A: I am not really ... posals; I think the ... Are we pursuing p...

It seems to me ... Union, given its ec... thing that allows f...

Sandinist... and perse...

To the Editor:

There has been much dis... sion recently about the Sandi... government of Nicaragua ... supposed human rights vi... tions. I would like to set ... matter completely straight. ... Sandinistas are definitely ... Semitic. During the revolu... they persecuted the Jews ... forced them to abandon ... country.

I know. I am a Nicara... Jew. In 1979 my family ... threatened with death by a S... nista agent. He brandished a... and said that if we did not ... the country we would be kil...

Slogans like "Death to ... Jewish pigs" apppeared on ... around Managua. The Te...

opinion

Column/Simson L. Garfinkel

Athena's inequities must be changed

A few days ago, I listened to Cathy (not her real name) explain to a professor how she uses Project Athena for word processing. Cathy has an IBM PC Junior in her dorm room, but no printer. She composes her essays on the PC, rather than on Athena, because "Athena is too slow," and because she does not have enough file space to store all of the projects she is working on.

When she is finished with the essay, she takes a disk to the Project Athena cluster in the Student Center, transfers it to one of the VAXs and prints it out. The problem is that to transfer the file, Cathy must use one of the IBM PC terminals in the Student Center, which are rarely available until after 4 am.

Gene (not his real name) doesn't share Cathy's problems: Gene is a Project Athena student staff employee. He has an account on every Project Athena VAX in every cluster. When Gene starts to write a paper, he scans every cluster and finds the one VAX with the lowest load and uses it for his editing. Gene keeps everything he has written for the past two years on different Athena machines; although his file space on any one machine is limited, accounts on every machine means that Gene effectively has unlimited storage.

Cathy and Gene are representative of two classes of users that Project Athena has created with the "cluster concept." Briefly, every Athena user is given an account on one or more VAXes. Each VAX resides in a cluster. A terminal in one cluster can be used to connect to any computer in that cluster. Terminals are restricted, however, from connecting to computers in other clusters unless the user has an account in both clusters. This restriction is arbitrary, the result of an early policy decision by Project Athena staff.

Project Athena staff imposed this restriction to prevent students in an Athena course which had a problem set due the next day from monopolizing every terminal in the Athena system — instead, they would only monopolize the terminals in one cluster.

At the time, those implementing the restrictions decided against the alternative solution: simply restricting the total number of users allowed to log onto each VAX at once. Although the complexity of the two solutions was roughly equivalent, Athena opted for the solution which prevented users from using terminals in clusters in which they didn't have accounts.

It is important to understand that the concept of having Athena accounts assigned to a particular cluster was the result of a strategy for managing resource

(Please turn to page 5)

The Tech

Volume 106, Number 19 Tuesday, April 15, 1986

Chairman ..... Ronald E. Becker '87
Editor in Chief ..... Harold A. Stern '87
Managing Editor ..... Eric N. Starkman '87

Guest Column/

Does socie scientifica

Did you ever dream as a ch of travelling through space, vi ing all the different planets a stars and exploring worlds al to our own? I used to dream this all the time. I thought h exciting it would be to gaze at icy landscape of a frozen mo or the hot and dusty surface o planet revolving around a giant.

I still remember the first tim looked through my telescope saw the craters of the moon was amazed at the clarity of view and how I could really the dark side of the moon. I remember the satisfaction I when I found Saturn among myriad of stars and was able see its rings.

I no longer have that telesco I no longer have the microsc which I had used to look at ion skins and dragonfly wi Saddest of all, I no longer exp ience innocent fascination observing nature and learn science. Now, it is a rare ev for me to gaze at the stars dream of other worlds.

I think this change in me be as far back as high school. I most teenagers in this countr went to a public high school suburbia. Although I had w derful teachers in mathema and science, the students in g eral were not particularly in ested in science or nature. them, football and cheerlead were more important, and their minds, being sensitive observant to nature was eq alent to being a nerd. E though I was a member of track and soccer teams, I co not help but feel their anta nism.

After I moved to Cambridg study, I thought my loss of fa nation with nature was simply result of the urban environm but something inside me sai was something else. Occasion I placed the blame on the h work load of MIT, and to a tain degree that was true constantly hear that people no time for hobbies or extrac cular activities because of work load.

opinion

Athena's class structure can be fixed

(Continued from page 4)

overload. The side effect — restricting users of one computer to a given physical workspace — was never part of the original cluster concept.

Athena's student hierarchy has largely been created by the cluster concept. Most students using Athena only have an account in the Student Center: these students make up Athena's lower class. Athena's student middle class is composed of students who have course or UROP related accounts in one additional cluster. Lastly, the cluster concept has created a student technological elite who have accounts everywhere.

Students in Athena's lower class have no choice of where to work: If they wish to use Project Athena they must use the overloaded Student Center machines — even if they live on the east side of campus. Students in Athena's elite have the choice of where they wish to work, which computer they wish to work on, and where they want to store their files. Students in the middle class fall between these two extremes, with differing options and availability of resources for each person.

Although students are technically forbidden to allow other students to use their accounts, often those with accounts in several clusters will allow their friends, who may have accounts only in the Student Center, access to a better account. While such covert action helps to minimize the inequalities of the system, in the end it hurts students who don't have friends with such access.

Athena should not be in the business of creating class distinctions between MIT students. If the formation of a class structure is inherent in the nature of the computer system being designed, then the design should be modified to minimize the differences between the classes, not reinforce them. I believe that unless changes are made now in Athena's policies, the new equipment which is expected to arrive in the following months will only serve to magnify these differences.

Athena could take a number of steps to minimize the differences between users:

- Instead of attempting to limit the load on a VAX by preventing students from accessing it from clusters in which they don't have accounts, the "login" program could be modified to prevent users from logging in when the load is above a preset limit.
- Student staff who must, by reason of their job, have accounts on every Athena VAX, could have their file space quota severely restricted on all but a few machines. The reclaimed space could be reapportioned to students who only have accounts in the Student Center.
- Further and substantial amounts of file space can be made available by deleting the files of students who have graduated.
- Staff modems which are currently prohibited from student use could be reprogrammed to allow student use during certain hours of the day, or whenever there are two or more modems available.

Until now, students have either lived with Athena's class structure or minimized its personal impact through subversive means. The time has come for Project Athena to equalize the differences between the classes, rather than perpetuate an unjust situation.

classified advertising

Meet someone special from another school. Provide: Name, address, phone, school, major, details, $16.50. College Romance, P.O. Box 662, Brookline, MA 02146.

Summer Sublets Wanted
Visiting profs seek furnished apts/homes 7/1-8/31. Will consider monthly arrangements. Cambridge-Harvard Sq. preferred. Call Kirsten Davis 868-3900. M-F, 9-5.

COUNCIL TRAVEL/CIEE
For Int'l Student I.D., Low cost flights USA and Worldwide, Work and Study Abroad and more!!! FREE Student Travel Catalog! Call 497-1497 or drop by at 1384 Mass. Ave., Harvard Square, Cambridge, MA 02138.

". . . $30K Star
. . . Please ser

It's that time of year
Companies all over
graduates — and the
professional-looking resur

We at *The Tech* can
you a beautiful copy
high-quality photocopying
typefaces to choose from
design your resumé. Call,
to our Production Manag

GRADUATE
CALL
1-800-457-40
FOR $400 AN
PRE-APPROV
CREDIT ON
NEW FORI

Human-powered flight: Daedalus seeks record

By Robie Silbergleit

Technology

Daedalus, the archetypal engineer of Greek mythology, escaped the labyrinth of King Midas by flying out with wings he built himself. He was the only mortal in ancient mythology to fly without divine assistance.

Project Daedalus, an undertaking jointly organized by MIT and the Smithsonian Air and Space Museum, may transform the Greek myth into reality. The project's developers seek to construct a craft capable of setting new world records for human-powered flight distance and duration.

"The Daedalus myth represents the dream of flight," said Stephen R. Bussolari '83, assistant professor in the Department of Aeronautics and Astronautics.

The group hopes by the spring of 1987 to make the craft fly 70 miles in about 4.5 hours, according to Bussolari, a member of the Daedalus working group. He discussed the project in an IAP lecture Jan. 17.

The current record for human-powered flight distance is held by the Gossamer Albatross craft, which flew 22.5 miles across the English Channel. The Monarch B, a human-powered aircraft built at MIT, set the world speed record for human-powered flight — approximately 22 mph — at the Kremer World Speed Competition in 1984.

The Daedalus aircraft, like the mythological character, will fly from the island of Crete to the Greek mainland, Bussolari explained.

The Daedalus project has three goals, Bussolari continued. The first is the study of Daedalus, Western civilization's most prominent mythical engineer. The second is to explore new levels of human physiological achievement. Finally, the project will utilize new advances in aeronautical engineering.

The Daedalus team hopes to take away the distance record from the Gossamer Albatross by designing a better airplane and by flying in more favorable weather, Bussolari said. The Albatross fought against a substantial head wind during most of its record-setting flight.

The design goals of the Daedalus plane include a 70-mile range, 15 knot speed, the ability to fly at night or in light fog, and a structure that can withstand about three times the force of gravity, Bussolari said. One prototype design of the craft has a wingspan of 31 meters and a mass of only 31 kilograms obtained using an advanced carbon fiber structure.

The pilot will provide three watts per kilogram of body weight. "That's like riding a bicycle on level ground at 20 mph for 4.5 hours," Bussolari observed.

The project will soon finish its feasibility study phase and enter the design phase, he said.

Look, in the sky!!! Pede Mass Ave Monday night to a rare event: firewor atop building 7, laste surprised the unknowin who learned of the eve ered in front of the S festivities.

MIT professors discuss future of US economy

By Earl C. Yen

In the coming years, Americans may suffer a decline in how well they live and how many things they can buy, said George N. Hatsopoulos '49, senior lecturer in the Department of Mechanical Engineering.

Hatsopoulos' prediction was one of several gloomy forecasts of the United States' economic future made in a Jan. 14 panel discussion on "American in the World Economy."

"Employment in the manufacturing sector has been declining for several years," Hatsopoulos observed. He predicted that a shift from a manufacturing-based economy to a service-based one would cause a decline in the standard of living.

On the average, service jobs are only half as productive as manufacturing jobs, he estimated. A lower productivity would reduce America's share of goods produced in the world, he continued, warning that such a reduction would place "our growth in standard of living in a very precarious situation."

(Please turn to page 10)

Physicists discover

By David P. Hamilton

Technology

Physicists at Purdue University believe they have discovered a fifth elementary force of nature. This postulated force, named hypercharge, may oppose the force of gravity.

Dr. Ephraim Fischbach and his colleagues have reinterpreted the results of the experiments of Roland von Eötvös, a Hungarian scientist of the early 20th century. Eötvös' work involved a test of the principle of equivalence, an Einsteinian postulate stating that gravity affects objects indepe dently of their composition. Eö vös found a small but systemat error in his calculations and d clared a null experiment.

The principle of equivalence one of the fundamental assum tions of Einstein's Gene Theory of Relativity. Even verification of hypercharge is u likely to seriously affect the pr ciple, according to Peter Sauls a principle research scientist the MIT Department of Physi

Fischbach declared in the J 6 issue of *Physical Review Lett* that Eötvös' error is systema enough to prove the existence an ephemeral force opposed that of gravity.

Saulson said that Fischba had found an "astounding good" correlation between t degree of the error and t baryon number of the tested m terials. The baryon number of material is equal to the to number of protons and neutro in its nucleus.

The extremely localized eff of the hypercharge force wou not significantly damage the th ory of relativity, Saulsan said.

Unlike gravity, whose effe seem to extend to an infinite d tance, hypercharge appears have a finite range of appro mately 200 meters, he continue

Two other elementary forc

Athena to use RISC machine

By Simson L. Garfinkel

International Business Machines (IBM) announced yesterday a "relatively new approach in computer architectures" involving reduced instruction set computer (RISC) technology that will be the basis for the Project Athena Phase II IBM workstation, according to Charles Salisbury '64, an IBM visiting engineer working with Project Athena. The IBM RT PC will be aimed at the engineering/science marketplace.

Microprocessors in traditional computers, such as the Digital Electronic Corporation VAX series, have several hundred instructions. Not all instructions are able to execute in one cycle. RISC machines have a small number of instructions, each executing in one machine cycle. The microprocessor in the RT PC has a little more than 100 instructions. These machines can be easily pipelined to increase the average computational speed.

Admissions seeks to cut class size

TODAY -- NO CLASSES

eTech

MIT
Cambridge
Massachusetts

Friday, September 27, 1985

Reorganization of the Provost's Office

John M. Deutch '61, Provost.

Samuel J. Keyser, Associate Provost for Educational Policy and Programs.

Frank E. Perkins '55, Dean for Graduate Education.

Shirley M. McBay, Dean for Student Affairs.

Margaret L. A. MacVicar '65, Dean for Undergraduate Education.

Tech Graphic by Andrew S. Gerber '87. Tech photos by Mike J. Feldman '88.

Student breaks Athena security

By Timothy Huang, Simson L. Garfinkel and Craig Jungwirth

Several students discovered a Project Athena security breach on Sept. 18 at the cluster in the Julius A. Stratton '23 Student Center Library, according to Project Athena Director Steven R. Lerman '72.

An MIT student, who Lerman declined to name, had written and left running a "Trojan horse" program on one of the terminals in the cluster. The program emulated the normal Athena login procedure, but actually recorded the usernames and passwords of students attempting to use the terminal.

The term "Trojan horse" is commonly used to describe programs which appear to perform one function but actually perform another, such as recording a person's password.

Project Athena staff immediately disabled the program and identified the offending student when the "Trojan horse" program was discovered. No serious damage resulted from the incident, although the potential for damage was great, according to Lerman.

The offending student obtained some usernames and passwords, he said. Affected students have been advised to change their passwords.

Lerman does not know how long the program was running in the cluster. There is no evidence that the student used any of the passwords he obtained, according to Lerman.

The offending student has stated that he will never again violate Project Athena's security policies. Lerman added that Project Athena condemns such use of its resources.

Lerman will decide on an appropriate punishment for the student. He is considering revoking the offending student's Student Center cluster account.

(Please turn to page 2)

relocate

The Tech Coop's lease on its space in the Student Center expires in June 1986, according to the MIT Real Estate Office. One member of the Coop Board of Directors said, "The Coop should not consider itself under any obligation to keep a store in the MIT Student Center," according to the minutes of the June 19 meeting of the Executive Committee.

Committee on Discipline to develop policy on computer resources

(Continued from page 1)

There is no precedent for such disciplinary action because there have been no security violations of this type before, Lerman added. The Committee on Discipline (COD) will consider the case and issue a ruling only if the student decides not to accept Lerman's decision, he said.

The COD will not review the breach in Project Athena's security unless a complaint is filed by a member of the MIT community, according to COD Chairman Elias P. Gyftopoulos '58. "We do not take the initiative to create a case against a student," he said.

"I think that the response to the individual incident has to be tailored *to the* particular incident," said Project Athena Technical Director Jerome H. Saltzer '61. "You can't generalize. I think that rifling through a person's files without permission is something very comparable to going through their desk without permission."

"It is certainly unethical" for a student to write a "Trojan horse" program, Saltzer said. "That is the reason why the Athena statement of principles of responsible use points out explicity that one should not do this."

"To do a really simple 'Trojan horse' program is an easy task," said Henry N. Holtzman '86, MIT Media Laboratory's system programmer.

A "user can never tell that he has been 'Trojan horsed' " by a "good Trojan horse" program, he said. A bad "Trojan horse" program is *one that* gives "bogus error information," he continued.

"If somebody wrote a good Trojan horse, it would have been *the curiosity* that it could be written. But why would they run it? To actually go ahead and set up a break-in has got to be some sort of mania," Holtzman added.

Lerman said that the UNIX operating system used by Project Athena is not very secure. "Students should change their passwords periodically . . . about every month. Also, students should use long passwords: at least four, [but] preferably eight, characters," he said. "Passwords should not be common words like names. Instead they should consist of strange characters."

"I think that the protection provided by the Athena systems is very comparable to the protection provided by a doorlock in a dormitory," Saltzer said. "If you come to a locked door, you know that the owner of the room doesn't want you to enter it. If you have burglary tools . . . [or] happen to know how to pick locks, we don't provide terribly high security locks on our dorm room."

"As a dorm resident, you would not keep millions of dollars in diamonds in your dorm room," he continued, "because you know that the security is not appropriate. But at the same time, you might keep your textbooks there.

"I think that the protection afforded by the Athena system is similar in that it provides a way for users to mark information as private and those privacy marks should be respected by everybody else, even if someone happens to have special knowledge that would allow him to bypass the usual protection systems."

Others working with computer systems at MIT feel that no amount of computer security is sufficient. "In general, whenever people are dealing with any computer system, they should assume that anything stored on the computer is readable by anyone," said William C. Saphir '86, chairman of the Student Information Processing Board.

"Users should not assume that anything on the computer is protected from anybody else. As long as people take this attitude, then no damage can really be done," Saphir added.

Sensitive files, such as administrative records, are not kept on Project Athena. They are kept on systems with guarded terminals and no telephone dial-up access, according to Lerman.

MIT is currently developing a policy pertaining to theft of computer resources or information, according to COD Chairman Gyftopoulos. He declined to comment on the proposed policy because it "may change as the result of" current discussion.

"Eventually, the Institute is going to have to develop a position that is uniform and understood. At this point, many of the organizations such as Athena have suggested positions with respect to [malicious] behavior," Saltzer said, "and I believe that the privacy committee has said things in the past which are consistent with this approach."

classified advertising

ANGRY STUDENTS WANTED
$200-$275/week
Are you upset about the high cost of phone rates, auto insurance and health care? Do environmental and voter registration issues concern you?

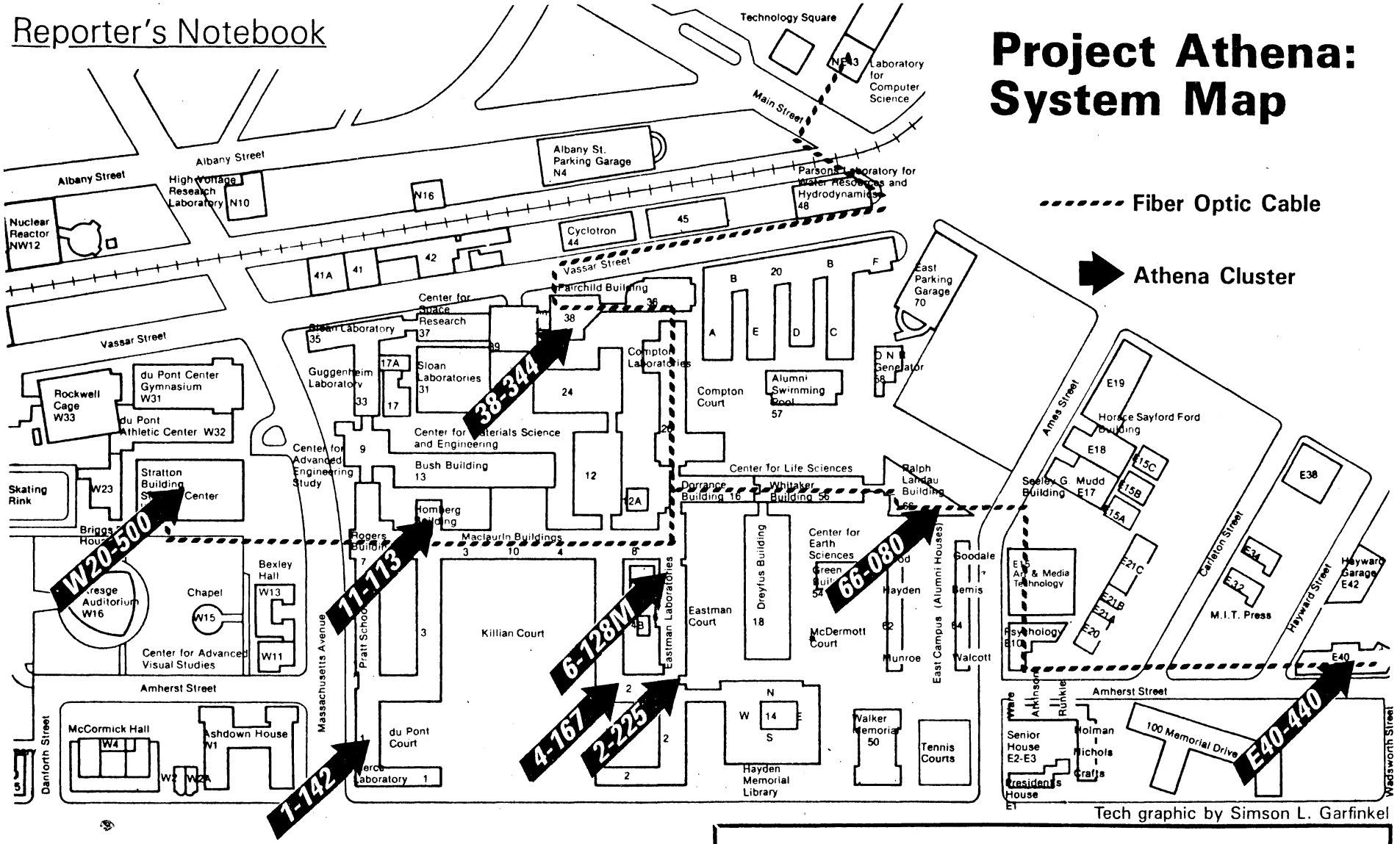
FIGHT BACK
Mass. Fair Share, the largest statewide citizen action organization, is currently hiring articulate, energetic students for its fundraising and public outreach staff. Full-

HAND-TAILORED CLOTHING at off-the-rack prices! Customs suits for men & women ($220-$250). Top quality fabrics (over 5000) to choose from. Serving Harvard & MIT for over 13 years. 100% Satisfaction Gurranteed! Call Bill at Harvard Custom Clothing - 259-1214 for appt, info, or reference.

PIANO LESSONS, composition, music theory, offered by Rhys Scott. Experienced teacher - playing and composing since 1954.

Reporter's Notebook

Project Athena: System Map



Tech graphic by Simson L. Garfinkel

Athena at MIT

Analysis

By Simson L. Garfinkel

Project Athena is a five-year experiment. As a result, major changes have been made in mid-stride. This has caused the system to evolve differently from original predictions and promises.

IBM has often failed to meet deadlines.

The IBM PC/XT was to be a shell within which the IBM Athena workstation was to be built. High-speed co-processor cards and high-resolution graphics boards were to be piggybacked onto the IBM PCs.

These plans fell through because of problems with the co-processor card. An idea was then proposed to network the

Athena calendar

Compiled By Simson L. Garfinkel

Project Athena has been a part of MIT for almost two years. Projections made in the early days were not always accomplished. Here is a summary of what officials in the project have said, and what has happened.

May 27, 1983

MIT announced Project Athena, billing it as a large-scale experiment in in-

Wilson said that Athena plans to connect the 500 IBM PC/XTs it expected to receive in 1984 in five to eight local networks by September of that year. Each network would have an IBM 4341 mainframe acting as a file server.

Wilson added that use of word processing facilities in April and May would be restricted. "If every student who had something to write used Athena," the use would overload the sys-

made when Athena was first announced in May 1983 were unrealistic. Athena was to increase by more than an order of magnitude the amount of computer power at MIT. The project would give the Institute three thousand more terminals.

The networking would be so transparent that the system could be viewed as one large computer, with thousands of users working simultaneously. Alternatively, the final system could be viewed as thousands of personal computers, all sharing common disks, printers and other resources.

Although Athena has accomplished remarkable feats, it has fallen behind its original schedule.

From the beginning, "coherence" was a key goal of Athena. Programs written on the IBM equipment had to run on the DEC equipment, and vice versa. The final system of three thousand terminals and workstations was to consist of both DEC and IBM equipment. "Coherence" meant that the entire system had to run together without any problems.

Today, almost two years into the project, Athena has gone a long way toward accomplishing many of its goals.

Five Microvax I's, 44 VAX 11/750s, and one VAX 11/780 serve 243 operational terminals at nine clusters. Many problems not anticipated have been uncovered and solved.

Athena's Failures

Although Athena has accomplished remarkable feats, it has fallen behind its original schedule. The current system bears only partial resemblance to its 1983 forecast.

Athena announced in the summer of 1983 that by January 1985 between five and eight IBM clusters consisting of over 500 IBM Personal Computers would be available for campus use. Athena also planned to give accounts to every undergraduate by that time.

Part of the reason behind the equipment shortfall lies with one of Athena's two major suppliers: IBM. According to sources both inside and outside of the project, The 4341s would have acted as file servers and network managers. IBM's role in Athena had to be rethought, over the summer of 1984, when it was decided that Athena would not be receiving the IBM 4341 mainframes the project had intended to use.

The IBM 4341 mainframes were cancelled for a variety of reasons. Foremost, Athena was not able to support the machines. Supporting these machines requires a specially trained group to operate and maintain the computers' hardware and software. Athena was already severely understaffed.

Additionally, single 4341 mainframes would have required more floor space than Athena had available for entire clusters.

But officially, Athena cited technical problems as reasons for scrapping the 4341s.

The Use of PCs

Although Athena is using 63 IBM PC/XTs in the clusters, the XTs are running terminal-emulation programs that make them functionally equivalent to Heathkit H19 terminals. The Heathkit terminals cost almost a fifth of the price. While students can run private software on the IBM PC/XTs, not many do. There is no official program to encourage this use.

There have been marginal benefits to using IBM PC/XTs as terminals. They are more rugged than most terminals. In addition, students may use the PCs floppy disk drive to augment their file storage limit by storing data on removable floppy disks.

This ability is important in light of the restrictive limits on file space in the new Student Center cluster [see Jan. 23, 1985 entry in accompanying Athena calendar]. Currently, two floppy disks will hold more information than the standard Student Center account.

The remaining PC/XTs Athena received are used as independent computers, and are not in place in the clusters. Some laboratories use the PCs as data acquisition devices. Other PCs are being used to run special stand-alone programs such as drafting software in the Department of Architecture.

The ultimate disposition of the project's 150 IBM PC/XTs has yet to be determined.

(Please turn to page 17)

integrating computers and interactive graphics.

International Business Machines Corp. and Digital Electronic Corp. would provide five employees each to the project. Between them, the companies would donate almost $30 million in equipment to MIT.

MIT was expected to raise an additional $20 million for the project on its own.

Gerald L. Wilson '61 said that Project Athena expected to receive 63 DEC VAX 11/750 and 11/730 minicomputers over the next two years, and 1600 advanced personal computers by 1988.

IBM was to provide 500 PC/XT's in the next two years, and another 500 advanced single-user systems by 1986.

DEC equipment would be used solely by the School of Engineering. The remaining schools, and the freshman class, would use IBM machines.

September, 1983

Prof. James D. Bruce '60, Athena's director of equipment installation, said that DEC had delivered 75 personal computers, terminals and workstations, and that another 75 were expected by the end of the term.

Negotiations between MIT and IBM began six months later than those with DEC, resulting in a delay in IBM's first shipment of PCs, which were now expected to arrive in January 1984.

Bruce said that the first phase of the project would be finished by September 1984, when 800 machines from the two companies were installed. At that time, IBM's computers would be connected in a network.

The final system, scheduled for completion in 1988, was expected to consist of 3000 machines.

Mid-October, 1983

MIT had acquired $5 million out of the $20 million it had to raise for the project.

The Project Athena Committee released in September "An Introduction to Project Athena," a report detailing its plans for the next five years.

The system would be "available to interested undergraduate students and faculty" by the end of the month (September 1983), according to the report.

tem, he explained.

Joel Moses PhD '67, head of the Department of Electrical Engineering and Computer Science, said at a faculty meeting that the initial Athena system would consist of UNIX, EMACS, Scribe, FORTRAN-77, C, LISP and Pascal.

February, 1984

Steven R. Lerman '72, director of Project Athena, said that "by January [1985] every undergraduate will receive an account for the Athena system."

Ramin Zabih '85, chairman of the Student Information Processing Board at that time, asked Athena to install terminals in the Student Center library. Bruce said that he was considering installing 70 to 80 terminals along with supporting minicomputers and a mainframe computer.

Two clusters were functioning at this time, in Buildings 1 and 11, according to a report in *Tech Talk*, and one was soon to come up in Building 38.

Athena promised eight DEC clusters, with 300 terminals, by December 1984.

In addition, there were to be eight to 10 IBM clusters operational by December. "Planned sites include East Campus [Sloan School] and the Student Center," said Lerman.

By this time, most of the software Athena had promised was in place, but more was needed. Lerman hoped to have most of the software by September 1984.

"We are in the process of negotiating for a statistical data package, a major graphics package, a complete business text processing system, a spreadsheet program, and software in symbolic math and database management," he said.

Summer 1984

Lerman announced Friday, July 27, that clusters in Buildings 38 and 66 would be on line in time for the fall semester, with the Student Center cluster due in September or October.

"Terminals will be woven in through the stacks, and the carrels will be converted to combination carrels and work stations," Lerman said.

(Please turn to page 17)

Athena Calendar

(Continued from page 16)

He said that clusters in Building 6 would be the next to go into operation. "These will be smaller, IBM-based clusters, with only 12 or so terminals," he said. "They will start with PC's and gradually evolve to more sophisticated, networked terminals."

Lerman said that the system would eventually have 2600 workstations and terminals (down from the September 1983 estimate of 3000 terminals).

October 17, 1984

Jerome H. Saltzer '61, professor of computer science, was appointed technical director for Project Athena.

Saltzer was to be reponsible for the technical design of the system, according to Lerman. Lerman would remain the project's director, overseeing the operation's management issues and faculty grants.

October 30, 1984

Lerman admitted that Athena was "behind the schedule we were supposed to meet." The opening of undergraduate accounts would be delayed until February 1985.

The Student Center cluster would be opened in November, and not September or October as previously announced, Lerman said. The cluster would contain 30 DEC terminals, 30 IBM PC's running terminal emulation programs, and DEC VAX's. Lerman predicted it would have 107 DEC and 73 IBM terminals by the end of the term.

Lerman blamed IBM for the delay, saying that the change came about when the plan to use IBM 4341 mainframes to network the PC's was scrapped. He explained that the IBM mainframes were not designed to serve other computers but were designed to function independently.

A new plan to incorporate IBM equipment was announced by Ler-

Athena: the five-year experiment

(Continued from page 16)

While Athena will likely meet its latest deadline to offer accounts to every undergraduate in the Student Center cluster, nobody knows what computing environment will result.

Most feel that while the Athena VAXs in the Student Center will be slow due to the high user load, they will still be faster than MIT's Honeywell MULTICS, the computer on which students have traditionally received free accounts for text processing.

Athena's Triumphs

The Athena staff has had a number of major triumphs in its two years of existence. The list includes:

- **X:** *The development of a networked window system (named X).* "X has been developed from essentially nothing," Douglas J. Wilson '78 said. Robert W. Scheifler '76, a staff researcher at the Laboratory for Computer Science, brought X into its final form. DEC has done additional work on the project and may market the program in the near future.
- **UNIX:** *The debugging of the majority of the UNIX operating system.* The source code supplied with the Berkeley Standard Distribution 4.2 UNIX operating system did not match the object code files which accompanied them. When the source files were compiled, they did not run properly. David G. Grubbs '76, Athena Systems Programmer, spent a considerable amount of time getting the operating system to compile and operate.
- **Reliability:** *The development of one of the most stable UNIXs in existence.* Athena machines rarely crash, and typically run until shutdown for maintenance.
- **Third party software:** *The debugging of a large body of third party software.* Although Project Athena has purchased and been given a good amount of third-party software, much of it has had to be debugged to get it to function properly.
- **Hardware installation:** *Installations of nine terminal clusters and six machine rooms across campus.* Athena has installed nine terminal clusters across the MIT campus, with almost 250 terminals total. Along with Information Services, it

Athena Clusters
As of Feb. 2, 1985

Cluster	VAXs	Terminals	Vax Stations	IBM/XTs	Max. Users	Local Printer?
1-131	7	19[1]	8	1	28	yes
2-225	1	0	0	8	8	no[2]
4-167	1	0	0	8	8	no[2]
6-218M	2	0	0	15[4]	15	yes
11-113	6	19[3]	7	0	26	yes
38-344	5	12	4	0	16	yes
66-080	9	28[5]	2	5	35	yes
W20-500	6	20	12	10	42	yes[6]
E40-440	6	27[7]	20	18	65	yes
Total	43	125	53	65	243	

Notes:
[1]Includes 6 DEC PRO/350 Computers being used as terminals
[2]Users can pick up printed output from printers in other clusters
[3]Includes 8 DEC PRO/350 Computers being used as terminals
[4]The Building 6 Cluster also includes 8 IBM PC/AT computers
[5]Includes 8 VT100 terminals from Joint Computer Facility
[6]The Student Center Cluster also has a user-accessible tape drive.
[7]Includes 5 DEC PRO/350 Computers being used as terminals
(All figures are the result of direct observation on Feburary 2, 1985)

"gateways" for use on the campus network. Until the Codex gateways are ready, Athena plans to use Microvaxes and PDP 11/23s as necessary.

Looking to the future

Athena is about to release a remote procedure call (RPC) compiler. This software package would allow programs running on one computer to call subroutines running on another computer. The release, which will include a complete programmer's manual, is scheduled for later this semester, according to Wilson.

The RPC compiler will allow programmers to "build distributed applications without knowing anything about networking," Wilson said.

to log onto any other Athena host, while the TFTP enables file transfer between the two machines, according to Wilson.

There could be a major change this fall in the way student accounts are distributed, Wilson said. Clusters in the Student Center, and Buildings 1 and 66 will most likely be dedicated to student use.

Course material will reside on special computers in these clusters, rather than in special clusters for courses as is now the case. Students will no longer own an account for each course they are taking. Instead, they will have one account with access to all course material they desire.

Conclusion

A conflict between the need to build a stable campus computing resource and the

man that called for the use of IBM PC/AT's. Athena already had 80 AT's, and an order was placed with IBM for another 80.

Eventually, Athena would switch away from the PC/AT's to more advanced workstations, Lerman said. These would consist of 32-bit processors, high resolution displays, one million bytes of memory and would run UNIX.

November 29, 1984

At a Project Athena forum, Lerman said that any undergraduate who wanted an Athena account would get be able to one by spring term, 1985. These accounts would all be located in the right wing of the Student Center Library.

Lerman said that there were currently 1600 Athena users, a number which he expected to double in the spring.

Lerman added that living groups would begin to get equipment in late 1986, and that it would take 1½ years to install all of the equipment.

Janurary 23, 1985

Lerman pushed back the date that undergraduates would receive accounts to March 1985, saying that he would announce the opening with slides at LSC movies and announcements in *The Tech*.

Student storage would be limited on the new system. Most students with course accounts have 2.5 megabytes of storage, but the new accounts will only have 250 to 500 kilobytes, enough for 150 to 300 pages of typed text.

Cecilia R. D'Oliveira '77, manager of user services for Project Athena, said that delays were largely caused by the desire not to use IBM PC/XT's as computers but to wait for more advanced equipment.

"We are planning on using up to 200 PC/AT's to carry us through this year," she said, with 63 being used by faculty and Athena staff.

IBM placed a hold on the remaining shipment of 80 AT's until May, due to suspected hard disk problems. 17 of Athena's AT's have not been released, for similar reasons.

has installed a campus fiber optic network which extends from 545 Tech Square to Building E40, with connections to Buildings 4, 11, 38, and the Student Center.

Athena Today

According to Doug Wilson, Athena is expecting 2700 users this term. Last Thursday, Athena registered 50 students an hour for course accounts.

Codex Inc. has joined IBM and DEC as a primary Athena hardware supplier, according to Wilson. Codex will design, with Athena staff, a new generation of network

MIX, a new database system.

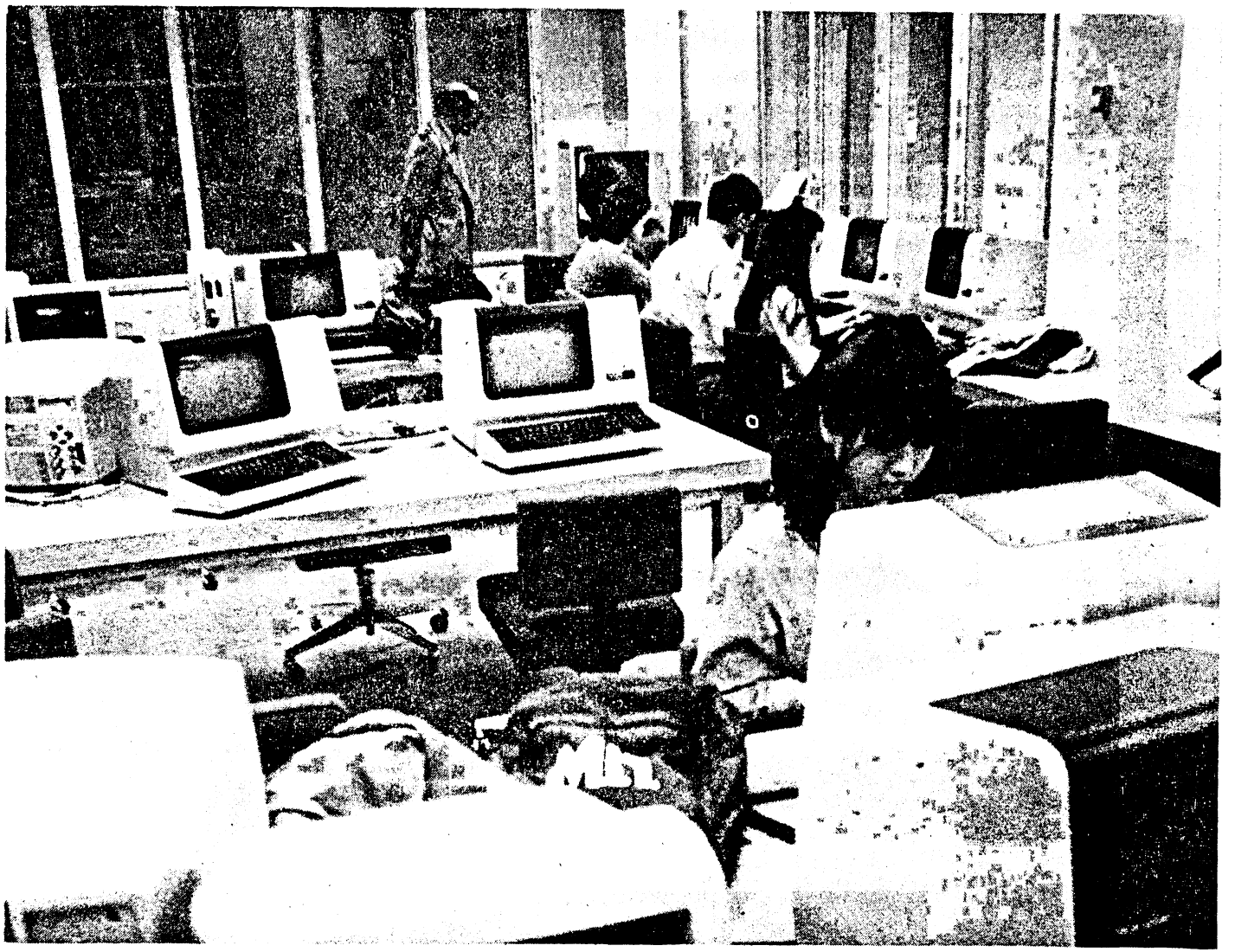
The project awaits the delivery of 80 IBM PC/ATs. These machines will run XENIX, a version of the UNIX operating system. Larry W. Allen, a staff researcher at LCS, recently wrote programs to allow the PC/ATs to communicate over the Athena network. IBM's Yorktown Heights research laboratory modified the programs at Athena's request.

The PC/ATs will support TCP/IP protocol as well as TELNET and TFTP (Trivial File Transfer Program) programs. The TELNET program allows a PC/AT user

ers in education lies at the heart of Athena. Which is the real purpose of Athena?

"It's both," Wilson said. "The permanent campus resource is the network. The computer infrastructure is the network and the network services." Wilson hastened to point out the large amount of course software which has already been written for the Athena system.

The Athena system is in a state of flux. Over the next few semesters, the emphasis will shift away from time-shared minicomputers to single-user workstations. The course Athena will take is still unknown.



Tech file photo by Joseph LaRococa

Students use the Building 11 Athena terminal cluster.