HB

54

SENATE COMMITTEE REPORT

FURTHER: FINANCE

3/19/87

DATE TURNED INTO OFFICE ______________

Mr. President:

RESOURCES Committee considered CSHB 54(HESS)

creating an Alaska earthquake and volcano hazards assessment project.

and recommended:

[ ] replace with CS FOR ______________) [] same title
[✓] or adopt CSHB 54(HESS) CS FOR ______________) [] new title

[ ] attached amendment(s) and

[ ] do pass

[ ] do not pass

[ ] no recommendation

[✓] individual recommendations

[ ] further referral to ______________

[ ] letter of intent adopted ______________

Committee [ ] attached or [✓] adopted fiscal note(s)
[ ] new [ ] updated or [✓] previous
[ ] zero [✓] fiscal impact

MEMBERS SIGNING DO PASS	OTHER RECOMMENDATIONS
[signature]	[signature] Do Not Pass Until DNR gets funds for reforestation Program.
	[signature] no rec.

[signature] Do PASS

Chairman signature and recommendation

[ ] Committee Backup Attached

Alaska State Legislature
House of Representatives
COMMITTEE ON HEALTH, EDUCATION
AND SOCIAL SERVICES

OFFICIAL BUSINESS

POUCH V
JUNEAU, AK 99811
465-3759

LETTER OF INTENT

CSHB 54 (HESS)

"AN ACT CREATING AN ALASKA EARTHQUAKE AND VOLCANO HAZARDS ASSESSMENT PROJECT"

It is the intent of the House Health, Education and Social Services Committee that a request be made for federal monies from the Federal Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) and other applicable federal sources to help offset the costs of The Alaska Earthquake and Volcano Hazards Assessment Project. The amount requested should match the state funding level for this program.

In an effort to save the State both time and expense, this letter is offered in place of a resolution to Congress and shall be delivered to the members of the Alaska Congressional Delegation with appropriate backup information.

Rep. Niilo Koponen, Co-Chair

Rep. Johnny Ellis, Co-Chair

February 18, 1986

Alaska State Legislature

Senate Resources Committee

Box V
Juneau, Alaska 99811
(907) 465-4907

TO: SENATE RESOURCES COMMITTEE

FROM: COMMITTEE STAFF

DATE: MAY 6, 1987

RE: CSHB 54 (HESS), "An Act creating an Alaska Earthquake and Volcano Hazard Assessment Project"

CONTENTS

STATE OF ALASKA 1987 LEGISLATIVE SESSION
FISCAL NOTE

REQUEST:

Bill Version : CSHB 54(HESS)
Publish Date : HOUSE 3/13/87

Revision Date:
Title : Creating an Alaska earthquake & volcano hazards assessment project
Sponsor : Koponen & Davis
Requestor : House Finance Committee

Agency Affected : University of Alaska
BRU :
Components :

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES	-	-	-	-	-	-
TRAVEL	-	-	-	-	-	-
CONTRACTUAL	-	-	-	-	-	-
SUPPLIES	-	-	-	-	-	-
EQUIPMENT	-	-	-	-	-	-
LAND & STRUCTURES	-	-	-	-	-	-
GRANTS, CLAIMS	-	-	-	-	-	-
MISCELLANEOUS	-	-	-	-	-	-
TOTAL OPERATING	-	-	-	-	-	-
CAPITAL	-	-	-	-	-	-
REVENUE	-	-	-	-	-	-

FUNDING: (Thousands of Dollars)

GENERAL FUND	-	-	-	-	-	-
FEDERAL FUNDS	-	-	-	-	-	-
OTHER	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-

POSITIONS:

FULL-TIME	-	-	-	-	-	-
PART-TIME	-	-	-	-	-	-
TEMPORARY	-	-	-	-	-	-

ANALYSIS : (Attach a separate page if necessary)

There is fiscal impact associated with this bill but funds are included in the FY 88 budget. These funds, as well as the need for any new funds, will be addressed through the budget process.

Prepared by: Al Adams, Chair AAA
Division : House Finance Committee
Phone : 465-3706
Date : 3/11/87

Approved by Commissioner :
Agency :
Date :

Distribution (by preparer):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)
Senate Secretary

Supersedes Fiscal Impact 3/20/87

No. 2

STATE OF ALASKA 1987 LEGISLATIVE SESSION
FISCAL NOTE

Bill Version : CSHB 54(HESS)
Publish Date : HOUSE 2/23/87

REQUEST:

Revision Date: 2/18/87
Title : Ak. Earthquakes and Volcanoes Hazards Project
Sponsor : Rep. Koponen and Rep. Davis
Requestor : Rep. Koponen

Agency Affected : Natural Resources
BRU : Geology, Energy and Mining
Components :

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING						
CAPITAL						
REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND		75.1 **				
FEDERAL FUNDS						
OTHER						
TOTAL		75.1 **				

POSITIONS:

FULL-TIME						
PART-TIME						
TEMPORARY						

ANALYSIS : (Attach a separate page if necessary)

In the DNR FY 88 proposed budget, 75.1 is being transferred to the University of Alaska to consolidate the State's Seismic Monitoring efforts. This merging of the two programs will facilitate management and provide a measure of economy. (See Page 2)

Prepared by: Carol Wilson — Phone : 465-2100
Division : Commissioner's Office — Date : 2/19/87

Approved by Commissioner : [signature] — Date : 2-19-87
Agency : Natural Resources

Distribution (by preparer):
- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)
- Senate Secretary

No. 1

STATE OF ALASKA 1987 LEGISLATIVE SESSION
FISCAL NOTE

Bill Version : CSHB 54(HESS)
Publish Date HOUSE 2/23/87

REQUEST:

Revision Date:

Title : Creating Alaska Seismic Hazard Center

Sponsor : Koponen

Requestor : House Hess

Agency Affected : University of Alaska

BRU : UAF Organized Research

Components :

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES		17.0	17.5	18.0	18.6	19.1
TRAVEL		17.0	17.5	18.0	18.6	19.1
CONTRACTUAL		40.0	41.2	42.4	43.7	45.0
SUPPLIES		4.0	4.1	4.2	4.4	4.5
EQUIPMENT		22.0	22.7	23.3	24.0	24.8
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING		100.0	103.0	106.1	105.3	112.6
CAPITAL						
REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND		100.0	103.0	106.1	109.3	102.6
FEDERAL FUNDS						
OTHER						
TOTAL						

POSITIONS:

FULL-TIME		0	0	0	0	0
PART-TIME						
TEMPORARY						

ANALYSIS : (Attach a separate page if necessary) See attached

Prepared by : Brian Rogers, Director of Budget Development
Phone : 907 474-6490
Division : University of Alaska
Date : February 20, 1987

Approved by Commissioner : Vice President
Date : February 20, 1987
Agency : University of Alaska

Distribution (by preparer):
- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)
- Senate Secretary

Superseded by Fiscal

No. 1
2/23/87

CONTINUATION OF FISCAL NOTE ANALYSIS

For Bill/Resolution No. CSHB 54(HESS)

In August 1986, the UAF Geophysical Institute agreed to take over the seismic hazard program from the Alaska Department of Natural resources. The FY88 UA budget contains $130.5 in partial funding for this program. The additional funding contained in this fiscal note provides funding of Alaska's program for collection, recording and archiving of seismic data at an annual level equivalent to the level when the program was transferred to UAF.

Alaska State Legislature

Representative Niilo Koponen

Pouch V
Juneau, Alaska 99811
(907) 465-4992

542 4th Avenue, Suite C
Fairbanks, Alaska 99701
(907) 456-8161

MEMORANDUM

TO: SENATOR COGHILL AND SENATOR FISCHER

FROM: REPRESENTATIVE NIILO KOPONEN

DATE: MARCH 24, 1987

RE: HB 54 "AN ACT CREATING AN ALASKA EARTHQUAKE AND VOLCANO HAZARDS ASSESSMENT PROJECT"

I would appreciate it if you would schedule HB 54 at your earliest convenience.

The purpose of this legislation is to ensure that the State of Alaska maintains a viable seismographic network to record Alaska's earthquake and volcanic eruptions, by establishing the Alaska earthquake and volcanic hazards assessment project within the University of Alaska's Geophysical Institute's seismology program.

HB 54 amends AS.14.40 (University of Alaska and Community Colleges) by adding the Alaska Earthquake and Volcanic Hazards Assessment project within the University. AS.41.08.020 (Geological and Geophysical Survey) will maintain it's same responsibilities except for section (6) which will now read "collect, evaluate and distribute geologic data on seismic events and engineering geology of the state.

HB 54 has a zero fiscal note. The Department of Natural Resources has agreed to transfer monies over to help offset the program costs. The House Health Education and Social Services Committee has attached a letter of intent that a request be made for federal monies from the Federal Earthquake Hazards Reduction Act of 1977 in order to match the state funding level for this program.

HB 54 passed the House March 18 with a vote of 39-0.

I have enclosed backup material. If you need any further information on this bill, please feel free to contact me or my staff assistant, Shari Paul

Alaska State Legislature

Representative Niilo Koponen

Pouch V
Juneau, Alaska 99811
(907) 465-4992

542 4th Avenue, Suite C
Fairbanks, Alaska 99701
(907) 456-8161

POSITION PAPER
HB 54 "AN ACT CREATING AN ALASKA EARTHQUAKE AND VOLCANO HAZARDS ASSESSMENT PROJECT"
FEBRUARY 17, 1987

From the International impact of the 1912 Katmai explosion and 1964 earthquake to the more recent eruptions of Mount St. Augustine last year and in 1976, the State of Alaska has been voted for its seismic activity.

The purpose of this legislation is to ensure that the State maintains a viable seismographic network to record Alaska's earthquake and volcanic eruptions, by establishing the Alaska earthquake and volcanic hazards assessment project within the University of Alaska's Geophysical Institute's seismology program.

To implement this project, the Department of Geological and Geophysical Survey has agreed to transfer to this project the money for seismic monitoring and seismic hazard mitigation for the state of Alaska. DGGS will continue to be responsible for the geological aspects of seismic hazard mitigation.

HB 54 amends AS.14.40 (University of Alaska and Community Colleges) by adding the Alaska Earthquake and Volcanic Hazards Assessment project within the University.AS 41.08.020 (Geological and Geophysical Survey) will maintain it's same responsibilities except for section (6) which will now read "collect, evaluate and distribute geologic data on seismic events and engineering geology of the state".

The creation of the hazards assessment project will place the state of Alaska at the forefront of seismic studies within the nation and the world and provide the data necessary to protect lives and property and preserve safe, cost-effective economic development and land use planning.

Alaska State Legislature

Representative Mike Davis

P.O. Box V
Juneau, Alaska 99811
(907) 465-4930/4941

Interim Office:
P.O. Box 81435
Fairbanks, Alaska 99708

MEMORANDUM

To: Rep. Al Adams, Chairman
House Finance Committee

From: Rep. Mike Davis, Member
House Finance Committee

Date: March 9, 1987

Re: CSHB 54 (Hess); An Act creating an Alaska earthquake and volcano hazards assessment project.

The House Finance Committee established a subcommittee to review CSHB 54, and the subcommittee was specifically directed to address conflicts regarding the bill's fiscal notes. The establishment of an Alaska earthquake and volcano hazards assessment project does not in itself have a fiscal impact, although there would be costs associated with the project's future activities.

Based on the information provided below, the subcommittee recommends that the bill be allowed to proceed with a zero fiscal note. The subcommittee further recommends that the fiscal note state that budget hearings are the proper forum in which to determine the level of funding to be appropriated for the project.

CSHB 54 is accompanied by two fiscal notes. DNR provided a net-zero fiscal note consisting of a 75.1 transfer from the department to the University of Alaska, whereas the university provided a fiscal note of 100.0 for FY 88 and of slightly more than 100.0 per year for the next four years.

These conflicts emanate from circumstances beyond either party's control. In August 1986, DNR and the university agreed to transfer the position and duties of the state seismologist from DNR to the university's geophysical institute, pending legislative approval. This agreement was based on the understanding that DNR would transfer to the university all of the funds that the department had allocated for that purpose.

The funds in question consisted of 75.1 from DNR's seismic engineering program and 56.4 from the department's seismic monitoring program, for a total of 131.5 [due to a 1.0 discrepancy, the university understood that 130.5 was involved in the transfer]. Prior to the agreement taking place between the agencies, funding for the seismic engineering program had been reduced from 115.7 to 75.1, and funding for the seismic monitoring program had been reduced from 83.0 to 56.4.

Subsequent to the agreement, DNR eliminated all funding for the seismic monitoring program. This funding was eliminated under the direction of OMB, since the 56.4 in question was a one-time-item appropriation that had been provided last year in HB 574.

The result of these actions is that the Department of Natural Resources FY 88 budget shows an outgoing transfer of 75.1 to the University of Alaska, whereas the University of Alaska FY 88 budget shows an incoming transfer of 130.5. The university's 100.0 fiscal note is intended as a supplement to the anticipated transfer of 130.5, for a total FY 88 budget of 230.5.

The subcommittee on CSHB 54 believe that these conflicts are best resolved through the budget process. It is the belief of the subcommittee that the sponsors of the legislation, the University of Alaska, and the Department of Natural Resources concur in taking this approach.

January 15, 1987

Mr. Merritt Helfferich
Assistant Director for Administration
Geophysical Institute
University of Alaska
Fairbanks, AK 99775-0800

Dear Mr. Helfferich:

The concern for the Seismic Monitoring function expressed in your November 26, 1986, letter is well founded and shared by the Department of Natural Resources. It is, and always has been, the practice of this department to honor its commitments. However, in this instance, a commitment was based on erroneous information. A brief background discussion of the issue may be useful.

Of the FY 87 operating budget appropriation for the Geology, Energy and Mining BRU, Land/Public Safety component, $115.7 was allocated to the Seismic Engineering function. (This is the amount referenced in Pedro Denton's September 10, 1986, memorandum). Additionally, Section 212 of the Reappropriations Bill (CSHB 574) appropriated $83.0 to the DGGS operating budget for monitoring of St. Augustine and for statewide monitoring. Section 213 provided an additional $80.0 CIP appropriation for monitoring tsunami potential off St. Augustine. Governor Sheffield vetoed $16.6 of the $83.0 operating appropriation, leaving $66.4 available for Seismic Monitoring. In July, the entire operating budget was reduced by Governor Sheffield as part of the "FY 87 Revised" budget. At that time, the Seismic Engineering operating budget allocation was reduced from $115.7 to $75.1, and the operating reappropriation (CSHB 574) was reduced from $66.4 to $56.4. (The $80.0 CIP was completely restricted, but later made available.)

In August, 1986, an agreement was reached with the Geophysical Institute to transfer the Seismic Monitoring Program from DNR/DGGS to the University, with the following operating funding:

FY 87 Operating - Land/Public Safety Component	$ 74.1
FY 87 Operating - Reappropriation Bill	56.4
TOTAL	$130.5

(Reference Pat O'Rourke's August 27, 1986, memorandum. Additionally, please note that the agreement for $74.1 is $1.0 less than the allocation of $75.1. This is due to a misunderstanding of the amount available by the DGGS representative.)

As we have since learned, the reduced reappropriation of $56.4 is considered to be a one-time item and was not included in the department's FY 88 budget base. Unfortunately, DNR staff involved in developing the August agreement with the University was not aware of this fact. In essence, staff committed funds that were not available.

DNR has been advised by OMB that the FY 87 Operating Reappropriations Bill for $83.0 (reduced to $56.4 by the Governor) was a one-time item and would not be added to the budget base and could therefore not be transferred (via C-4) to the University.

In an attempt to carry through with the agreement, DNR has transferred all available Seismic Engineering funds, $75.1 ($1.0 more than the agreement) from the Land/Public Safety Operating Budget to the Geophysical Institute. We simply cannot transfer what we do not have.

We would need to further reduce funding for other DNR projects to transfer the additional $56.4 to the University for FY 88. I am certain you will understand that, because of the severe program cuts already proposed in our FY 88 budget, this is an action we cannot take.

In light of these circumstances, it may be necessary to change the terms of the agreement or perhaps void it entirely. I suggest that DNR and University staff meet as soon as possible to discuss this matter. If this is agreeable, please contact Laurel Murphy in Anchorage (762-2170) concerning meeting arrangements.

I fully understand your concerns about this matter and hope that an acceptable solution can be found.

Sincerely,

Robert D. Arnold
Deputy Commissioner

cc: Laurel Murphy
Dick Reger
Virginia Stonkus

Sharon IS

MEMORANDUM

State of Alaska

~~CC RB~~

HW | VS

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING & GEOLOGY

TO: Esther C. Wunnicke
Commissioner

DATE: September 10, 1986

FILE NO:

TELEPHONE NO: 762-2177

FROM: Pedro Denton
Director

SUBJECT: Transfer of Seismic Monitoring Program

As a result of the reduced FY 87 operating budget for the Division of Geological and Geophysical Surveys and because we anticipate that operating budgets will continue to decrease during the next few years due to sustained low oil prices, we are considering elimination of various DGGS programs. One program that was established when budgets were much larger is the Seismic Monitoring Program. Our present level of funding for this program ($115.7) is about one-third the amount that we consider sufficient to maintain an adequate siesmograph network in Alaska and to effectively coordinate seismic-monitoring efforts among the many agencies engaged in this activity. In addition, the layoff procedures recently agreed to between the State and APEA makes our ability to maintain the expertise necessary to the project very uncertain.

During the past several years, the Geophysical Institute of the University of Alaska (Fairbanks) has made important contributions in the area of seismic monitoring and engineering. This organization possesses the largest concentration of seismic specialists in the state. Discussions with Dr. Patrick O'Rourke, Chancellor of the Fairbanks campus, Dr. Juan Rhoderer, retiring Director of the Institute, and Dr. Syun Akasofu, incoming Director of the Geophysical Institute, resulted in a verbal agreement that the Geophysical Institute will accept available state funds to support maintenance of the existing seismic network for the rest of FY 87 and will provide an appropriate Research Associate position for our seismologist, John N. Davies, who will voluntarily leave DGGS and join the University staff. Our agreement also stipulates that an equivalent amount of seismic-monitoring funds will be deleted from the adjusted base for the FY 88 DMG operating budget and this amount will be added to the adjusted base of the University of Alaska (Fairbanks) operating budget. Further, it was agreed that in the future the University of Alaska Geophysical Institute will be responsible for generating funding support for seismic monitoring in Alaska and Institute personnel will accept responsibility for maintaining the existing seismograph network in Alaska and for coordinating their activities with other agencies engaged in seismic monitoring. Discussions between Dr. Akasofu and John Davies, who is presently on annual leave Outside, indicate that this arrangement is satisfactory. We are currently preparing an RSA for the balance of the project funding to complete the first step in the process of transferring the program out of DNR.

PD/lkb

cc: Dick Reger
Randy Updike

TRANSFERS FROM/DELETIONS:

AGENCY: Department of Natural Resources
BRU: Geology, Energy and Mining
COMPONENT: Land & Public Safety
PROJECT: Seismic Engineering

FUNDING INFORMATION

TRANSFERS TO/ADDITIONS:

AGENCY: University of Alaska
BRU: Organized Research
COMPONENT: Geophysical Institute
PROJECT: Seismic Monitoring

What is being transferred from or deleted from this unit? Why? Include PCN and position title.

The Seismic Engineering Project is being transferred to the University of Alaska to consolidate the State's Seismic Monitoring efforts. In the past this project has worked closely with the University to monitor and document earthquake activity in Alaska. This merging of the two programs will facilitate the management process and provide a measure of economy as fiscal resources decline.

AMOUNT		EXPEND. BY OBJECT	AMOUNT
(71.3)	100	Pers. Service	71.3
(1.0)	200	Travel	1.0
(2.0)	300	Contractual	2.0
(0.8)	400	Supplies	0.8
	500	Equipment	
	600	Lands/Bldgs.	
	700	Grants, Claims	
	800	Miscellaneous	
(75.1)		TOTAL	75.1
		I-A Transfer	
	1002	Fed. Receipts	
	1003	GF Match	
(75.1)	1004	General Fund	75.1
	1006	I-A Receipts	
		Other	
	15	PFT	
	16	PPT	
	17	Non Permanent	
	18	Staff Months	

What is being transferred to or added to this unit? Why? Include PCN and position title.

The Seismic Engineering Project is being transferred to the University of Alaska to consolidate the State's Seismic Monitoring efforts. In the past this project has worked closely with the University to monitor and document earthquake activity in Alaska. This merging of the two programs will facilitate the management process and provide a measure of economy as fiscal resources decline.

C4 TRANSFER WITHIN ADJUSTED BASE

AGENCY: Department of Natural Resources
BRU: Geology, Energy and Mining
COMPONENT: Land & Public Safety

Cowper 1/87

Revised Date

FY 88

(6/86)-rj

PROJECT NUMBER	PROJECT TITLE	PRIOR YEAR FY 86 ACTUAL		CURRENT YEAR FY 87 AUTHORIZED		FY 87 REVISED		FY 88 TRANSFERS		FY 88 DECREMENTS		FY 88 INCREMENTS		FY 88 REQUEST		GOVERNOR'S BUDGET	
		GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL	GENERAL FUNDS	TOTAL
98	Archaeological Surveys			250.0	250.0	212.5	212.5	(212.5)	(212.5)					0.0	0.0		
99	Archaeological RSA				470.6		470.6		(470.6)					0.0	0.0		
100	Statewide Engineering Geology			302.0	302.0	283.6	283.6	65.9	65.9	(49.4)	(49.4)			300.1	300.1	300.1	300.1
101	Seismic Engineering			115.7	115.7	75.1	75.1	(75.1)	(75.1)					0.0	0.0		
102	Statewide Seismic Monitoring			66.4	66.4	56.4	56.4			(56.4)	(56.4)			0.0	0.0		
103	Interagency Technical Support			704.3	704.3	595.0	595.0	(470.7)	(470.7)	(124.3)	(124.3)			0.0	0.0		
104	Federal Receipts Land/ Public Safety				97.0		97.0								97.0		97.0
105	Coastal Marine Boundary			316.8	316.8	296.8	296.8	358.9	358.9	(50.8)	(50.8)		105.4	604.9	710.3	604.9	604.9
106	District Survey			59.4	59.4	14.4	14.4			(14.4)	(14.4)			0.0	0.0		
107	Survey Coordination			337.3	337.3	288.3	288.3	(288.3)	(288.3)					0.0	0.0	0.0	0.0
108	Survey Operations			29.	293.4	256.4	256.4	(71.0)	(71.0)	(30.0)	(30.0)		794.5	155.4	949.9	155.4	155.4
	TOTAL																

0120X

P1 PROJECT LISTING

AGENCY Department of Natural Resources

URU Geology, Energy and Mining

COMPONENT Land & Public Safety

Comper 1/87

Revised Date

FY 88

TITLE OF INCREMENT/DECREMENT:
Reduction of One Time Items

AGENCY CONTACT/PHONE NUMBER:
Updike 688-3555

DESCRIBE WHY THIS INCREMENT/DECREMENT IS NEEDED AND WHAT IT PURCHASES:

This project, Statewide Seismic Monitoring, is a one time appropriation to enhance the Seismic/Earthquake Monitoring System. It is not intended to become a part of the components adjusted base and must be decremented for FY 88.

CODE	EXPENDITURE BY OBJECT	AGENCY REQ.	GOV'S REQ.
100	Personal Services		
200	Travel	(7.3)	(7.3)
300	Contractual Services	(44.4)	(44.4)
400	Supplies	(4.7)	(4.7)
500	Equipment		
600	Lands, Buildings, Etc.		
700	Grants, Claims, Etc.		
800	Miscellaneous		
	TOTAL	(56.4)	(56.4)
	I-A Transfer (NON-ADD)		
1002	Federal Receipts		
1003	General Fund Match		
1004	General Fund	(56.4)	(56.4)
1006	I-A Receipts		
	Other		
POSITION INFORMATION	PFT		
	PPT		
	Non Permanent		
	Staff Months		

/ / Enhance Existing Service Compared to FY 87

/ / New Service Compared to FY 87

/ / Continuation of FY 87 Service Level

/ / Formula Program

IMPACT FROM CAPITAL PROJECT (NAME)

Chapter _____ SLA _____ Page/Line _____

CS INCREMENT/DECREMENT REQUEST

Agency Priority _____ of _____

AGENCY Department of Natural Resources

BRU Geology, Energy and Mining

COMPONENT Land & Public Safety

PROJECT Statewide Seismic Monitoring

COWPER - 1/87

Cowper 1/87

Page 1 of 1

Revised Date

FY 88

2008

(6/86)-cs

STATE OF ALASKA
DIVISION OF BUDGET REVIEW

DATE: 01/28/87
TIME: 14:38:36
PROG: OPRRPT9

GOVERNOR'S FY '88 OPERATING BUDGET REQUEST COMPONENT SUMMARY

AGENCY: DEPARTMENT OF NATURAL RESOURCES
COMPONENT: LAND AND PUBLIC SAFETY

BUDGET REQUEST UNIT: GEOLOGY, ENERGY AND MINING

***** COMPARISON OF AGENCY BUDGET SUBMISSION TO GOVERNOR'S REQUEST, BY IMPACT ITEM *****

DESCRIPTION	REF NUM	TRANS TYPE	PROPOSED BY	AGENCY SUBMISSION PFT	AGENCY SUBMISSION PPT	AGENCY SUBMISSION TOTAL	AGENCY SUBMISSION GEN FUND	AGENCY SUBMISSION OTH FUNDS	GOVERNOR'S REQUEST PFT	GOVERNOR'S REQUEST PPT	GOVERNOR'S REQUEST TOTAL	GOVERNOR'S REQUEST GEN FUND	GOVERNOR'S REQUEST OTH FUNDS
FY '87 REVISED AUTHORIZATION				29.0	12.0	2,646.1	2,078.5	567.6	29.0	12.0	2,646.1	2,078.5	567.6
Transfer to provide ANWR Support	1515	TROUT	AGENCY	-1.0	0.0	-45.9	-45.9	0.0	-1.0	0.0	-45.9	-45.9	0.0
Transfer Publication Spec. to Land and Water	1516	TROUT	AGENCY	-1.0	0.0	-41.6	-41.6	0.0	-1.0	0.0	-41.6	-41.6	0.0
Transfer Archaeology function to Parks	1517	TROUT	AGENCY	-2.0	-5.0	- 683.1	- 212.5	- 470.6	-2.0	-5.0	- 683.1	- 212.5	- 470.6
Consolidate publications/information function	1518	TRIN	AGENCY	4.0	0.0	182.7	182.7	0.0	4.0	0.0	182.7	182.7	0.0
Transfer Seismic Engineering projet to University	1519	ATROUT	AGENCY	0.0	0.0	-75.1	-75.1	0.0	0.0	0.0	-75.1	-75.1	0.0
Seismic Monitoring One-Time Item	2008	OTI	AGENCY	0.0	0.0	-56.4	-56.4	0.0	0.0	0.0	-56.4	-56.4	0.0
Juneau Surveyor position	2047	DEC	AGENCY	0.0	-1.0	-14.4	-14.4	0.0	0.0	-1.0	-14.4	-14.4	0.0
Reduce technical support divisions	2049	DEC	AGENCY	-3.0	-1.0	- 124.3	- 124.3	0.0	-3.0	-1.0	- 124.3	- 124.3	0.0
Engineering Geology position	2060	DEC	AGENCY	0.0	-1.0	-49.4	-49.4	0.0	0.0	-1.0	-49.4	-49.4	0.0
Downgrade land disposal surveyor	2089	DEC	AGENCY	-1.0	1.0	-30.0	-30.0	0.0	-1.0	1.0	-30.0	-30.0	0.0
Coastal Marine Boundary Surveyor	2090	DEC	AGENCY	-1.0	0.0	-50.8	-50.8	0.0	-1.0	0.0	-50.8	-50.8	0.0
Downgrade Fbks Mining Info positions	2092	DEC	AGENCY	-3.0	3.0	-53.9	-53.9	0.0	-3.0	3.0	-53.9	-53.9	0.0
Add AK Power Auth RSA receipts	2114	INC	AGENCY	0.0	2.0	288.3	0.0	288.3	0.0	2.0	288.3	0.0	288.3
Convert Survey Operation to Prgm Rcpts	2117	INC	AGENCY	7.0	0.0	476.3	0.0	476.3	0.0	0.0	0.0	0.0	0.0
Provide prior land disposal survey needs	2118	INC	AGENCY	5.0	1.0	282.0	0.0	282.0	0.0	0.0	0.0	0.0	0.0
Add Coastal Bndry/SW Platting funding	2119	INC	AGENCY	0.0	0.0	141.6	0.0	141.6	0.0	0.0	0.0	0.0	0.0
*** COMPONENT TOTALS ***				33.0	11.0	2,792.1	1,506.9	1,285.2	21.0	10.0	1,892.2	1,506.9	385.3

Invest change CIP

(N)

TITLE OF INCREMENT/DECREMENT:
15% Reduction

AGENCY CONTACT/PHONE NUMBER:
John Davies 474-6166

DESCRIBE WHY THIS INCREMENT/DECREMENT IS NEEDED AND WHAT IT PURCHASES:

At the reduced level only support for the seismologist in charge of the project is provided. No state support of installation of accelerographs can be provided. No support of seismic stations around the state can be provided.

CODE	EXPENDITURE BY OBJECT	AGENCY REQ.	GOV'S REQ.
100	Personal Services		
200	Travel	(0.5)	
300	Contractual Services	(37.7)	
400	Supplies	(2.4)	
500	Equipment		
600	Lands, Buildings, Etc.		
700	Grants, Claims, Etc.		
800	Miscellaneous		
	TOTAL	(40.6)	
	I-A Transfer (NON-ADD)		
1002	Federal Receipts		
1003	General Fund Match		
1004	General Fund	(40.6)	
1006	I-A Receipts		
	Other		
POSITION INFORMATION	PFT		
	PPT		
	Non Permanent		
	Staff Months		

___ / ___ / Enhance Existing Service Compared to FY 87

___ / ___ / New Service Compared to FY 87

___ / ___ / Continuation of FY 87 Service Level

___ / ___ / Formula Program

IMPACT FROM CAPITAL PROJECT (NAME)

Chapter _____ SLA _____ Page/Line _____

C5 INCREMENT/DECREMENT REQUEST

Agency Priority _____ of _____

AGENCY Department of Natural Resources

BRU Geology, Energy and Mining

COMPONENT Land & Public Safety

PROJECT Seismic Engineering

FY87 REVISED

Page 1 of 1

Revised Date

FY 88

(6/86)-c5

TITLE OF INCREMENT/DECREMENT:
Line Item Spread

AGENCY CONTACT/PHONE NUMBER:
John Davies 474-6166

DESCRIBE WHY THIS INCREMENT/DECREMENT IS NEEDED AND WHAT IT PURCHASES:

This increment/decrement spreadss the special appropriation, Ch 130, Sec 212, for St. Augustine and maintenance of the Statewide Seismic Monitoring System to the appropriate line items.

Appropriation	83.0
Veto	16.6
Balance	66.4

100	
200	12.3
300	49.4
400	4.7
800	___
TOTAL	66.4

CODE	EXPENDITURE BY OBJECT	AGENCY REQ.	GOV'S REQ.
100	Personal Services		
200	Travel	12.3	
300	Contractual Services	49.4	
400	Supplies	4.7	
500	Equipment		
600	Lands, Buildings, Etc.		
700	Grants, Claims, Etc.		
800	Miscellaneous	(66.4)	
	TOTAL	0.0	
	I-A Transfer (NON-ADD)		
1002	Federal Receipts		
1003	General Fund Match		
1004	General Fund		
1006	I-A Receipts		
	Other		
POSITION INFORMATION	PFT		
	PPT		
	Non Permanent		
	Staff Months		

___ / ___ / Enhance Existing Service Compared to FY 87

___ / ___ / New Service Compared to FY 87

___ / ___ / Continuation of FY 87 Service Level

___ / ___ / Formula Program

IMPACT FROM CAPITAL PROJECT (NAME)

Chapter _____ SLA _____ Page/Line _____

C5 INCREMENT/DECREMENT REQUEST

Agency Priority _____ of _____

AGENCY Department of Natural Resources

BRU Geology, Energy and Mining

COMPONENT Land & Public Safety

PROJECT Statewide Seismic Monitoring

FY87 REVISED

Page 1 of 1

Revised Date _____

FY 88

(6/86)-c5

TITLE OF INCREMENT/DECREMENT:	AGENCY CONTACT/PHONE NUMBER:
15% Reduction	John Davies 474-6166

DESCRIBE WHY THIS INCREMENT/DECREMENT IS NEEDED AND WHAT IT PURCHASES:

Reductions to this project will limit the installation of monitoring devices on Mt. Augustine and throughout Southcentral Alaska. Funding is also intended to provide for the monitoring, telemetry, and analyses of the devices. At the reduced level only limited interpretation of the data is possible, primarily resulting in only archive of information obtaine.

(5)

CODE	EXPENDITURE BY OBJECT	AGENCY REQ.	GOV'S REQ.
100	Personal Services		
200	Travel	(5.0)	
300	Contractual Services	(5.0)	
400	Supplies		
500	Equipment		
600	Lands, Buildings, Etc.		
700	Grants, Claims, Etc.		
800	Miscellaneous		
	TOTAL	(10.0)	
	I-A Transfer (NON-ADD)		
1002	Federal Receipts		
1003	General Fund Match		
1004	General Fund	(10.0)	
1006	I-A Receipts		
	Other		
POSITION INFORMATION	PFT		
	PPT		
	Non Permanent		
	Staff Months		

/___/ Enhance Existing Service Compared to FY 87

/___/ New Service Compared to FY 87

/___/ Continuation of FY 87 Service Level

/___/ Formula Program

IMPACT FROM CAPITAL PROJECT (NAME)

_____ _____

Chapter _____ SLA _____ Page/Line _____

C5 INCREMENT/DECREMENT REQUEST

Agency Priority _____ of _____

AGENCY Department of Natural Resources

BRU Geology, Energy and Mining

COMPONENT Land & Public Safety

PROJECT Statewide Seismic Monitoring

FY87 REVISED

Page 1 of 1

Revised Date

FY 88

(6/86)-c5

APR 13 1987

April 10, 1987

Jack Coghill
Chair, Senate Resources Committee
PO Box V (Mail Stop 3100)
Juneau, AK 99811

VOLCANIC HAZARDS OF MT. ST. AUGUSTINE

Enclosed, for your information, is a copy of a brief summary of our key public responses to the recent eruption of Mt. St. Augustine, which we put together in response to a request from Henry Cole, Science Advisor to the Governor. The key to our response was the remote seismograph network on the volcano that is radio-linked to our Fairbanks laboratory.

We hope that this information will be useful to you in discussions concerning the bill introduced by Nilo Koponen to create the State Seismologist/ Volcanologist position. Please call us if you have any further questions.

JUERGEN KIENLE (474-7467) AND JOHN DAVIES (474-6166), GEOPHYSICAL INSTITUTE

vli
Enclosures

Geophysical Institute, University of Alaska
Fairbanks, Alaska 99775-0800

PHONE: 907-474-7558 TELEX: 35414 GEOPH INST FBK
FAX: 907-474-7290 TELEMAIL: GEOPH.INST.FBK

MEMO March 30, 1987

TO: Henry Cole

FROM: John Davies and Juergen Kienle

SUBJECT: Monitoring of the 1986 eruption of Augustine

Per your request, we have prepared the attached, one page account of our key actions during the recent eruption of Mt. St. Augustine. Implicit in this account is the fact that none of these public service actions would have been possible without the continuous operation of the seismic network on and around Augustine over the past 15 years or so. As you are aware this capability is now in jeopardy since we have no funding to continue this work beyond July 1, 1987.

Also attached are copies o

1. letter from Cervantes, Director, OES, Anchorage
2. letter from Miller, volcanologist, USGS, Anchorage
3. Aviation Week article of April 7, 1986
4. Geo. Inst. Quarterly issue of July 1986
5. EOS article of April 8, 1986
6. EOS article of July 22, 1986

These will provide considerable background and amplification to our necessarily limited one-page account. Please call if you need any further info.

Geophysical Institute, University of Alaska
Fairbanks, Alaska 99775-0800

PHONE: 907-474-7558 TELEX: 35414 GEOPH INST FBK
FAX: 907-474-7290 TELEMAIL: GEOPH.INST FBK

KEY ACTIONS RESULTING FROM THE SEISMIC MONITORING CAPABILITY OF THE GEOPHYSICAL INSTITUTE DURING THE RECENT ERUPTION OF MT. ST. AUGUSTINE VOLCANO IN MARCH AND APRIL OF 1986

John Davies and Juergen Kienle, March, 1987

Public alerts and interpretations of the seismic activity of Mt. St. Augustine during the 1986 eruption were based on an understanding of the patterns of seismic activity gained from research on previous eruptions. Much of this information was presented in a 1985 report by Kienle and Swanson entitled "Volcanic Hazards from Future Eruptions of Augustine Volcano, Alaska". In particular, this report contained an observation that successive intervals between eruptions of Mt. St. Augustine were systematically decreasing (see Fig. 2, July 22 EOS) such that only 12 years had elapsed between the 1964 and 1976 eruptions and that if this pattern continued we could expect another eruption about a decade following 1976.

The first hint that Mt. St. Augustine was reawakening was a swarm of small volcanic earthquakes in July, 1985. With increasing seismic activity and reports of fumerolic activity in February, 1986 (see Fig. 3, July 22 EOS) we participated in the decision to alert the FAA, USAF, and DES. By prior agreement this task fell to the USGS in Anchorage. In our discussions we noted that in 1976 a swarm of volcanic earthquakes had preceded the eruption by about 8 months, a pattern that was repeated in 1986. Our concerns are documented in an article written for EOS in early March and published on April 8, 1986 with an editor's note to the effect that events had justified our concerns.

On the afternoon preceding the eruption we noted the dramatic increase of activity (Fig. 3, loc. cit.) and made two phone calls to the USGS suggesting that follow-up alerts to the briefing meetings were in order. At about 2AM on March 27 Mt. St. Augustine erupted and for the next ten days a 24-hour per day watch was maintained in the Seismology Lab of the Geophysical Institute. During this watch we were able to provide minute by minute reports of new plume activity. This information was provided immediately to DES, the Governor's Office, USGS, and through them to the FAA, USAF and the Coast Guard.

Early on March 27 the Air Force evacuated many of their aircraft from the Anchorage area and for three days commercial air service nearly ceased. The immediate threat was to aircraft and fishing vessels operating in the vicinity of Mt. St. Augustine. Other concerns were whether the ash clouds would require the closure of the Beluga power plant, schools and offices in Anchorage. We were asked to provide input to these decisions of the Municipality of Anchorage through the DGGS. Through DES and local emergency officials we provided advise and information to the people on the lower Kenai Peninsula. A major concern here was the possibility of a repeat of the 1883 volcanogenic tsunami. Scientists from the Institute and IMS received emergency NSF funds to model the effects of the impact in the sea of a major debris avalanche from Mt. St. Augustine (Fig. 5, July 22 EOS). This effort confirmed the seriousness and quantified the time frame and spatial extent of the hazard.

Municipality of Anchorage

POUCH 6-650
ANCHORAGE, ALASKA 99502-0650
(907) 267-4900

TONY KNOWLES
MAYOR

FIRE DEPARTMENT
Administration
(1301 East 80th Avenue)

March 12, 1987

Dr's. Juergen Kienle
and John Davies
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99775-0800

Dear Sirs:

I would like to take this opportunity to comment on the valuable services provided by the Geophysical Institute during the volcanic eruption of Mt. Augustine in 1986. The observations provided by the Institute and the United States Geological Survey were critical to the decision-makers in the Municipality of Anchorage in determining actions contemplated if a serious emergency had occurred.

When Mt. Augustine erupted on March 27, 1986, the plume of ash-fallout was directed to the northeast up Cook Inlet and towards Anchorage and the power station at Beluga. Initially, there was not much concern, until it was learned of the potentially deleterious effects the ash could have on electrical generators and turbines. If significant amounts of ashfall were detected approaching these power stations, there would have been no alternative to shutting down the generators, causing the loss of between 67 and 75% of the electrical service provided to the Municipality. The potential for the disruption of day-to-day activities could have been devastating. As it was, a large segment of the municipal, state and federal workforce was released to go home in anticipation of traffic jams caused by the loss of signals from power failures.

The Emergency Operations Center was activated at 11:00 a.m. on March 27th in order to monitor volcanic activities and keep the administration advised on the latest information from Mt. Augustine. The EOC maintained its operation for 69 hours until it could be determined that volcanic activity subsided or significant wind changes occurred.

The most prevalent rationale for keeping the EOC open was to monitor reports coming from the Geophysical Institute, USGS, Alaska Division of Emergency Services, Weather Service, and the Federal Aviation Administration. After subsidence in

volcanic activity the EOC was closed. However, the potential for another significant eruption demanded the close liaison between the Municipal Office of Emergnecy Management an the Geophysical Institute, at least through the months of April and May, 1986.

One year later the potential for another catrastrophic volcanic eruption has not diminished. To reduce the vulnerability of ash damage to major electrical generators will cost millions of unavailable dollars to acquire air filtration systems. The electric companies are unwilling to expend monies for a contingency they perceive to be remote. It makes more economic sense to them to have sufficient warning to shut down generators in case of ashfall approaching their power plants. Therefore, it would appear the burden will fall to the Geophysical Institute to provide continuous monitoring of volcanoes that can produce ashfall with potential to inundate the upper Cook Inlet.

For the forseeable future, the Office of Emergency Management will continue to rely upon the services of the Geophysical Institute for information concerning the seismic activity of the Cook Inlet volcanoes. Needless-to-say, the loss of the Geophysical Institute's monitoring program would produce a crippling effect on Anchorage's emergency preparedness.

Sincerely,

J.A. Cervantes, Director
Office of Emergemcy
Management

JAC:mj

United States Department of the Interior

GEOLOGICAL SURVEY

Branch of Alaskan Geology
4200 University Drive
Anchorage, Alaska 99508-4667

March 25, 1987

Drs. John N. Davies and Juergen Kienle
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99775-0800

Dear John and Juergen:

As we approach the anniversary of the March 27, 1986, eruption of Augustine volcano, I think it's appropriate to acknowledge the response of the seismological group at the Geophysical Institute to the eruption and to the hazards posed to life and property.

The five station seismic array on the island proved invaluable in interpreting events both prior to and during the three main episodes of eruptive activity. The precursor seismic activity coupled with our visual overflights allowed us to brief the Division of Emergency Services, the FAA, the USAF, and the media about the hazards and nature of possible Augustine eruptions several weeks prior to the actual event. Many of the changes in the character of the eruption were detected seismically and allowed timely notification of the appropriate government agencies and the general public. Much was learned in terms of eruption prediction and in basic science.

I hope you will be able to continue the seismic monitoring of Augustine volcano and indeed to participate in additional geophysical monitoring in the future. We all know the hazards associated with Augustine volcano; the 1986 eruption was "for practice" and with the knowledge gained from the eruption and the 10 years of background research on the island by the Geophysical Institute, we can respond to future eruptions so as to protect the public. Let's hope the funding for our hazard-related studies continues.

Congratulations on a job well done.

Sincerely yours,

Tom Miller

Dr. Thomas P. Miller
Chief,
Alaska Volcanic Hazards Project

NTSB Impounds United 767 After Engine Power Loss

San Francisco—National Transportation Safety Board has impounded a United Airlines/Boeing 767 transport while it seeks to learn what caused both engines to lose power briefly, shortly after takeoff from here Mar. 31.

Soon after the incident, United instructed its flight crews to change procedures for operation of its 767s' Pratt & Whitney JT9D-R4D engines.

The aircraft, Flight 310 bound for Denver with 183 passengers, was passing through 3,400 ft. when both engines lost power, according to the NTSB. The board has designated the occurrence an accident.

A United official said the engines were out for about 30 sec., but that the aircraft did not lose altitude during that time. The engines were restarted and the aircraft returned to San Francisco International Airport, landing without incident, the airline official said.

The NTSB official said the aircraft was impounded here because board investigators need to examine and test such items as the engines and electrical system. The cockpit voice recorder and flight data recorder were removed and were scheduled to be taken to Washington, D.C., for analysis.

The United official said engine power was lost when the flight crew switched from manual operation to the engine electronic control system. He said that shortly after the incident, United's 767 crews were instructed not to make the switch until the aircraft had reached 30,000 ft., and to make the change one engine at a time rather than simultaneously.

Routine Switch

A Pratt & Whitney official said the company has made no recommendation as to when the switch should be made. United routinely disengages the system before takeoff and reengages it at about 3,000 ft., he said. Other operators keep the system engaged during takeoff, he said.

While the 767 is designed to operate with the electronic engine control (EEC) system engaged at all times, United last year elected to operate with it disengaged during takeoff and climb after a problem with the system's overtemperature warning feature caused three incidents of power reduction. Two of these occurred in flight during climb and one on takeoff, causing an abort, according to an industry official source. The problem was due to chafing of the wire harness for the exhaust gas temperature (EGT), which signaled a false impending overtemperature warning and triggered a throttle cutback.

Operators were advised of the problem by Boeing and the EEC manufacturer—United Technologies' Hamilton Standard Div.—and instructed how to delete the overtemperature feature. As United had experienced the three spurious warning incidents, it elected to disengage the system during takeoff and climbout pending deletion of the feature, according to an industry official source.

No Apparent Cause

There is no immediately apparent reason for engaging the EEC to cause engine power loss, he said. Engagement involves lifting the plastic guards on two buttons located on the aisle stand just below the throttle levers and pushing the buttons.

The same aircraft—also operating as Flight 310—was involved in a dual-engine shutdown incident on Aug. 19, 1983, on a Los Angeles-Denver flight, but the occurrences appear to be unrelated (AW&ST Aug. 29, 1983, p. 30). In that case, a compressor stall related to an anti-ice valve malfunction led to both engines overheating, being purposely shut down and then restarting, United said. The airline pointed out that the engines have been changed several times since that incident, most recently within the last 60 days. ☐

Ransome Airlines Buy

Washington—Pan Am Corp. is planning to purchase Ransome Airlines, which is scheduled to begin full operation under the name Pan Am Ransome Express by June 1.

"A key element of Pan Am's marketing strategy is to increase its U.S. domestic feed," C. Edward Acker, chairman and chief executive officer of Pan Am Corp. and Pan American World Airways, said. Approximately 70% of the airline's business is international.

Ransome, a regional carrier, will become the third subsidiary of Pan Am Corp. The other two are Pan American World Airways and Pan Am World Services, Inc., a contract services company specializing in aviation and aerospace management and technical assistance.

Pan Am Ransome Express will operate a feeder system linking Pan American's Kennedy International Airport service with Albany, Rochester and Syracuse, N.Y.; Hartford and New London, Conn.; Providence, R.I.; Allentown, Lancaster and Philadelphia, Pa.; and Baltimore, Md.

Pan Am Ransome Express will continue to operate flights on its existing routes. The transaction is subject to regulatory review and a definitive buy agreement.

Alaskan Air Traffic Disrupted by Ash From Volcano

San Francisco—Volcanic ash from eruptions of Alaska's Augustine volcano last week was disrupting commuter air traffic in the southern Alaska area, while operations at Anchorage International Airport had returned to normal following a three-day period of flight cancellations.

Air carrier service at Anchorage was nearly at a standstill Mar. 27-29, due to clouds of highly abrasive volcanic ash that were driven into the Anchorage and Kenai Peninsula areas by southerly winds. The National Weather Service reported that the wind subsequently shifted to a northerly direction, carrying the airborne ash away from those areas and over Kodiak Island, where it has disrupted commuter airline traffic between Anchorage and the airports at Kodiak and King Salmon.

The volcano, located on Augustine Island in the lower Cook Inlet about 175 mi. southwest of Anchorage, began a series of eruptions during the early morning of Mar. 27 that continued last week. According to the National Weather Service, the volcanic ash cloud has stayed below 15,000 ft., but a strong eruption Mar. 31 sent ash up to as high as 30,000 ft.

Operations Impact

Alaska Airlines reported the worst impact on its operations occurred Mar. 28, when it canceled 40 Anchorage arrivals and departures out of 68 scheduled operations, and also canceled a few flights to Fairbanks. During the three-day period, the airline was deleting the Anchorage stop of many of its Seattle-Anchorage-Fairbanks flights, resulting in many Anchorage-bound Easter travelers being delayed until flight conditions improved.

Western Airlines canceled its entire schedule of flights to and from Alaska Mar. 27-28, and flew a partial schedule on Mar. 29. Affected were flights between Anchorage and the Pacific Coast, Salt Lake City, Utah, and Honolulu. United Airlines, Northwest Airlines and other international carriers also canceled service during the period of worst ash conditions. United cancelled 35 Alaska flights during the Mar. 27-29 period.

A Federal Aviation Administration official reported that general aviation operations were very limited at Anchorage and surrounding areas during the Mar. 27-29 period, and the FAA's Alaska region office "strongly suggested" that pilots not fly in the Kenai Peninsula area. The FAA reduced the staffing of its Kenai flight service station to one person per shift, and shut down its air-route surveillance radar for a two-day period at that location to prevent equipment damage. ☐

The Geophysical Institute
QUARTERLY

Editors: Gunter Weller
Carla Helfferich
Sue Keller
(907)474-7371

Vol. 4, No. 4 | University of Alaska-Fairbanks | July 1986

Public Safety vs. Augustine's Eruption

Although all scientific work on hazardous natural phenomena such as weather, earthquakes, and volcanic eruptions can advance the public safety, sometimes direct considerations of safety demand specific actions. These actions are normally at the fringes of scientific research and become important only during some crisis, as in the eruption on March 27, 1986, of Augustine Volcano. That eruption called for coordinated action among several agencies, in an attempt to communicate in the most meaningful way possible a prediction of what could happen next and how it would affect the public. The agencies involved were the Geophysical Institute, the Alaska Division of Geological Surveys (DGGS), and the U.S. Geological Survey (USGS).

In February 1982 DGGS sponsored a meeting on seismic, volcanic, and tsunami hazards in Alaska. Following this meeting an informal agreement and a pooling of resources among the Geophysical Institute, DGGS, and USGS created a minimal Cook Inlet volcano monitoring capability at the Anchorage USGS office in Gould Hall. In addition to monitoring each of the Cook Inlet volcanoes from Augustine to Spurr, this informal "observatory" served as a continual reminder of the need to formalize a national research program centered on Alaska's volcanoes, to seek stable funding, and to decide how each agency would respond to a future volcanic event.

A Geophysical Institute report published by Juergen Kienle and Samuel Swanson in February 1985 gave a detailed chronology and description of the previous eruptions of Augustine, especially those of 1963-64 and 1976. The generalized sequence of events in the previous eruptions was the scientific basis for the forecasts made at various stages of the 1986 eruption. Of course, none of the eruptive sequences were identical, so frequent reinterpretations of the events were necessary to assess the potential for future eruptive activity.

The first indication that Augustine was reawakening was a swarm of microearthquakes in July 1985. Our level of concern began to accelerate in February as the seismicity and the frequency of reports of fumarolic activity increased. In mid-March the USGS arranged meetings to brief the Federal Aviation Administration (FAA), the Air Force (USAF), and the State Division of Emergency Services on the potential hazards from an eruption of Augustine Volcano. On March 22, with support from DGGS, Geophysical Institute scientists visited Augustine to repair some of the existing seismic stations and to install one additional station, bringing the total on the island to five. On March 26 a dramatic increase in the seismicity rate from a few hundred events per day to 6,000 per day prompted an informal prediction that the volcano would soon erupt: it did, at two o'clock the next morning.

The demand for information during the first phase of the eruption was overwhelming. As many state and local agencies were referring calls to the USGS, the major burden of providing information fell on the Gould Hall staff, who remained on duty around the clock during this phase. Personnel from DGGS and the Geophysical Institute kept a 24-hour-a-day watch at the Institute's Seismology Lab. Volcanologists from the USGS Cascade Volcano Observatory in Vancouver, Washington, assisted both at Gould Hall in Anchorage and at the Seismology Lab in Fairbanks.

Because the seismic events were again increasing, at an information meeting in Homer on April 22 a second informal prediction was made that a dome-building phase would soon begin. With the continued increase in event counts on the 23rd, the prediction was communicated to the FAA, the USAF, the Coast Guard, and the State Division of Emergency Services as well as to the press.

A new dome was emplaced during the period April 24-27. This phase was not accompanied by dramatic eruptive plumes (a possibility mentioned in the prediction given to the press), leading the media initially to report this as a failed prediction, while in fact it was in its main aspect completely correct.

Between and following the two main phases of the eruption, volcanologists from USGS, DGGS, and the Geophysical Institute visited the volcano to map and sample the flows, to repair the seismic stations, and to survey geodetic deformation networks. During the summer field season we hope to complete several research projects that will allow improved predictions of future eruptions of Augustine.

John Davis
Alaska State Seismologist, DGGS

VGP (cont. from p. 171)

News & Announcements

Augustine Volcano: Awake Again?

Editor's Note: The question posed in the title of the following item, which was written on March 20, was answered in the affirmative at 12:30 A.M. (Alaska time, equal to UT −9h) on March 27, 1986. As of March 31, the eruption had produced numerous pyroclastic flows, and the eruptive column had reached a maximum altitude of 14 km (see Figure 1). Air traffic in and out of Anchorage was disrupted. The 1976 dome is presumed to have been destroyed.

The first microearthquake activity since the spectacular eruptions of 1976 is occurring on Augustine Volcano, Cook Inlet, Alaska. Activity began in July 1985 and now averages 30–50 events of greater than 0.5 magnitude per day. The events are shallow, less than 1000 m deep, and occur within the 1976 lava dome. Beginning in mid-February 1986, numerous pilot reports have documented a dramatic increase in fumarolic activity, with associated melting of snow, light ashfalls, and plumes extending as far as 10 km from the summit.

The postglacial andesitic island volcano in the eastern Aleutian arc has had five significant eruptions since Captain James Cook discovered and named it on May 10, 1778 (St. Augustine's Day). Major eruptions occurred in 1812, 1883, 1935, 1963/1964, and 1976, each dramatically modifying the volcanic edifice. There has been a curious shortening of repose times, from 71 yr to 52 to 28 to 12, for these five historic eruptions. If the pattern of decreasing repose time between eruptions continues, another eruption may be imminent. The highly explosive nature of Augustine's eruptions and their short recurrence rate make Augustine the most hazardous volcano in the most populous part of Alaska.

The volcano is a symmetrical 1200-m-high cone consisting of an apron of pyroclastic deposits and a central complex of dome and dome remnants. Lava flows are rare. Augustine lavas are predominantly andesitic (57%–63% silica) with minor dacite and basalt. Eruptions are typically 0.5 km³ in volume (dense magma equivalent) and resemble those of Mount St. Helens, Washington, in [illegible] and explosivity.

Augustine eruptions typically begin with an explosive vent-clearing phase. During this phase, collapse of tall (10–15 km) eruption columns produces extensive pyroclastic flows that commonly reach the sea on nearly all flanks of the volcano. If the eruption occurs in winter, melting of snow produces lahars. The last five eruptions all ended with extrusion of a new lava dome into the crater, often with spine development (in 1812, 1964, and 1976). Block and ash avalanche activity and nuées ardentes often accompanies dome extrusion as sections of the emerging dome collapse. During the last four eruptions, the block and ash avalanche paths were predominantly directed to the north-northeast through a northern breach in the summit crater.

Augustine Island is uninhabited. The nearest population centers are on the Kenai Peninsula and at Lake Iliamna, about 100 km distant. Nevertheless, historic eruptions of Augustine Volcano have had effects reaching that far and farther, including heavy regional ash falls and tidal waves, a special hazard of Augustine Volcano because of its island setting. Sudden displacement of a large volume of sea water by impact of a dry debris avalanche produced a tsunami in Cook Inlet during the 1883 eruption. G. Davidson gave a vivid description of the October 6, 1883, event in a paper published in 1884 in *Science*:

> Twenty-five minutes after the great eruption, a great "earthquake wave," estimated at from twenty-five to thirty feet high, came upon Port Graham like a wall of water. It carried off all the fishing boats from the point, and deluged the houses. This was followed, at intervals of about five minutes, by two other large waves, estimated at eighteen and fifteen feet; and during the day several large and irregular waves came into the harbor . . . Fortunately it was low water, or all the people at the settlement must inevitably have been lost. The tides rise and fall about fourteen feet.

New, detailed mapping of the bathymetry surrounding Augustine Island has revealed at least five hummocky debris avalanche lobes extending up to 6 km offshore, suggesting repeated collapse of the volcanic edifice in the prehistoric past. Each one of these collapses could have been tsunamigenic. Avalanches of debris and of block and ash have enlarged the island to the north and west to a distance of 6–8 km from the vent, suggesting that the more recent pyroclastic flow activity was directed predominantly north and west. However, the distance from summit to shore on the southern and eastern flank of the volcano is only 3.5–5 km, and a debris avalanche descending in these directions could again produce tsunamis. A tsunami generated at Augustine would cross Cook Inlet to the nearest settlement in about 50 min to 1 h. Such a wave today, particularly during the summer when there is heavy recreational use of the lower Kenai Peninsula shoreline, could take many lives and cause great property damage.

Regional ash falls from Augustine Volcano can be expected to affect much of the Cook Inlet area from Anchorage to Kodiak and out to the Gulf of Alaska. High-altitude winds will control ash dispersal; prevailing lower Cook Inlet winds are from the west, south-

west, and south. This wind pattern would disperse Augustine ash across Cook Inlet to Homer or Kenai or up the Inlet to Anchorage. Ash did spread over Kenai Peninsula communities during all five previous historic eruptions. During one particular ash fall, on January 23, 1976, a fall of sand grain–sized tephra reduced visibility in Homer at a distance of 100 km to a few hundred meters. The timing, cloud heights, and horizontal dispersion for 13 eruptions that occurred between January 15 and 22, 1976, were determined from radar measurements, reports of pilots intercepting the plumes, satellite photography, seismic data, and detection of infrasonic waves. Several of the plumes penetrated the stratosphere and were carried rapidly by the subpolar jet stream through southwestern Canada and the western United States, then northeast across the United States into the Atlantic. One plume was visually observed passing over Tucson, Ariz., on January 25.

Plumes of volcanic ash are a major hazard to airliners traveling at high altitudes. Anchorage, a metropolitan area of approximately 250,000 people (60% of Alaska's population), is a hub of commercial, civil, and military air traffic. A major approach route for the daily international transpolar flights to Europe and also to Japan and the Far East is along Cook Inlet, downwind from Augustine Volcano. Aircraft could easily fly inadvertently into an ash cloud at night or in bad weather. Five civil and military aircraft (two F-4 Phantom jets, two DC-8's, and one Boeing 747) did in fact intercept hidden plumes from Augustine under overcast conditions in January 1976 during the violent vent-clearing phase of that eruption. Fortunately, nothing serious happened aside from heavy scouring of windshields, outside antenna leads, wings, and external tanks and ingestion of fine dust into the cockpits of the two F-4 Phantoms. However, the recent near-fatal encounters of two Boeing 747 passenger jetliners with eruption clouds from Galunggung, Indonesia, in 1982 are a reminder of how dangerous encounters of aircraft with ash-laden plumes can be. Ash ingested into jet aircraft engines, which operate at temperatures close to the melting point of andesitic tephra, can cause engine failure within minutes as turbine blades become coated with ceramic-like melted ash.

At present, monitoring of Augustine is minimal, with four radio-telemetered seismic stations and occasional visual overflight observations. One of the seismic stations is telemetered to Gould Hall on the Alaska Pacific University campus in Anchorage, where the U.S. Geological Survey (USGS) Branch of Alaska Geology (USGS-AB) offices are located. At the moment, there is an informal cooperative agreement, known as the Alaska Volcano Observatory, between the University of Alaska's Geophysical Institute in Fairbanks, where all four Augustine stations are being recorded, the USGS-AB, the State of Alaska Department of Natural Resources Division of Geological and Geophysical Surveys, and the Alaska Division of Emergency Services to coordinate responses to volcanic emergencies.

Although seismicity, tilt, and deformation patterns are fairly clearly related at certain basaltic volcanic centers (e.g., Krafla in Iceland, Kilauea in Hawaii), the relationship is not clear for andesitic volcanos. A problem has been that in many cases, detailed instrumentation at andesitic volcanos was installed only after the main eruptions had already occurred. Augustine, which may have entered a preparation stage for a new eruption, offers the best opportunity in the United States at present to test our forecasting theories and abilities.

This item was submitted by Juergen Kienle, *Department of Geology and Geophysics and the Geophysical Institute, University of Alaska, Fairbanks.*

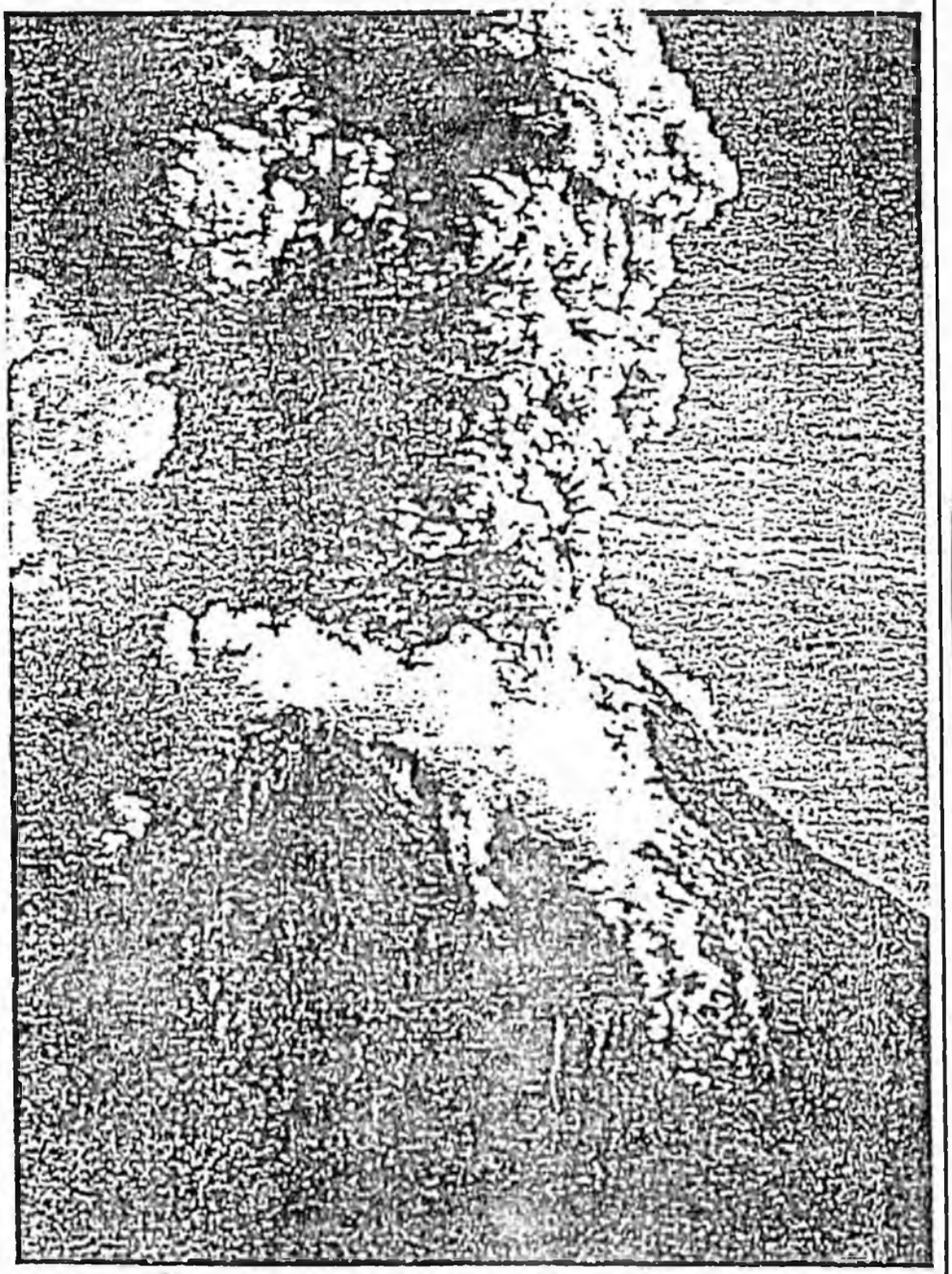

Fig. 1. Augustine Volcano, Alaska, in relatively mild eruption on March 31, 1986. This steady state plume was observed 5 h after a major explosion hurled debris to an altitude of 14 km, as observed by radar and a Japanese jetliner. Photograph by Juergen Kienle.

Eos July 22, 1986

The VGP News

The VGP News: The focal point for volcanologists, geochemists, and petrologists.

Editor: John C. Eichelberger, Geochemistry Division 1845, Sandia National Laboratories, Albuquerque, NM 87185 (telephone 505-846-0398, or leave message at 505-846-0212).

News & Announcements

1986 Eruption of Augustine Volcano: Public Safety Response by Alaskan Volcanologists

Although, in a general sense, all scientific work on hazardous natural phenomena such as weather, earthquakes, and volcanic eruptions can advance the public safety, we wish to describe some specific actions that were motivated by direct considerations of safety. These kinds of actions are normally at the fringes of scientific research and become important only during some crisis; in this instance, the crisis was the eruption on March 27, 1986, of Augustine Volcano (Figure 1). The agencies involved were the Geophysical Institute of the University of Alaska (UAGI), the Division of Geological and Geophysical Surveys of the State of Alaska (DGGS), and the Alaska Branch of the United States Geological Survey (USGS). The central theme of our mutual effort during the crisis was to communicate to response agencies and the public, in the most meaningful way possible, a prediction of what could happen next and how it would affect the public.

Between Eruptions (1982–July 1985)

Following the 1976 eruption of Augustine and prior to any indication that it might soon reawaken (see "Augustine Volcano: Awake Again?" in *Eos*, April 8, 1986, p. 172), there were several key events that affected our scientific response to the 1986 eruption. There was a series of meetings about the hazards posed by Alaskan volcanos. In February 1982, the DGGS sponsored a meeting on seismic, volcanic, and tsunami hazards in Alaska. A resolution from this meeting called for a national program focused on Alaska for comprehensive studies of explosive volcanism, including a research consortium to study the Cook Inlet volcanos. Subsequently, an informal agreement and a pooling of resources among the three agencies (UAGI, DGGS, and USGS) led to the creation of a minimal Cook Inlet volcano monitoring capability at the USGS office at Gould Hall in Anchorage, Alaska. Then, in February 1985, J. Kienle and S. E. Swanson published a report entitled "Volcanic hazards from future eruptions of Augustine Volcano, Alaska" (published by UAGI as *Report R-275*).

The informal "observatory" in Anchorage, in addition to possessing the ability to monitor each of the four Cook Inlet volcanos from Augustine to Spurr, served as a continual reminder of the need to formalize the research program, to establish stable funding, and to agree how each agency was going to react to a future volcanic crisis. By the time of the 1986 eruption of Augustine a series of discussions had resulted in a draft Memorandum of Understanding, which specified that USGS would be the principal source of scientific information to the public. The guidelines provided by the memorandum were essentially followed during our response to the 1986 eruption of Augustine.

The Kienle and Swanson report proved to be a good basis for forecasting the imminent activity of Augustine. It provided a detailed chronology and description of the previous eruptions of Augustine (Figure 2), especially the events of 1963–1964 and 1976 and clarified a common event sequence.

Preeruption Period (July 1985–March 26, 1986)

The first indication that Augustine Volcano was reawakening was a swarm of microearthquakes in July 1985. For ~3 days the daily count of events detected at the summit station (AUH) reached approximately 300, before gradually returning to a "background" level of 0 to a few tens of events per day. This background level was maintained for most of the fall and winter of 1985–1986 before the seismicity began a rather steady increase in February and March 1986 (Figure 3).

As this crucial period of monitoring progressed, our level of concern increased. Proposals were written to improve the instrumentation on Augustine, to study the surficial geology on the island, to improve estimates of eruption and major landslide (debris avalanche) frequency, and to model the tsunami generated by the 1883 debris avalanche at Burr Point (north shore of Augustine Island).

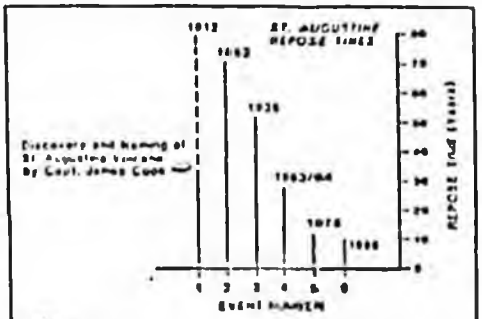

Fig. 2. Systematic shortening of repose times for historic eruptions of Augustine Volcano.

Improvements in our monitoring capability were made more difficult by several factors:

- It was not clear even in late February that the eruption was only a month away.
- It was still winter in Alaska, and tasks such as installing tiltmeters or establishing a deformation net were difficult if not impossible.
- Many of the USGS volcanologists and much of their equipment were still committed to the monitoring effort at Ruiz Volcano in Colombia. Nevertheless, on March 22, with support from DGGS, UAGI scientists visited Augustine to upgrade some of the existing seismic stations and to install one additional station, bringing the total on the island to five.

The increase in seismic events and vapor emitted from the summit area of Augustine Volcano during February and early March strongly indicated that Augustine was headed for an eruption. The principal hazards of a typical Augustine eruption were judged to be

- hazards to aircraft by airborne ash,
- nuées ardentes, which would pose a danger principally to the herring fishing fleet in the vicinity, and

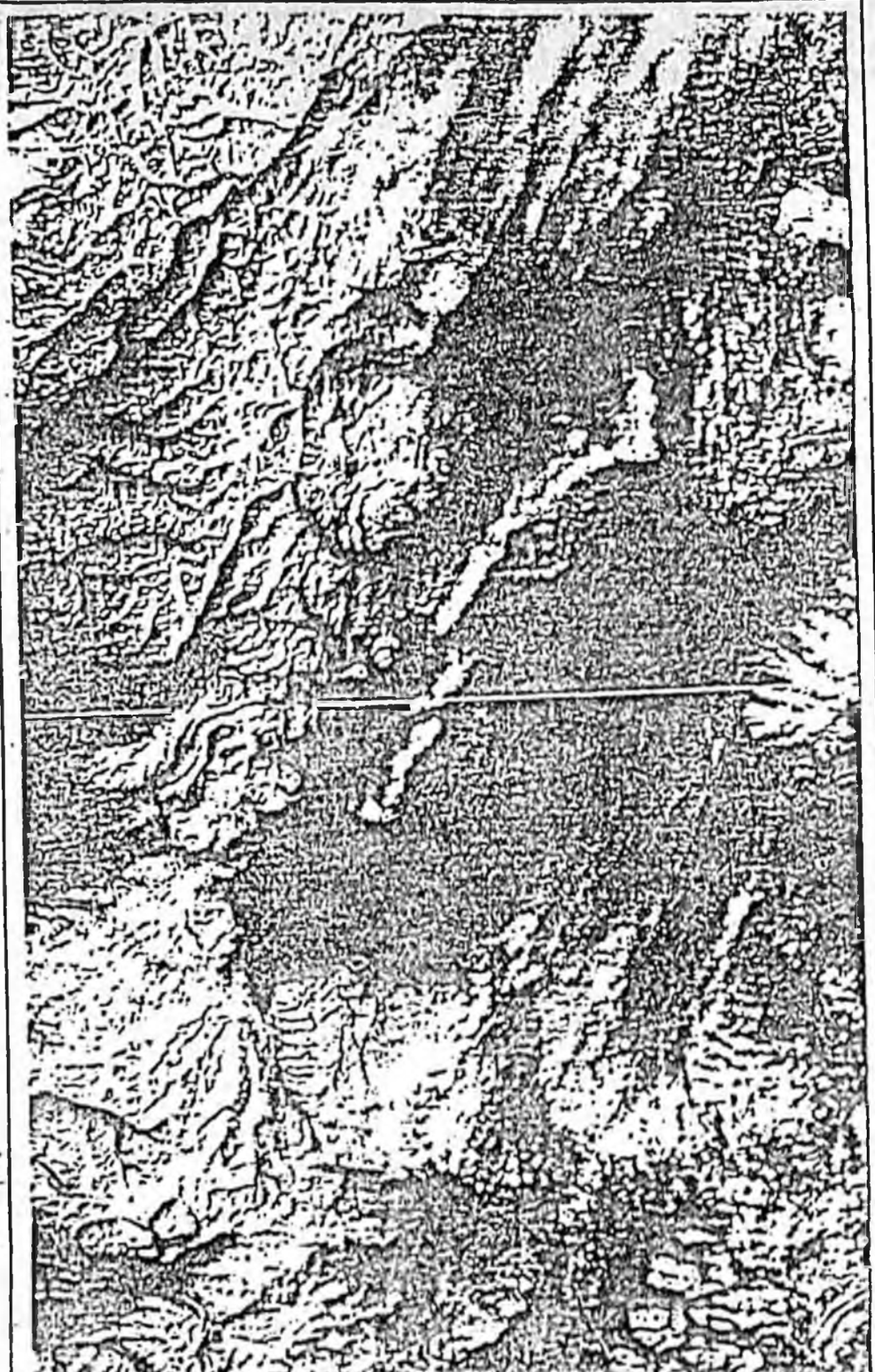

Fig. 1. Landsat 5 image of March 27, 1986, 12:47 AST, showing an eruption plume that consists of distinct puffs drifting NNE, up the Cook Inlet estuary. Most of the mudflows and pyroclastic flows on Augustine Island were directed northward. The east-west diameter of the island is 14 km.

• the possibility of a massive failure of the volcanic edifice, resulting in a landslide-induced tsunami similar to that generated during the 1883 eruption.

Accordingly, on March 18 and 21, 6–9 days prior to the eruption, the Federal Aviation Administration (FAA) and the U.S. Air Force (USAF) were briefed on the possibility of an eruption and its potential effects on aircraft and air traffic. Information and liaison procedures were established with both agencies. The increase in activity at Augustine was discussed several times with the Alaska Division of Emergency Services (DES) in the month prior to the eruption, and a summary briefing had been scheduled for March 27.

On Wednesday, March 26, 1986, a dramatic increase in the seismicity rate from a few hundred events per day to 5000–6000 events per day led us to believe that the volcano would soon erupt. The first eruption report was received by the U.S. Coast Guard (USCG) about 0230 AST (Alaska Standard Time, equal to UT − 9h), Thursday, March 27, from a fishing boat 55 km ESE of Augustine. The vessel reported smoke and orange flashes emanating from the volcano. Police department observers at Homer, 110 km ENE of the volcano, corroborated this report. Residents on the east side of Cook Inlet north of Augustine noted a strong sulfur smell preceding the first ashfalls.

Main Eruption (March 27–April 8, 1986)

During the first several days of the eruption, the prevailing winds were from the south rather than from their usual west and northwest direction. Large amounts of airborne ash filled the lower atmosphere of the Cook Inlet bowl, and ash was carried north into the most densely populated parts of Alaska including Anchorage, the hub of air traffic in south-central Alaska (see cover). Early in the morning of March 27, the USAF evacuated their aircraft from Elmendorf Air Force Base and kept them away until March 30. The effect of airborne ash on air traffic, particularly commercial air traffic, was severe. Although Anchorage International Airport was never officially closed, most of the major interstate and international air carriers decided to cancel or divert flights away from Anchorage, principally out of concern for the effect of ash on engines, electronic gear, and fuselage components, including windshields. Several small intrastate air carriers cancelled Cook Inlet flights, in many cases on the advice of their insurance companies. On March 28, when Anchorage International Airport usually would have handled about 300 flights, only 16 flights departed or arrived. On March 29, one DC-10 airplane suffered significant abrasion of windshield and turbine parts while descending to Anchorage airport in near-zero visibility conditions caused by finely disseminated ash in the atmosphere. As the winds shifted, the Cook Inlet basin cleared; most flights resumed by March 31.

Ash falls had a moderate to severe effect on commerce and the populace. Most of

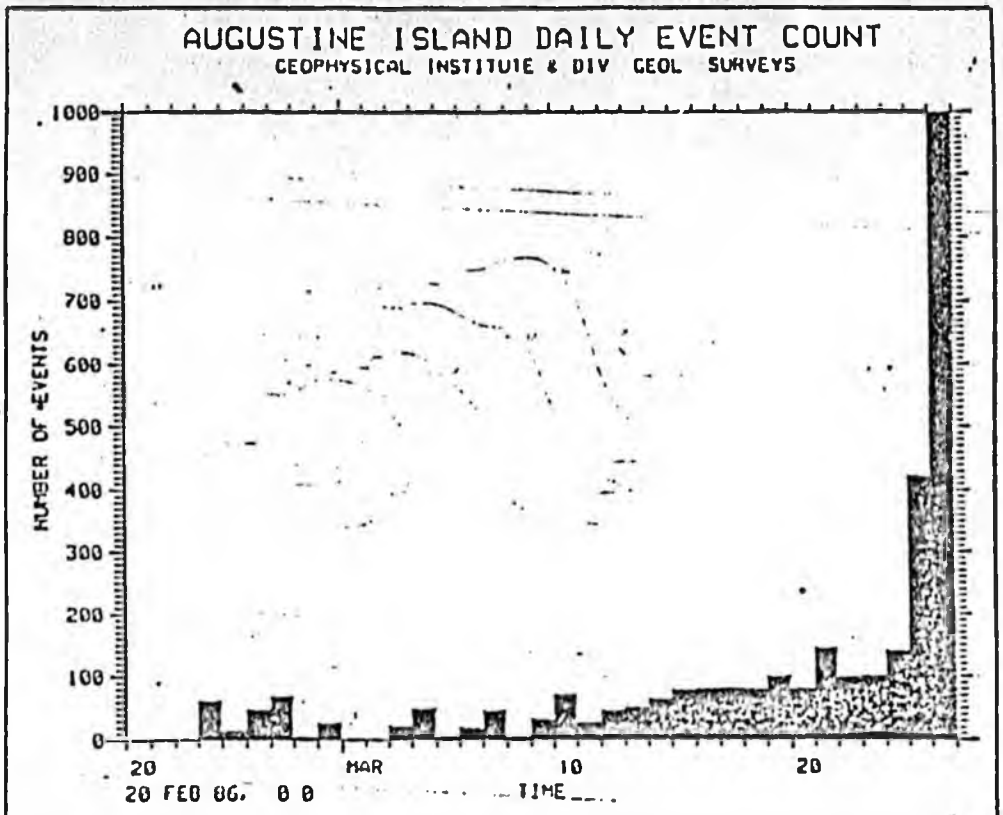

Fig. 3. Number of seismic events that were recorded daily at the summit station of Augustine Island (AUII), February 20–March 26, 1986 (compiled by John Power, University of Alaska).

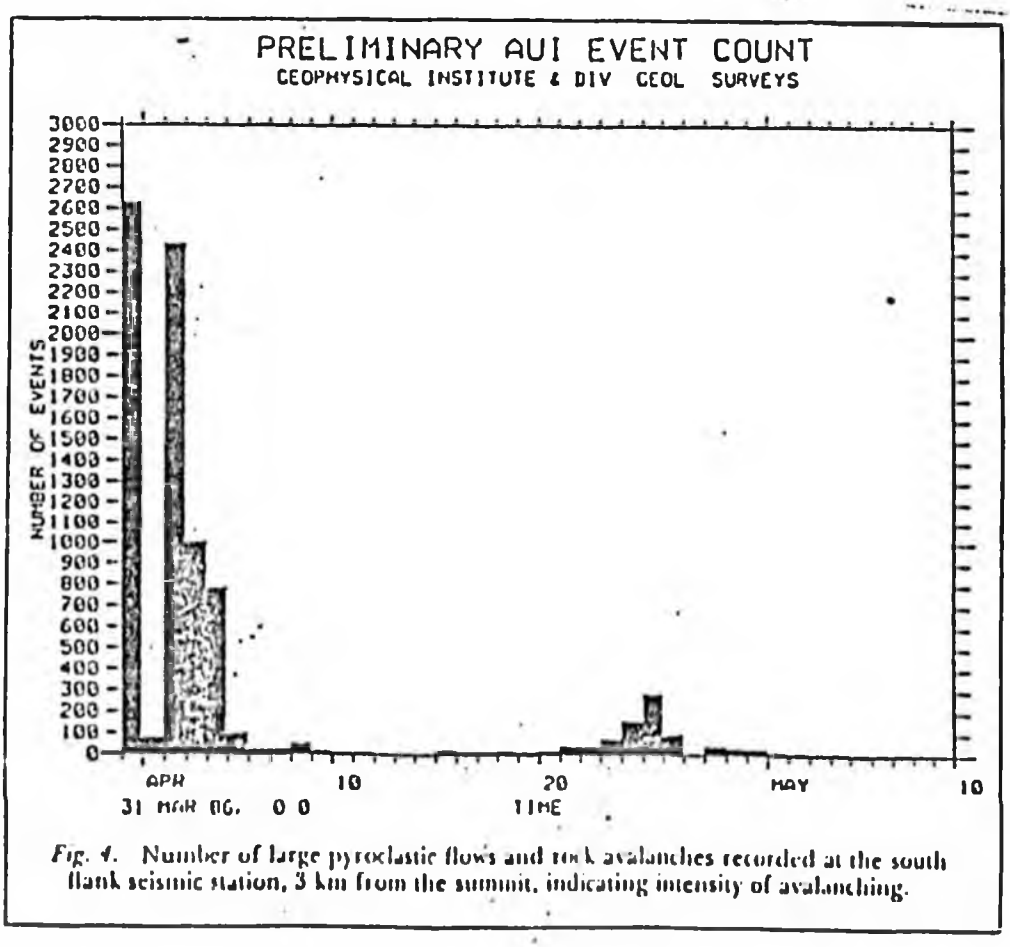

Fig. 4. Number of large pyroclastic flows and rock avalanches recorded at the south flank seismic station, 3 km from the summit, indicating intensity of avalanching.

south-central Alaska derives its electricity from natural gas–powered generators that are located on the west side of upper Cook Inlet. Because of damage to these generators by ingestion of airborne ash during the 1976 eruption of Augustine, public officials considered shutting them down and drawing on power generated from utilities outside the immediate area. A shortfall in power supply was predicted, and requests for power conservation were made on March 27 to the public and to commercial users. There was also considerable concern with regard to the effects of ash on machinery, particularly automobiles, and on electronic equipment. As a result, numerous companies, government agencies, stores, restaurants, banks, and so on either closed or reduced their operations, sending employees home. Postal service was cancelled for the day.

As particulate content of the air rose, reaching 900 $\mu g/m^3$ in Anchorage on March 28, local health officials became concerned about air quality and the possible effects of ash on people who suffered from respiratory problems. Although only traces of ash fell on Anchorage itself and no community in the Cook Inlet area received more than 6 mm, the ash was pervasive and was characterized by its fineness. As a result, the ash tended to hang in the air for relatively long periods. Grain size and ash particle morphology suggest that there was a strong phreatomagmatic component in this 1986 eruption.

The demand for information during this first phase of the eruption was overwhelming. Because many state and local agencies were referring calls to USGS, the major burden of providing information fell on the USGS staff at Gould Hall in Anchorage, which operated 24 hours a day throughout this period. Personnel from DGGS and UAGI kept a 24-hour per day watch at the UAGI Seismology Laboratory in Fairbanks. Volcanologists from the USGS Cascade Volcano Observatory in Vancouver, Wash., assisted both at Gould Hall Anchorage and at the UAGI Seismology Lab. USGS, assisted by personnel from UAGI, concentrated on overflights and visual reports; UAGI and DGGS concentrated on the seismicity. Visual and radar reports of eruptive activity were compared with seismic events, and interpretations of activity were made. Close communications, in some cases amounting to dozens of phone calls per day, between USGS in Anchorage and DGGS and UAGI in Fairbanks resulted in a smooth and uniform flow of information to those state and federal agencies concerned with public health and safety, as well as to the media and the public.

Second Phase of the Eruption (April 23–28, 1986)

Most of the concerns and actions noted above abated after the first phase of the eruption ended on about April 8. However, public concern about the possibility of an eruption-induced tsunami persisted in low-lying eastern Cook Inlet communities on the Kenai Peninsula. Several meetings were held at the instigation of DES to address this topic. On April 11, representatives of DES, DGGS, UAGI, USGS, National Weather Service, Alaska Tsunami Warning Center (TWC), Alaska Department of Environmental Conservation, USCG, and USAF met to identify capabilities and shortfalls and to arrive at a recommended course of action. On April 22, DES organized a public meeting in Homer, at which representatives from USGS, DGGS, and TWC gave presentations on the progress of the eruption and fielded questions from the audience. This meeting was taped for later airing on a local radio station.

Daily seismic event counts began to increase again on April 20, peaking on April 25, when counts rose to about 300 events (Figure 4). On the basis of this seismicity increase, we advised the wire services and state and federal response agencies on April 23 that another eruptive phase appeared imminent. On April 24, we first observed new lava at the summit vent. We were concerned about the possibility of a major vent-clearing eruption, the stability of the upper cone, and the potential for a landslide-induced tsunami. The media gave much coverage to these possibilities. When dramatic explosive eruptions did not develop, they reported that the volcano had "fooled the scientists," although a major extrusive phase had indeed occurred. From about April 5 to April 28, lava extruded from the summit vent, piling on top of the 1976 lava dome, draping its east face, and feeding a short blocky lava flow. On May 16, another public lecture was given in Homer by UAGI at the request of the Pratt Museum, to discuss the tsunami hazard due to dome growth.

Media interest, both national and local, was intense throughout both phases of the eruption. The 1980 eruption of Mount St. Helens was recent enough to remain fresh in the media's memory, and the spectacular nature of some of the eruptive events at Augustine was sufficient to capture public interest. The low probability but dramatic possibility that a major landslide would create a tsunami remained a central issue. Numerical modeling of long wave propagation across Cook Inlet completed in May confirmed that the debris avalanche at Burr Point on the north shore of Augustine Island could indeed have caused the tsunami run-up of 8 m reported in Port Graham in 1883 (Figure 5).

Posteruption Period (May 1986 to the Present)

Between and following the main eruptive events, the volcano was visited and studied by helicopter teams from USGS, UAGI, and DGGS. The pyroclastic flows were sampled, fumarole temperatures were measured, and seismic equipment was repaired and maintained. Preliminary results of this work have been reported in the March and April issues of the Scientific Event Alert Network (SEAN) Bulletin of the Smithsonian Institution (summaries appeared in *Eos*, May 6, 1986, p. 450, and June 17, 1986, p. 524). Reporting will continue during the summer field session, as will work on mapping, aerial photography, geochemistry of the eruptive products (ejecta and gas), tephrachronology of previous eruptions, dating of debris avalanches on the west, north, and east flanks of the volcano installation of tide and tilt meters, and the surveying of a geodetic network on the island. This information should permit more precise predictions of future eruptions of Augustine than was possible this time.

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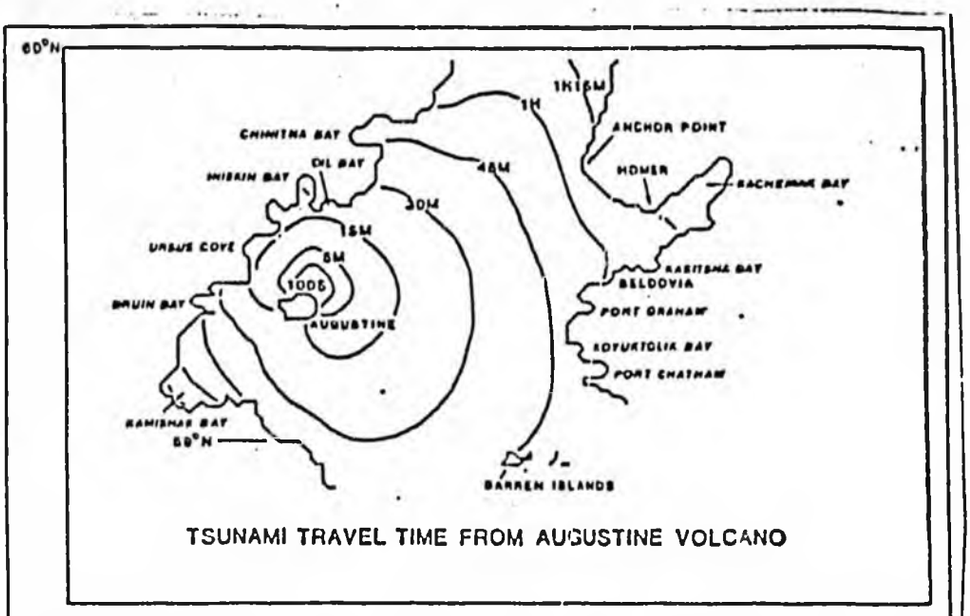

Fig. 5. Travel time of 1883 tsunami generated by the impact of a debris avalanche on the northern shore of the volcano (Burr Point). The numerical simulation of the resulting long waves was carried out by Zygmunt Kowalik of the Institute of Marine Science, University of Alaska.