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IT SEEMS PARTICULARLY APPROPRIATE THAT YOUR MEETING IS BEING HELD IN ALASKA, AND IN A CITY WHICH WAS DEVASTATED BY ONE OF THE HISTORICALLY GREAT EARTHQUAKES EVER RECORDED. NO COMMUNITY ON EARTH HAS A GREATER INTEREST IN YOUR CONCERNS THAN ANCHORAGE. THAT INTEREST IS HEIGHTENED BY THE FACT THAT ANCHORAGE AND ALASKA ARE IN WHAT IS PROBABLY ONLY THE BEGINNING OF A CONSTRUCTION PERIOD WHICH MAY RIVAL ANY WE'VE EVER SEEN. THE PROBABILITY OF A NEW CAPITAL CITY AT WILLOW: THE LIKELIHOOD THAT WE WILL BE EXPANDING TRACKAGE FOR THE ALASKA RAILROAD: THE FACT THAT WE ARE CONSTRUCTING PUBLIC AND PRIVATE BUILDINGS IN VIRTUALLY EVERY COMMUNITY IN THE STATE: THAT NEW HARBORS, AIRPORTS, ROADS AND BRIDGES ARE IN THE OFFING IN MANY LOCATIONS: THAT WE ARE PRESENTLY PREPARING TO BUILD THE KNIK ARM CROSSING: NOT TO MENTION THE TREMENDOUS PLANS WE HAVE FOR HYDROELECTRIC DEVELOPMENT, INCLUDING THE GIANT SUSITNA PROJECT, AND THE PROBABILITY OF NEW PIPELINE PROJECTS, ALL MAKE THE RESULTS OF YOUR RESEARCH EFFORTS OF PRIMARY IMPORTANCE TO ALASKA.

AS AN ENGINEER, I CAN APPRECIATE THE SPECIAL IMPORTANCE OF YOUR WORK. I THINK ANYONE WHO IS NOT AN ENGINEER OR IN A RELATED DISCIPLINE, OR WHO WAS NOT IN ANCHORAGE IN MARCH OF 1964, CANNOT FULLY COMPREHEND THE AWESOME FORCES PENT UP IN THE EARTH WHICH IT IS YOUR MISSION TO UNDERSTAND AND TO PROTECT AGAINST IN CONSTRUCTION.

BOTH SEISMIC PREDICTION AND ENGINEERING DEFENSIVELY AGAINST SEISMIC DISRUPTION HAVE COME OF AGE. COMPUTERS HAVE GIVEN US THE CAPABILITY NOT ONLY OF USING PROBABILITY PREDICTION WITH RESPECT TO OCCURRENCE OF QUAKES, BUT ALSO TO MODEL POTENTIAL CONSEQUENCES. EVEN PREVIOUSLY UNACCOUNTABLE ANIMAL BEHAVIOUR IS BEING STUDIED AS A KEY TO SEISMIC UPSET.

ALTHOUGH I AM NOT PROFESSIONALLY QUALIFIED TO SPEAK ON THE MORE TECHNICAL ASPECTS OF YOUR UNDERTAKINGS, I DO HAVE AN ENGINEER'S APPRECIATION OF THEIR VALUE. YOUR RELATIVELY ESOTERIC AND TREMENDOUSLY EXCITING FIELD IS OF IMPORTANCE TO EVERY ALASKAN, FROM HOMEOWNERS TO ROAD BUILDERS, FROM INVESTORS TO CIVIL AUTHORITIES AT EVERY LEVEL. AS AN ENGINEER IN PUBLIC OFFICE, I HAVE A VERY SPECIAL INTEREST IN YOUR WORK AND IN THIS CONFERENCE, PARTICULARLY BECAUSE OF THE UNDERSTANDING I DO HAVE OF YOUR FIELD, AND OF THE INTEREST GOVERNMENT MUST NECESSARILY HAVE IN IT. IT IS OBVIOUS TO ME THAT YOUR INTEREST IN MY PARTICIPATION HERE IS THE DUAL ROLE I HAVE OF ENGINEER AND ELECTED OFFICIAL. I CAN APPRECIATE THE IMPORTANCE OF YOUR WORK MORE THAN THE AVERAGE LAYMAN MIGHT, AND I WILL HAVE AT LEAST SOMETHING TO SAY ABOUT HOW AND TO WHAT EXTENT STATE GOVERNMENT AFFECTS YOUR EFFORTS AND INTENTIONS.

BEING ON THE CONSERVATIVE SIDE OF THE POLITICAL SPECTRUM, I TEND TO RESIST GOVERNMENT INVOLVEMENT IN AREAS IN WHICH IT IS NOT ESSENTIAL, BELIEVING THAT GOVERNMENT BEST WHICH GOVERNS LEAST. IN THIS LATTER HALF OF THE TWENTIETH CENTURY, HOWEVER, GOVERNMENT IS NECESSARILY AND UNAVOIDABLY INVOLVED MORE AND MORE IN ALL OUR LIVES. AS MANKIND PROBES FURTHER INTO THE MYSTERIES OF THE EARTH AND OF THE UNIVERSE, WE FIND MORE AND MORE INTERESTS WHICH ARE BEYOND THE FINANCIAL CAPABILITIES OF PRIVATE FUNDING, AND WHICH ARE OF SUFFICIENT BROAD PUBLIC INTEREST AND IMPORTANCE THAT THEY BECOME A CONCERN OF GOVERNMENT. REGULATION FOR STANDARDIZATION, FOR THE SAKE OF BOTH PUBLIC AND PRIVATE SAFETY, HAVE COME TO BE LEGITIMATE CONCERNS OF GOVERNMENT. IT BECOMES THE RESPONSIBILITY OF THE CONSERVATIVE, IT SEEMS TO ME, TO REGULATE THE REGULATORS: TO BE SURE THAT REQUIREMENTS IMPOSED BY GOVERNMENTS ARE NOT SOMETHING WHICH MIGHT BETTER, MORE EFFICIENTLY, OR MORE

PROPERLY BE ACCOMPLISHED BY THE PRIVATE SECTOR.

IN THAT CONNECTION, THERE ARE TWO AREAS I WOULD LIKE TO DISCUSS WITH YOU. BOTH ARE SUGGESTIONS FOR YOUR CONSIDERATION. NEITHER IS A PROMISE OR A GUARANTEE.

IN ONE OF THE MOST EARTHQUAKE-PRONE REGIONS OF THE WORLD, WE DO NOT HAVE DESIGN, ENGINEERING OR CONSTRUCTION STANDARDS WHICH ARE CONSISTENT AND RELIABLE FOR BOTH PUBLIC AND PRIVATE ENTERPRISES. WE HAVE SOME VERY GENERALIZED GUIDELINES AND BASIC STANDARDS WHICH ARE COMMONLY OBSERVED, BUT NO RULE BOOK UPON WHICH ALL MAY RELY AND TO WHICH ALL MAY TURN FOR THE ANSWERS TO SOME VERY IMPORTANT QUESTIONS. THE ESTABLISHMENT OF EARTHQUAKE CONSTRUCTION STANDARDS, WHICH DOUBTLESS WOULD DIFFER IN MANY LOCAL REGIONS, GIVEN THE WIDE VARIETY OF GEOLOGY IN ALASKA AND IN THE COUNTRY, WOULD BE OF INTEREST AND VALUE TO A NUMBER OF DIVERSE CONCERNS. ARCHITECTS, ENGINEERS AND BUILDERS OBVIOUSLY WOULD HAVE A PRIMARY INTEREST. IN ADDITION, HOWEVER, INSURANCE COMPANIES, REAL ESTATE BROKERS AND FINANCIAL INSTITUTIONS WOULD HAVE AN INTEREST. AT THE CORE OF GOVERNMENT INTEREST IS PUBLIC SAFETY AND THE FINANCIAL STAKE IN THE BROAD VARIETY OF PUBLIC FACILITIES WHICH THIS STATE PRESENTLY OWNS AND OPERATES, AND THE MAJOR ADDITIONS TO THAT INDUSTRY WHICH WE WILL BE CREATING IN COMING DECADES AS ALASKA ATTEMPTS TO CATCH UP WITH ITS OLDER SISTER STATES IN DEVELOPING ITS PUBLIC INSTITUTIONS AND SERVICE SYSTEMS. OTHER STATES AS WELL, CONTINUE TO ERECT PUBLIC BUILDINGS AND FACILITIES WHICH ARE SUBJECT TO EARTHQUAKES.

OUR STATE GOVERNMENT, IN PARTICULAR THE LEGISLATURE, HAS A VESTED INTEREST IN THESE CONCERNS. IT WOULD BE OUR RESPONSIBILITY TO CONSIDER FINANCIAL ASSISTANCE FOR THE RESEARCH REQUIRED TO ESTABLISH SUCH STANDARDS.

IT WOULD BE OUR JOB TO "REGULATE THE REGULATORS" IN DETERMINING WHETHER OR HOW MUCH CONTROL, BY WAY OF STANDARDS ENFORCEMENT, WOULD BE APPROPRIATE, NECESSARY, AND NOT UNDULY RESTRICTIVE. IT WOULD BE OUR DUTY TO MONITOR THE USE OF SUCH CONTROLS, PERHAPS THROUGH THE DEVICE OF OUR SUNSET LAWS, AND BY PERIODIC AMENDMENT WHICH MIGHT BE APPROPRIATE. GIVEN THE MAGNITUDE OF THE EFFECTS OF SUCH INFORMATION AS YOUR RESEARCH CAN PRODUCE -- WHICH ALL OF US WHO WERE HERE IN 1964 CAN APPRECIATE -- IT SEEMS ENTIRELY APPROPRIATE THAT THE LEGISLATURE SHOULD BE INVOLVED ON BEHALF OF THE CITIZEN-STOCKHOLDER OF THE STATE OF ALASKA.

MY OWN RECOLLECTIONS OF THE 1964 EARTHQUAKE, IF I MAY DIGRESS, ARE VARIED: THEY RANGE FROM CONSTERNATION TO TERROR TO A LITTLE HUMOR. A SECRETARY, FLEEING THE TWO-STORY BUILDING IN WHICH MY OFFICE WAS HOUSED, WENT THROUGH A STREET DOOR JUST AS THE SECOND-STORY CONCRETE BLOCK WALL FOLDED ON ITS RE-BAR HINGES AND PINNED HER AGAINST THE WALL OF THE FIRST STORY. WHEN OTHER EMPLOYEES FROM THE BUILDING MANAGED TO SWING THE WALL BACK TO FREE HER, THEY SAW HER IMAGE IN BLOOD ON THE LOWER WALL. SHE WAS PROBABLY ONE OF THE MOST SERIOUSLY-INJURED OF THE QUAKE SURVIVORS. I HAD AN AUTOMOBILE WHICH DIED OF A CRACKED DISTRIBUTOR CAP IN FLIGHT FROM A POTENTIAL TIDAL WAVE ZONE, BUT I SURVIVED WITH FAMILY INTACT. ALMOST IMMEDIATELY AFTER THE QUAKE I WAS ASSIGNED TO A TEAM WHICH MET DAILY TO REPORT MONITORING OF POTENTIAL BUILDING SLIPPAGE, WHICH WE CHECKED WITH ELECTRONIC MEASURING INSTRUMENTS. I WAS ASSIGNED TO ANOTHER TEAM RESPONSIBLE FOR CHECKING AND CERTIFYING THE SAFETY OF PUBLIC BUILDINGS BEFORE THEIR BEING REOCCUPIED. I WAS IN THE CEILING CRAWL SPACE OF A THEATRE BUILDING A FEW DAYS LATER, WORKING ALONG ON MY BACK CHECKING TRUSS JOINTS WITH THE AID OF A FLASHLIGHT, WHEN ANOTHER QUAKE OCCURRED. I AM VERY GRATEFUL TO

THIS DAY THAT MY CLAUSTROPHOBIA QUOTIENT IS MINOR. I WOULD PROBABLY OTHERWISE HAVE HAD A HEART ATTACK. THE INEVITABLE HUMOR WHICH ARISES IN SUCH SITUATIONS WAS PROVIDED BY ONE OF MY BUSINESS PARTNERS AT THE TIME. HE RECALLS HAVING DIVED UNDER A DESK OR CONFERENCE TABLE WITH A CLIENT WHO WAS IN THE OFFICE AT THE TIME OF THE QUAKE. YEARS LATER, HIS MOST VIVID RECOLLECTION OF THE EARTHQUAKE WAS THAT THE CLIENT HAD HAD A GENEROUS PORTION OF GARLIC AT LUNCH THAT DAY.

MY OWN RECOLLECTIONS NOTWITHSTANDING, I RETURN TO CONSIDERATION OF STATE PARTICIPATION IN YOUR EFFORTS. FOR THE REASONS CITED, I INVITE YOUR INSTITUTE -- PERHAPS EVEN AT THIS WEEK'S MEETING, TO CONSIDER PROPOSING STATE-ENDORSED EARTHQUAKE ENGINEERING STANDARDS, AND A PROPOSAL FOR STATE FINANCIAL ASSISTANCE FOR YOUR RESEARCH EFFORTS, UPON WHICH SUCH STANDARDS WOULD NECESSARILY BE BASED.

I DELIBERATELY REFER TO "STATE ENDORSED" STANDARDS, AS OPPOSED TO PERHAPS "STATE ENFORCED" STANDARDS, FOR A NUMBER OF REASONS. AS TO STATE CONSTRUCTION, OF COURSE, AND PROJECTS INVOLVING STATE LOANS OR PARTICIPATION, SUCH STANDARDS COULD BE EXPECTED TO BE A MATTER OF SPECIFICATION. VENTURES MADE POSSIBLE THROUGH THE LOAN GUARANTEES OF THE ALASKA INDUSTRIAL DEVELOPMENT AUTHORITY WOULD PROBABLY ALSO BE AFFECTED. THE STANDARDS WOULD ALMOST CERTAINLY BE USED BY MANY PRIVATE ENTERPRISES AS WELL. THE DISTINCTION BETWEEN ENFORCEMENT AND ENDORSEMENT WOULD ALSO PROTECT THE OPTIONS AND CONTROL OF LOCAL GOVERNMENTS WITHIN THE STATE. IF OUR JOINT EFFORTS -- THOSE OF YOUR INSTITUTE AND OF STATE GOVERNMENT -- WERE TO MAKE SUCH WELL-RESEARCHED AND DEFENSIBLE STANDARDS AVAILABLE, THEY WOULD PROBABLY BECOME A BENCHMARK FOR THE CONSTRUCTION INDUSTRY, SIMPLY BECAUSE OF THE EFFECTS THEY WOULD HAVE

IN THE MARKET. SUCH STANDARDS WOULD INFLUENCE INSURANCE, FINANCING, SALE AND RESALE, AND MOST OTHER CONSIDERATIONS INVOLVING BUILDING CONSTRUCTION. THEY SHOULD, WE MAY HOPE PROMOTE REDUCTIONS IN INSURANCE PREMIUMS WHERE EARTHQUAKE INSURANCE IS AVAILABLE AND USED, AND THEY SHOULD PROMOTE EXTENSIONS OF THE LIFE EXPECTANCY OF BOTH PUBLIC AND PRIVATE CONSTRUCTION IN LARGER PROJECTS THEY SHOULD IMPROVE PUBLIC AND PRIVATE SAFETY -- AND IF EVEN ONE HUMAN LIFE WERE TO BE SAVED BY THEIR IMPLEMENTATION, THEIR VALUE WOULD HAVE BECOME IMPOSSIBLE TO QUANTIFY.

SHOULD YOUR INSTITUTE ELECT TO SEEK THE ESTABLISHMENT OF SUCH STANDARDS WITH THE ASSISTANCE OF THE LEGISLATURE, I CAN ASSURE YOU OF THE COMPETENT AND WILLING COOPERATION OF MY OFFICE AND OTHER LEGISLATIVE AGENCIES. I WOULD CERTAINLY USE MY OFFICE AND ITS INFLUENCE TO HELP YOU GAIN THE COOPERATION OF APPROPRIATE ADMINISTRATIVE AGENCIES. I WOULD LOOK WITH FAVOR UPON A PROPOSAL FOR FINANCIAL PARTICIPATION IN YOUR RESEARCH EFFORTS BY THE STATE, AND WOULD EXPECT TO BE ABLE TO SUPPORT A REASONABLE PROPOSAL. SUCH A MOVE WOULD CERTAINLY BE TO THE BENEFIT OF ALL THE STATES REPRESENTED AT THIS MEETING, AND PRESUMABLY TO MOST OTHER STATES AND TO MANY FOREIGN NATIONS.

THE UNITED STATES' TRADITIONAL ROLE AS A LEADER IN PURE RESEARCH IN MANY DISCIPLINES MAKES IT APPROPRIATE THAT WE SHOULD PURSUE SUCH A COURSE, AND ALASKA'S POSITION IN THE VANGUARD OF AREAS NEEDING AND PURSUING PRIVATE, PUBLIC AND COMMERCIAL DEVELOPMENT PROPERLY PLACES IT IN THE FOREFRONT OF SUCH INVESTIGATION. I WILL LOOK FORWARD TO WORKING WITH THE APPROPRIATE COMMITTEES OF YOUR INSTITUTE, AND TO HEARING FROM YOU SHOULD YOU ELECT TO ACCEPT MY INVITATION. IF THE EFFECTS OF OUR JOINT EFFORTS REACH AS FAR AS I THINK THEY MIGHT, AND IF THEY SERVE WELL THE GOOD INTENTIONS I KNOW YOU HAVE, THEY MIGHT EVEN BE CALLED EARTHSHAKING. THANK YOU.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

Bill Sheffield — Governor
Esther Wunnicke — Commissioner
Ross G. Schaff — State Geologist

April 1983

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Report of Investigations 83-11
SEISMIC, VOLCANIC, AND TSUNAMI
MITIGATION IN ALASKA - AN UNMET NEED

By
J.N. Davies

STATE OF ALASKA
Department of Natural Resources
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

According to Alaska Statute 41, the Alaska Division of Geological and Geophysical Surveys is charged with conducting 'geological and geophysical surveys to determine the potential of Alaska lands for production of metals, minerals, fuels, and geothermal resources; the locations and supplies of ground waters and construction materials; the potential geologic hazards to buildings, roads, bridges, and other installations and structures; and shall conduct other surveys and investigations as will advance knowledge of the geology of Alaska.'

In addition, the Division shall collect, evaluate, and publish data on the underground, surface, and coastal waters of the state. It shall also file data from water-well-drilling logs.

DGGS performs numerous functions, all under the direction of the State Geologist---resource investigations (including mineral, petroleum, and water resources), geologic-hazard and geochemical investigations, and information services.

Administrative functions are performed under the direction of the State Geologist, who maintains his office in Anchorage (3001 Porcupine Dr., 99501, ph 274-9681).

This report is for sale by DGGS for \$1. It may be inspected at any of the four DGGS information offices: Alaska National Bank of the North Bldg., Geist Rd. and University Ave., Fairbanks; 3601 C St. (10th Floor), Anchorage; 230 So. Franklin St. (4th Floor), Juneau; and the State Office Bldg., Ketchikan. Mail orders should be addressed to DGGS, P.O. Box 80007, College, AK 99708.

Workshop participants:

Pictured (left to right): front row - George Carte, Selena Billington, Klaus Jacob, Ray Steinmetz, J.P. Singh; second row - Lynn Sykes, Bob Engdahl, Cliff Frolich, Tom Sokolowski; third row - Carl Benson, Woody Savage, John Lahr; back row - Bob Page, Mike Blackford, Juergen Kienle.

Not pictured: Ross Schaff, Bill Barnwell, Randy Updike, John Reeder, Dick Reger, John Davies, Rod Combellick (photographer), Jack Townshend, Tom Miller, Jim Riehle, John Sindorf, Niren Biswas, Hans Pulpan, Larry Gedney, Lloyd Tuner, Don Drury, Dennis Thomason, Bob Horner.

Participating agencies, universities, and firms:

U.S. Geological Survey, Department of the Interior
Alaska Tsunami Warning Center, National Weather Service
Division of Geological and Geophysical Surveys, Department of Natural Resources, State of Alaska
Division of Emergency Services, Department of Military Affairs, State of Alaska
Geophysical Institute, University of Alaska, Fairbanks
Pacific Geoscience Centre, Victoria B.C.
Lamont-Doherty Geological Observatory, Columbia University
Cooperative Institute for Research in Environmental Sciences
(University of Colorado/National Oceanic and Atmospheric Administration)
Geophysics Institute, University of Texas, Austin
Alaska Oil and Gas Association
Woodward-Clyde Consultants
Harding-Lawson and Associates

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SEISMIC, VOLCANIC, AND TSUNAMI HAZARDS MITIGATION IN ALASKA -
AN UNMET NEED

Report from the Seismology Workshop
held in Wasilla, Alaska - February 15-16, 1982

By
J.N. Davies

EXECUTIVE SUMMARY

In mid-February 1982, seismologists from federal and state agencies, universities, and the private sector met in a workshop sponsored by the Alaska Division of Geological and Geophysical Surveys (DGGGS) to discuss specific initiatives to improve the availability of critical seismological information in Alaska. The motivation for holding this workshop was a widespread concern for the lack of a statewide program to collect and disseminate seismic data essential to mitigate the hazards from earthquakes, volcanoes, and tsunamis. The workshop also focused on Alaskan seismological programs jeopardized by rapidly declining federal support.

Resolutions from this workshop called for:

- a) Establishing an Alaska Division of Geological and Geophysical Surveys program to ensure and coordinate the statewide collection and dissemination of seismic data for Alaska
- b) Exploring methods to support seismic-hazard-mitigation programs in Alaska through direct and indirect funding from various sources---state and local agencies, subsidized transmission of seismic data, building-permit fees, a levy on property insurance, and the establishment of an endowment fund
- c) The appointment (by the State Geologist) of a working group on Alaskan earthquakes, volcanoes, and tsunamis to annually assess the future needs of seismic research, hazards mitigation, and hazards education in Alaska, and to be available to evaluate earthquake and eruption predictions and monitor ongoing seismic and volcanic crises
- d) Improving the preparedness of coastal communities vulnerable to tsunamis through upgraded communications and better mapping of potential postearthquake water heights
- e) Creating both a national program focused on Alaska for comprehensive studies of explosive volcanism and a Cook Inlet volcanological research consortium
- f) Making a strong statement to the Committee on Seismology of the National Academy of Sciences asserting that Alaska should receive increased priority in the setting of national objectives for earthquake research and monitoring.

BACKGROUND

Alaska is the most tectonically active state in the United States. Most activity---great earthquakes, explosive volcanism, and giant tsunamis---is concentrated in the Aleutian Islands, the Alaska Peninsula, and Prince William Sound. Until recently, the risk posed by these geologic hazards has been minimal because of a sparse population and a limited industrial base. But this situation is changing. The increasing pace of development of Alaska's abundant natural resources (minerals, fish, timber) has brought about a corresponding growth in population and a more sophisticated industrial infrastructure. With this, there is an increasing need to evaluate the vulnerability of Alaska's people and economy to the potentially devastating effects of major earthquakes and volcanic eruptions.

The state of Alaska does not have an adequate program to mitigate the hazards from earthquakes, volcanoes, and tsunamis. Elements of such a program would include:

- a) Geologic studies to understand the tectonic framework of Alaska, to identify active faults, and to determine the recurrence rates of major earthquakes
- b) Seismological studies to document the seismic history of Alaska and to use that history to forecast future seismic activity and its expected effects
- c) Geotechnical studies to characterize the seismic stability of geologic deposits
- d) Using the above studies in land-use planning, zoning, developing building codes, and siting major public buildings and facilities
- e) Seismic engineering investigations to develop earthquake design criteria for specific construction projects.

Critical data are lacking to apply any one of these elements to a specific seismic-risk study almost anywhere in Alaska. However, the most fundamental need is for comprehensive earthquake data, especially strong-motion accelerograph data from southern Alaska.

Seismologists are aware of these problems and until recently were content to rely on various federally funded research and hazard-mitigation programs to address Alaska's needs. Indeed, under the potpourri of programs that have existed in Alaska, including the Outer Continental Shelf Environmental Assessment Program (OCSEAP), about 180 sensitive seismographic stations were established in Alaska. But with the demise of OCSEAP support for seismology and with the stringencies that exist for most nondefense federal programs, about half of the existing stations are expected to close in 1983.

Concern for the deteriorating situation in seismic monitoring and for a state program in seismic-hazards mitigation and its underlying data base prompted this meeting on Alaskan seismology. Participants hope that the state

will, by adopting a coordinating role and providing a modest level of support, make much more effective use of the data that are collected. The consequences of not establishing the required comprehensive earthquake data base will not necessarily mean that unsafe construction and planning will take place (although in some cases it is likely). Rather, the more probable result with respect to critical facilities will be overly conservative designs and delays in licensing caused by uncertainties about actual risks.

The remainder of this report is devoted to resolutions made at the workshop. The first seven resolutions address specific aspects of the overall need to improve seismic- and volcanic-hazards-mitigation efforts in Alaska. The last two resolutions are directed at somewhat different audiences. Resolution 8 is primarily from some Alaskan scientists requesting that the state consider a general funding arrangement for the study of Alaska's natural resources, including natural hazards. Resolution 9 is directed at the national level of scientific funding and calls for an increased emphasis on Alaskan seismology and volcanology.

RESOLUTIONS

Resolution 1. Alaska Division of Geological and Geophysical Surveys program in seismology

WHEREAS, Alaska, the most seismically active state, will continue to be an area of rapid development of natural resources, major construction projects, and population growth during the next few decades; and

WHEREAS, cost-effective planning and safe design for this development require an adequate definition of the seismic hazards; and

WHEREAS, a uniform and continuous base of seismic information (including strong-motion data) collected over a long period of time is lacking but is necessary to mitigate these hazards; and

WHEREAS, the need for these data at a specific site is commonly recognized just prior to individual construction projects, but no one project can be expected to accept responsibility for such long-term data collection; and

WHEREAS, this responsibility is appropriately undertaken by a state or federal agency; and

WHEREAS, DGGs has statutory responsibility to determine potential geologic hazards in the State of Alaska;

THEREFORE BE IT RESOLVED that DGGs establish a seismic program to:

- a) Ensure the operation of a statewide seismographic network, including instrumentation to record strong ground motion in areas of significant earthquake potential

- b) Establish a statewide seismic-data center
- c) Coordinate the collection and dissemination of seismic data for Alaska.

Implementation. An initial step to implement this program is to designate an Alaskan seismic-data center. Criteria for data storage, use, and dissemination would have to be established. Existing earthquake-data sets would be assembled and cataloged as a continuing function of the data center. To provide for uniform and continuous monitoring of Alaskan earthquakes, a statewide standardized seismograph network would be designed.

This network would be initially based on a selected configuration of seismograph stations now operated by a number of organizations and supplemented by additional stations as required. The network would be upgraded in phases to provide high-dynamic-range, broad-band recording of ground motions statewide. Also, an effective and efficient system for data collection and processing would be implemented to incorporate existing facilities in the state. These data would thus update the earthquake-data base now used for ongoing seismic analyses.

Special-purpose networks will probably be operated in the state from time to time; these networks will be coordinated and their data integrated with the statewide network as appropriate.

The seismic-data center will also provide information on earthquake hazards to the public.

Resolution 2. A multi-element program to provide funds for collection and dissemination of earthquake-hazard data

WHEREAS, the evaluation of potential geologic hazards is mandated for DGGs by the State of Alaska; and

WHEREAS, the maintenance of long-term earthquake-data collection is a necessary aspect of the earthquake-hazard-investigation program; and

WHEREAS, the federal government has provided major financial support for seismic data collection and research in Alaska, but this support is diminishing; and

WHEREAS, stability of funding is necessary to maintain the continuity of data collection and the maintenance of related technical expertise; and

WHEREAS, the primary financial support for the collection and dissemination of earthquake-hazard data should be provided by those who have the strongest requirements for these data;

THEREFORE BE IT RESOLVED, that a multi-element program of funding should be established to provide long-term fiscal support, recognizing both the startup and long-term-operations costs of the program. In the funding program:

- a) The State Geologist should actively coordinate and pursue financial support for both a statewide seismic-monitoring network and long-term collection of seismic data, and make these data available for scientific and public use
- b) The Alaska Power Authority and the Alaska Department of Transportation and Public Facilities---two state agencies with primary responsibility for large-scale construction that are major beneficiaries of seismic data used in designing earthquake-resistant structures---should contribute financial support for the long-term collection of seismic data
- c) The feasibility of a permit fee should be investigated to provide support for the collection and dissemination of strong-ground-motion and structural-response data that are of direct benefit to the safe design of engineered facilities. This fee could be equal to a percentage of the costs of construction of new facilities built in seismically active areas
- d) DGGs should establish a matching program with municipalities and boroughs to fund the purchase, maintenance, and operation of strong-ground-motion recorders
- e) The potential for obtaining funding for long-term seismic-data collection from a levy on property insurance should be researched through the appropriate state agency.

Resolution 3. State of Alaska support for seismic-data transmission

WHEREAS, the State of Alaska, through its statewide computer network and teleconferencing systems, has a statewide communications network; and

WHEREAS, seismic networks operated by the state government and university, by the federal government, and by private universities provide data essential for the mitigation of earthquake hazards and safe construction and development of resources; and

WHEREAS, seismic networks in Alaska are faced with large annual operating costs for transmission of earthquake data to centralized recording facilities;

THEREFORE BE IT RESOLVED, that the state should consider subsidizing the costs of transmission of seismic data.

Resolution 4. Working Group on Alaskan Earthquakes, Volcanoes, and Tsunamis

WHEREAS, there exists a significant potential for seismic, volcanic, and tsunami hazards in Alaska that may adversely affect the public safety, future development, and economy of Alaska; and

WHEREAS, there is a large variety of federal, state, academic, and private organizations performing research related to seismic, volcanic, and tsunami hazards in Alaska with a variety of techniques; and

WHEREAS, the State Geologist has statutory responsibility for identification and evaluation of these hazards; and

WHEREAS, there exists a body of expertise in Alaskan seismic, volcanic, and tsunami research that could be drawn on for advice by the State Geologist and various state and federal agencies; and

WHEREAS, there exists a general lack of public awareness of potential seismic, volcanic, and tsunami hazards in Alaska;

THEREFORE BE IT RESOLVED, that a working group on Alaskan earthquakes, volcanoes, and tsunamis meet at least annually to:

- a) Evaluate and document both the state of research and data collection and any additional research necessary on seismic, volcanic, and tsunami hazards in Alaska
- b) Recommend standards for seismic monitoring and data reporting by the organizations operating seismic stations in Alaska
- c) Assist in public education on mitigation of seismic, volcanic, and tsunami hazards in Alaska.

In addition, participants of the Working Group could be called on by the State Geologist to:

- a) Recommend mitigation measures related to seismic, volcanic, and tsunami hazards in Alaska
- b) Evaluate short- and long-term predictions of earthquakes, volcanic eruptions, and tsunamis
- c) Monitor ongoing seismic, volcanic, and tsunami crises and advise duration, severity, areal extent, and effects. ^{government officials as to the}

The Working Group should be composed of seismologists, volcanologists, and others directly involved in research, data acquisition, engineering, or planning applicable to evaluation and mitigation of seismic, volcanic, and tsunami hazards in Alaska. A recommended means of establishing the membership of the Working Group is selection, by the State Geologist, of 10 to 15 voluntary participants.

Resolution 5. Continuous capability for tsunami warning to Alaskan coastal communities

WHEREAS, numerous coastal communities in Alaska are exposed to significant tsunami hazards; and

WHEREAS, some of these communities presently cannot always receive tsunami warnings because of a lack of a continuously functional communications system; and

WHEREAS, through satellite telemetry or other means, most of these communities could receive warnings 24 hours a day,

THEREFORE BE IT RESOLVED, that the Alaska Division of Emergency Services investigate communications options and seek funds to establish round-the-clock warning capability for all vulnerable coastal communities.

Resolution 6. Tsunami-runup determinations for Alaskan coastal communities

WHEREAS, tsunami runups (the maximum height of water expected along a coast following a major earthquake or volcanic eruption) have in general only been subjectively determined in Alaska; and

WHEREAS, the imprecise nature of runup determinations has resulted in delineation of larger hazard zones than may be required if current computation techniques were used; and

WHEREAS, these techniques require both expertise and extensive computer capability unavailable in the National Weather Service Tsunami Warning System or any cognizant state agency;

THEREFORE BE IT RESOLVED, that DGGs seek funding to obtain improved tsunami-runup determinations for those communities with a high tsunami risk, as identified by the Alaska Tsunami Warning Center.

Resolution 7. A national program focused on Alaska for the study of explosive volcanism and a Cook Inlet volcanological-research consortium

WHEREAS, the United States research effort on explosive volcanism has devoted less than 1 percent of its total commitment to Alaska, which contains 90 percent of the explosive volcanoes in the country and hence the greatest research opportunities; and

WHEREAS, of the 40 historically active volcanoes in the Aleutian arc, 28 have advanced to caldera stage, which attests to the great explosivity of the arc volcanoes; and

WHEREAS, other north-Pacific-rim nations such as Japan and the U.S.S.R. have established major programs to study and understand explosive volcanism; and

WHEREAS, the funding for volcanological research in the United States has remained at a very low level compared with that of many other sciences;

THEREFORE BE IT RESOLVED, that a major innovative program on a national scale be created to study explosive volcanism in Alaska. This program should be multidisciplinary and should include universities and the federal and state governments; and further,

WHEREAS, the size and geographical extent of the problem are so overwhelming, efforts must be focused primarily on that region of greatest social and economic importance to Alaska, the Cook Inlet area,

BE IT ALSO THEREFORE RESOLVED, that funds should be sought to establish a Cook Inlet volcanological research consortium to conduct multidisciplinary research on the geologic history, seismotectonic setting, eruptive style, and hazards of the five active volcanoes in the Cook Inlet area. Such an umbrella organization would use the resources and facilities of established federal, state, and university researchers with expertise on explosive volcanism.

Resolution 8. An endowment fund for research on natural resources and hazards

WHEREAS, the primary source of Alaska's wealth comes from renewable and nonrenewable natural resources, but natural phenomena such as frost heaving, avalanches, earthquakes, flood, and volcanic eruptions can destroy Alaskan lives and property. To care for and develop these resources and to mitigate fear and damage from these hazards, it is essential to understand them. This understanding is best gained by basic research on the fundamental physical and biological processes that yield the resources and contribute to the hazards.

THEREFORE BE IT RESOLVED, that an endowment fund be established, the interest from which is to be used for research on natural resources and hazards.

Two options may be considered for implementation:

- a) Establish a fund for research, care, and development of Alaska's natural resources and mitigation of damage from natural hazards. The fund would be invested and administered in a manner similar to that of the Alaska Permanent Fund. It could be disbursed by the Alaska Council on Science and Technology (ACST) as special-project funding, beyond the range of the council's present scope. The present function of ACST would not be altered by assuming this added responsibility
- b) Set aside 5 percent of the earnings from the Permanent Fund for this purpose.

Resolution 9. An increased national emphasis on Alaskan seismology and volcanology

Several critical decisions are coming up regarding a United States national seismic network, the funding of regional networks, and directions for future research in earthquake prediction and hazards.

Alaska is the most seismically active state, has the highest proven reserves of petroleum and several other natural resources, represents a unique tectonic setting, and is likely to play an even more important role in future research in areas of high national priority. Nevertheless, Alaska has consistently received low priority in the setting of national objectives for earthquake research and monitoring. Unique opportunities exist to study subduction processes, active volcanism, seismic gaps in which great earthquakes can occur, transitions in tectonic style from oceans to continents and from interplate motion to intraplate processes, geothermal energy, and the generation of tsunamis.

Members of the workshop recommended establishing a network of digitally recording broad-band seismographs to uniformly monitor earthquakes statewide, a center to process and disseminate the data, an intensified program of broad-based geological and geophysical measurements in seismic gaps, an array of portable instruments and ocean-bottom seismometers for both special Alaska-Aleutian studies and response to major earthquakes, an adequate deployment of strong-motion instrumentation, and advanced data-communication techniques that will help reduce the increasing costs of transmitting data. The group also emphasized the necessity for geodetic, in-situ stress and sea-level measurements in zones of active deformation. To focus attention on Alaskan seismology, the workshop members recommended special Alaskan themes at national meetings, holding future national meetings in Alaska, and conducting seismic-reflection profiles across Alaska of the Consortium for Continental Reflection Profiling (COCORP)-type (such as a north-south transect across the state that would also include the adjacent continental margins). Members also recommended a periodic review of projects in Alaska, particularly a review of the status of major seismic gaps and other areas of special seismic study.

ACKNOWLEDGMENTS

The time and energy contributed by each of the participants are greatly appreciated. Reviews of the manuscript by Bob Page, John Lahr, ~~R.A. Red~~ Combellick, and ~~R.D.~~ Reger are gratefully acknowledged.

Dick

APPENDIX A

GENERALIZED AGENDA

Workshop on Alaskan Seismology

February 15-16, 1982

Wasilla, Alaska

MONDAY MORNING

Open Plenary Session, John Davies, Chair
Welcome by Ross Schaff
Introduction and general discussion of Workshop I, Combellick
Introduction and general discussion of Workshop II, Davies
Introduction and general discussion of Workshop III, Carte
Introduction and general discussion of Workshop IV, Miller
Introduction and general discussion of Workshop V, Page
Introduction and general discussion of Workshop VI, Sykes

MONDAY AFTERNOON

Workshops I, II, and III meet separately

MONDAY EVENING

Workshops IV, V, and VI meet separately

TUESDAY MORNING

Open Plenary Session, Davies, Chair
Discussion of resolutions from Workshop I, Combellick
Discussion of resolutions from Workshop II, Davies
Discussion of resolutions from Workshop III, Carte
Discussion of resolutions from Workshop IV, Miller
Discussion of resolutions from Workshop V, Page
Discussion of resolutions from Workshop VI, Sykes

TUESDAY AFTERNOON

Final rewrite of resolutions
Trip to Palmer Observatory

WORKSHOP TITLES

- I. Alaska Council on Tsunamis, Earthquakes, and Volcanoes
- II. State of Alaska Seismic Observatory
- III. Cook Inlet Volcano Observatory
- IV. New Basis for Funding
- V. New Basis for Funding
- VI. Input to National Dialogue on Seismology

APPENDIX B

LIST OF PARTICIPANTS AND ADDRESSES

Workshop on Alaskan Seismology

February 15-16, 1982

Wasilla, Alaska

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Bob Horner Seismologist
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by mail) Sidney, B.C. V8L 4E2
 Canada
 (604)656-8432

Introduced:
Referred:

BY

IN THE HOUSE

HOUSE BILL NO.

IN THE LEGISLATURE OF THE STATE OF ALASKA
THIRTEENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act establishing a seismic hazard program within the Department of Natural Resources, and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 41.08.017 is amended to read:

Sec. 41.08.017. HYDROLOGICAL AND SEISMIC HAZARD DATA DECLARED TO BE OF PUBLIC INTEREST. (a) Systematic collection, recording, evaluation, and distribution of data on the quantity, location and quality of water of the state in the ground, on the surface of the ground, or along the coasts, are in the public interest and necessary to the orderly domestic and industrial development of the state.

(b) Systematic collecting, recording, evaluation, archiving and distribution of data on seismic events and engineering geology, and identification of potential seismic hazards throughout the state are in the public interest and necessary to orderly, safe and cost-effective development in the state.

* Sec. 2. AS 41.08.020 (b) is amended by adding new subsections to read:

(5) collect, record, evaluate, archive and distribute data on seismic events and engineering geology of Alaska;

(6) identify potential seismic hazards which might affect development of Alaska;

(7) inform public officials and industry about potential seismic hazards which might affect development of Alaska;

* Sec. 3. This Act takes effect July 1, 1983.



AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS

May 6, 1983

The Honorable Joseph Flood
Alaska State House of Representatives
Pouch "V", State Capital Building
Juneau, Alaska 99811

RE: House Bill 379-380

Dear Representative Flood:

The Alaska Section of the American Institute of Professional Geologists would like to voice support for HB 379-380. It is our understanding this bill is to provide funding for the continued service and maintenance of a seismic network in south central Alaska through the State of Alaska, Department of Natural Resources.

As a professional organization of geologists in Alaska, the membership of AIPG feels it is imperative to maintain a seismic monitoring network particularly in south central Alaska where seismic events are common and earthquake records vital to present and future development.

We strongly urge passage of this bill so that irretrievable earthquake information is not lost in the future.

Respectfully submitted,

American Institute of Professional Geologists

Alan J. Krause
Secretary/Treasurer

143 East 9th Avenue, Suite 200
Anchorage, Alaska 99501

I. REQUEST

Bill/Resolution No.: HB 379
 Title: Establishing seismic hazard program
 Sponsor: Flood & Hayes
 Requestor: House Resources

II. FISCAL DETAIL

Agency Affected: Natural Resources
 Program Category Affected: NRMEC
 BRU, Program of Subprogram(s) Affected: Geologic Hazards

EXPENDITURES/REVENUES: (Thousands of Dollars)

	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88
OPERATING						
100 PERSONAL SERVICES		56.9	59.7			
200 TRAVEL		17.2	18.9			
300 CONTRACTUAL		375.0	394.5			
400 COMMODITIES		6.3	8.0			
500 EQUIPMENT		47.2	42.0			
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC						
TOTAL OPERATING		502.6	524.0			
CAPITAL		-	-			
REVENUE		-	-			

FUNDING: (Thousands of Dollars)

GENERAL FUND		502.6	524.0			
FEDERAL FUNDS						
OTHER (Specify Source)						

POSITIONS:

FULL-TIME		1	1			
PART-TIME						
TEMPORARY						

III. SOURCE OF FUNDS TO OFFSET FISCAL IMPACT OF BILL:

Unknown (HB 380 would appropriate \$500,000 to implement this legislation)

IV. ANALYSIS: Attach a separate page for any Analysis

Prepared By: Ross Schaff, State Geologist
 Division: Geological & Geophysical Surveys

RS

Phone: 274-9681
 Date: 5/10/83

Approved by Commissioner: Wm D. ...
 Department: Natural Resources

Date: _____

Distribution:

- Original to Legislative Finance
- Copy to Office of Management and Budget (for Legislature introduced bills)
- Copy to Department (for Governor introduced bills)
- Copy to Sponsor
- Copy to Requestor (if different from Sponsor)

PROJECT	FY	100	200	300	400	500	TOTALS
	1. Cook Inlet Kodiak Seismic Network RSA to Support Existing UAGI Stations	84			250		
	85			262.5			262.5
2. Interior Alaska Seismic Network RSA to Support Existing UAGI Stations	84			50			50
	85			52.5			52.5
3. Stations in SE and SW Alaska Install 2 and Maintain 2 DGGS Stations	84		10	12.6	3.2	24.2	50
	85		10.5	13.2	3.4	25.4	52.5
4. Seismic Instrumentation in Anch. Bldg. And other Areas in '85	84		.6	1	0	16	17.6
	85		1.5	2	1.2	10	14.7
5. Cook Inlet Volcano Observatory Cooperate with USGS, UAGI, DES, NOAA	84		.6	2.4	1	1	5
	85		.6	2.5	1.1	1.1	5.3
6. Alaska Seismological Data Center Cooperate with UAGI (Fairbanks)	84	56.9	0	37	1.1	5	100
	85	59.7	0	38.8	1.2	5.3	105
7. Engineering Geological Studies in Various Municipal Areas	84		6	22	1	1	30
	85		6.3	23.0	1.1	1.1	31.5
TOTALS	84	56.9	17.2	375	6.3	47.2	502.6
	85	59.7	18.9	394.5	8.0	42.0	524.0

ATTACHMENT - ANALYSIS FOR FISCAL NOTE FOR IIB 379

TABLE 1

April 15, 1983

TO: J. Aho J. Lambe
D. Bruggers T. Smith
B. Hickel M. Swalling
A. Krause B. Tart

FROM: D. Cole

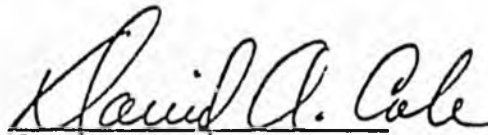
Gentlemen:

The enclosed material was given to me by Dr. John Davies, the State Seismologist. The information is a bill which will be proposed in the House this session by Representative Joe Flood (Anchorage). Technical background material supporting and explaining the proposed bill is also included, along with a copy of Speaker Joe Hayes' speech presented at the Earthquake Engineering Research Institute seminar held in Anchorage last year.

If the measure is not passed this session, funding for the seismic monitoring network in the Cook Inlet area will be lost - along with important and irretrievable earthquake information. I personally believe that it is imperative to keep the seismic networks in the state functioning continuously. Therefore, I propose that as a technical advisory group, the Commission officially support this issue. And further, I suggest that we recommend to the Mayor and to the Assembly that they officially support the proposed legislation also.

The next Assembly meeting is Tuesday, April 19 - before our next scheduled meeting; therefore, I will contact each of you by phone for vote on this matter.

If you have any questions, please call.


David A. Cole, P.E.
Chairman

Attachments

Purpose:

To establish a State of Alaska program in seismic hazards mitigation which will provide, in a timely manner, basic information that is critical to the safe and cost effective development of Alaska's economic, natural and recreational resources.

Background:

- Declining federal support has resulted in the closing of over 25% of the seismic stations in Alaska over the past two years.
- Present distribution of stations is uneven and not adequate for state's needs.
- Present lack of coordination results in information from Alaska seismic stations being scattered among archives in New York, Colorado, California and 4 places in Alaska.
- Future development of Alaska will require information about geologic hazards that must be collected continuously and over the long term - industry cannot and will not collect such information - it is the appropriate function of state government [Hayes].
- Wasilla Workshop on Alaskan Seismology called for DGGs program of the scope proposed.
- Hayes speech at EERI symposium promised support for seismic hazard mitigation research.

Objectives:

Listed in Table 1 are the costs to establish or maintain various seismic monitoring and/or hazard assessment projects. Together this

package would be a reasonable seismic hazard mitigation program for the State of Alaska and would go a long way toward meeting the State's responsibility to assess one of the major geological hazards in Alaska. Below are brief descriptions of each of the projects:

1. Cook Inlet - Kodiak Seismic Network

Of about 25 seismic stations established by UAGI in this area under various federal (DOE, NOAA, NSF) research grants and contracts (circles and triangles, lower left of Figure 1) 6 are now closed and 19 are now maintained under a grant from the Governor's Office (derived from the Federal Budget Impact Fund). These stations are important for monitoring the seismic and volcanic activity of the lower Cook Inlet and Kodiak Island areas. In addition to that in the subduction zone (area of contact between the Pacific and Alaskan plates) these stations monitor possible activity on three major fault systems which are important to seismic hazards assessment in the greater Anchorage area: (1) the Bruin Bay-Castle Mtn. system; (2) the Border Ranges-Eagle River system; (3) the offshore Kodiak-Montegue Island system. This network also provides a means to monitor the activity of the following volcanoes: Katmai group, Mt. Douglas, Augustine, Illiamna and Redoubt.

Useful support can be given at any level of funding between \$80,000 and \$250,000. Costs for various portions of this network are as follows: \$80 K, Cook Inlet; \$75 K, Kodiak Island; \$60 K, Alaska Peninsula. The remaining \$35 K would be used for preparation of a comprehensive seismic hazards assessment of the greater Cook Inlet region.

2. Interior Alaska Seismic Network

This network consists of about 15 stations (5 now closed) generally located along the Glen, Parks and Alaska (between Glennallen and Fairbanks)

Highways (see upper right portion of Figure 1). It monitors seismic activity in the Mat-Su Valleys, the Talkeetna Mountains, the Railbelt and major highway routes into the interior and the Fairbanks-Nenana region. Major fault systems monitored include the northeastern most corner of the Pacific-Alaska plate interface (subduction zone), the Denali and Castle Mountain Fault systems, numerous other smaller faults north of the Alaska Range and the Fairbanks seismic zone.

The Interior Alaska Seismic Network includes some of the original stations established immediately following the 1964 Good Friday Earthquake. It has been supported under grants and contracts from the federal government as well as unrestricted funds allocated to the Geophysical Institute of the University of Alaska. These latter funds now are the sole source of support for the Interior Network. The \$50 K sought would not cover all of the costs of this network but would ease the burden on the Institute overhead.

A more permanent solution to supporting this network would be to fund it through the University of Alaska, Fairbanks as a seismic laboratory for the purpose of graduate and undergraduate student education. The total annual costs of this network are about \$125 K.

3. Stations in SE and SW Alaska

One of the consequences of relying upon federal research grants and contracts for seismic networks to monitor earthquakes in Alaska is that the coverage is uneven and changes depending upon the priorities of the federal programs and not necessarily the needs of Alaska. Two examples of this situation are in SE and SW Alaska.

Until recently DOE and NOAA supported networks operated by Columbia University in the Pribilof Islands and around Dutch Harbor. All of these stations have been closed, save one in Dutch Harbor which is barely

supported by the Alaska Division of Geological and Geophysical Surveys (DGGGS). The second example is the Hyder-Ketchikan area of southeastern-most Alaska. Notwithstanding the fact that this area is adjacent to a major plate boundary fault - the Queen Charlotte-Fairweather system - it has never been adequately instrumented to monitor the local seismic events.

The \$50 K sought here would allow the maintenance of two stations, one each in Dutch Harbor and the Kantishna Mining District and the installation and maintenance of two stations in the Hyder-Ketchikan area. The cost per station is somewhat high because DGGGS does not now operate enough seismic stations to be most efficient.

4. Seismic Instrumentation in Anchorage Buildings

One of the most effective ways to save lives and property in the event of a major earthquake is to have designed large buildings to an appropriate level of seismic resistance and to have carefully chosen the sites for both public buildings and private dwellings so as to avoid those areas that pose special seismic risks. Two essential kinds of data for the seismic engineering of large structures are provided by strong-motion accelerographs. These instruments can measure exactly how hard the ground vibrated at a given location and exactly how severely a given building may have been shaken in response. Ordinary seismic stations are designed to locate as many small earthquakes as possible and so are far too sensitive to measure the strong ground motion and building response during a large earthquake at distances close enough to the epicenter to cause serious damage.

A very serious problem in Alaska is the lack of strong motion accelerograph data. The seismic designs of the Trans Alaska Pipeline

System and of offshore platforms as well as the State Office Building in Anchorage have had to rely upon extrapolations from data collected in California and Japan. The geologic environment of Alaska is different enough from these regions that it is important to have data collected in Alaska to use in the design of Alaskan structures.

The Municipality of Anchorage recently took a big step forward in reinstating the Uniform Building Code requirement that certain large buildings must have strong motion accelerographs installed when they are built. To assure that the data from these instruments are maximally useful, the Division of Geological and Geophysical Surveys has proposed to the Municipality a joint program for the maintenance and processing of data from these instruments. This proposal also calls for the installation of some additional instruments to augment those that will be installed under the new Municipal Building Code.

The \$18 K sought here would support the states share of this joint program: \$16 K is for the purchase of instruments and \$1.6 K is for 1/2 the installation and maintenance costs of the first year of the program. The annual maintenance costs are expected to total about \$5 K to \$6 K with the state share being about half of this figure. The additional FY 85 funds shown would be to initiate similar programs in other municipalities such as Valdez, Kodiak, Seward, Whittier, Juneau, Palmer and Fairbanks, for examples.

Note that a major assumption in this program is that data from the various short period networks are available. These data will be important to pinpoint the specific fault which caused the strong ground motion and building response recorded by the strong motion accelerographs. Without this information much of the utility of these strong motion data will be lost.

5. Cook Inlet Volcano Observatory

Seismic stations are located on or nearby each of the four major volcanoes which line the western shore of Cook Inlet; viz., Augustine, Iliamna, Redoubt and Spurr. Potentially these stations could be used to warn the communities along the Inlet of an impending volcanic eruption - an event that is expected at least every 20 years from one of these four volcanoes. Such eruptions have posed serious hazards in the past, particularly to aviation and to tidewater communities.

These stations, however, are operated by three different agencies, are recorded at three different locations, for three different purposes. Since all of the stations and associated transmission equipment already exist, it is a relatively trivial matter to relocate the recording facility for some of these stations such that they are all recorded at a common place. Once this is done, then it is quite easy to monitor the activity of all of the volcanoes along Cook Inlet.

It has been proposed that the "Cook Inlet Volcano Observatory" be established at the USGS offices in Gould Hall on the Alaska Pacific University campus. A tentative agreement has been reached between all of the agencies involved: USGS, DGGs, ATWC, ADES, NWS and UAGI. Since the USGS already has assigned a person to monitor some of these volcanoes and since most of the facilities and equipment already exist, the incremental operational costs for establishing this "observatory" are minimal. The \$5 K sought here should be reduced in future years to about \$1 K or \$2 K for the DGGs share of the annual maintenance.

6. Alaska Seismological Data Center

Seismic stations are operated in Alaska by 13 different agencies. The data from these stations are archived in 12 different locations

ranging from New York to California and from Colorado to Fairbanks.

There is no agency in Alaska (or otherwise) which can provide ready access to all of this data. Consequently, when a specific project is proposed, as the State Office Building in Anchorage, e.g., one of the first tasks of the consultant hired to assess the seismic risks is to travel to a number of these different archival sites to collect the basic data needed for the study. Indeed, some studies simply have not been done because of the difficulties involved in assembling the data.

The total annual cost of the seismic monitoring effort in Alaska exceeds two million dollars. What we propose is to spend less than five percent of this amount to assure that the data collected is readily available in Alaska for all Alaskans to use. This is the only project in this package which requires the hiring of new personnel. The personnel service funds sought here would support 1 (full-time) geological assistant and 1 (two-thirds time) graduate student intern. The geological assistant would be charged with continuously acquiring new data, maintaining the seismic data archive, and providing routine data products such as bulletins and maps. The student intern would provide special purpose analyses of the data on an as-requested basis. Supervision and facilities for the data center would be provided through existing DGGs and UAGI program support.

7. Engineering Geological Studies in Municipal Areas.

One of the questions most often asked of DGGs is a variation on "Is this site where I plan to build safe from earthquakes?" The answer to this question of course depends upon a detailed knowledge of the seismic history of the area, but it also depends, equally importantly upon an understanding of both the general geology and specific soil properties of the site in question.

This fact was dramatically demonstrated by the damage patterns of the 1964 Good Friday Earthquake in Anchorage. Most of the damage in Anchorage by that earthquake was not done as a direct result of the shaking, but as a result of the failure or liquifaction of sandy soils in the Bootlegger Clay Formation (a soil horizon found under most of the city of Anchorage). The importance of a detailed knowledge of the engineering geology of a given site was vividly illustrated by the contrast of homes which were unscathed by the 1964 earthquake standing next to piles of rubble which previously had been neighboring dwellings.

It is not, in general, the province of DGGs to do site-specific geologic studies. What we propose is a series of area-wide studies in a number of municipalities to map soil horizons, do engineering studies to characterize the general seismic properties of these soils, and to integrate this type of information with other knowledge such as water table height, slope, and expected level of seismic shaking to arrive at area-wide, general maps of the potential for foundation soil failure during future earthquakes.

Priorities

It is difficult to assign priorities to these projects because they are all important for different reasons. Some level of support for the Cook Inlet-Kodiak seismic network is most urgent because without this support it will close this summer. Next, I would place the Alaska Seismological Data Center since it will help to utilize those data which are being collected. Third, I would place the strong motion accelerograph program in Anchorage. Fourth I would place the support for the Interior Network and the installation and maintenance of stations in SE and SW.

- Last, would be the Cook Inlet Volcano Observatory and the Engineering Geological Studies, only because these are derivative operations which require the existence of data collected and made available through the projects listed above.

PROJECT	FY	100	200	300	400	500	TOTALS
1. Cook Inlet Kodiak Seismic Network RSA to Support Existing UAGI Stations	84			250			250
	85			262.5			262.5
2. Interior Alaska Seismic Network RSA to Support Existing UAGI Stations	84			50			50
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	85		10.5	13.2	3.4	25.4	52.5
4. Seismic Instrumentation in Anch. Bldg. And other Areas in '85	84		.6	1	0	16	17.6
	85		1.5	2	1.2	10	14.7
5. Cook Inlet Volcano Observatory Cooperate with USGS, UAGI, DES, NOAA	84		.6	2.4	1	1	5
	85		.6	2.5	1.1	1.1	5.3
6. Alaska Seismological Data Center Cooperate with UAGI (Fairbanks)	84	56.9	0	37	1.1	5	100
	85	59.7	0	38.8	1.2	5.3	105
7. Engineering Geological Studies in Various Municipal Areas	84		6	22	1	1	30
	85		6.3	23.0	1.1	1.1	31.5
TOTALS	84	56.9	17.2	375	6.3	47.2	502.6
	85	59.7	18.9	394.5	8.0	42.0	524.0

TABLE 1

CENTRAL ALASKA SEISMIC STATIONS

- GEOPHYSICAL INSTITUTE
- △ GEO. INST. CLOSED
- USGS / NOAA

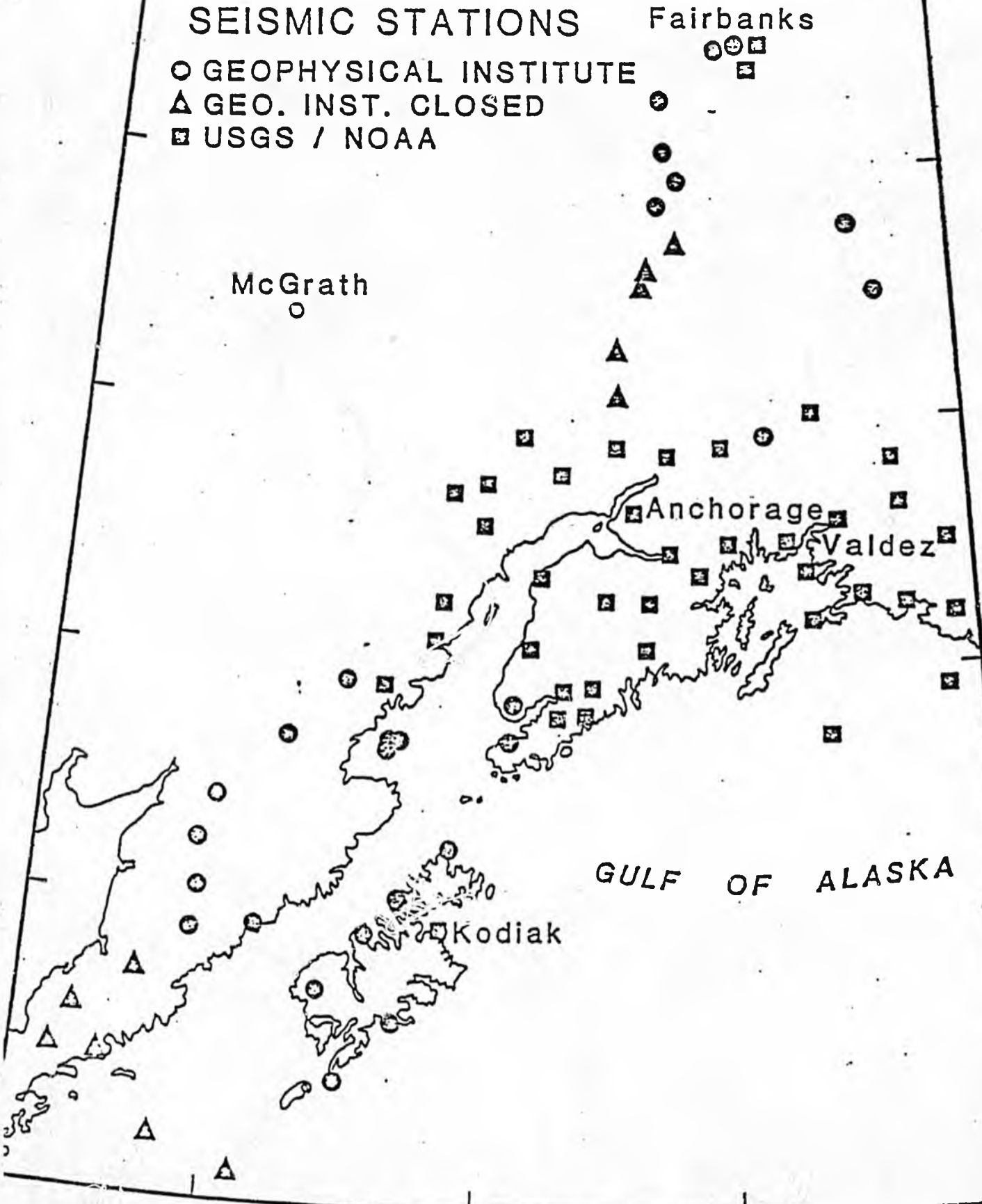


FIGURE 1

