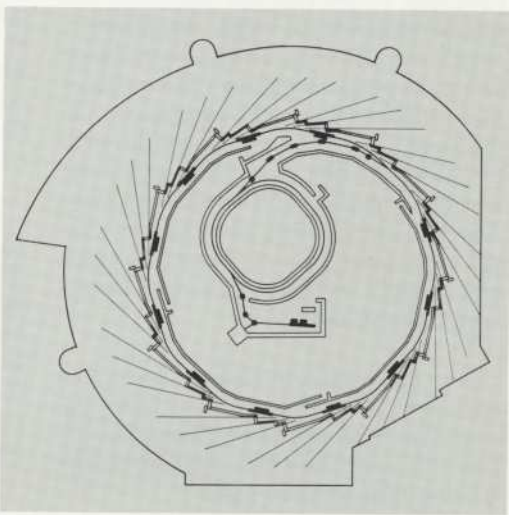
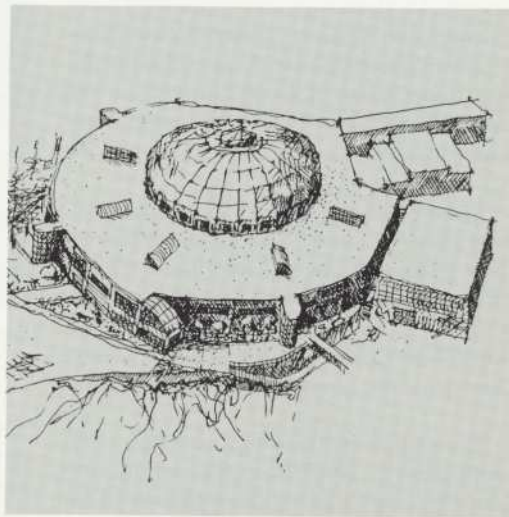
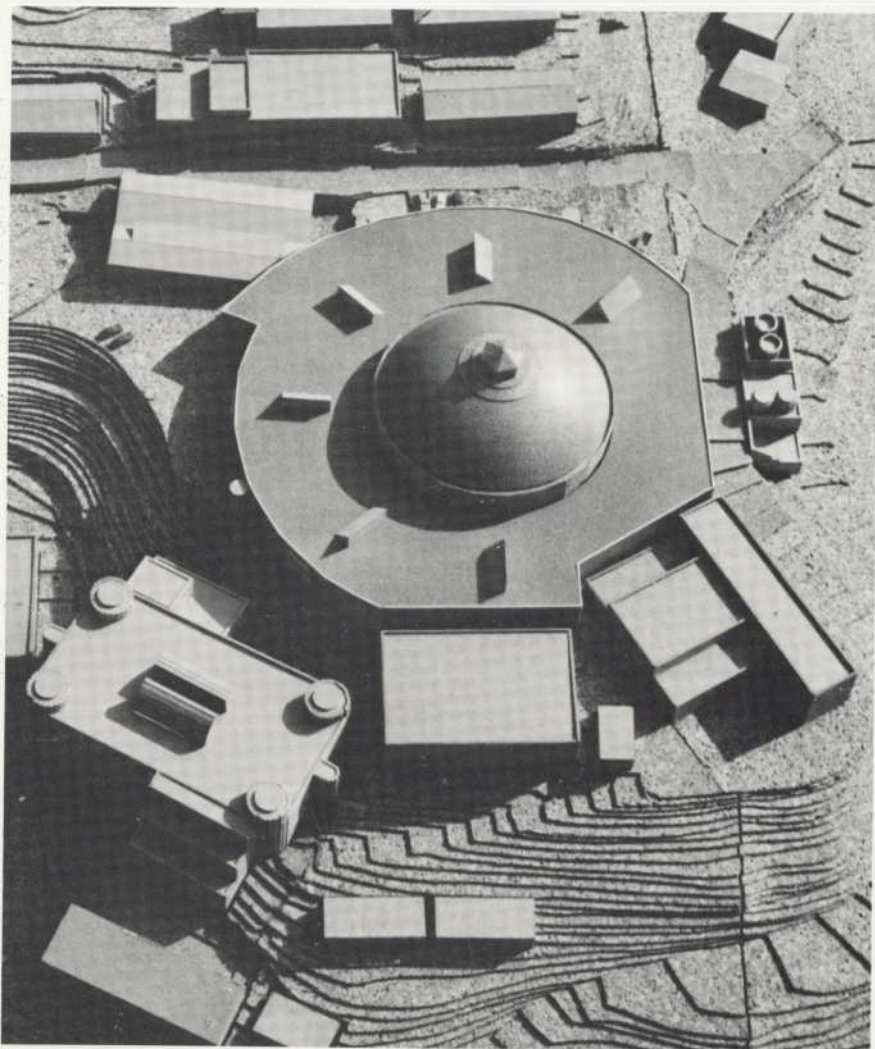


TUDOR

Quarterly

Spring 1987

1-2 Ge V Synchrotron Radiation Source



1-2 Ge V Synchrotron Radiation Source Plan

In October 1984, Tudor, in joint venture with Keller & Gannon, was selected to design the Center for Advanced Materials Project at Lawrence Berkeley Laboratory. The Advanced Materials Laboratory was funded first and is now under construction. In December 1986 the second phase of this project, the 1-2 Ge V Synchrotron Radiation Source, received funding for a site development study, to be followed by preparation of design documents.

This second project is a 50,000-square-foot addition to an existing building, but with a twist. The structurally independent addition will completely surround the existing circular building. Column locations must be coordinated with 100 beam lines that will radiate tangentially from a new cyclotron being designed and built by the Lawrence Berkeley Laboratory staff. The preliminary design began in May with construction targeted for March 1989. Tudor will perform the civil and structural design and joint venture management, with Kirit Shah as the Structural Project Engineer. Keller & Gannon will provide the electrical and mechanical design, and Reid & Tarics Associates will provide the architectural work.

Projects

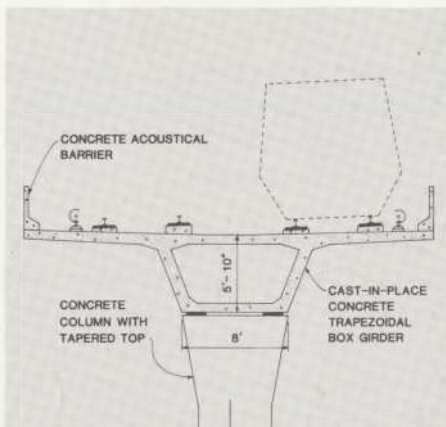
MARTA Aerial Redesign

When Tudor originally began designing the standard aerial structures for MARTA in the early 1970s, a design concept was developed using steel box girders with precast concrete deck panels. At that time, the cost of steel was historically low compared to that of concrete, so a steel girder design was considered more economical. However, concrete girder construction alternatives were added to the design to maximize bidding competition. The basic dimensions of the concrete girders were made to match those of the steel alternative.

As expected, the first several miles of structure were built using steel girders, but in recent years, the price of steel has risen appreciably in relation to that of concrete. Consequently, the contractors on all recent MARTA projects involving aerial structures have used the concrete girder alternative.

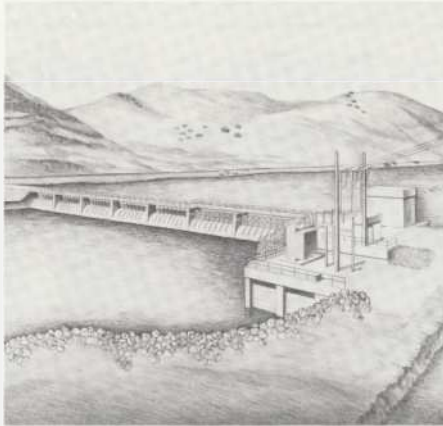
Since steel construction is no longer competitive for the MARTA aerial structures, and since the original girder dimensions were not optimized for the concrete alternative, the original design is no longer cost-effective. MARTA can realize significant cost savings on future segments if the girder cross section is modified to best fit concrete construction. On that basis, Tudor is performing a redesign of the concrete girders that will employ wider and deeper girders with thinner webs, and a trapezoidal box section rather than the original rectangular section. The typical span length will be increased from 70 feet to between 90 and 100 feet.

Keith Bull is Project Manager, assisted by engineers Wu-Chieh Chen, Mike Goldberg, Diana Lee, Perry Lin, Rainer Rungaldier, Eva Spatenka, and Walter Zien. The CADD work is being done by Sanae Lame.



MARTA new Standard Aerial Structure

Broadwater Power Project



Broadwater Dam and Power Plant

The State of Montana authorized Tudor in April to prepare a Definitive Report for the Broadwater Power Project. Based on this report, Tudor assisted the State in deciding whether the hydropower potential at the existing dam should be developed by the State or by a third party. On June 5th, the State Water Resources Commission voted to develop the project as a state facility, and authorized Tudor to proceed with equipment procurement, and final design for the project.

Tudor has been involved in the Broadwater Power Project since its inception in 1977. Over the years, Tudor has provided engineering services for the state on reconnaissance investigations, a feasibility report, Federal Energy Regulatory Commission (FERC) license application, transmission line route selection, and various studies related to power development.

Broadwater Dam, located on the Missouri River in Western Montana, is a low concrete gravity dam built in 1939. The dam currently diverts irrigation water to adjacent farmlands. The project will utilize the low power drop of 22 feet and flows of up to 6,500 cfs to realize the 10 MW power potential. The powerhouse will contain a single full Kaplan turbine mounted in a horizontal, pit-type configuration. Additional work will include replacing existing spillway flashboards with automatic gates, refurbishing the headworks of the existing irrigation canal, and installing more than three miles of 100 kV transmission line. The generation from the project will be sold to the Montana Power Company. Hugh Brown is Project Manager.

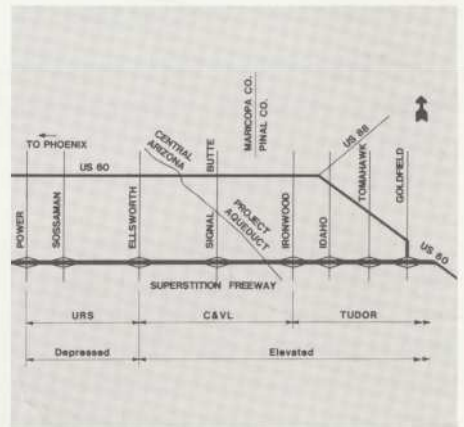
Repackaging the Superstition Freeway

The Arizona Department of Transportation (ADOT) has selected Tudor to repackage three section designs prepared by separate consultants for a ten-mile extension of the Superstition Freeway, east of Phoenix. The goal is to create two construction contract packages for the extension. The first package, to be let in 1988, will consist of structures, drainage, and earthwork. The second, to be let in 1989, will consist of paving, signals, and signing. Tudor has been designing one of the sections, Ironwood Road to U.S. 60, under the direction of Sverdrup Corporation, the statewide management consultant for ADOT.

ADOT's analysis indicates that repackaging could create significant efficiencies for contractors and save substantial costs. For example, the first section of the extension will be depressed and create large amounts of surplus earth that can be hauled directly to the adjoining elevated sections as fill. Without the repackaging, ADOT would have to pay one contractor to haul the earth from the first section to a stockpile site, and then pay other contractors to haul it to the second and third sections.

Designs for the three sections are more than 60 percent completed, and it will be a challenge to obtain consistency among the separate plan sets. There are hundreds of details to be checked and coordinated to complement Sverdrup's role as overall coordinator.

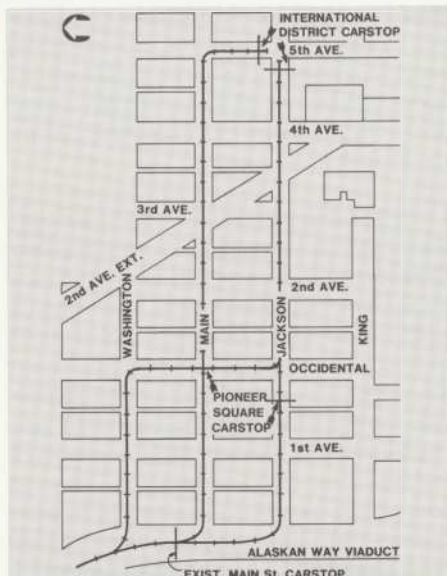
Clint Brookhart, Tudor's Project Manager for the repackaging, is working closely with Roger Brassfield, Jim Schroeder, Lori Egly, Jun Quiray, and Jim Richardson.



Ten-mile extension of Superstition Freeway

Projects

Seattle Waterfront Streetcar Extension



Waterfront Streetcar Extension Routes

Tudor's Seattle office is nearing completion of an alternative route alignment study for an extension of the Seattle Waterfront Streetcar. Tudor prepared the design of the original project for the city that resulted in the operation of vintage trolleys on abandoned railroad tracks along the Seattle harborfront. More recently, Tudor performed a study to extend the trolley inland to serve Seattle's Pioneer Square and International District. That study examined three basic predetermined routes. Of the three routes investigated, the Jackson Street realignment was the most favorable. We recommended that the Jackson Street route be implemented. However, one of the negative factors about the Jackson Street alignment was its impact on traffic, since it is a heavily travelled arterial. Subsequently, Tudor was asked to study a possible new alignment along Main Street, a more favorable route in terms of its lower traffic impact.

The study on the Main Street Alternative was conducted by Bela Vadasz and Peter De Boldt. It is planned that a Local Improvement District will be formed to provide funding through assessment of adjoining properties. Assuming that everything comes together as planned, final design could begin later this year.

SSC Studies

The RTK joint venture has begun environmental studies in support of the Superconducting Super Collider (SSC). These studies are an extension of work performed for the Department of Energy (DOE) Conceptual Design Report for conventional facilities.

The main ring of the Collider is a 10-foot diameter tunnel that will be 53 miles in circumference. Although the site has not been selected, environmental work will begin with analyzing the SSC's effect on a generic site. As sites are proposed and the selection narrows, site-specific characteristics will be included in the analysis.

In April 1987, DOE issued an invitation for site proposals and defined their criteria and schedule for site selection. All site proposals must be received by August 1987, and those that meet the minimum qualifications criteria will be referred to a selection panel composed of members of the National Academies of Science and Engineering. The panel will prepare a "best qualified list of proposers" (BQL), approximately six unranked site proposals, for submittal to DOE in December.

RTK is responsible for the Environmental Impact Statement (EIS) process from initial data collection and generic analysis preparation to preparation of the final EIS. RTK will finalize the generic environmental assessment and provide DOE with a detailed list of information required from each site for completing the EIS. DOE will request this information by March 1988, and after reviewing the environmental submittals, will select a preferred site. DOE's final SSC site selection is scheduled for January 1989.

Last January, DOE reported that President Reagan had approved construction of the SSC. The current cost estimate for the project totals \$4.4 billion. When in operation, the SSC will have a permanent staff of 2,500 and up to 500 visiting scientists and engineers.

Tudor's partners in the RTK joint venture are Kaiser Engineers (KE), the Managing Partner, and Keller & Gannon-Knight. Mack Riddle (KE) is Project Manager for RTK, and Beverly Asmus (KE) is Technical Leader for the environmental assessment. Tudor's people include Keith Bull, Technical Leader for underground facilities, and Don Scapuzzi, who is responsible for underground cost estimates.

Central Oregon Siphon Hydro

One of the next hydroelectric design projects for the San Francisco office is one of the early jobs Tudor looked at outside California. The Central Oregon Siphon Power Project was originally the subject of a feasibility report performed by the San Francisco office in 1981, and a Federal Energy Regulatory Commission (FERC) License Application performed by the Seattle office in 1982. Dave Alden, formerly with the Seattle office, and Dave Willer in San Francisco, have continued to monitor and assist the Central Oregon Irrigation District in overcoming numerous regulatory hurdles.

The project consists of utilizing the District's existing canal diversion on the Deschutes River, the existing 10-foot-diameter siphon pipeline, and a portion of the Central Oregon Canal to transport water along the rim of the Deschutes River Canyon. New buried penstock and twin 2.75-MW turbine-generator units would return the flow to the Deschutes River.

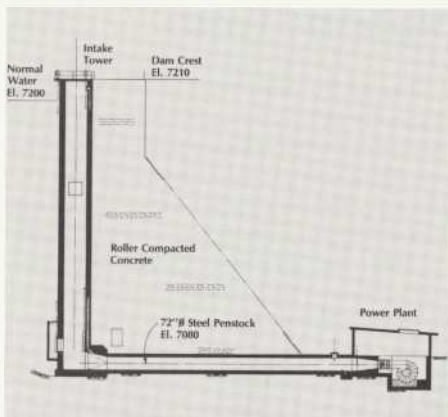
In recent months, the District has reached agreement with both the U.S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife on the minimum amount of water to be left in the river. Agreements have also been reached with neighboring homeowners' associations and landowners regarding aesthetic considerations. As a result, minor modifications were made to the FERC license, and it was resubmitted. The present project schedule calls for the immediate preparation of the Design Memorandum, followed by turbine-generator specifications. The project is scheduled to be on-line by early 1989.



Siphon Headworks on Deschutes River

Projects

Stagecoach Dam



Stagecoach Dam and Power Plant

Tudor is continuing work on the Stagecoach Dam Project as a subcontractor to Woodward-Clyde Consultants. Bid opening for general construction of the dam, powerhouse, and civil works was held on May 5th. Construction is scheduled to begin this July, with a targeted completion date of fall 1988. The dam will be a 140-foot-high roller-compacted-concrete (RCC) dam on the Yampa River in Colorado. Tudor was responsible for the design of the dam's spillway, outlet works, and powerhouse. Besides working on the design phase, Tudor will provide construction services.

Work on the turbine-generator furnish-and-install contract is scheduled to begin in August. The power plant will be run-of-the-river, with a turbine rating of 800 kW at 125 foot of head. Project Engineer is Sal Todaro, and working on the civil and hydro contracts are Don Guild, mechanical; Ron Dusterdick, electrical; and Paula Dierkop, specifications.

South Graham Street Bid Opening

On March 18th bids were opened for the South Graham Street Roadway Realignment Project for the City of Seattle. This was a re-bid of a job that had originally been bid in November 1986, with a low bid of \$533,090. This amount was in excess of the City's available budget for project construction. The primary cause of the overage was a 45-foot-deep, 8-foot inside diameter special manhole.

Roeder Avenue

Tudor was selected by the City of Bellingham to prepare a design report and final plans, specifications, and estimates for the Roeder Avenue South Connection Project. The project consists of realignment of the Bay/Chestnut Street Bridge approach roadway embankment, and rehabilitation or reconstruction of the existing bridge structure which elevates the Chestnut and Bay Streets intersection over the Burlington Northern Railroad tracks. The present Chestnut Street right-of-way cuts through Georgia Pacific paper manufacturing plant property, and requires trucks to negotiate a pair of sharp corners when travelling from Roeder Avenue to the Chestnut Street Bridge.

The purpose of the project is to improve the alignment of roadway between Roeder Avenue and Chestnut Street, and to consolidate Georgia Pacific property, allowing them to expand their plant, located on Bellingham Bay. Utility relocations, poor soil, and railroad coordination all contribute to making this a challenging project. The base map for the project site was prepared on the Intergraph CADD system, using data from City of Bellingham surveyors, transferred directly from an IBM data disk.

Tom O'Neill is Project Manager, with Bela Vadasz and Dewitt Jensen following the civil design, Harry Jasper holding up the structural efforts, Einer Handeland directing the traffic efforts, and Roger Mason contributing computer production. Rosemary George and Richard Rudolph from the Phoenix office helped with the bridge field inspection.

Based on Tudor's recommendation, the City agreed to reject all bids, relocate and downsize the proposed manhole, and re-advertise for bids. The result was a substantial decrease in bid amounts. The new low bid was \$451,398, and the second low bid was \$491,432. The engineer's estimate was \$493,829.

Project Manager on the job was DeWitt Jensen, with Pete Paterson assisting on water main and drainage design. Tudor will provide assistance to the Seattle Engineering Department during construction, performing shop drawing reviews and other tasks on an as-needed basis. Construction should start this summer and last approximately six months.

Stockton Creek Project

Tudor was recently selected by the Mariposa Public Utility District and the Mariposa County Water Agency to prepare a feasibility study for the Stockton Creek Project, a proposed expansion of the existing water supply system for the town of Mariposa. Tudor's efforts will consist of identifying and analyzing alternative means of increasing the town's firm water supply.

The existing Stockton Creek Project consists of a small dam and reservoir on Stockton Creek that deliver water through a pipeline to an existing treatment plant. The reservoir spills in most years; spills occurred in March of this year, when runoff throughout the Sierra foothills was substantially below average. The feasibility study will focus on increasing the available reservoir storage capacity on Stockton Creek to capture this spilled water and store it for use during the dry summer months. Several potential new dam sites have been identified downstream from the existing dam, in addition to possibly raising the dam. New diversions will also be evaluated.

The existing dam has been identified as needing repair by the State of California's Division of Safety of Dams. The feasibility study will also address issues concerning the dam's safety.

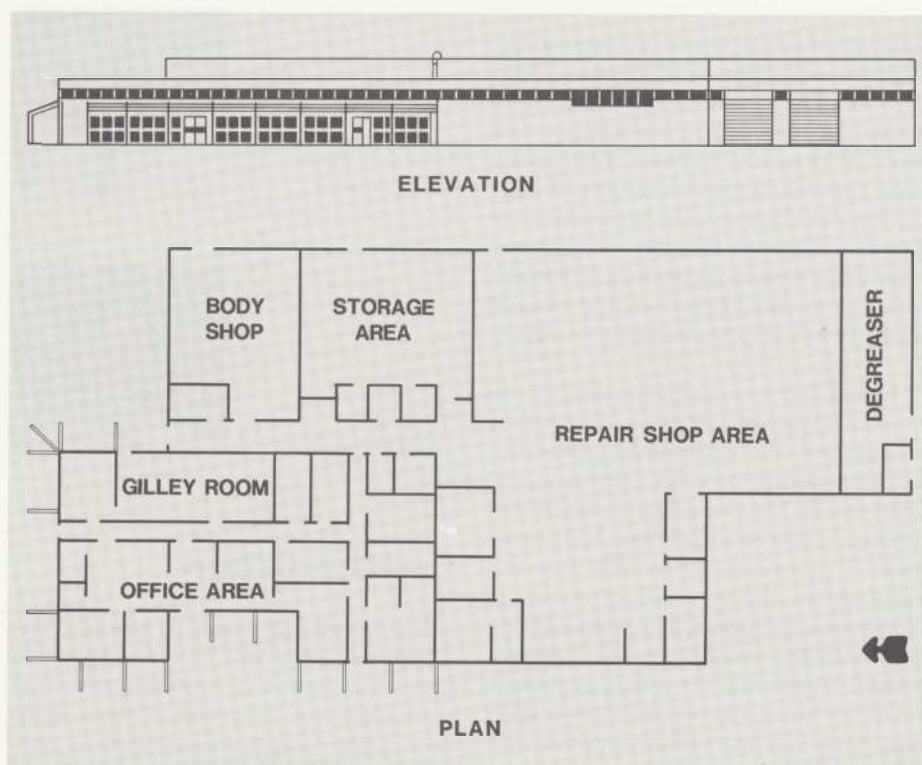
Tudor will be assisted in this study by Woodward-Clyde Consultants, who will provide geotechnical services and dam design, and Bartle Wells Associates, who will assist in obtaining project financing. Bob Toothman is Project Manager, and Hugh Brown is Project Engineer.



Stockton Creek Reservoir

Projects

Vallejo Bus Maintenance and Operations Facility



Vallejo Bus Facility Elevation and Plan

Final design of the Vallejo Bus Maintenance and Operations Facility for the City of Vallejo was completed in May and is about to be advertised for construction.

The new facility will be built on a five-acre parcel of undeveloped land off Broadway in northern Vallejo. It will function as the storage, maintenance, and operations center for a predicted fleet of 50 standard diesel buses. The current fleet is operated for the city by Vallejo Transit Lines. The site will include a 25,000-square-foot, one-story, steel-frame, metal-clad building with a slab-on-grade floor. This structure will house 19,000 square feet of shop, repair bay and storeroom space, and 6,000 square feet of office area for maintenance, operations, and administrative staff. The shop and repair bay areas contain two run-through bays with pits for light repair/running inspection, two heavy-repair stalls, a tire shop with a fixed-post lift, and space for brake repair, hydraulic and electrical unit repair, engine and transmission repair, unit repair, engine testing, a body shop, and welding. A semi-enclosed degreasing area is part of the building.

The support section includes a large reception area, offices for city and operations staff, lunchroom and toilet rooms, the dispatch office, and a fare counting room. Exterior improvements include a covered service/fuel island with two lanes, a fare vault room adjacent to the fueling stop, a bus washer, and parking for 50 buses and 70 cars. Most of the site will be surrounded on its perimeter by an 8-foot-high precast concrete sound wall. The main building is set back from the street, with car parking and extensive landscaping located between.

Construction of the \$3.35 million facility is scheduled to begin mid-August, 1987, and be completed in seven months. Throughout design, Mike Harrington has been the Responsible Principal, Lou Salaber the Project Manager, Bob Cermak the Structural Engineer, Charlie Tsang the Drafter, and Paula Dierkop the Specifier. The staff has received support from Perry Lin, Don Scapuzzi, and Sanae Lame.

Leroy Anderson Dam and Spillway Modification

The final design of the modification work on Santa Clara Valley Water District's Leroy Anderson Dam near Morgan Hill, California was completed in January 1987. The design documents were received and approved by the California Division of Safety of Dams in February 1987. The major modification work consists of enlarging the existing spillway and raising the crest of the existing rockfill dam, which was built in 1950.

Construction bids were received on April 8, 1987. The low bidder was Raisch Construction with a bid price of \$4,368,700. Construction started May 1987 and is scheduled to conclude by February 1988. The District has retained Tudor to provide engineering services during construction, which include resident engineer and inspection services, and engineering consultation and review. Wahler Associates of Palo Alto will be Tudor's geotechnical and soil testing subcontractor.

Ted Purcell has been assigned as Tudor's Resident Engineer. Others who will be involved include Clyde Earnest, Construction Manager; Kurt Scholz, Project Engineer for Design; Tony Lea, Deputy Project Engineer; and S.T. Su, Project Manager.



Leroy Anderson Spillway

People

The World Center, SF

In the spring of 1986, Tudor completed a computer program conversion/modification project for an individual client. Cloaked in secrecy, Steve Alters and Ivan Mlaker converted the Cartographic Automatic Mapping Program, developed by the Central Intelligence Agency, to our Intergraph CADD System.

The program performs a variety of cartographic functions, and can plot these functions on any one of 18 map projections. Using a data file containing latitudes and longitudes of 8,200 world coastline points, and similar information for the world's major cities, various world map projections were plotted.

Almost a year later, the mystery was solved when our client, William Blackwell, presented Tudor with an attractive map entitled "THE WORLD Centered on the San Francisco Bay Area," which he is marketing. If this map sells well, he plans to produce similar maps for other cities in the United States and abroad.



The World Centered on San Francisco

United Way

The Valley of the Sun United Way Campaign has presented Tudor's Phoenix Office with their special Gold Award for contributing an average of more than \$100 per employee. This is their highest category of award, and Tudor is one of only 15 organizations in the Metropolitan Phoenix Area to receive this honor. The Phoenix Office also had 100 percent participation. United Way presented Tudor's Campaign Coordinator, Jim Richardson, with a handsome plaque at their Awards Luncheon on January 29, 1987. Jim also received a calligraphic certificate recognizing his efforts.

Mardi Gras Time in Phoenix

Tudor's Phoenix Office Manager, Mike Ellegood, and his wife, Julie, Marketing Director for HNC Architects, lived in Louisiana for several years and like to call it home. This year, they brought an authentic New Orleans Mardi Gras celebration, complete with a Cajun chef flown in from Lafayette, Louisiana, to their new home in Phoenix. They invited many acquaintances and friends, including a broad cross section of the Phoenix public and private design and construction community.

The fete had many authentic touches; for instance, it was held on "Fat Tuesday," not on the weekend. Chef Eric brought appropriate recipes for Louisiana crayfish and shrimp, and Cajun spices. The Dixie Beer Company donated cases of brew, usually found only in the South. Cajun fiddle tunes played on the sound system, and the Ellegoods' home was decorated with posters depicting Louisiana food, festivals, and lifestyle. The Ellegoods costumed themselves as the King and Queen of Misrule; also costumed, Ed Peters and his wife, Barbara Blunt, welcomed guests and proclaimed their arrival.

More than 200 guests celebrated the event, with many participating in the Cajun cooking demonstration that Chef Eric used to create a new "Southwest Cajun" dish—"Crayfish Enchiladas." Guests also made voluntary donations to the United Way. Three local TV stations broadcast clips of the celebration. Reviewing the event's success, the Ellegoods are considering making it an annual event, perhaps in the form of a charity fundraiser.



Costumed for the occasion are Mike and Julie Ellegood, Barbara Blunt and Ed Peters.

New Faces . . .

Tudor welcomes new employees:
... for Phoenix



Clint Brookhart
Civil Engineer



Craig Force
CADD Operator

Congratulations

Tudor President Robert N. Janopaul was elected in March 1987 as a Director of the Consulting Engineers Association of California (CEAC). The 3-year term of office begins July 1. CEAC is a statewide organization composed of 450 consulting engineering firms.

Louis W. Riggs, former Chairman of Tudor's Board of Directors, has been elected to the National Academy of Engineering. Election to the Academy is the highest professional distinction that can be conferred on an engineer and honors those who have made "important contributions to engineering theory and practice. . ." Mr. Riggs was particularly cited for "innovative leadership and design of bridges and rapid transit structures."

S.T. Su was elected to ASCE Fellow member status on November 1, 1986.

THE TUDOR QUARTERLY is published by Tudor Engineering Company for information and the enjoyment of its employees, their families, and friends.

CONTRIBUTING AUTHORS: Steve Alters, Keith Bull, Clyde Earnest, Mike Goldberg, Tom O'Neill, Ed Peters, Greg Reichert, Lou Salaber, S.T. Su, Sal Todaro, and Bob Toothman.

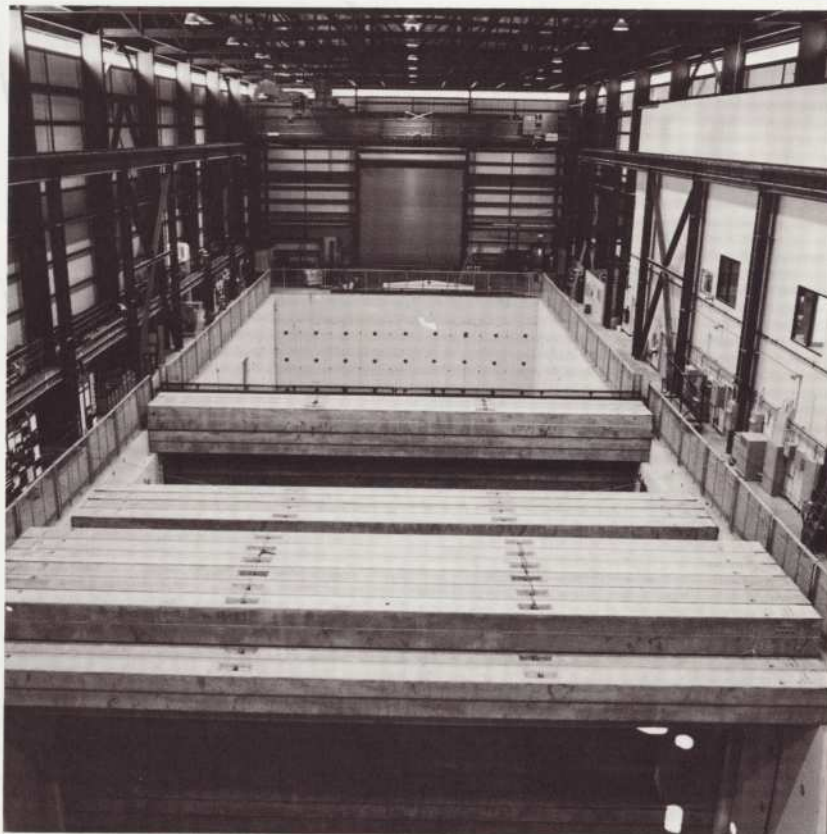
EDITING AND PRODUCTION STAFF: Frank Chiappella, Paula Dierkop, and Jim Flannery.

TUDOR

Quarterly

Winter 1987

SLAC Linear Collider



*Shotcreted Beam Tunnel
Experimental Hall Exterior*

Experimental Hall Interior

During November, 1986, the Collider Experimental Hall which is a major part of SLAC's Linear Collider was accepted by the Owner, and brought a challenging project to a successful conclusion. The design, installation and testing of physics equipment, however, is reaching a peak. A small celebration on February 27, 1987, marked the successful generation and routing of an electron beam from the LINAC through the north arc, final focus, and on to the experimental interaction point, the proof of satisfactory operation of many subsystems. The physics equipment installation work is scheduled to be completed during the summer of 1987, and high energy physics work will be underway by the end of 1987.

Design and construction of the conventional facilities were accomplished with major participation of Tudor Engineering Company during a time frame of approximately 6 years. Total construction cost for the 2-mile long tunnel and the experimental hall, including underground pit, was in the neighborhood of 22.5 million dollars, and was accomplished under budget.

One of the more interesting aspects of Tudor's work was the design, installation and monitoring of 650 permanent tie-back anchors. These anchors hold the 60-foot-high walls of the underground pit in place. SLAC, with Tudor's assistance, has developed a monitoring program for the tie-back anchors that encompasses reading and interpreting 65 permanently installed load cells that register information about the inherent stresses in the anchor rods. SLAC personnel have been trained by the tie-back contractor and have the equipment to reduce the prestress in the anchors in the unlikely event that stresses reach unacceptable levels.

Many Tudor people contributed to this project from early design through construction, including: Mike Harrington, Responsible Principal; Clyde Earnest, Resident Engineer; Greg Colzani and Ray Buffington, Inspectors; Heinz Mueller, Project Manager; Walter Zien, Project Engineer; Grant Larsen, Specifications; and Jim Albert, Project Control.

Projects

LA—Light Rail System

Tudor's design of guideway structures for the Los Angeles County Transit Commission's Long Beach-Los Angeles Light Rail Transit system is nearing completion. The system will run 21 miles from southern Long Beach to downtown Los Angeles, using 90-foot long articulated cars. A maximum of four cars, each having a loaded design weight of 135,000 pounds, will be coupled to form trains up to 360 feet long.

As subcontractor to Delon Hampton and Associates, Tudor designed reinforced concrete and prestressed concrete structural elements and conduit work for five major overpasses, and a flood control pond crossing that connects the main northbound and southbound tracks to the vehicle maintenance yard. The most unusual part of Tudor's work was the pond crossing design, which consists of two sharply-curved, single-track structures that converge into a double-track crossover structure, supported on columns up to 45 feet high. Tudor's work included the design of precast box girders up to 100 feet in length, girder/column connections, supports for the overhead system, and other appurtenances.

Key staff members include Wu-Chieh Chen, lead engineer for design of the 350-foot three-span prestressed concrete crossover structure and for the extensive static and dynamic computer analyses; Eva Spatenka, lead engineer for design work on the five primary crossings; Walter Zien, lead engineer for design of the curved yard access structures; and Sanae Lame, who led the CADD production effort. Mike Goldberg was Project Manager and Paul Potter was Responsible Principal.



Map of Long Beach-Los Angeles LRT

Bowman Project



Bowman Power Project

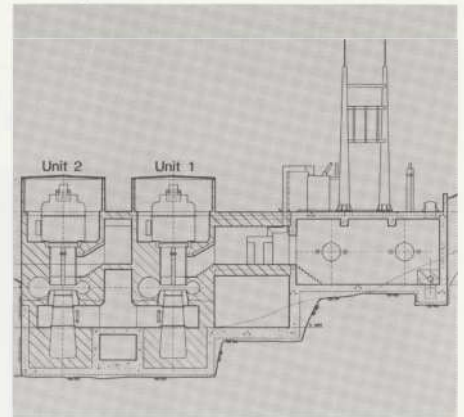
The general construction of the Bowman Power Project, which began in March 1985, was completed in October 1986. The turbine-generator unit began its 30-day performance run on September 19, 1986, and at that time was declared ready for unmanned operation and production of energy revenues for the Nevada Irrigation District.

The project construction went smoothly, was completed ahead of schedule, and final costs were under the construction budget. Tudor's field staff and engineers followed the construction closely, and all required field or design changes were made quickly to minimize the contractor's costs and potential for delays. This, along with the cooperation of general contractor Bechtel Constructors Corporation, equipment supplier Axel Johnson Engineering Corporation, and District representatives contributed to the success of the project.

Of special interest to the project was the installation of a 400-foot long, 62-inch ID steel tunnel liner inside the existing outlet works tunnel at Bowman Dam. This difficult construction task was completed during a 105-day-long tunnel outage, despite having to "thread" liner cans through tight spaces in the existing tunnel, and having to shore the liner to maintain critical tolerances during encasement. During the tunnel outage, the District released water at the dam's spillway to maintain downstream discharge requirements.

Major Tudor contributors during construction included Manager of Field Engineering Services Oral Conyers, Resident Engineer Jeff Ghilardi, Bill Untiedt, Jim Gormly, and Project Manager/Engineer Paul Kneitz. Dave Willer is the Responsible Principal for the project.

Abiquiu Power Project



Power plant section

The Abiquiu project has reached a new stage in the implementation process. Oriental Engineering and Supply Company (ORENCO) was awarded the approximately \$3,000,000 contract for turbines, generators, valves and associated electrical equipment, manufactured in the People's Republic of China, Japan and the United States.

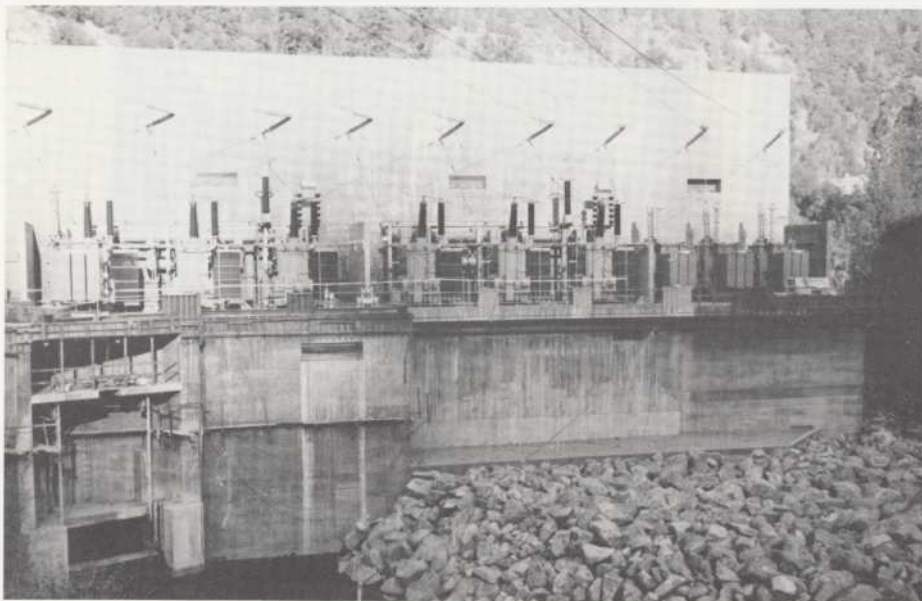
The project general construction was advertised on December 17, 1986, and the bid opening was February 26, 1987. Six bids were received, with the apparent low bidder Bechtel Construction, Inc. at \$13,612,291. Construction is scheduled to start in April 1987, and be completed in May 1989.

The installation of the tunnel liner and construction of the plenum chamber structure require a complete tunnel shutdown for two consecutive periods during the winter (low flow) months. During tunnel shutdown water releases will be made through a pumping system. In addition, the diversion of water from the existing tunnel to the new powerhouse required a special structure that could satisfy hydraulic conditions under two modes of operation (power generation and flood control). The structure that was successfully tested by means of a small scale hydraulic model has been accepted by the Corps of Engineers.

The successful and timely completion of the project design was made possible due to the hard work and dedication of many Tudor employees—Roberto Iniguez, Project Manager; Paul Kneitz, Project Engineer; Greg Reichert, Jim Gormly and Bill Untiedt, Powerhouse Design; Hugh Brown, Hydraulic Model Study; and Paula Dierkop, Project Specifications.

Projects

Kirkwood Powerhouse Addition



Kirkwood Powerhouse Addition

An important milestone in the Kirkwood construction was reached during a 13-day shutdown period in the first half of November 1986. The existing Units No. 1 and 2 were shut down and the Canyon tunnel and Kirkwood penstock were dewatered. The pipe length between two mechanical couplings was removed and replaced with a bifurcation. The connection to the new penstock branch via a closure piece was accomplished by full penetration welds.

The new spherical turbine shutoff valve was installed at the same time, and after dry testing, was locked in a closed position. Upon completion the Canyon tunnel and the Kirkwood penstock were filled with water and existing Units No. 1 and 2 were re-started.

The 230-kV Transmission Lines No. 9 and 10 also were relocated during the shutdown, and all steel construction and electrical installation at the Intake Switchyard was completed. A new disconnect switch was installed on the 230-kV main bus, permitting separate operation of the Holm and Kirkwood power plants on separate circuits of the 230-kV transmission line to Warnerville.

All concrete work is substantially complete. The roof is on and the 100-ton bridge crane can travel the full length of the extended powerhouse. The generator rotor was assembled on the existing stand in the repair bay and the two stator halves were connected on a heavy timber platform between Units No. 1 and 2. The stator and rotor were lifted by the bridge crane into their final locations and the rotor connected to the turbine shaft.

All auxiliary mechanical equipment, piping and ductwork is being installed, as well as electrical equipment, switchgear and control boards, conduits, wiring and terminations. The date for the start of commercial operation is April 1, 1987. The general contractor, intent on earning a bonus, has scheduled the startup for March 21, 1987.

Consulting services during construction were provided by Tony Lea, Eldon Floodeen and Kirit Shah, civil engineers; Don Guild, mechanical engineer; Bill Untiedt and Kelvin Yee, electrical engineers; and Paula Dierkop, specification writer. Designer-drafters Mel Bulseco and Birgit Chase, together with the CADD group, prepared the electrical interconnection diagrams, cable and wire schedules. Ocie Williams and Diane Alexander kept track of the contractors' shop drawing submittals. Our subconsultants, Geo/Resource Consultants, Fitz Consultants Inc., and Kwan/Henmi Architects and Planners, participated in the review of shop drawings. Responsible Principal is Michael B. Harrington and Project Engineer is Kurt A. Scholz.

NAS Alameda Corrosion Control

Construction of the Corrosion Control Facility at NAS Alameda, which contains all structures and equipment to strip and spot blast NAS aircraft, except exhaust air systems, was awarded to Tutor-Saliba in October 1984.

The \$14 million contract should be finished and ready for use by the Naval Air Rework Facility by the end of June 1987.

A separate construction contract to essentially complete the facility by adding the exhaust system for the stripping bays, including exterior fans and stacks, was just awarded for \$321,000 and should be completed by June. However, one final item required to allow the Government to begin operations is a revision to the industrial waste treatment plant to meet the new EPA standards for total toxic organisms in the effluent. This is being designed now, and will be added to the exhaust contract as a change order also.

The original basis for design in preparing documents for the 58,000 square foot main hangar and its support facilities was that two bays would be provided for stripping paint from aircraft with a phenolic agent containing methylene chloride, and one bay for spot blasting with glass beads. These bays would be designed with ventilation systems optimizing the working conditions for the stripping and blasting crews.

Throughout the design and construction phases, Tudor Engineering has provided services for the project management, civil and structural design. Mike Harrington is the Responsible Principal, Lou Salaber, Project Manager, and Joe Culpepper, Inspector.



Corrosion Control Hanger

Christmas Party



Seattle

The annual Seattle Office Christmas Party was held on Saturday, December 13 at the Columbia Tower Club. Robert Janopaul travelled from San Francisco for the occasion and was warmly welcomed by the Seattle staff. Robert presented service awards to Don Hoel (15 years) and Dave Alden (10 years). The party also served as a farewell to Dave and Jeri Alden, who are moving to Bend, Oregon, to begin new careers.

Pictures and captions from left to right

Judith Hoel, Barbara Blunt, Lela Paterson and Ed Peters relaxing.

Dave and Jeri Alden wondering what life will be like in Bend.

Patty and Greg Arnquist enjoying the party.

Robert Janopaul with service award recipients Don Hoel and Dave Alden.

Rosemary George and Carol Jensen are not about to be distracted.

Einer and Marilyn Handeland and Pete Paterson engaged in some light conversation.

Christmas Party



San Francisco

The San Francisco Office Christmas Party was held on December 6th at the Engineers Club. Louis and Patricia Riggs were honored on the occasion of his retirement after 35 years of service with Tudor.

Special guests for the evening were Joe and Kaye Carson, Stan and Harriette Froid, Barbara LaVigne, Irene Croft, Don and Ethel Moore, Wil and Marge Pacheco, Tom and Sandra O'Neill, Henry and Helen Weast, Doug and Ann Mansfield, and John Williams.

During courses of the dinner, Robert Janopaul and Paul Potter gave a special tribute to Louis and Pat. Letters from many of Louis' colleagues and friends were read that recalled Louis' career from the early days, pre-BART until the present. At the end of the tribute, all of the letters were presented to Louis and Pat bound in a special album. A Waterford crystal bowl and airline tickets for a golfing holiday completed the retirement gifts.



Pictures and captions from left to right

The after dinner social hour.

Karen and Steve Van Til dancing to the music of Nightwind.

Sandra and Tom O'Neill visiting from the Seattle office.

Don Moore, retired employee, is greeted by S.T. Su, Robert Janopaul, and Bob Ganse.

Pat and Louis Riggs enjoying the party.

Don Scapuzzi, Bob and Sue Myrdal and Pat Scapuzzi enjoying each other's company.

Christmas Party



Denver

John and Janet Williams hosted the Denver office staff at the annual Christmas Party on December 12 in the Colorado Room of the Denver Athletic Club. Dave Willer was the special San Francisco guest. The evening began with cocktails and hors d'oeuvres, and continued with an excellent dinner. John made welcoming remarks and congratulated Nelson Jacobs, Sal Todaro, and Ed Barbour on completing five years of service with Tudor. After dinner, a group from the Winterset

Talent Agency led the group in spirited singing of carols and songs, followed by a delightful presentation of Dickens' "A Christmas Carol," complete with audience participation.

Pictures from left to right

Susan Stevens, Patti Todaro, Dawn Jacobs and Janet Williams before dinner.

Clarence and Susan Colyn, Nelson and Dawn Jacobs, and Dave Willer enjoying dinner.



Phoenix

Tudor's Phoenix Office held its first annual Christmas Party at the Cafe de Perouges on Friday, December 19. The evening began with a social hour held in the Cafe's Wine Cellar. Dinner featured Coq Au Vin and Prime New York Steak.

Special guest, Tudor President, Robert Janopaul, began the evening program by explaining the history and traditions of the

Tudor Christmas Party. Following, he presented Dick Rudolph with his 15-year Tudor Service Award.

Pictures and captions from left to right

Cindi Spofford, Dick Rudolph, Katie Keser, Jim Spofford and Phyllis Rudolph settled in a cozy corner.

Posing for the photograph are, Seated, Dick and Phyllis Rudolph, Donna Agosto, Barbara Blunt, Tracy Wolfe, Karen Yapp. Middle, Dessi Quiray, Felipe Agosto, Ed Peters, Cindi Spofford, Lori Egly, Robert Janopaul, Jun Quiray. Rear, Craig Force, Jim Spofford, Bruce Braaten, Jim Schroeder

Projects

EPRI Guidebook Pumped Storage

The Electric Power Research Institute (EPRI) has selected a team consisting of Tudor and Harza Engineering Company of Chicago to prepare a guidebook for the preliminary evaluation of potential pumped storage sites. This guidebook is intended to be used by the electric utility industry for nation-wide application to improve the selection process of potential pumped storage projects.

In the past, Tudor has prepared a similar guidebook for EPRI on the screening of potential small hydro sites. According to EPRI, the small hydro guidebook was one of the most popular reports that EPRI has published.

Due to the difficulties to assess the system-specific plus site-specific conditions, the electric utility planners are often not well-equipped to analyze pumped storage additions. This is especially true for the benefit side of pumped storage. In addition to the conventional benefit gained from the replacement of thermal peaking units, the dynamic benefit which relates to the interaction effect between the pumped storage project and the thermal units, is only beginning to be quantified and is rarely included in an economic analysis. The proposed guidebook is designed to assist the electric utility planners in overcoming these difficulties.

As a subcontractor to Harza, Tudor's effort will be concentrated in the overall review of the cost and benefit presentations, and the development of case studies to demonstrate how to follow the guidebook procedures.

WSB-2 Update

A project which is dominating the winter workload of several Seattle office members is the West Seattle Bridge—Phase 2. This \$65 million project is scheduled to begin construction mid 1987, and includes a state-of-the-art swing bridge. Tudor, as part of a joint venture, was responsible for all civil design of the project and played a major role in the design of the steel bridge alternative. The completed drawings and specifications will be advertised in the early spring with a bid period of approximately two months.

Tudor's effort is led by DeWitt Jensen, Dar-

AML Update

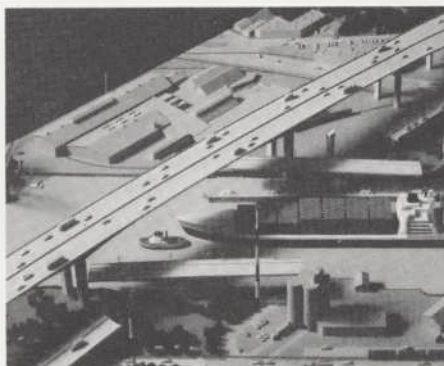
In the 1985 Fall Issue of the Tudor Quarterly, we reported the start of final design for the 80,000 square foot Advanced Materials Laboratory (AML) of the Lawrence Berkeley Laboratory (AML) of the Lawrence Berkeley Laboratory's Center for Advanced Materials, a project financed by the U.S. Department of Energy.

The design provided for the sequencing of construction under two separate contracts. The first contract, for about 1.5 million dollars, was awarded in June 1986 and will be completed in January 1987. Its primary task is the massive hillside excavation for the future building foundations, involving more than 20,000 cubic yards of material. This contract also included extensive utility relocations, and the construction of about 700 linear feet of three different types of retaining walls.

The second contract provides primarily for construction of the laboratory building, and furnishing of fixed equipment. This contract was awarded to the low bidder for about 16 million dollars. Work will start upon completion of the first contract, and is scheduled to last for 21 months.

The design team consists of the joint venture Keller & Gannon-Tudor, with subconsultants Reid & Tarics, as project architect, and Mel Lee Associates, landscape designers. Tudor's staff performed the civil and structural design, with Project Engineer Kirit Shah, assisted by Jim Schroeder, Jun Quiray, Bob Cermak, Jim Spofford, and others. Mike Harrington is the Responsible Principal, and Rainer Rungaldier is Project Manager. Heinz Mueller had guided the project through its initial stages.

rel Chambers, Peter DeBoldt and Rosemary George. Bela Vadasz and Einer Handeland provide general supervision.



West Seattle Bridge—Phase 2, Swing Bridge

El Vado Dam Power Project



El Vado Power Plant

The civil contract for construction of the El Vado Dam Power Project was awarded to Avery Structures, Incorporated, from Buena Vista, Colorado. Construction started in April 1986, and after nine months of construction activities significant progress has been made. The demolition work and powerhouse excavation were successfully completed; the penstock and 96-inch butterfly valve have been installed; and powerhouse concrete work is proceeding on schedule. Underwater removal of the tunnel concrete plug began in February.

Almost all hydro generation equipment provided by Voith has been delivered to the site, and equipment installation has begun. The unit is scheduled to go into commercial operation in July 1987.

Tudor is providing engineering services during construction. Two individuals who are actively involved are William Gray, Resident Engineer, and Greg Reichert, Project Engineer, who coordinates all technical input provided to the field. Others participating on the project on a less active role are Roberto Iniguez, Project Manager; Oral Conyers, Manager of Field Engineering Services; Jim Gormly, Mechanical Engineer and Procurement Contract Administrator; and Bill Untiedt, Electrical Engineer.

Projects

Calaveras Project Update

The 1986 construction season was eventful and found the contractor, Sierra Constructors, maintaining their schedule on the \$276 million Calaveras Project.

New Spicer Meadow Dam plinth concrete and grout curtain construction maintained an ambitious schedule throughout the summer and fall, leaving less than 10 percent of the work for next year. Approximately 300,000 cubic yards of rockfill was placed in the Spicer Saddledam leaving 50,000 cubic yards to top out next year. The main dam rockfill was placed to cover the foundation, leaving 2.1 million cubic yards to be placed next year.

The 7,000 foot, 14-foot diameter lower power tunnel at the Collierville Power Plant was completed in September. The Jarva tunnel boring machine (TBM) was moved to Spicer to bore the two mile, 12-foot diameter North Fork Diversion tunnel. As of January 1, 1987, 1,400 feet of tunnel had been mined and plans were made to continue through the winter, weather permitting. The 18-foot diameter Robbins TBM has advanced four miles in the eight-mile long Collierville upper power tunnel.

The 14-foot diameter, 2,200-foot power/surge shaft excavation got underway last summer with a 14-inch pilot hole being drilled to intersect both upper and lower tunnels. The shaft is being raised a total of 1,440 feet in the first stage; approximately 260 feet has been completed.

Bob Beal joined the QC/QA staff in July 1986. Presently Tudor has four of the twelve staff positions currently employed by Northern California Power Agency.



New Spicer Meadow Saddledam is approximately 80 feet high.

Baker Creek Hydro

Western Energy Associates Inc. awarded Tudor Engineering Company a contract for the conceptual design of the Baker Creek project in Humboldt County, California. Baker Creek is a tributary of the Van Dusen River, and runs in a steep rocky canyon with numerous water falls, dropping from elevation 4050 to elevation 1160 over a three-mile distance. The static head available is 820 feet. The plant size is limited by the FERC license and power sales contract with Pacific Gas and Electric Company to 1,500 kilowatts.

The owner purchased the five foot high steel girders of the collapsed Eel River Bridge for scrap value, and wants to use this material in the project design. The diversion structure will be a ten foot high rubblemound dam with a steel core made of bridge girders. The intake structure with sand trap will be welded steel construction using scrapped bridge girders. A self-cleaning screen will be installed ahead of the penstock entrance to prevent debris from entering the penstock and possibly plugging the turbine.

The penstock will be a buried 30-inch diameter, unprotected steel pipe, rather than coated and wrapped pipe; however, a galvanic protection system still might be required at a later date.

The powerhouse will contain a vertical-shaft four-jet 1,500 kW Pelton turbine and a small single-jet 100 kW Pelton unit for low flow periods. The tailrace will be a flume discharging at the bottom of the waterfall section where normal fish migration stops.

Access road survey and design is by a surveyor, Raymond G. Haberstock. The transmission line design, with a river span over the Van Dusen to an existing PG&E substation near Bridgeville, will be provided by Don Keef, although Tudor will assist with the PG&E electrical interconnection design.

The conceptual design of the diversion was completed during January, and the penstock and powerhouse in February. Construction of the project is contemplated to be during 1987 on a fast track schedule.

Responsible Principal is Michael B. Harrington, Project Engineer is Kurt A. Scholz, assisted by Bill Untiedt, Don Guild, Tony Lea and Birgit Chase.

People

Service Awards

Tudor's 1986 Service Awards Luncheon was held on December 4th at the San Francisco Engineers Club. Following the lunch, featuring grilled salmon, Tudor President Robert Janopaul presented awards to the following:

Ten Years



Joe Culpepper

Twenty Years



Lou Salaber



Clyde Earnest



Dave Willer



Stephen Wong

Thirty-Five Years



Louis Riggs

Certificate of Merit to



Grant Larsen, shown with Robert Janopaul

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