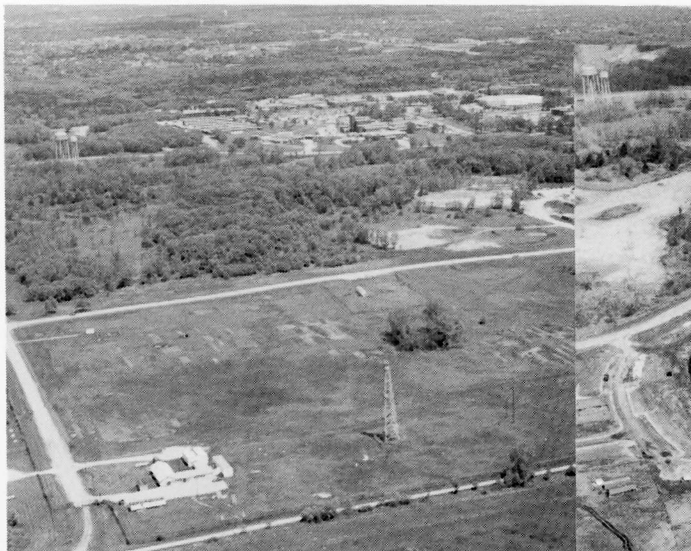
A Progress Update for Employees of the Advanced Photon Source at Argonne National Laboratory

The Source

March 1993 Number 1

THE APS - 1990



The APS - 1993

Instant update - *Above, the green-field APS site on May 25, 1990, 11 days before ground-breaking ceremonies and the start of construction. Right, the APS site on March 18, 1993.*

Experiment Hall concrete pour comes full circle

Concrete work for the APS Experiment Hall began on April 26, 1991. The 1104-meter-circumference ring was closed on December 16, 1992, with the pour of the final floor slab. (The storage ring enclosure and ratchet wall were finished earlier in December.) Some 53,000 cu yds of regular concrete and 1600 cu yds of heavy-weight concrete for radiation shielding were used. That works out to 7666 9-yd truckloads of concrete. Or, as one subcontractor put it, "There's enough concrete here to shrug off an atom-bomb near miss or a direct hit by a tornado."

Some of the principals in conventional-facilities construction gathered at the site of the last pour to mark the occasion by arranging themselves along a bull float while resisting the temptation to scratch their initials in the still-damp concrete. Left to right in the photo above: Yang Cho, Deputy to the Associate Laboratory Director, APS; David Moncton, Associate Laboratory Director, APS; William Sproule, Assistant Project Director, Conventional Facilities, APS; Rudy Etheridge, Deputy Assistant Project Director, Conventional Facilities, APS; and James Wozniak, Construction Coordination Manager, Conventional Facilities, APS. ❍

Linac installation sets the pace

Installation of the electron/ positron linear accelerator, the first stage of the APS particle-beam acceleration and storage system, is proceeding on schedule. Marion White, Linac Group Leader, credits the efforts of the Linac Group, and the invaluable advice and assistance being provided by members of other ANL Divisions.

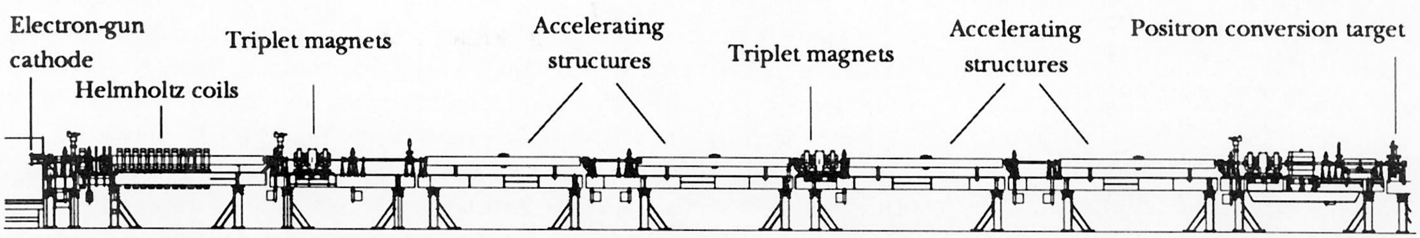
The history of the APS linac has been markedly successful. The first accelerator section to be procured, the linac came in on schedule and below estimated cost under the guidance of then Linac Group Leader, now ASD Associate Division Director George Mavrogenes. The first APS particle beam was accelerated at the linac test stand in Building 371 on April 15, 1992. On the first try, the test stand (actually the first sector of the electron linac) reached the design current of 1.6 A electrons at 58 MeV. This achievement demonstrated that most of the components had been fabricated to specifications and that the overall design of the linac was sound. In addition, current monitor and loss monitor prototypes developed by the ASD Diagnostics Group also functioned well. Much of the test stand's readout and control software, which helped ensure rapid debugging and smooth operation, was written by the ASD Controls Group. White, who at that time was a member of the group, notes that, "Equally valuable to all of us was the experience of actually building something before moving to the tunnel for installation of the complete system."

Members of the ASD/Linac Group, and some of their friends from other groups who are lending a hand during installation, gathered in the Linac Tunnel for a family portrait. Pictured are (kneeling, l. to r.): John Fitzgerald, Charles Gold, Arthur Grelick, John Kristy, and, Matthew Lagessie; (standing, l. to r.): Marion White, Ray Fuja, Lynn Peterson, Thomas Russell, Val Svirtun (ASD/Vacuum), David Yuen, William Berg, Michael Douell, William Wesolowski, Robert Whitman (EL), Jack Goral, David Jefferson, Stanley Pasky, and Fred Onesto (APO). Not pictured: Ned Arnold (ASD/Controls), David Fallin, Tim Jonasson, Eric Ko (ASD/Controls), Renee Lanham, Anatoly Oberfeld (EP), and Don Vafias (RUST Engineering).

In fact, some members of the Linac, Power Supply, RF, and Magnet groups gained more experience than planned when manufacturing difficulties diverted them to unexpected roles as designers and fabricators of linac pulsed-power-supply modulators. This successful endeavor received major support in the form of controls design from the ANL Electronics Division. The ASD Vacuum Group lent their expertise to cleaning the transmission waveguides that bring power to the linac.

Three subcontractor firms engaged in linac work are also making significant contributions. MSI Contracting, Inc., is supplying the riggers who placed all the equipment in the Klystron Gallery and are now installing the linac girders and beamline components to within the required ± 1/16 in.

"Linac" cont'd on page 3



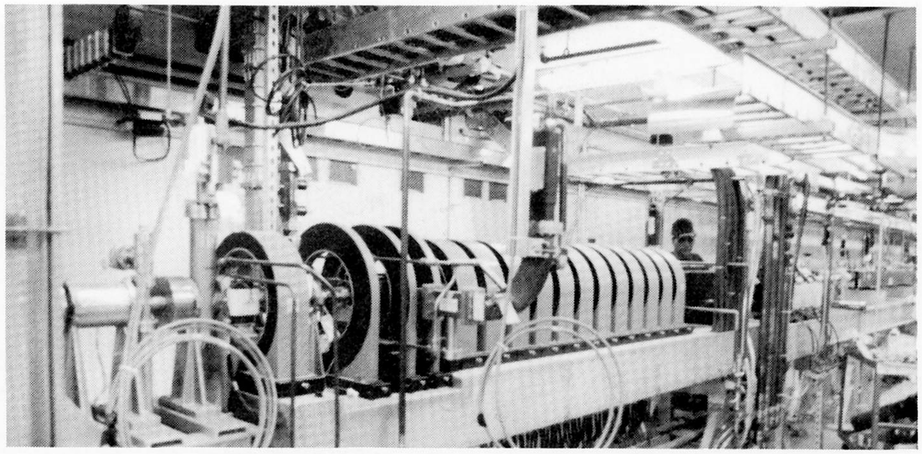
Computer-aided drawing of the APS electron linac viewed from the northwest. Beginning at the upstream (left in drawing) end are the electron gun, a set of Helmholtz coils, triplet magnets for beam focusing, accelerating structures bisected by another set of triplet magnets, and the positron target, beyond which lies the positron linac and the rest of the APS accelerator.

"Linac" cont'd from page 2
Electricians from West Elsdon Electric are responsible for pulling and terminating miles of cables. Intrastate Pipefitters is connecting water systems to magnets, accelerating structures, and waveguides.

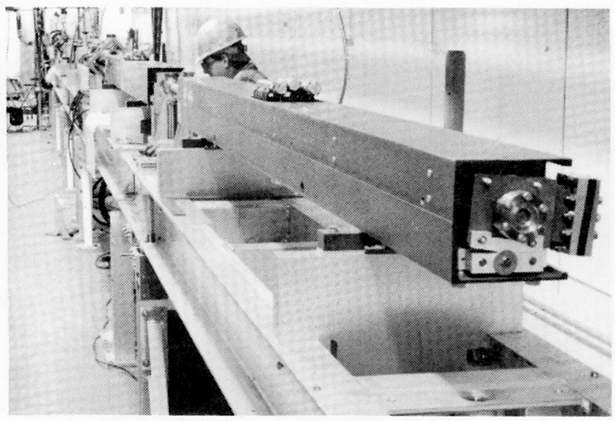
Work at the Linac Wing began on July 27, 1992, with the delivery of water pumping stations to the Klystron Gallery. This hall adjoins the Linac Tunnel and houses the power, water, and control systems needed for linac operations. Installation of the linac inside the 80-m-long tunnel in the Linac/Injection Building began in early September 1992 and is following the path of the particle beam. The linac is divided into five sectors, each connected to a klystron amplifier. The second, fourth, and fifth sectors are equipped with SLED's, SLAC Energy Doubler Cavities, which, as the name implies, double the energy per klystron. The first sector (see diagram, page 2) begins at the electron gun and raises the electron energy to ~60 MeV. Four beam-accelerating structures, interspersed with triplet quadrupole magnets for beam focusing, increase the energy to 250 MeV.

At the end of the second sector is the positron target, a piece of tungsten situated inside a special housing, where electrons are converted to electron/positron pairs. The third through fifth sectors comprise the positron linac, which includes more accelerating structures, beam-focusing quadrupole magnets, and solenoids. Here, the beam energy is raised to 450 MeV for transfer to the Positron Accumulator Ring. Both linacs are equipped with fluorescent screens, and beam position and current monitors. As of March 10, Sector 2 was nearly complete, with work progressing on the other three sectors.

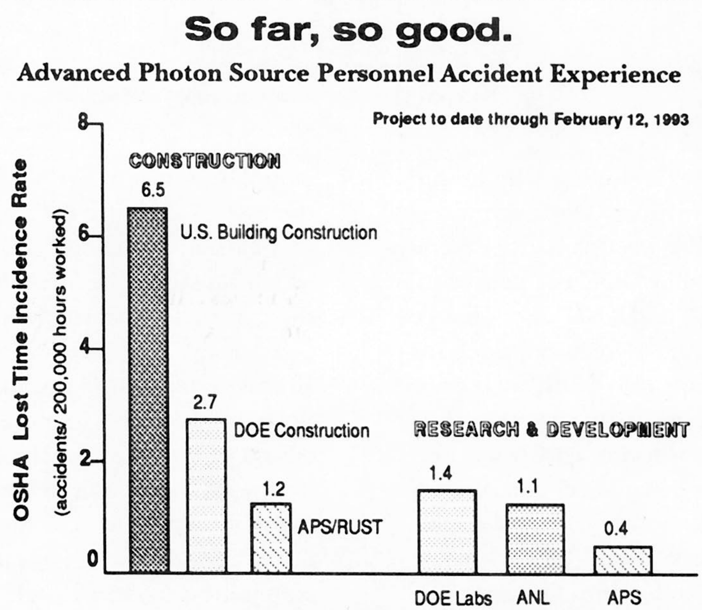
Commissioning of the complete linac is scheduled to begin in July 1993. O



↑ *Bill Wesolowski (ASD/Linac), framed by a transmission waveguide, works on the electron section of the APS linear accelerator. The photograph only hints at the complexity of an accelerator system — thousands of parts that must fit together with precision and then function harmoniously.*



← *The electron linac viewed from downstream shows accelerating structures resting on support girders. Since this photograph was taken, installation has progressed through another two accelerating structures, completing Sectors 1 and 2 of 5.*

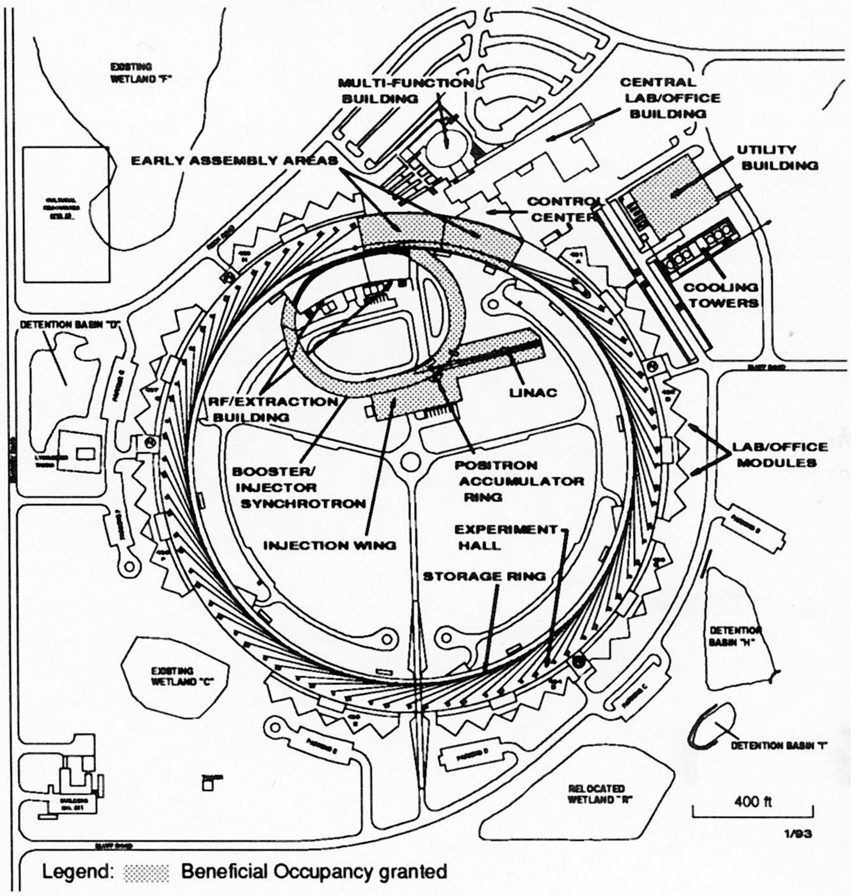


Results of the APS construction and R&D safety programs to date, relative to industry, ANL, and other DOE projects. Bars indicate accidents/100 workers/year.

Beneficial occupancy: oxymoron or a tenant's best friend?

Beneficial occupancy. All of us at APS are hearing these two words more and more lately; but what do they mean? Who does beneficial occupancy benefit? To some of the APS people who are occupying new buildings, it is not always clear that there are any benefits at all to this so-called beneficial occupancy.

APS Beneficial Occupancies to Date



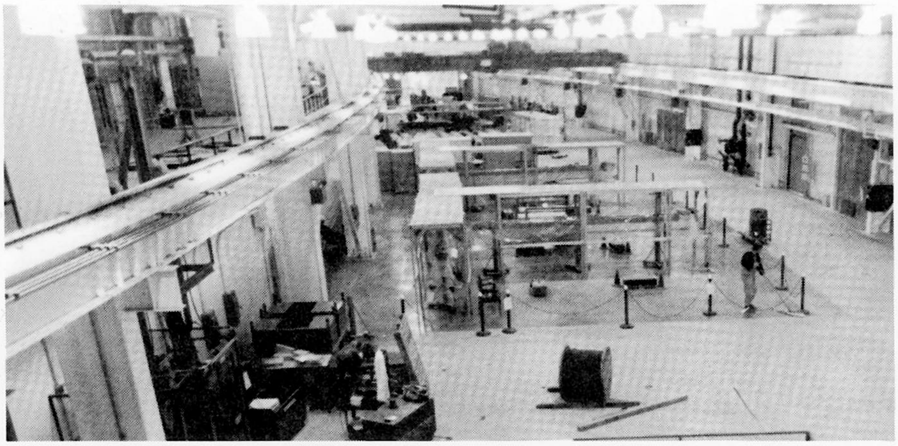
Formally, the meaning of beneficial occupancy is that the responsibility for a facility has been transferred from RUST Engineering, the APS construction-management firm, and its subcontractors to the Department of Energy (DOE) and ANL. Before beneficial occupancy, all work going on in the building is under the control of RUST, and RUST is responsible for all aspects of the work taking place there, including scheduling of work, quality of work, safety, etc. At beneficial occupancy, the facility is accepted by DOE as a part of the ANL plant, and ANL takes on all of these responsibilities. So much for the formality. In reality, what does beneficial occupancy mean?

In the world of construction, whether it be construction of a private dwelling or construction of a large industrial building, a time comes when the building is pronounced by the contractor to be complete and ready for occupancy by the customer. As anyone who has ever had a house built for them knows, such a pronouncement may be somewhat misleading. Indeed, the house may be ready for occupancy, but usually the contractor will not have every single detail of completion taken care of. Even in the case of a private dwelling, there may exist a "punch list" of items which remain to be finished before the contractor vacates the premises completely. The new owner will almost certainly find mistakes, omissions, or oversights in either the design of the house or the contractor's work — a required electrical outlet is missing or is in the wrong place; a window won't open; a leaky pipe joint or roof; a closet floor improperly finished.

In the case of large industrial buildings, such as our APS facilities, the incompleteness of the facility is recognized in advance, by accepting "beneficial occupancy." The customer accepts the building as ready for occupancy, with certain explicit reservations — a "punch list" of items which must be completed before final building acceptance is agreed upon. One of the benefits of beneficial occupancy is that the customer finds out the other things that are wrong with the building and can get the contractor to fix them before he vacates the premises. Since the mistakes found in a private dwelling are usually multiplied by an order of magnitude for a large industrial building, it is important to identify problems early so they can be rectified by the original contractor.

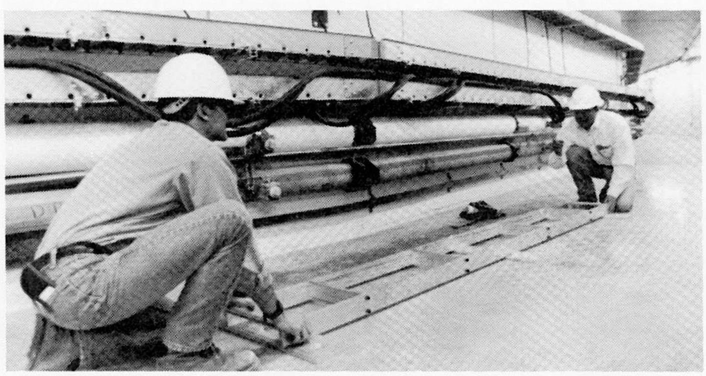
Many of the tribulations occupants of the newly "completed" APS buildings are undergoing are the result of the necessary "debugging" of a new building rather than the fact that the building itself was not totally complete. Life under beneficial occupancy isn't always easy, but moving into a new building and identifying the problems as early as possible means that solutions can be found sooner rather than later. It is an experience that all of us at APS will eventually face. ❍

See page 5 for more on APS beneficial occupancies.



↑ *The Early Assembly Area as of March 10, 1993. Intensive cleanupcan be seen in the Storage Ring girder assembly area (foreground). At the far end of the EAA is the Magnet Measurement and Test Facility.*

↓ *Francis Gaudreault (l.) and Mark Reinesto (both ASD/ Survey & Alignment) use a template to denote locations where bolt-holes will be drilled for magnet supports in the Booster/Synchrotron Tunnel.*



Construction of the DOE's APS facility at Argonne began in June of 1990 almost as soon as six ceremonial shovels of dirt were simultaneously turned at ground-breaking festivities. Now, 34 months later, the buildings that have risen under the stewardship of RUST Engineering and the APS Conventional Facilities group are being turned over to the Project for use.

On April 15, 1992, the DOE Argonne Area Office approved beneficial occupancy of the Linac Tunnel (see diagram, page 4). On September 18, 1992, the Injection Wing was transferred from RUST to ANL. Occupancy of this 18,524-sq-ft structure signified essential completion of the entire Linac/ Injection Building. The Injection Wing provides space for electronics laboratories, storage of linac and power supply components, and primary power distribution. The Injection Wing also houses the Positron Accumulator Ring and leads to the Booster/ Injector Synchrotron Tunnel.

Beneficial occupancy of the Early Assembly Area (EAA) came on December 23. In the words of Tom Mann, System Integration and Installation Coordinator, "This marked a pivotal event in the process of designing, fabricating, and installing the APS accelerator systems." The EAA has approximately 27,700 sq ft of floor under roof in the northern portion of the Experiment Hall where there are no beamlines due to the radio-frequency equipment located in the Storage Ring tunnel. This is where accelerator magnets will be tested and assembled with vacuum chambers on girders prior to installation in the Storage Ring. The EAA is equipped with a 15-ton crane, two mezzanines for HVAC and electrical equipment, and sanitary facilities. Once storage ring installation activities are complete, the EAA will house offices, assembly space, and large laboratories for several APS technical groups.

The APS Utility Building fell to the forces of beneficial occupancy on January 22, 1993. This building contains the mechanical heart of the facility, providing chilled water, high-temperature-equipment cooling water, hot water for heating requirements, compressed air for general services, and electrical power. Especially noteworthy is the APS deionized water system, which is the largest such single system in the U.S., with 30-in.-diameter water distribution mains handling a flow rate of 15,000 gallons per minute.

On February 10 the Project occupied the 368-m-circumference Booster/Synchrotron Tunnel.

Only two major technical areas remain officially unoccupied — the Storage Ring enclosure and the adjoining Experiment Hall where, beginning in 1996, APS users will carry synchrotron-radiation-based research to new frontiers. ❍

APS Collaborative Access Teams taking shape

The APS is being built as a national user facility. Our users will be coming in two varieties: CATs (members of Collaborative Access Teams) or Independent Investigators. During the first few years of research, our major users will be CATs. Each CAT will be responsible for building, operating, and paying for at least one APS sector (that is, one bending magnet beamline and one insertion-device beamline).

CATs are being selected through a process that began in May of 1990 with the submission of Letters of Intent (LOIs), 10-page documents from groups that wanted to become CATs. The LOIs outlined what kind of science each group wanted to do at the APS and how they would build beamlines to carry it out. The 33 LOIs, and the full proposals that followed in March of 1991, were carefully evaluated by the APS Proposal Evaluation Board (PEB) and a number of subsidiary outside review committees. (At the APS, we certainly know how to use review committees!) The PEB, which is chaired by Mike Knotek, Deputy Director of Batelle Pacific Northwest Laboratory (and formerly Director of the National Synchrotron Light Source), consists of Jens Als-Nielsen from Denmark (now on sabbatical at the European Synchrotron Radiation Facility); Howard Birnbaum, Director of the Materials Research Laboratory at the University of Illinois (and a member of Argonne's Board of Governors); Roger Pynn, Director of LANSCE, the neutron-scattering facility at Los Alamos National Laboratory; and Wayne Hendrickson, a professor at Columbia University; with Roy Clarke, Chair of the APS Users Organization, serving as an *ex officio* member.

The CAT Workshop held at Argonne on February 25-26, 1993, featured a bus-and-walking tour of the APS facility, culminating in an opportunity for attendees to mingle among the magnets in the Early Assembly Area.

As soon as a prospective CAT receives full scientific approval from the PEB, it becomes an APS CAT. However, before it actually gets to the floor of the Experiment Hall to begin construction, a number of things must take place. Each CAT must prepare a conceptual design report (CDR), which is carefully evaluated by a CDR review panel (both ANL and non-ANL reviewers) that may suggest changes. The CAT must also prepare a detailed management plan, which is scrutinized by an APS review group, and it must obtain (and document that it has obtained) the funds necessary to build the two beamlines in its sector. When all of these things are in place, the CAT can sign a Memorandum of Understanding with the APS. At that time, CATs will be assigned to specific locations on the Experiment Hall floor.

Before construction of experimental apparatus can begin, preliminary engineering, final engineering, and preconstruction reviews must take place, and management plans must be expanded, with considerable attention paid to safety planning for both construction and operation.

Fifteen CATs have received PEB approval, eight have had their conceptual designs approved, and two have submitted management plans for review. These CATs currently represent more than 500 individuals, 72 different universities, 18 research laboratories (national labs and others), and 28 industrial firms, from 29 states and 6 foreign countries.

User activities and CAT contacts are coordinated through the XFD User Administration and Support Office (Susan Barr); user technical questions are handled by the XFD User Technical Interface Group (Steve Davey).

- Susan Barr

The Source is a vehicle for enhancing communications within the APS Project on matters of technical accomplishments and progress, ES&H, awards, research programs, and management news.

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