

NASA

National Aeronautics and
Space Administration

1976 Mishap and Injury Data

OFFICE OF SAFETY AND ENVIRONMENTAL HEALTH
Washington, D. C. 20546

FOREWORD

This report contains statistical and narrative data concerning NASA mishap and injury experience for calendar year 1976. Injury data is reported for full-time NASA civil servants only. However, total mishaps also include the one fatality and accidents reported at NASA contractor facilities and operations.

Since there were no mission failures in 1976, our program and operational personnel deserve to be commended.

Aviation mishaps and fire incidents were at an all time low for 1976. Whatever our people were doing in those areas - which in the past have had periodic large losses - we wish they would continue.

Bad news was brought to us earlier this year in a contractor loss control/safety study. They found that the 45-day Continuation of Pay (CoP) program for federal personnel injured on the job is extremely vulnerable to abuse.

The statistics from selected NASA installations certainly bear them out. Our lost time injuries and frequency rate skyrocketed to a new high and the chargeback billing which the Office of Workmen's Compensation imposes on NASA. Reimbursement was almost three million dollars. In addition, there was a big jump in the automotive accident frequency rate. All of the above have occurred while we have a declining number of NASA employees and relatively fewer operations. Each installation should examine the administration of CoP to minimize employee abuse without limiting justifiable claims. Top management attention can dramatically reduce the NASA loss.

Supervisory personnel should extend themselves to oversee potentially hazardous operations so as to preclude, whenever possible, employees from taking shortcuts and perhaps injuring themselves. If we had more bosses roaming the NASA workplace, I am convinced we can reduce our accidents and injuries considerably. Our most hazardous operations tend to have the fewest injuries. The seven-year continuous rise in our accident/injury rates is something that requires the utmost attention of management and supervisory personnel.

The statistical information presented in this report is designed to assist each NASA employee in evaluating how his work environment historically stacks up against the rest of NASA for his safety and health. Please, in the future, use these lessons from the past to avoid more loss and grief.

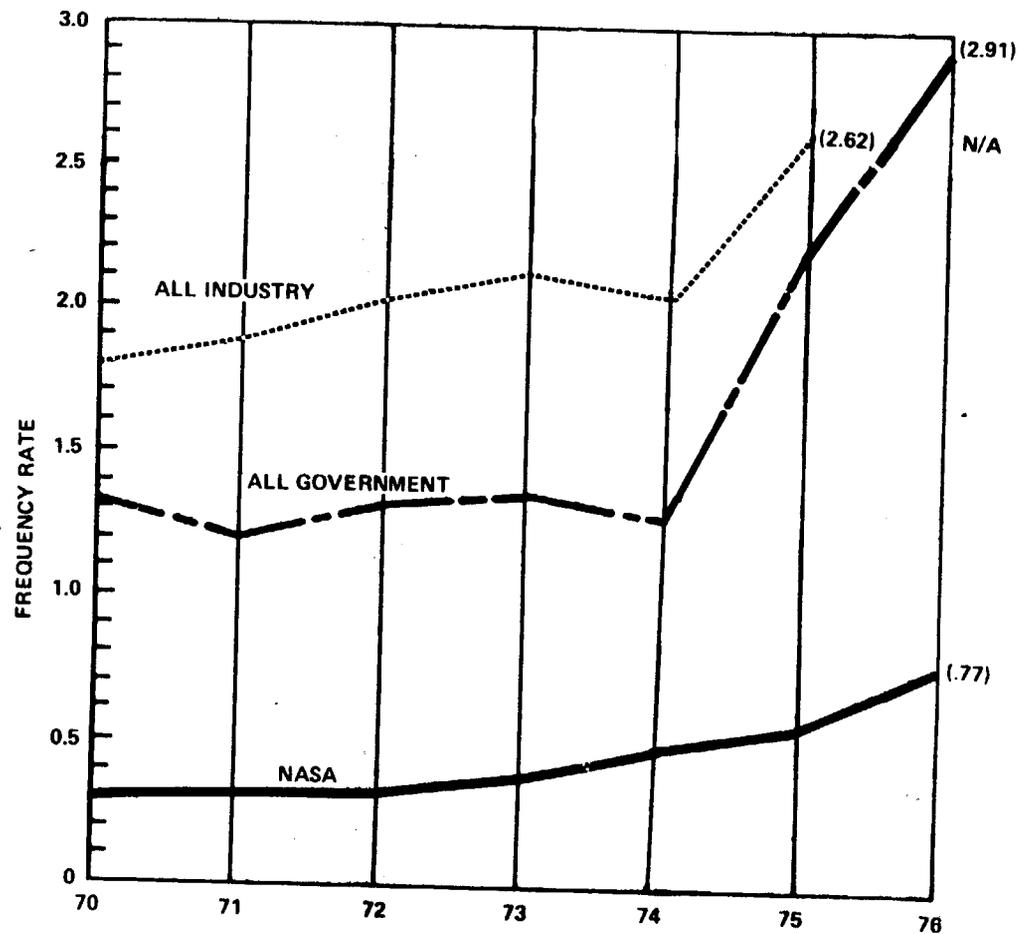


Reuben P. Prichard
Acting Director, Safety and
Environmental Health

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**NASA
INJURY
EXPERIENCE
1970
THROUGH
1976**



FREQUENCY RATE - NASA

70	71	72	73	74	75	76
.29	.30	.30	.37	.49	.54	.77

* FREQUENCY RATE - ALL GOVERNMENT

70	71	72	73	74	75	76
1.32	1.20	1.30	1.36	1.28	2.25	2.91

† FREQUENCY RATE - ALL INDUSTRY

70	71	72	73	74	75	76
1.77	1.87	2.03	2.11	2.04	2.62	N/A

AVERAGE NUMBER OF NASA EMPLOYEES

70	71	72	73	74	75	76
31,200	29,100	28,300	27,900	26,700	26,023	25,794

LOST TIME INJURIES - NASA

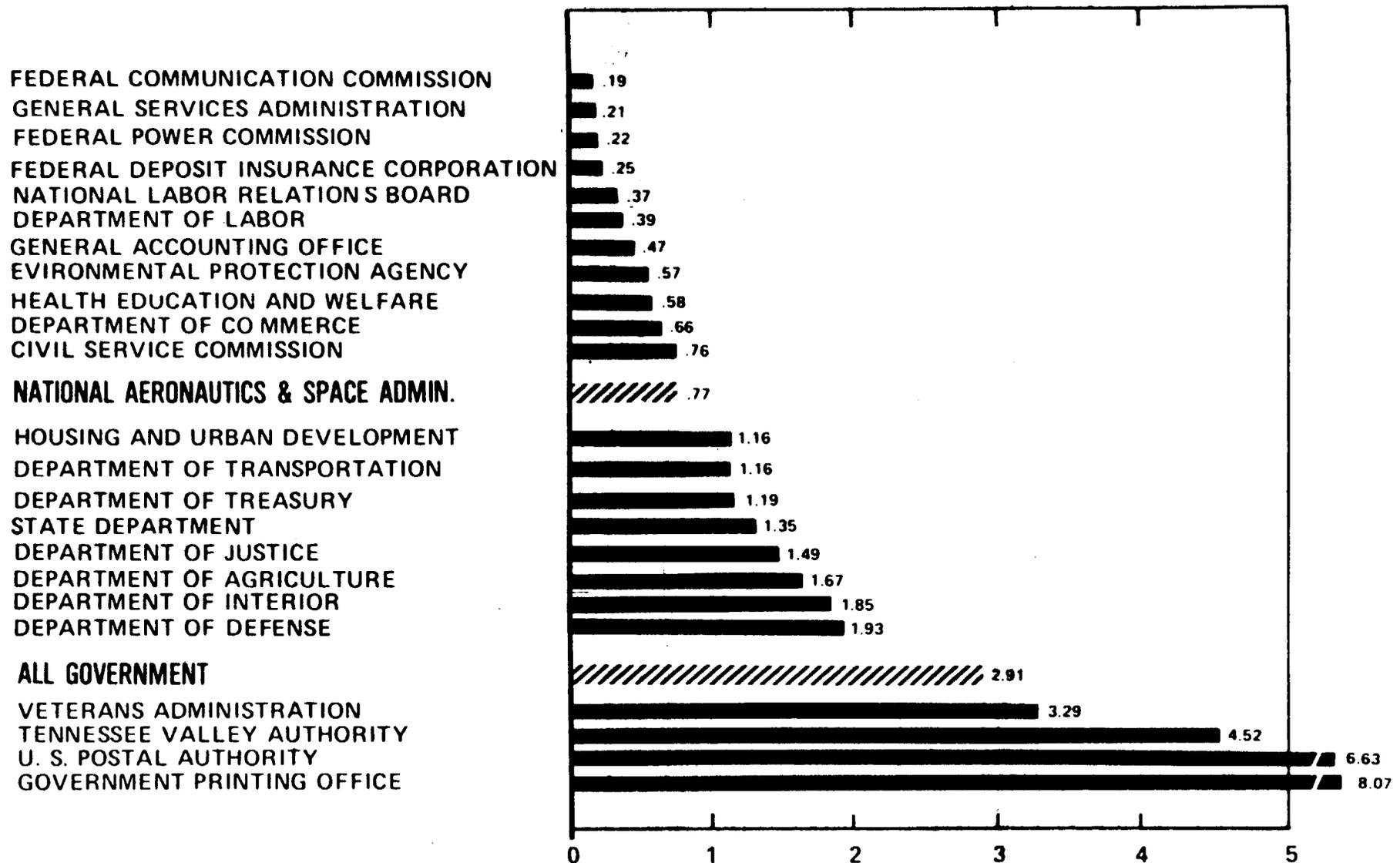
70	71	72	73	74	75	76
85	83	79	93	116	127	175

FREQUENCY RATE IS DEFINED BY OSHA AS THE NUMBER OF LOST TIME INJURIES PER 200,000 MAN-HOURS WORKED.

* SOURCE: OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION, DEPT. OF LABOR

† SOURCE: NATIONAL SAFETY COUNCIL

LOST WORK DAY CASES IN FEDERAL AGENCIES OCCUPATIONAL INJURY RATES FOR CIVILIAN PERSONNEL PER 200,000 MAN-HOURS - 1976



SOURCE: Occupational Safety and Health Administration, U.S. Department of Labor

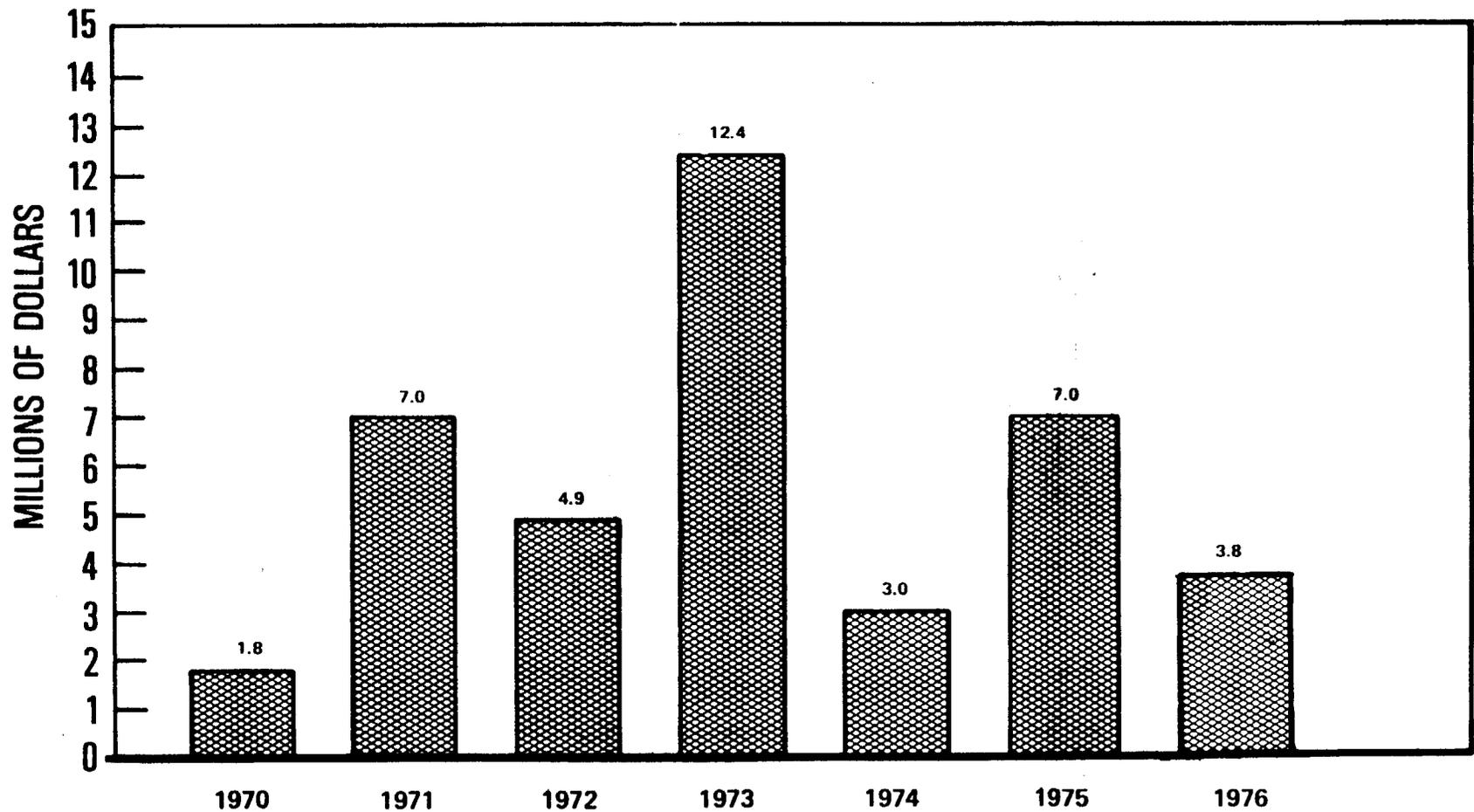
NASA HQ Y276-3082 (1)
4-30-76

COST OF 1976 NASA ACCIDENT/INCIDENTS/INJURIES

MANPOWER LOSS:	0 311 175 2,968	FATALITIES NON-LOST TIME INJURIES LOST TIME INJURIES WORK DAYS LOST = 11.4 MAN-YEARS EFFORT												
MONEY LOSS:	WAGES CHARGE BACK BILLING TO FEDERAL EMPLOYEES COMPENSATION FUND (FY 1976)	\$258,860 = 11.4 MAN-YEARS@ AVERAGE NASA 1976 WAGE OF \$22,707/ YEAR \$2,762,039												
MATERIAL LOSS:	AIRCRAFT VEHICLES FIRE OTHER PROPERTY	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center;"><u>NO. OF MISHAPS</u></td> </tr> <tr> <td style="text-align: right;">\$ 3,210</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: right;">43,449</td> <td style="text-align: center;">74</td> </tr> <tr> <td style="text-align: right;">20,124</td> <td style="text-align: center;">37</td> </tr> <tr> <td style="text-align: right;">691,000</td> <td style="text-align: center;">26</td> </tr> <tr> <td style="text-align: right;"><hr/>\$ 3,778,682</td> <td style="text-align: center;"><hr/>138</td> </tr> </table>		<u>NO. OF MISHAPS</u>	\$ 3,210	1	43,449	74	20,124	37	691,000	26	<hr/> \$ 3,778,682	<hr/> 138
	<u>NO. OF MISHAPS</u>													
\$ 3,210	1													
43,449	74													
20,124	37													
691,000	26													
<hr/> \$ 3,778,682	<hr/> 138													
<u>TOTAL LOSS:</u>														

DOES NOT INCLUDE CONTRACTOR DATA.

TOTAL COSTS TO NASA DUE TO MISHAPS*

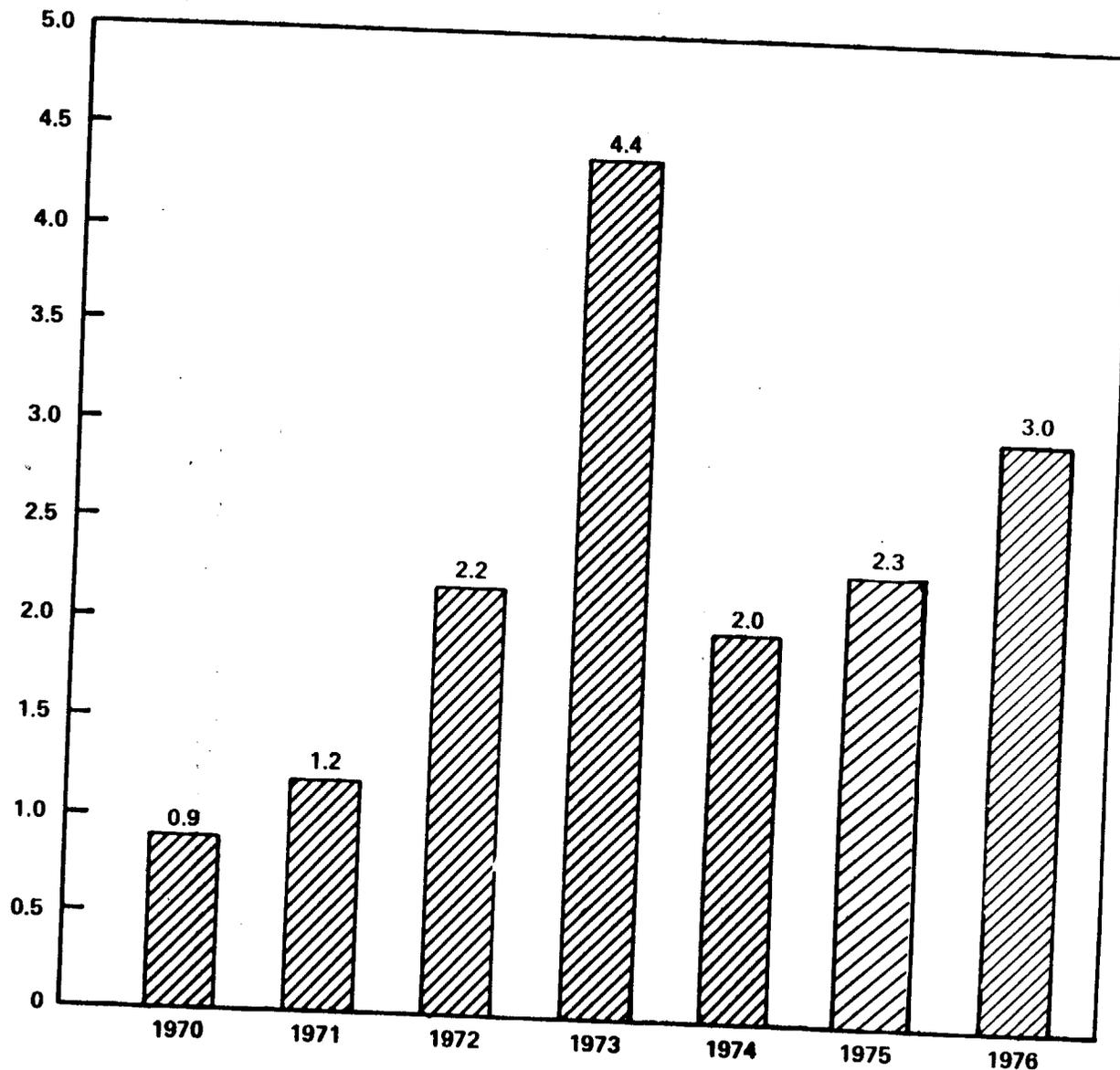


* DOES NOT INCLUDE CONTRACTOR LOSSES.

* DOES NOT INCLUDE MISSION FAILURES.

NASA MONEY LOSSES DUE TO MISHAPS *

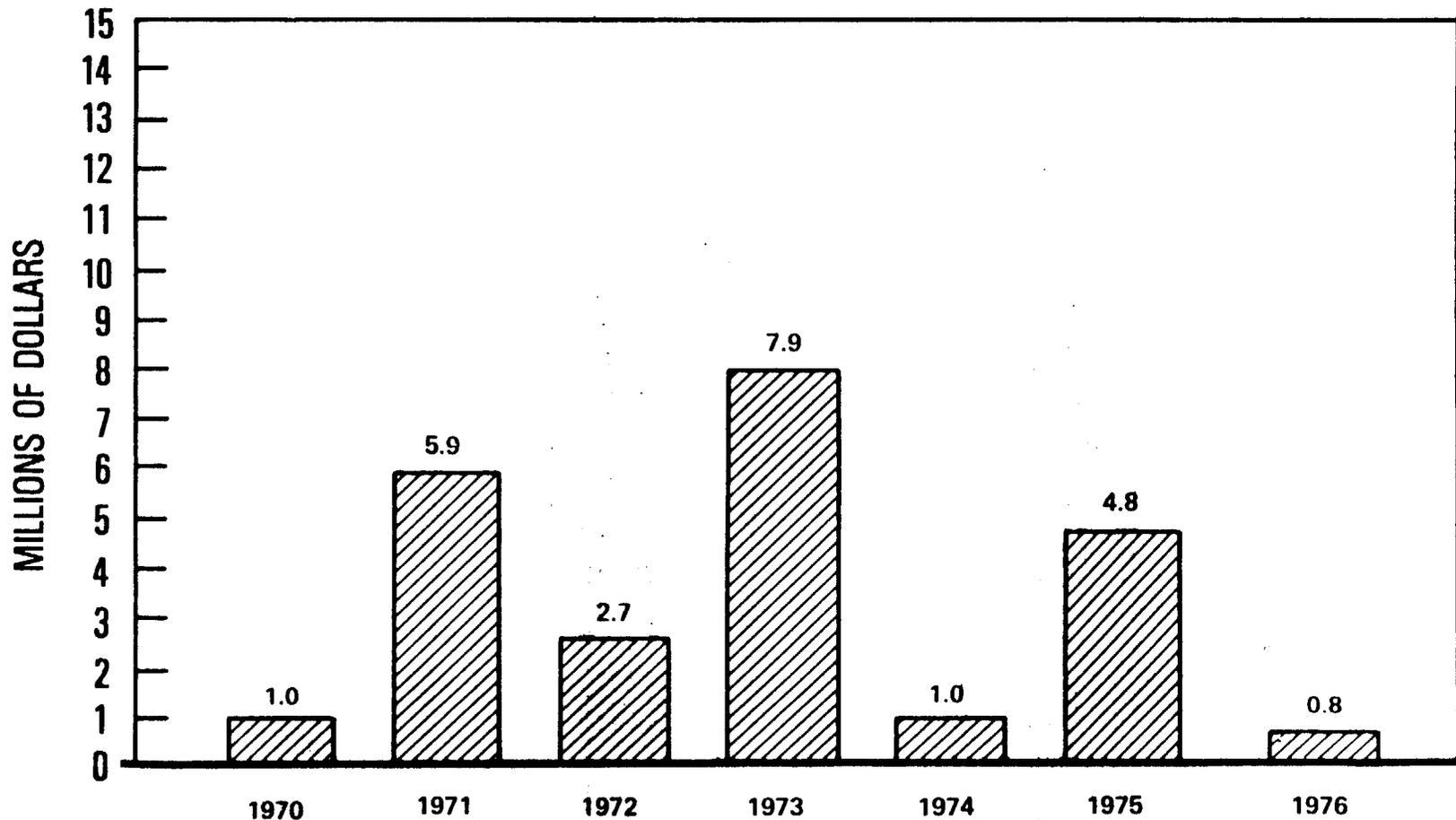
MILLIONS
OF DOLLARS



* INCLUDES LOST WAGES AND CHARGE BACK BILLING TO THE FEDERAL EMPLOYEES COMPENSATION FUND, BUT DOES NOT INCLUDE CONTRACTOR LOSSES.

TWO FATALITIES IN 1972 AND SEVEN IN 1973 DROVE COSTS UP FOR THOSE YEARS.

NASA MATERIAL LOSSES DUE TO MISHAPS*



* INCLUDES AIRCRAFT, VEHICLE, AND FIRE MISHAPS AND LOSSES OF OTHER PROPERTY.

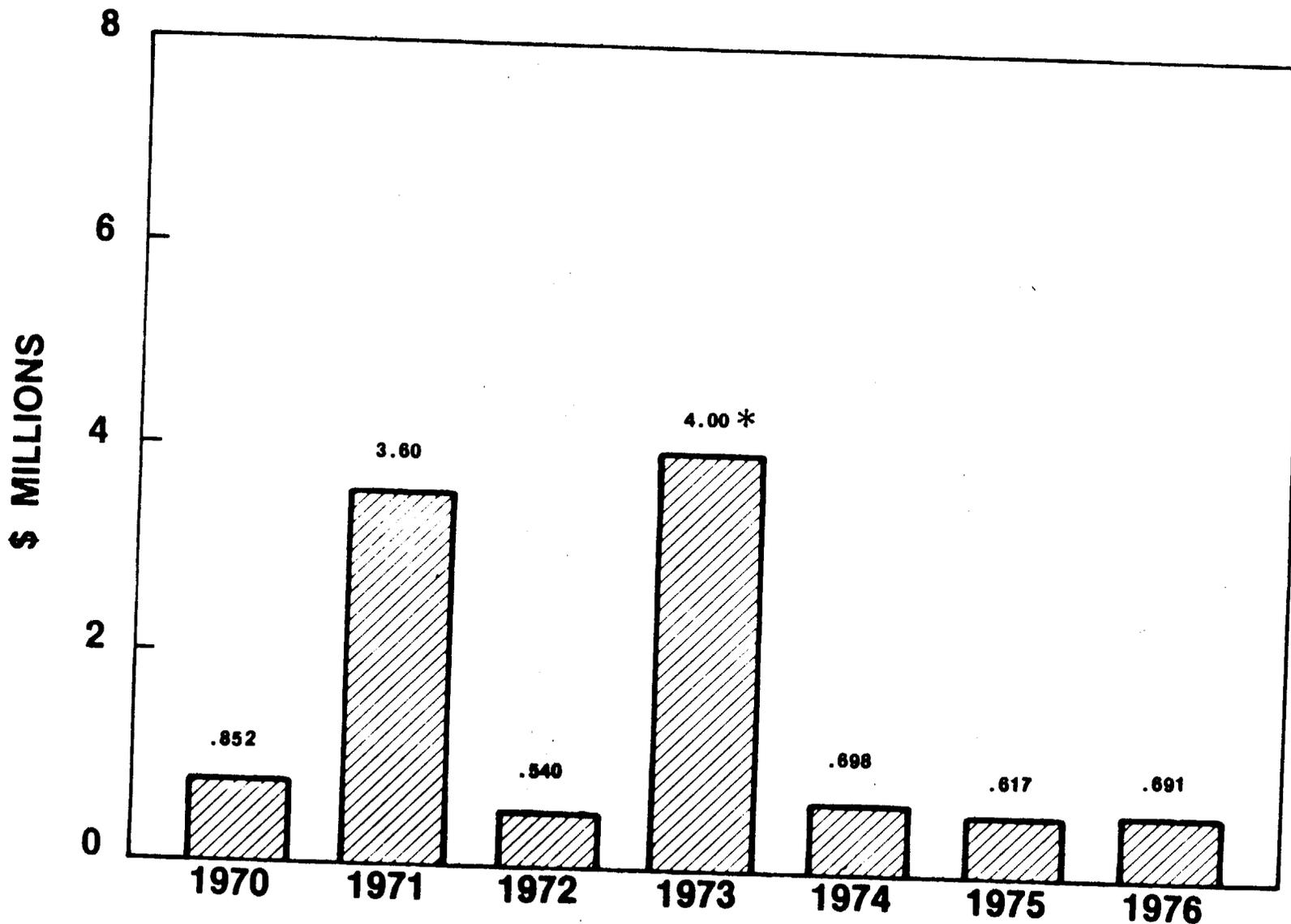
DOES NOT INCLUDE MISSION FAILURE COSTS.

DOES NOT INCLUDE CONTRACTOR LOSSES.

CONVAIR 990 LOSS IN 1973 DROVE COSTS UP THAT YEAR.

OTHER NASA MATERIAL LOSSES

1970-1976

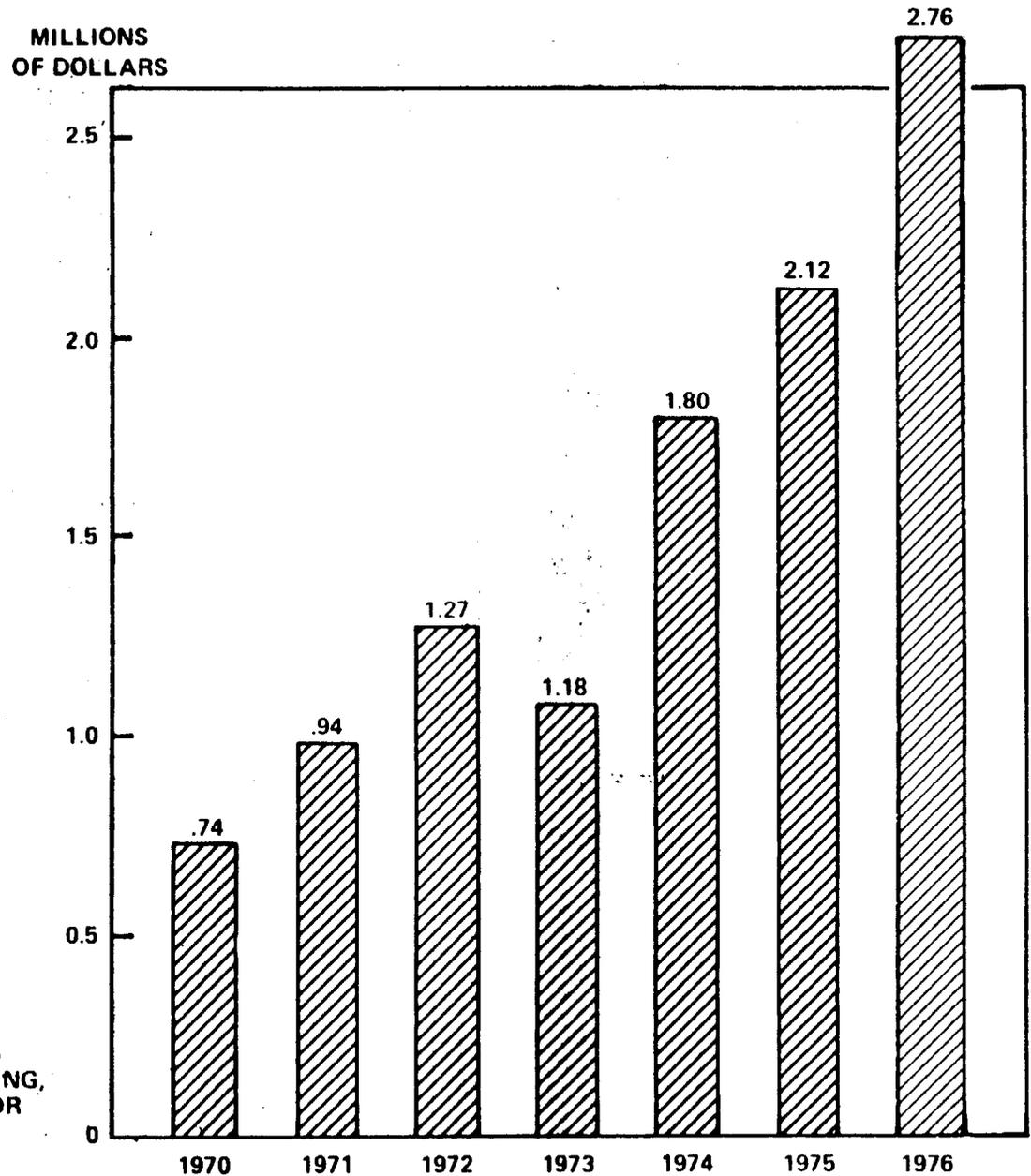


* NASA CONTRACTOR DROPPED PAYLOAD

**COSTS NASA PAID
TO FEDERAL EMPLOYEES
COMPENSATION FUND
(BY FISCAL YEARS)**

8

1. THESE COSTS ARE CHARGED AGAINST NASA AS REIMBURSEMENT TO THE FEDERAL EMPLOYEES COMPENSATION FUND FOR PAYMENTS MADE ON ACCOUNT OF IN JURY OR DEATH OF NASA EMPLOYEES OR PERSONS UNDER THE JURISDICTION OF NASA .
2. THE SLIGHT DECREASE FOR FY 73 MAY HAVE BEEN DUE TO A CHANGE OF STATUS OF BENEFICIARIES, I.E. WIDOWS REMARRYING, DEPENDENT CHILDREN COMING OF AGE, OR DEATH OF THE PRINCIPAL .



NASA ACCIDENT/INCIDENT EXPERIENCE IN 1976

DEFINITIONS:

1. Type A Accident - A mishap causing death, disabling injury to five or more persons, damage to equipment or property exceeding \$100,000, or destruction of an aircraft.

2. Type B Accident - A mishap causing disabling injury to four or fewer persons or damage to equipment or property exceeding \$10,000, but under that of a Type A accident.

3. Incident - A mishap of less than accident severity to persons or property, causing less than \$10,000 in damages, but exceeding \$100, or a non-serious injury.

4. Mission Failure - Any event which jeopardized a mission, prevents accomplishment of major mission objectives, or causes premature mission termination.

5. Costs - Direct costs of repair, replacement or recovery, including man-hours, material and contract costs, but excluding indirect costs of clean-up, investigation, injury, and normal operational delay.

TOTAL NASA SIGNIFICANT MISHAPS

The significant mishaps shown on the following charts are only those reported by the NASA Field Installations and contractors as having significance beyond the minor dollars loss or injury incident categories.

	1970	1971	1972	1973	1974	1975	1976
FATAL ACCIDENTS	2	2	3	2	2	3*	1*
TYPE A ACCIDENTS	6	13	11	4	6	10	3
TYPE B ACCIDENTS	12	11	7	6	11	12	15
INCIDENTS	20	24	9	22	13	8	6
MISSION FAILURES	1	3	0	3	2	2	0
ALL MISHAPS	38	48	37	32	30	30	24

*NON-NASA FATALITIES

NASA TYPE "A" ACCIDENTS - 1976

<u>LOCATION</u>	<u>DATE</u>	<u>DESCRIPTION</u>	<u>CAUSE</u>	<u>COST</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
Santa Susana, CA	2-04-76	Shuttle engine oxidizer Turbo-pump failure	Facility flowmeter blades separated	over \$1M	Redesign flowmeter
LaRC	3-29-76	Subcontractor fell through roof 80' to ground. Fatal	Inexperience, lack of supervision, lack of life line	Lawsuit pending	Supervise and train new men on the job
ARC	10-4-76	Aft end of fan engine blew up in 40'x80' wind tunnel	Fatigue failure in sun gear shaft	\$500K	Shut-off fuel flow indication of over- speed



Results of catastrophic failure of turbine wheel during wind tunnel testing.

NASA TYPE "B" ACCIDENTS - 1976

<u>LOCATION</u>	<u>DATE</u>	<u>DESCRIPTION</u>	<u>CAUSE</u>	<u>COST</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
Palmdale	5-19-76	Hydraulic actuator for lock-up device on landing gear failed	Design error	--	Perform development tests early
Guam	5-21-76	150' collimation tower blew down plug other damage	Typhoon	\$36.7K	Anchor and guy wire more extensively
WFC 12	7-17-76	Upper atmosphere research vehicle operational failure	Second stage failed to separate	--	Redesign separation mechanism
LaRC	8-76	Flash burst in deep air storage well	Unknown	\$32K	None
LeRC	9-14-76	Compressor blade failure caused fire	Fatigue cracking	\$30K	Redesign blade mountings
Madrid	9-27-76	Local national missed turn in road	Inattention to driving	--	Stay alert
Sioux Falls, SD	9-29-76	Balloon ruptured during launch	High wind conditions	\$23K	Launch only in calm weather
Palestine, Texas	9-30-76	Balloon ruptured during launch	Unknown	\$52K	None

<u>LOCATION</u>	<u>DATE</u>	<u>DESCRIPTION</u>	<u>CAUSE</u>	<u>COST</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
Sioux Falls, SD	9-30-76	Balloon launch release pyrotechnic failed & burst balloon	Incorrect ground wiring	\$24K	Rewire
Poker Flats, AL	9-30-76	Nike Tomahawk rocket ceramic nose cone failed	Nose cone came off prematurely	\$15K	Redesign nose cone attachment
WFC	10-6-76	Nike Cajun igniter failure; payload lost	12-G mechanical igniter failure	\$75K	Redesign mechanical igniter
NSTL	12-2-76	Damage to Shuttle turbopump during test	Poor location of GH ₂ igniter. Poor test procedures	\$49K	Relocate GH ₂ igniter. Use step-by-step test procedures for hazardous operations
Madrid	12-6-76	Leased vehicle hit cow on road at night	Cattle straying; no fences		None
GSFC	12-7-76	NASA employee went over embankment in Federal vehicle	Inattention to driving	\$2K	Stay alert
ARC (Crow's Landing, CA)	12-15-76	NASA employee run over by U.S. Government vehicle	Non-use of seat belts poor door latch, excessive speed	Non-fatal	Use seat belts, repair and maintain door latches, slow down

SIGNIFICANT NASA INCIDENTS - 1976

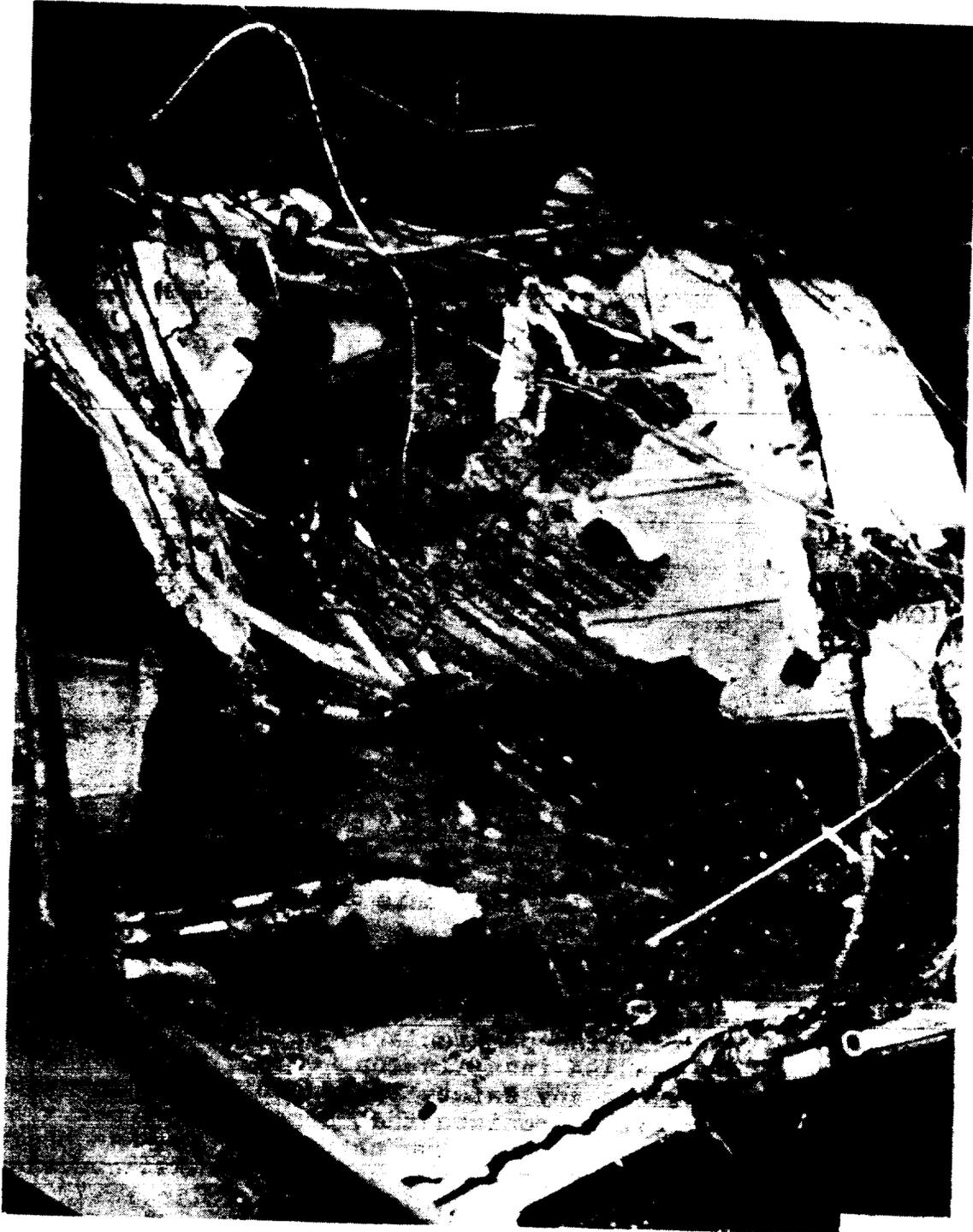
<u>LOCATION</u>	<u>DATE</u>	<u>DESCRIPTION</u>	<u>CAUSE</u>	<u>COST</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
ARC	3-11-76	Vertical gun hit ceiling beams and fell	Redesign error; poor procedures	None	Increase supervision
LaRC	6-07-76	Scale model of helicopter had seized hub and blades	Main vertical shaft failed	\$1.5K charged to U.S. Army	Inspect more frequently
JSC	7-07-76	Wing tip damaged by cable as aircraft was towed	Failure to follow written procedures	\$3.2K	Use wing walkers
Rosman, NC	7-15-76	Diesel engine fire	Leaking fuel	\$1.8K	Inspect more frequently
LaRC	8-76	Fatigue crack in mounting box of wind tunnel blades	Unknown	\$5K	Inspect more frequently
DFRC	9-01-76	Water/fog cooling of building fire caused extensive spallation	Accumulation of trash	\$5K	Inspect more frequently

TYPE A/B ACCIDENTS BY FIELD INSTALLATIONS

	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
AMES	0/0	0/0	0/0	1/0	0/2	1/0	1/1
DRYDEN	1/0	1/0	0/0	0/0	0/0	0/0	0/0
GODDARD	0/3	2/3	0/1	0/0	0/1	0/2	0/1
JOHNSON	3/1	3/3	6/2	1/0	0/5	0/1	0/0
KENNEDY	2/1	1/0	1/0	0/1	2/1	4/1	0/0
LANGLEY	0/1	1/0	0/1	0/1	0/1	0/2	1/1
LEWIS	0/0	3/0	2/0	0/1	0/0	0/1	0/1
MARSHALL	1/4	3/3	6/2	1/0	1/0	1/1	0/0
NSTL	-	-	-	-	0/0	0/1	0/1
WALLOPS	0/1	0/2	0/0	0/0	1/1	0/0	0/1
TRACKING STATIONS	-	-	-	1/3	2/0	2/2	0/3
HDQTRS.	-	-	-	-	-	2/1	0/0
TEST OPERATIONS	-	-	-	-	-	-	1/7
NASA TOTAL	7/11	14/11	15/6	4/6	6/11	10/12	3/16

Notes: Prior to 1974, MSFC included NSTL.
JPL has been excluded from this table.

This year we have initiated a new category in lieu of an Installation. It is called "Test Operations" to reflect the many accidents which occur during particularly hazardous test operations at locations away from NASA installations, e.g., Santa Susana, CA. This in no way denigrates any safety responsibilities for NASA operations. However, it recognizes that some mishaps occur at NASA contractor facilities, where the nature of the test operation involves predictably high risk/hazard and/or the NASA overview is considerably diminished. These should not be statistically charged to a NASA field installation which may be half a continent away.



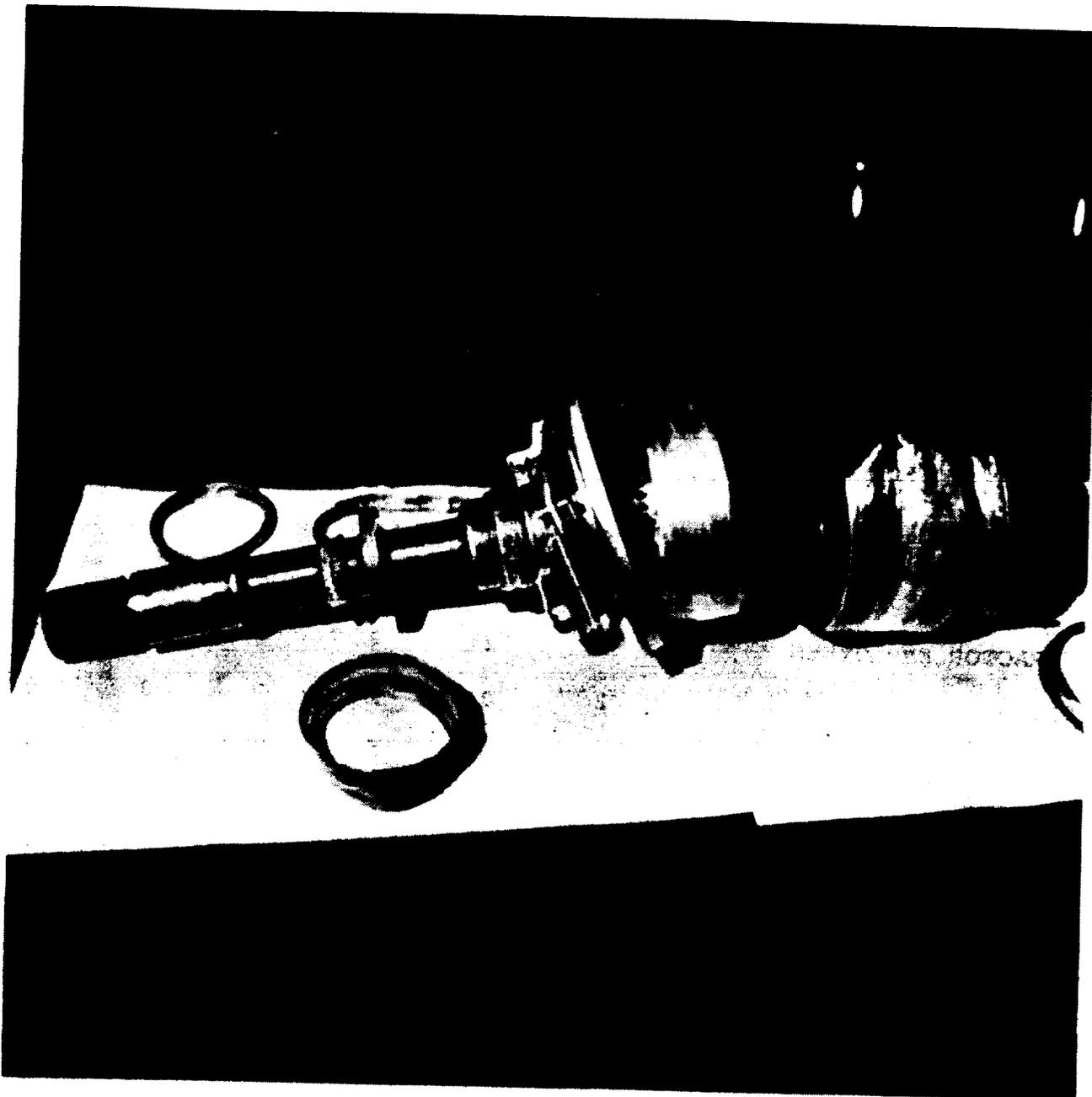
Results of gas turbine engine test failure

Type "A" accidents have dropped considerably this reporting year which is very commendable. On the other hand, type "B" accidents have gone up quite markedly. An examination of those reported accidents in the charts which follow shows no discernible pattern of lack of supervision - as was the case last year. However, the randomness of the accidents and the fact they occurred at all is indicative of a need for tightening up all the test procedures including a design review of the item, the test stand apparatus, and compatibilities of the associated ground support equipment.

FATAL ACCIDENTS AND FATALITIES

	1970	1971	1972	1973	1974	1975	1976
NUMBER OF FATAL ACCIDENTS	2	2	3	2	2	3	1
TOTAL NUMBER OF FATALITIES	2	5	4	17	3	3	1
NASA EMPLOYEES	0	0	2	7	0	0	0
CONTRACTOR EMPLOYEES	2	3	2	4	1	1	1
PUBLIC	0	2	0	1	2	2	0
MILITARY	0	0	0	5	0	0	0

The one fatal accident which occurred in NASA's operations for 1976 happened to a subcontractor employee. Although he was not a civil servant and the fatality is not chargeable to NASA per se, his death is symptomatic of several fatalities we have been plagued with in the past. In this case, a young male was on a roof working with a crew when he fell 80 feet through a corrugated ceramic roof. Because of the itinerant nature of subcontractor workers (painters, glaziers, roofers, etc.) they received little safety training, advice, or supervision. It behooves the NASA Contracting Officers and installation safety officials to make an added effort to assist these type of workers in this area to prevent similar casualties in the future.



Drive gear damaged during a wind tunnel test

SAFETY AND ENVIRONMENTAL HEALTH SURVEYS
1976

The NASA Headquarters Safety and Environmental Health Office conducted surveys at six field installations during the 1976 calendar year:

NaPO/Jet Propulsion Lab	January 26-30, 1976
Goddard Space Flight Center	April 19-23, 1976
Lewis Research Center	June 14-18, 1976
National Space Technology Lab	October 5-8, 1976
Ames Research Center	November 8-12, 1976
Dryden Flight Research Center	November 15-19, 1976

Due to travel fund limitations and the marginal manpower available, NASA HQ initiated a new Safety and Environmental Health survey schedule of visiting each Field Installation biennially in lieu of annually. To compensate for this change in scheduling, the field centers are now conducting self-surveys on the off-year. The field center survey teams are made up of third party members to negate the possibility of conducting a partisan review. To date, the results of the field center self-survey program have been very encouraging both in their comprehensive planning and productiveness.

The value of the HQ Safety and Environmental Health surveys are reflected by the general acceptance and recognition of the positive contributions and effects it has had on field center operations. The receptive attitude and support expressed by the Center Directors and Staff of the professional manner and conduct of the general survey program is indicative of its continuing worth in contributing to the upgrading of field center performance.

OCCUPATIONAL ILLNESSES

A total of 15 occupational illnesses were reported during 1976. Ten of these were non-lost time illnesses. The five lost time illnesses reported resulted in 21 lost work days.

NASA has a fairly comprehensive occupational health program which is geared to the control of health hazards in the work place and thus to the prevention of occupational disease. The low number of reported occupational illnesses is due in part to the various preventive activities associated with this program. However, these figures may not be indicative of the true incidence of such illness since it is quite well known that many illnesses have an occupational origin but are never recognized or reported. A study sponsored by the National Institute for Occupational Safety and Health found that about 89 percent of the occupational illnesses occurring in a select group of industrial facilities were either never recognized or reported. Approximately 25 percent of the work force, however, had some form of job related illness.

If good statistics relative to the incidence of occupational illness are to ever be available, a concerted effort must be made to gather pertinent data. Most illnesses with an occupational origin do not show up immediately following exposure to a health stress or hazard and in some cases 20 to 30 years or more elapse before symptoms of the disease are manifested. Therefore, accurate records relative to employee work and exposure histories must be obtained and kept up to date for extended periods of time. Health standards being proposed by OSHA address this area of concern.

NASA PERSONNEL INJURIES FOR 1976

For the seventh year in a row NASA has been faced with the anomaly of fewer and fewer employees having more and more lost time injuries. As is mentioned in the FOREWORD, a NASA Headquarters contracted study in the field of loss control indicated that the three-year old, 45-day continuation of pay law, which permits a government employee injured on the job to remain away from work without charge to either sick or annual leave, is subject to abuse. Tightening of supervisory and occupational medicine procedures is necessary if we are to bring down the soaring lost time injury rate and prevent abuse of a needed law.

In a collateral movement, the NASA injury frequency went up tremendously. Last year there were six NASA facilities which attained the "Safety '76" goal of 0.20 injuries per 200,000 man-hours worked; this year kudos go only to JSC, NSTL, and MAF for having reached that goal. The remaining installations have driven the injury frequency rate to a new all-time high of 0.77.

The contracted study on loss control also demolished the theory that NASA's aging work force played a role in this rate rise. It was discovered that older employees, while they are more susceptible to back strains, etc., have also advanced to the position of doing more supervising than actually lifting and bending. In addition, the acumen and work experience they have gained over the years has taught them how to maneuver heavy objects with more mechanical advantage.

Again as in years past, the message from all of this is that while slips, trips, and falls will always be with us, top managers can and should exercise more eyeball supervision of day-by-day working conditions and more fully investigate each injury so as to prevent both recurrences and potential abuse of continuation of pay procedures.

**1976 NASA INJURY FREQUENCY RATE
NUMBER OF DISABLING (LOST TIME) INJURIES
PER 200,000 MAN-HOURS WORKED**

	<u>1976</u>	<u>AVERAGE OF 1970-1975</u>
AMES RESEARCH CENTER	1.01	.49
DRYDEN FLIGHT RESEARCH CENTER	.40	.32
GODDARD SPACE FLIGHT CENTER	1.26	.36
JOHNSON SPACE CENTER	.12	.35
KENNEDY SPACE CENTER	.32	.32
LANGLEY RESEARCH CENTER	1.51	.52
LEWIS RESEARCH CENTER	1.22	.47
MARSHALL SPACE FLIGHT CENTER	.45	.31
MICHOUD ASSEMBLY FACILITY	0	Not Available
NATIONAL SPACE TECH. LAB.	0	Not Available
WALLOPS FLIGHT CENTER	.25	.23
HEADQUARTERS	.26	.11
NASA (TOTAL)	<u>.77</u>	<u>.36</u>

NASA INJURIES AND ILLNESSES BY INSTALLATIONS 1976

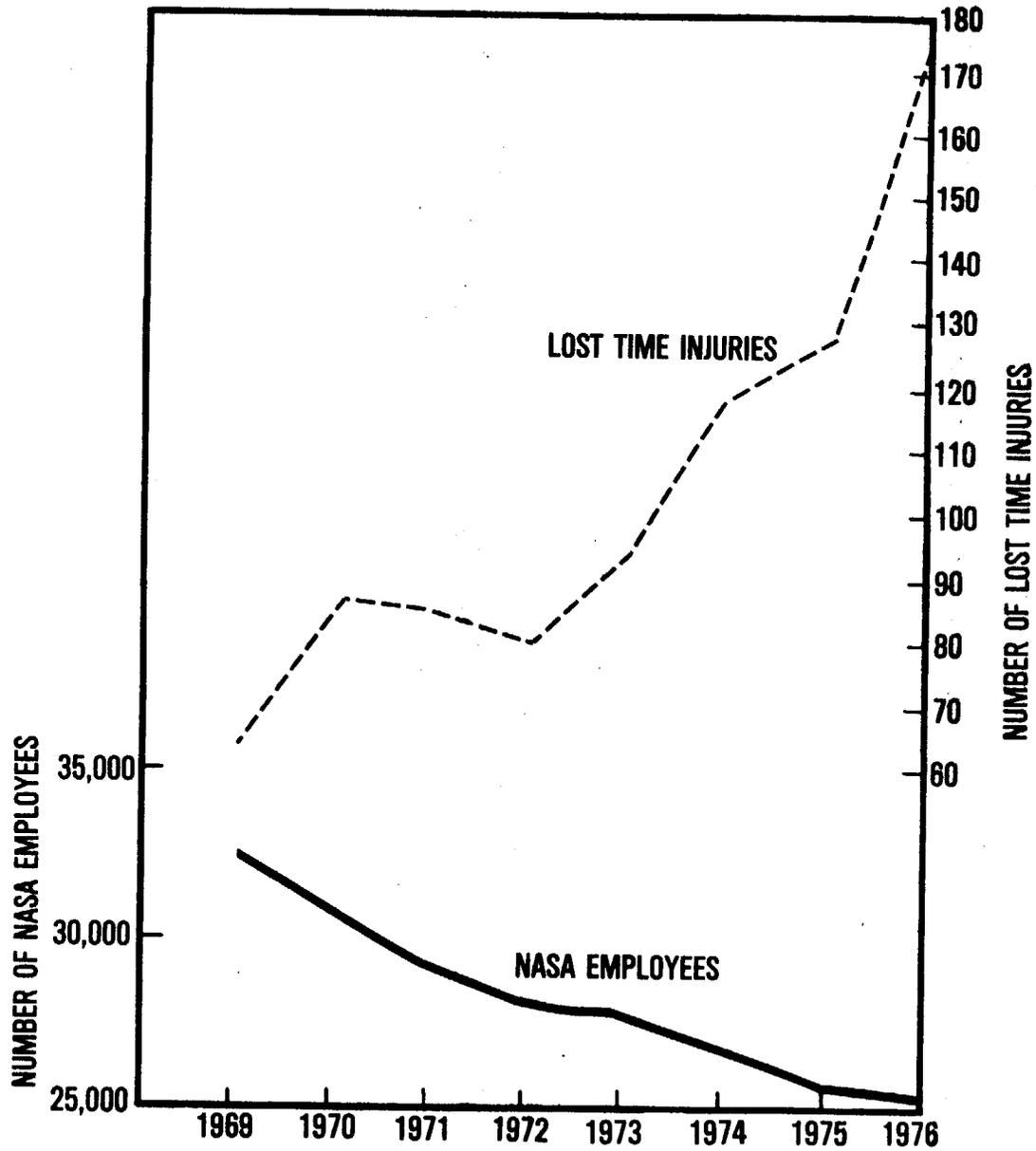
	NO OF EMPLOYEES	MAN HOURS WORKED IN K	TOTAL INJURY ILLNESS	NO LOST WORKDAY CASES	NO OF LOST WORKDAYS	INJURY FREQUENCY RATE THIS YEAR		INJURY SEVERITY RATE	AIRCRAFT MISHAP FREQ RATE	AUTO MISHAP FREQ RATE		NO OF FIRES	FIRE LOSS (\$ K)	NO OF OTHER MISHAPS	OTHER MISHAPS LOSS (\$ K)	TOTAL COST MISHAPS (\$ K)	MISHAP COST RATE (\$ K)
										GOV	POV						
ARC	1,811	3,377	37	17	238	1.01	.57	70.5	0	1.02	0	13	8.4	7	620	639	189.2
DFRC	579	1,011	6	2	10	.40	.21	9.9	0	0	0	1	5.0	0	0	5	4.95
GSFC	3,831	6,827	49	43	789	1.26	.44	115.6	0	6.7	0	11	4.7	28	8	29	4.25
JSC	3,961	6,727	11	4	50	.12	.06	7.4	9.85	0	0	10	1.0	3	1	8	1.19
KSC	2,376	4,403	13	7	44	.32	.74	9.99	0	19.7	0	0	0	20	4	7	1.6
LARC	3,428	6,108	168	46	915	1.51	.52	149.81	0	11.8	0	0	0	12	58	59	9.6
LERC	3,078	5,582	134	34	252	1.22	1.26	45.15	0	40.9	0	0	0	28	0	14	2.5
MAF	33	57	0	0	0	0	0	0	0	0	0	1	12	0	0	12	2.1
MSFC	4,410	7,620	37	17	655	.45	.62	85.96	0	1.4	0	1	.94	2	0	1	2.6
NSTL	70	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WFC	440	802	23	1	2	.25	0	2.49	0	0	0	0	0	0	0	0	0
HQ	1,777	3,031	8	4	13	.28	.28	4.29	0	3.8	6.7	0	0	3	0	35	1.1
TOTAL	25,794	45,668	486	175	2,968	.77	.54	64.99	4.67	8.3	.3	37	20.2	103	691	742.35	16.26
LAST YR	26,023	47,137	750	127	2,116	.54	---	44.9	11.3	5.7	1.1	42	3824	81	617.05	4538.7	96.29

SEVERITY RATE = $\frac{\text{NUMBER OF MAN DAYS LOST} \times 1,000,000}{\text{TOTAL MAN HOURS WORKED}}$

SEVERITY RATE IS THE NUMBER OF MAN DAYS LOST BY ACCIDENTS PER MILLION MAN HOURS WORKED.

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NUMBER OF NASA EMPLOYEES AND NUMBER OF LOST TIME INJURIES VS TIME

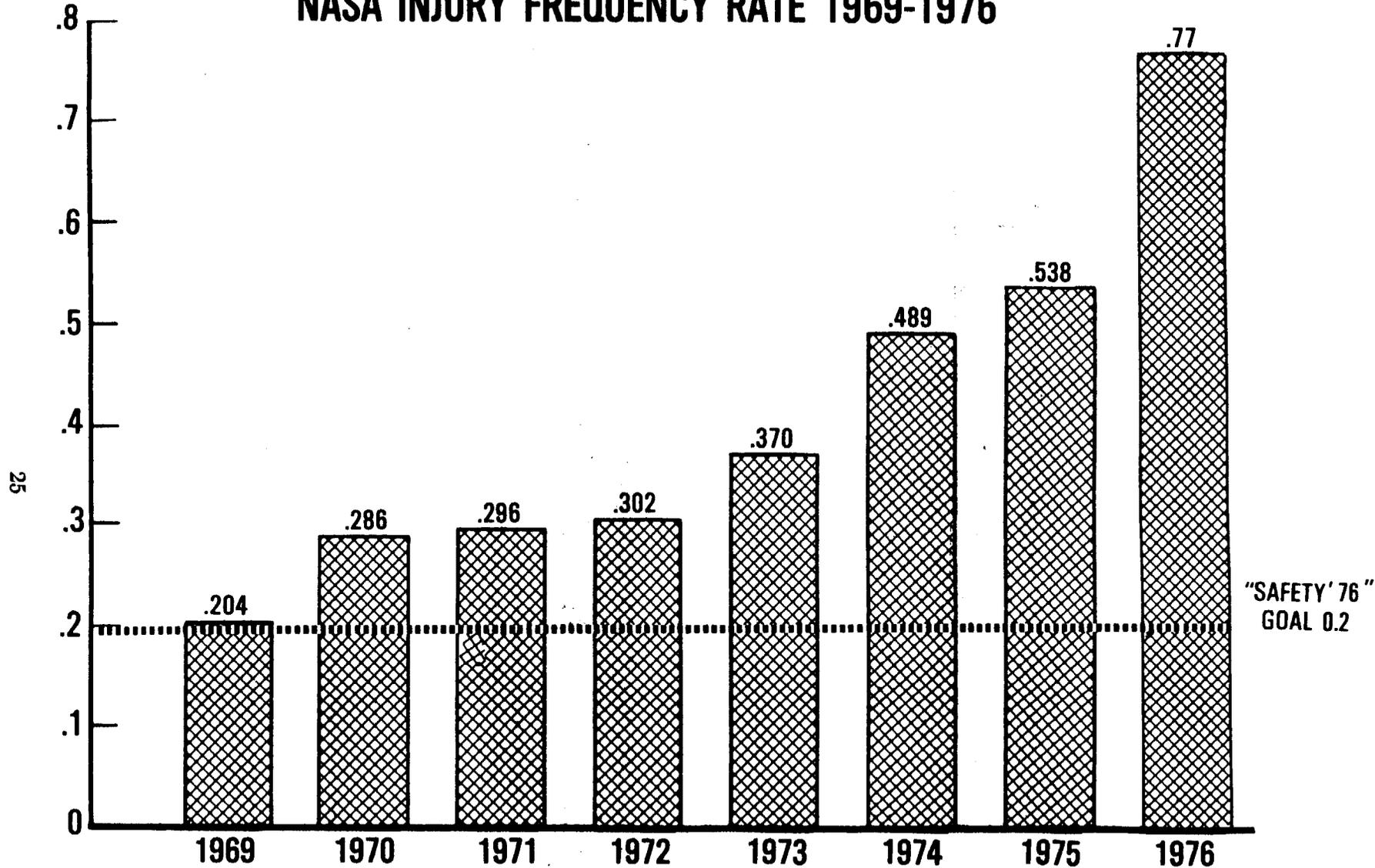


24

NASA HO YZ77-2087 (11)
3-21-77

FREQUENCY
RATE

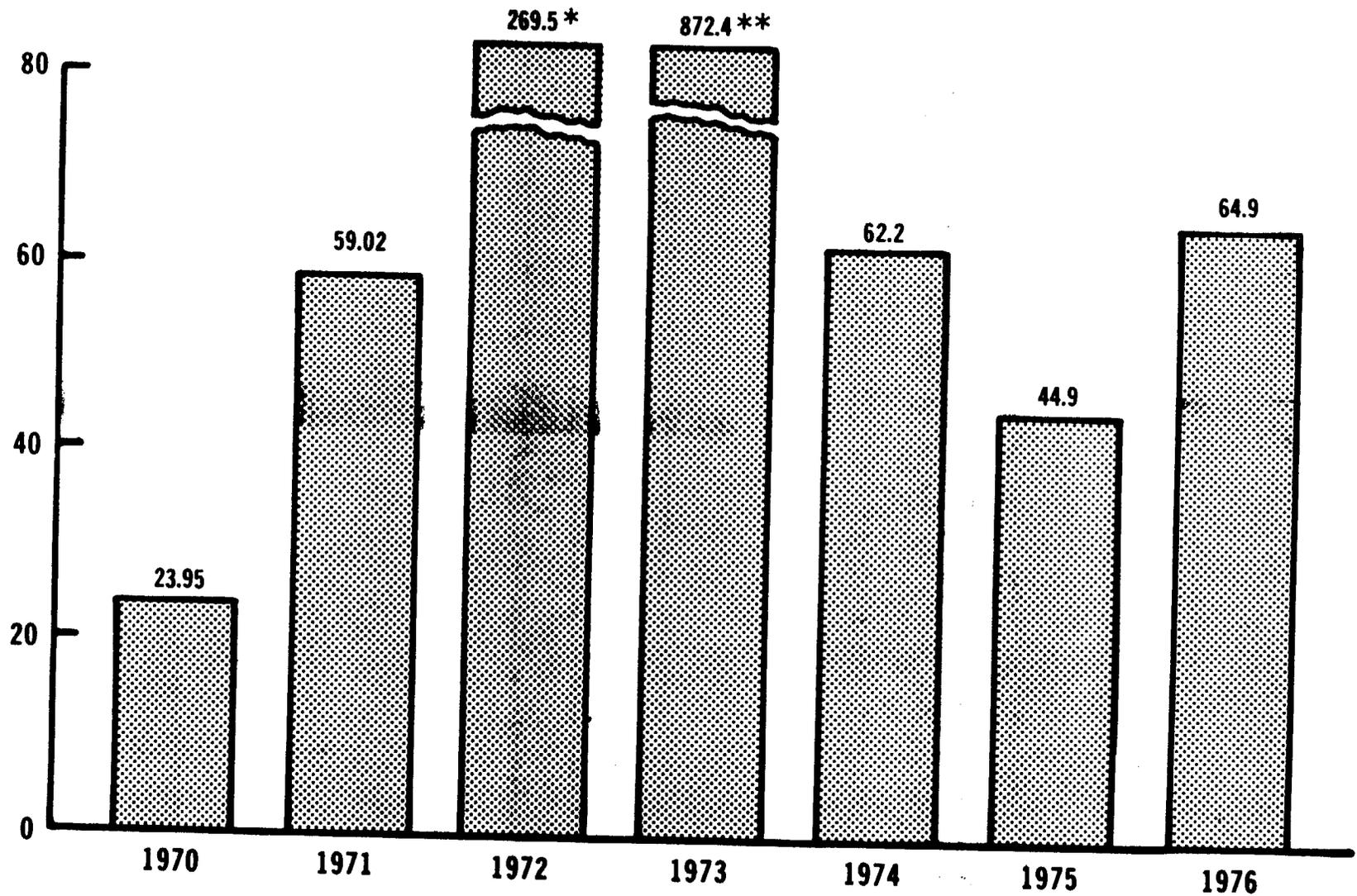
NASA INJURY FREQUENCY RATE 1969-1976



25

FREQUENCY RATE IS THE NUMBER OF LOST TIME INJURIES PER 200,000 MAN-HOURS WORKED.

NASA INJURY SEVERITY RATE



SEVERITY RATE IS THE NUMBER OF MAN DAYS LOST MULTIPLIED BY
1,000,000, DIVIDED BY THE TOTAL MAN HOURS WORKED

* TWO FATALITIES, EACH CHARGED AS 6,000 WORK DAYS

** SEVEN FATALITIES, EACH CHARGED AS 6,000 WORK DAYS

NASA HQ YZ77-3181 (1)

7-13-77

7-13-77

AUTOCORRELATED INJURY AND FREQUENCY
RATES FOR NASA IN 1976

The autocorrelated injury frequency data for all NASA and those centers which had sufficient data for the period 1970 - 1976 are shown in the following charts. These figures indicate the trends during this period, and, in general, the trend is toward higher frequencies.

The related severity rates are also increasing as shown in the charts. The increases have been quite pronounced since 1973. One can assume that this significant increase is related to the Continuation of Pay (CoP) changes in the law which permit an injured employee to take up to 45 days to recover, after an injury incurred on the job, without using sick or annual leave. Also, during this same period there has been an increased willingness for physicians to suggest to injured personnel that staying home a few days or a week would be more comfortable than going to work. The net result is a tendency for employees to stay away from the job more often and for longer periods. There is no particular reason to assume that injuries are more frequent or more severe than in the past.

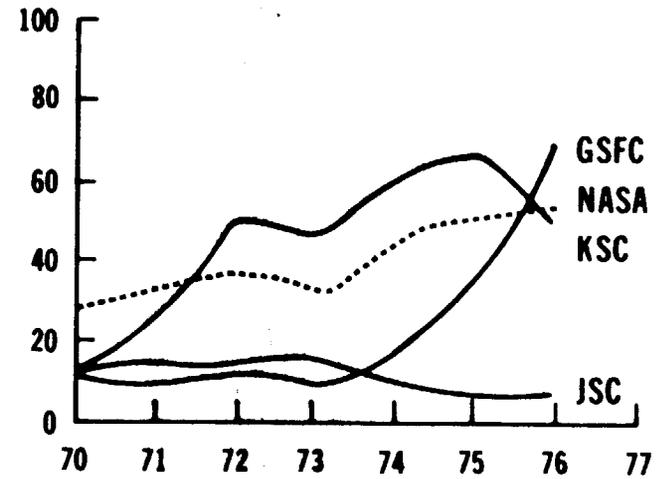
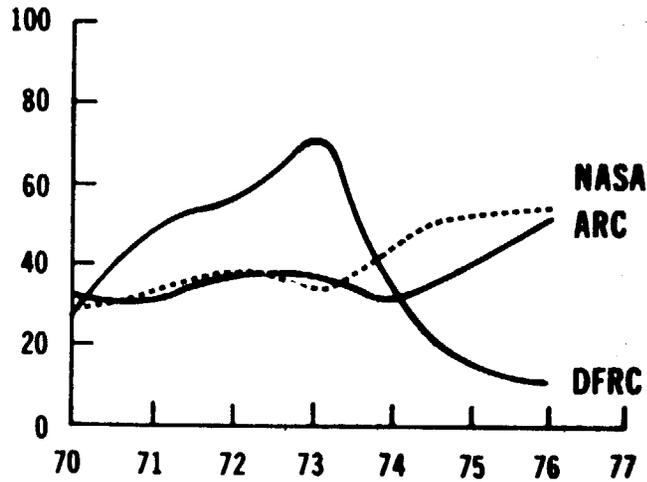
These are also the conclusions of an independent study performed by Weiner Associates at GSFC, LaRC, and HQ where they examined injury data covering the last five years.

The autocorrelation procedure shown in these charts is a smoothing technique which takes some of the randomness out of the data and yet preserves the form or pattern for the period being considered. Depending on the autocorrelation coefficient chosen, the program can retain the fine structure of the data or smooth the curve to show only the trends. Large coefficients would reduce the function to a constant (the mean value of the function for the range being considered).

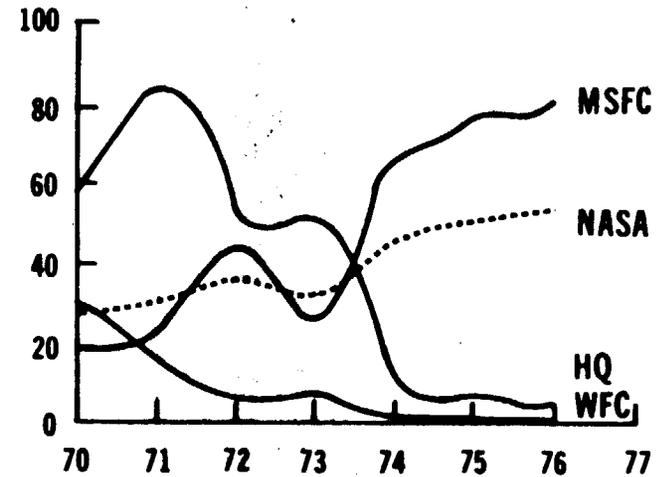
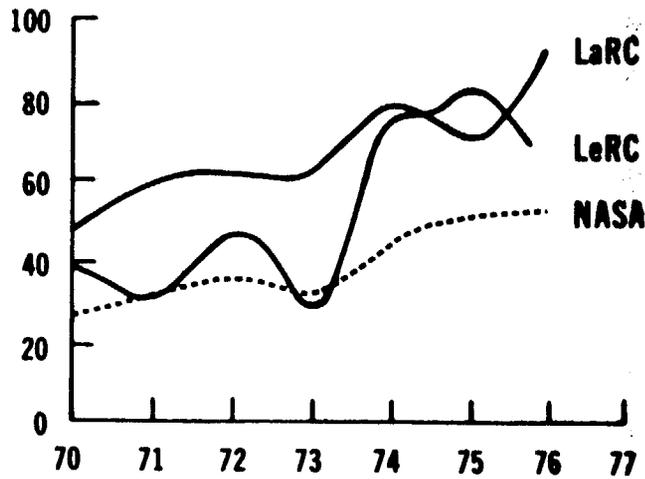
* TWO FATALITIES, EACH CHARGED AS 6,000 WORK DAYS

** SEVEN FATALITIES, EACH CHARGED AS 6,000 WORK DAYS

INJURY SEVERITY RATES 1970-1976 AUTOCORRELATED



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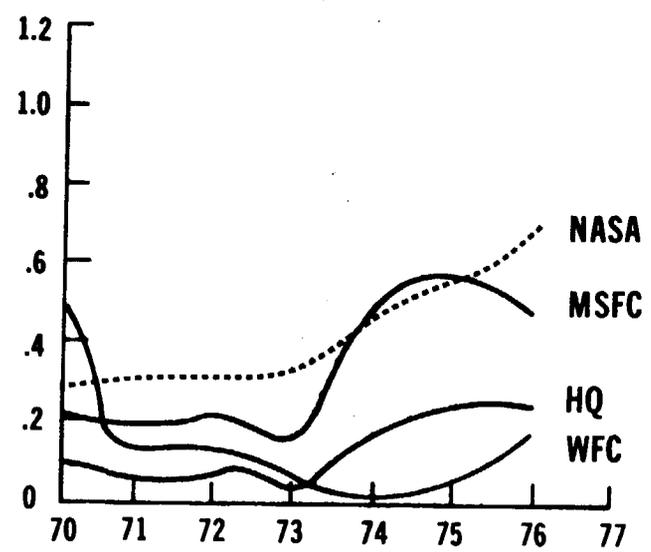
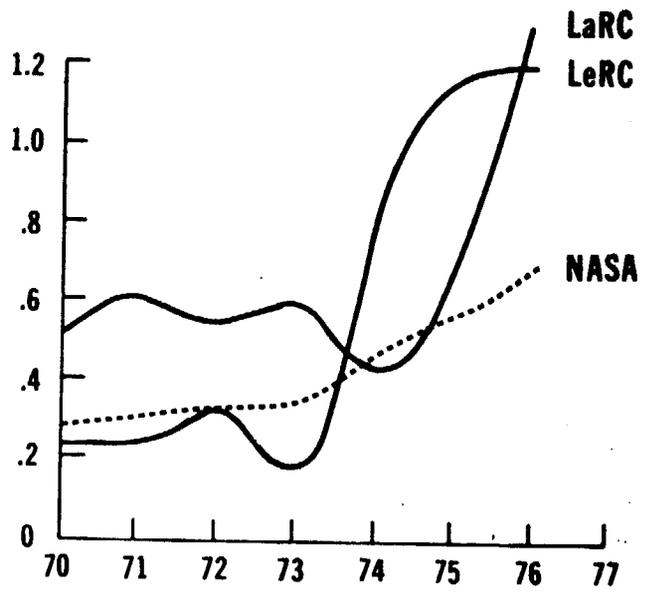
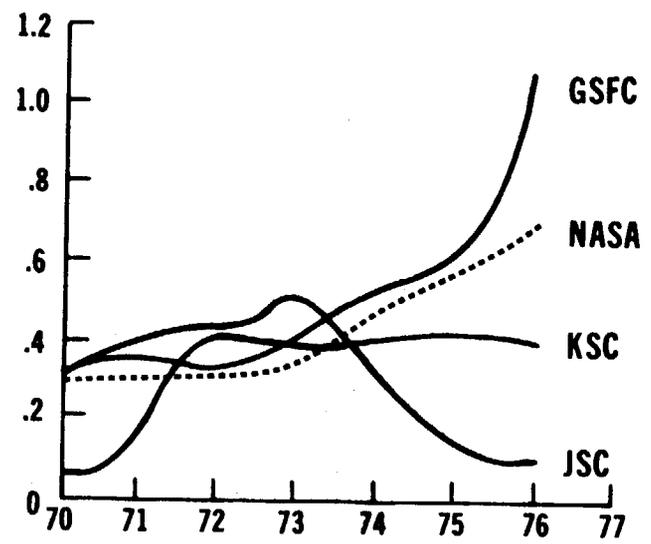
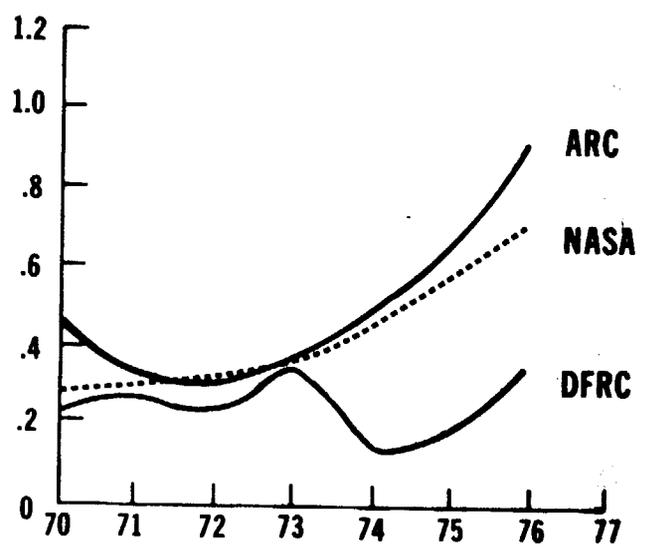
SEVERITY RATE IS THE NUMBER OF MAN-DAYS LOST BY ACCIDENT PER MILLION MAN-HOURS WORKED

NASA HQ Y77-3167 (1)

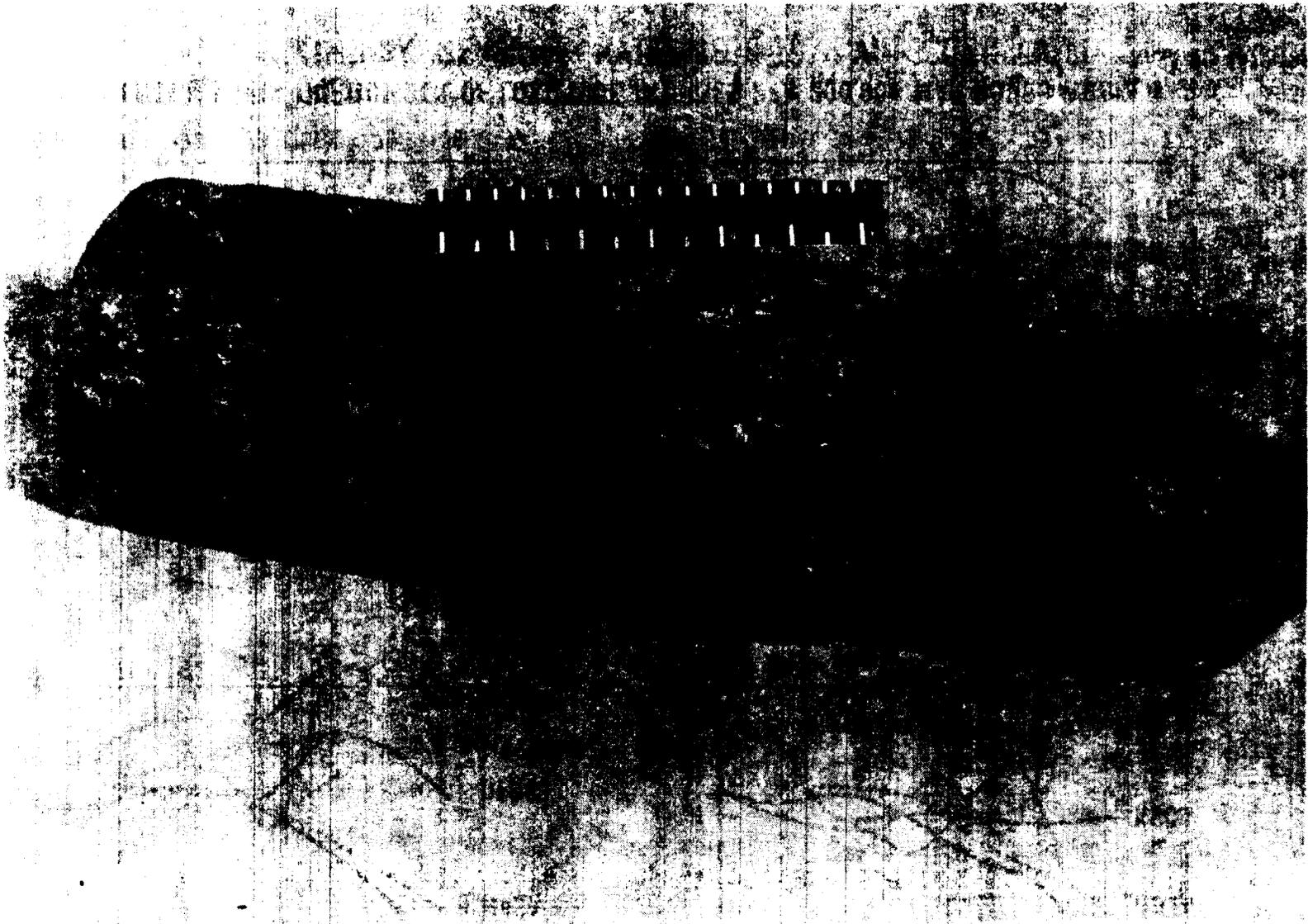
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INJURY FREQUENCY RATES 1970-1976 AUTOCORRELATED

INJURY FREQUENCY RATES 1970-1976 AUTOCORRELATED



FREQUENCY RATE IS THE NUMBER OF LOST TIME INJURIES PER 200,000 MAN-HOURS WORKED



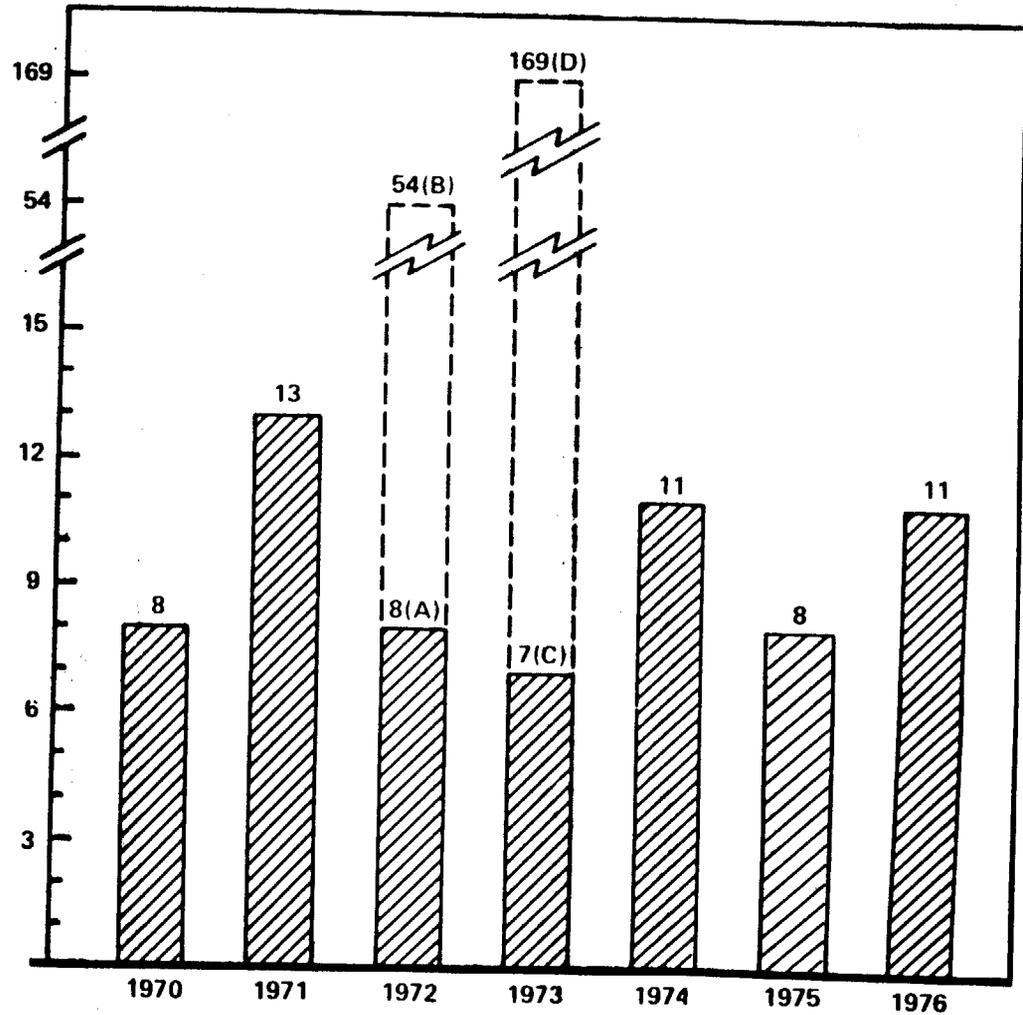
Burning epoxy in underground air storage system
got hot enough to melt this section of drill pipe

STATISTICAL CHANCE OF BEING INJURED IN NASA ON-THE-JOB IN 1976 VS 1975

	TOTAL OF LOST AND NON-LOST TIME INJURIES	AVERAGE NUMBER OF EMPLOYEES	CHANCES OF BEING INJURED IN 1976	CHANCES OF BEING INJURED IN 1975
NSTL	0	70	0	0
MAF	0	33	0	0
JSC	11	3961	1 IN 360.1	1 IN 249.9
HQ	8	1777	1 IN 222.1	1 IN 67.2
KSC	13	2376	1 IN 182.8	1 IN 84.5
MSFC	37	4410	1 IN 119.2	1 IN 108.4
DFRC	6	579	1 IN 96.5	1 IN 34.2
GSFC	49	3831	1 IN 78.2	1 IN 99.7
ARC	37	1811	1 IN 48.9	1 IN 7.3
LERC	134	3078	1 IN 23.0	1 IN 21.3
LARC	168	3428	1 IN 20.4	1 IN 23.8
WFC	23	440	1 IN 19.1	0
NASA (TOTAL)	480	25,794	1 IN 53.7	1 IN 34.7

NASA EMPLOYEE-YEARS LOST DUE TO ON-THE-JOB INJURIES *

EMPLOYEE-YEARS

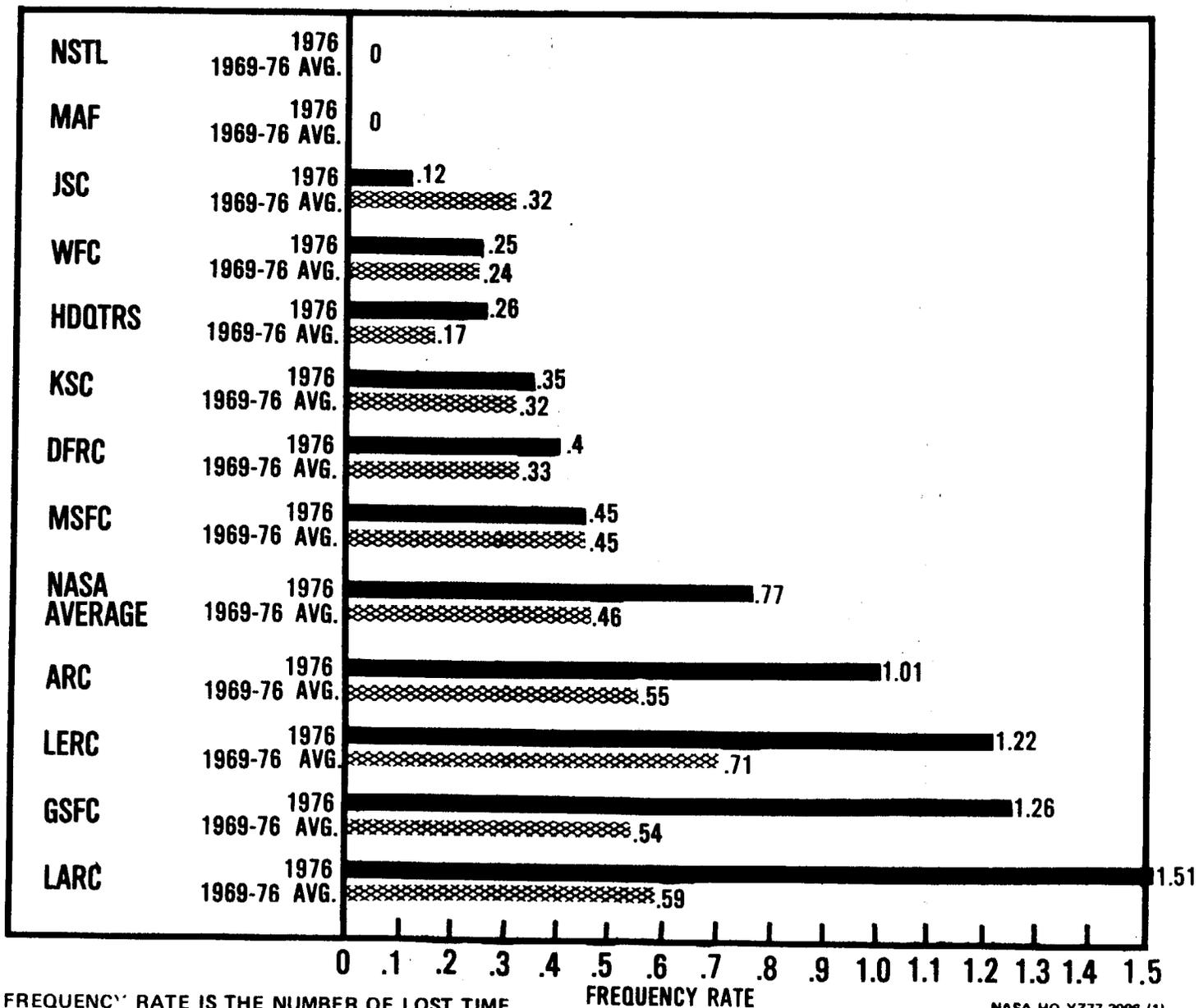


NOTES:

- (A) 1972 DATA EXCLUDING THE 2 FATALITIES
- (B) 1972 DATA INCLUDING THE 2 FATALITIES
- (C) 1973 DATA EXCLUDING THE 7 FATALITIES
- (D) 1973 DATA INCLUDING THE 7 FATALITIES

* 260 WORK DAYS = 1 EMPLOYEE-YEAR
EACH FATALITY CAUSES LOSS
OF 6,000 WORK DAYS

NASA INJURY FREQUENCY RATES (LOST TIME)



FREQUENCY RATE IS THE NUMBER OF LOST TIME INJURIES P. R. 200,000 MAN-HOURS WORKED .

NASA AVIATION ACCIDENT/INCIDENT EXPERIENCE
IN 1976

In a word, NASA's aviators and ground support personnel in 1976 were "superb." There were no fatalities, no Type "A" or "B" accidents and only one minor ground incident where a wing tip got entangled with a guy wire while the aircraft was being towed and resulted in a damaged figure of \$3,000. Whatever is being done, more of it should be accomplished and pass on the hints for safety procedures to other segments of NASA so we could all benefit from their expertise.

There is a phrase used occasionally in the Navy which certainly pertains here; it is "WELL DONE."

In the past decade, aviation accidents have been the major single cause of NASA loss. In the past three years, this loss has dramatically reduced. Now is the time to watch for complacency. Remember aviation's definition . . . "hours and hours of boredom interrupted by a few moments of stark terror."

AVIATION FLIGHT MISHAPS
1970-1976

	'70	'71	'72	'73	'74	'75	'76
TYPE A	0	2	2	2	1	0	0
TYPE B	0	0	1	2	1	1	0
INCIDENTS	5	6	2	10	3	2	0
AIRCRAFT DESTROYED	0	2	2	2	1	0	0
PILOT/CREW FATALITIES	0	0	2	11	0	0	0

AVIATION FLIGHT ACCIDENTS RATES - NO. OF ACCIDENTS PER 100,000 HOURS

FLIGHT ACCIDENT RATE	0	4	11	14	9	4	0
FATAL ACCIDENT RATE	0	0	7	4	0	0	0
AIRCRAFT DESTROYED RATE	0	4	7	7	4	0	0

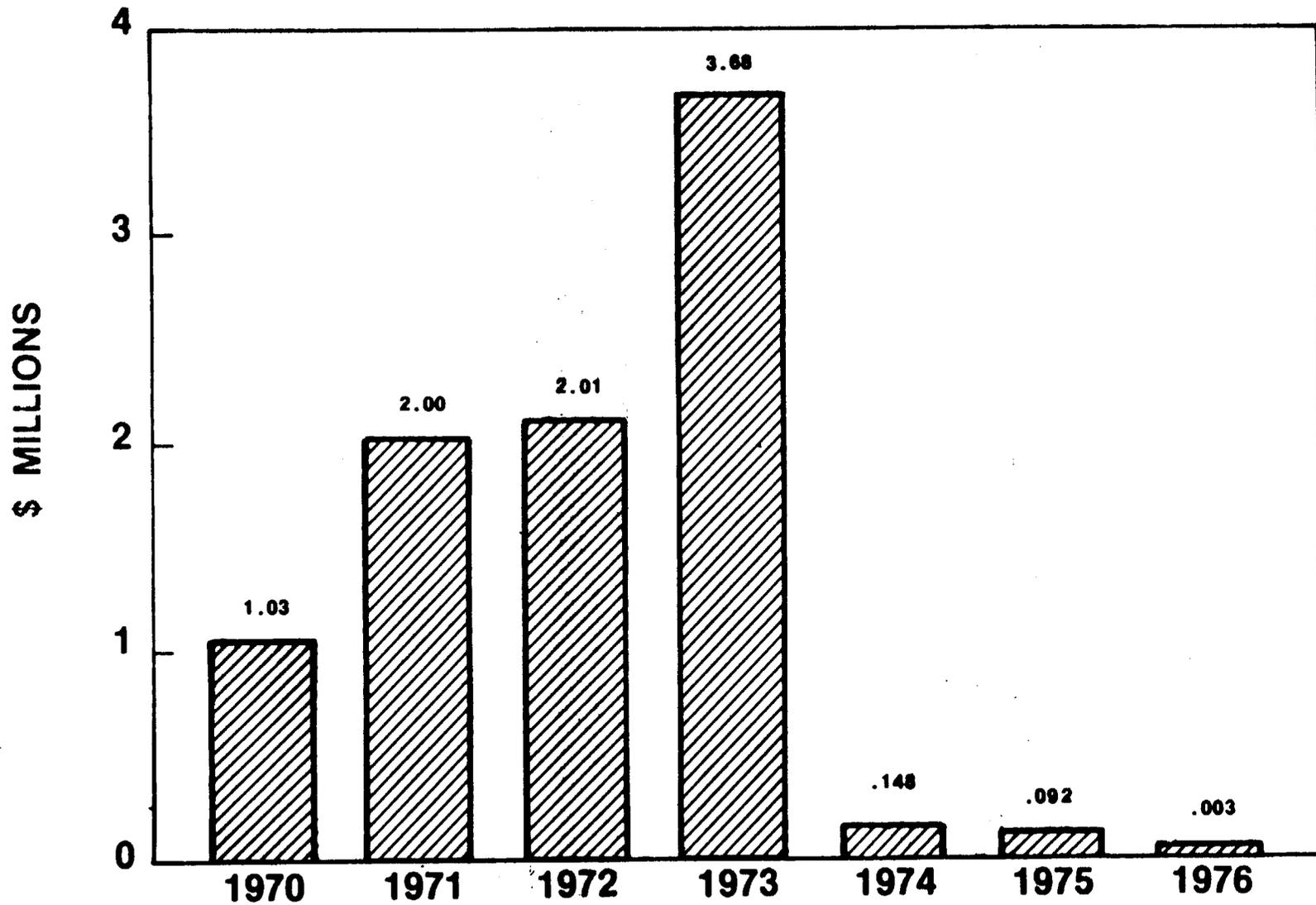
FLIGHT ACCIDENTS SUMMARY

CATEGORY OF AIRCRAFT

PROGRAM SUPPORT	0	0	0	0	1	0	0
ADMINISTRATIVE	0	0	0	0	0	0	0
SPACE FLIGHT READINESS & PROFICIENCY	0	2	2	1	1	1	0
R&D	0	0	1	3	0	0	0

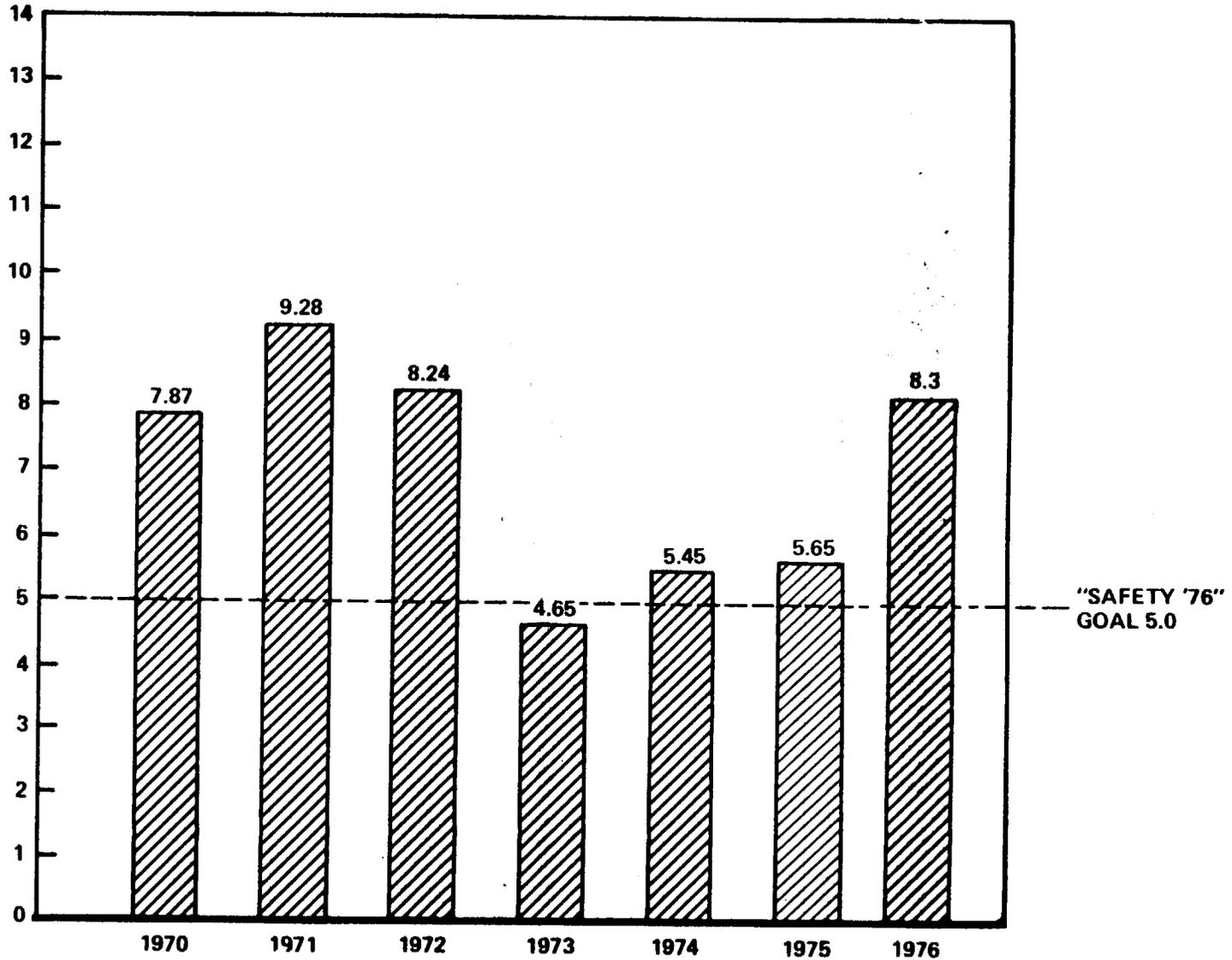
NASA AIRCRAFT LOSSES

1970-1976



NASA GOVERNMENT MOTOR VEHICLE ACCIDENTS

FREQUENCY RATE



FREQUENCY RATE IS THE NUMBER OF MOTOR VEHICLE ACCIDENTS PER MILLION MILES DRIVEN.

NASA MOTOR VEHICLE ACCIDENTS

There was a large increase in both the automotive accident frequency rate and the costs of accidents for 1976. Far from reaching the "Safety '76" goal of 5.0 accidents per million miles driven, which we met only in 1973, this year the rate climbed to 8.3, and the costs have risen dramatically enough so that inflation on repairs is not the culprit it was thought to be.

Increased costs can readily be noted in the charts this year and while we still advocate defensive driving, seat belt usage, and life safety, the dollar value of losses is something which should be getting management's attention.

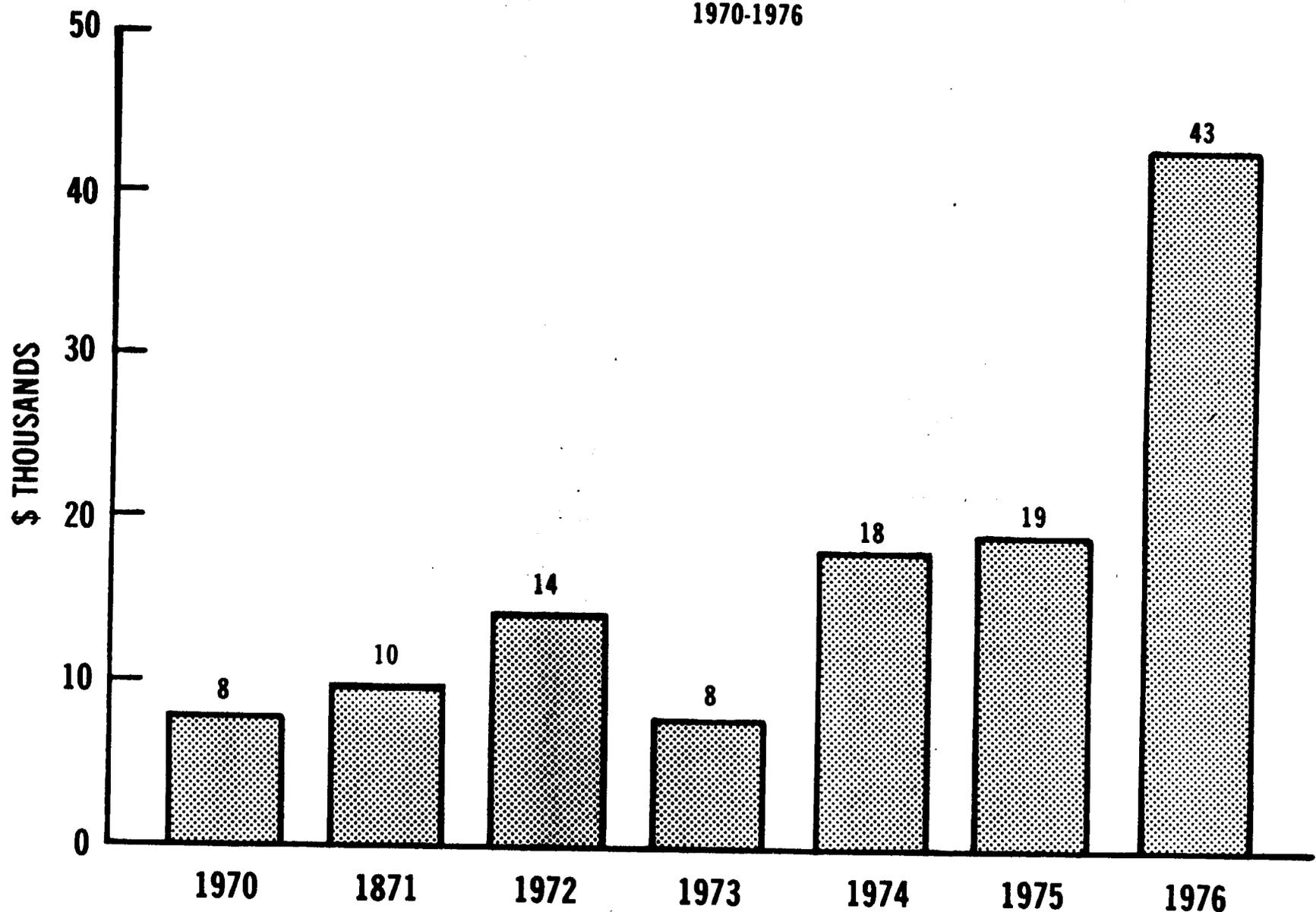
While privately owned vehicles travel almost as much on government business as do U.S. owned vehicles, there are only an insignificant number of accidents reported. Either employees aren't reporting damage to their private vehicles or they are driving them much more carefully than they do U.S. vehicles.

There was one close call, a near fatality, this year where a NASA employee was thrown from a fast-moving, sharp-turning vehicle and actually run over by the skidding machine. No seat belts in use, poor door latches, and extremely poor driving characteristics were all contributing factors.

Let's buckle up for safety!

NASA AUTOMOTIVE LOSSES

1970-1976

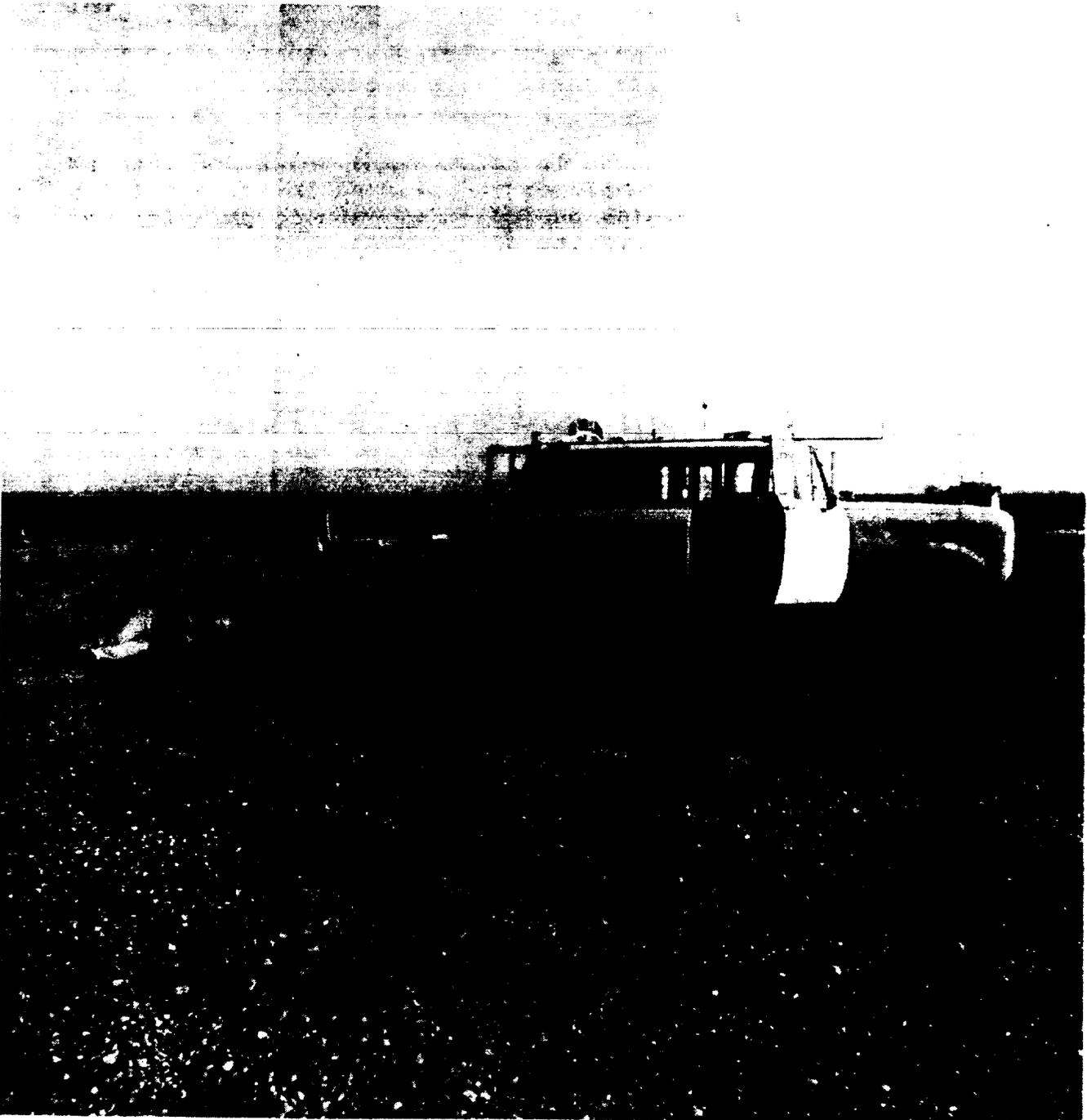


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NASA 1976 MOTOR VEHICLE ACCIDENTS

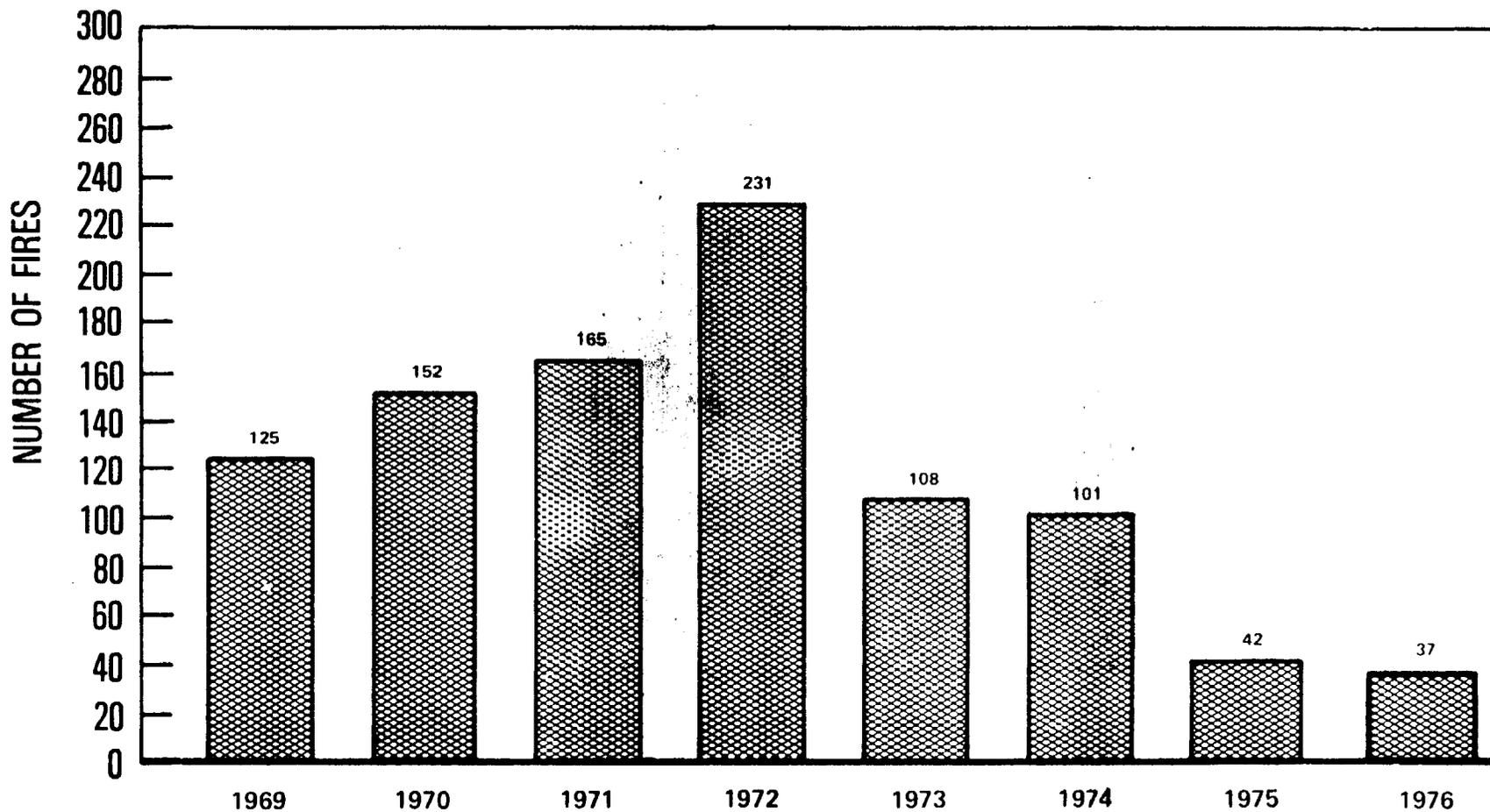
<u>Field Installations</u>	<u>No. of Accidents</u>		<u>Total Miles Driven (in thousands)</u>		<u>Total Cost</u>		<u>Frequency Rate* of Accidents</u>	
	<u>Govt.</u>	<u>Private</u>	<u>Govt.</u>	<u>Private</u>	<u>Govt.</u>	<u>Private</u>	<u>Govt.</u>	<u>Private</u>
AMES	1	0	982	900	\$10,000	0	1.02	0
DRYDEN	0	0	444	145	0	0	0	0
GODDARD	21	0	3,125	1,288	16,066	0	6.7	0
JOHNSON	0	0	153	1,183	0	0	0	0
KENNEDY	16	0	814	895	3,165	0	19.7	0
LANGLEY	5	0	422	1,111	803	0	11.8	0
LEWIS	28	0	684	0	12,857	0	40.9	0
MARSHALL	2	0	1,471	1,076	458	0	1.4	0
MICHOUD	0	0	3	12	0	0	0	0
NSTL	← NOT AVAILABLE →							
WALLOPS	0	0	608	0	0	0	0	0
HEADQUARTERS	1	2	262	297	100	150	3.8	6.7
NASA (TOTAL)	74	2	8,968	6,907	\$43,449	150	8.3	0.3

* FREQUENCY RATE IS THE NUMBER OF ACCIDENTS PER MILLION MILES DRIVEN



Posed view of NASA employee after he was thrown from vehicle during a sharp turn - without seat belts being used.

NUMBER OF NASA FIRE MISHAPS



42

NASA HQ YZ76-2594(1)

REV. 3-29-77

NASA FIRE EXPERIENCE IN 1976

Through the efforts of all personnel, both the number of fire mishaps and their costs for 1976 were at an all time low.

This is the direct result of the extensive fire prevention activities conducted and excellent fire safety awareness created at all facilities.

We must not allow the results of these efforts to foster a false sense of security or complacency which precedes the relaxing of our vigilance and determination or serves to initiate reduction of fire safety resources.

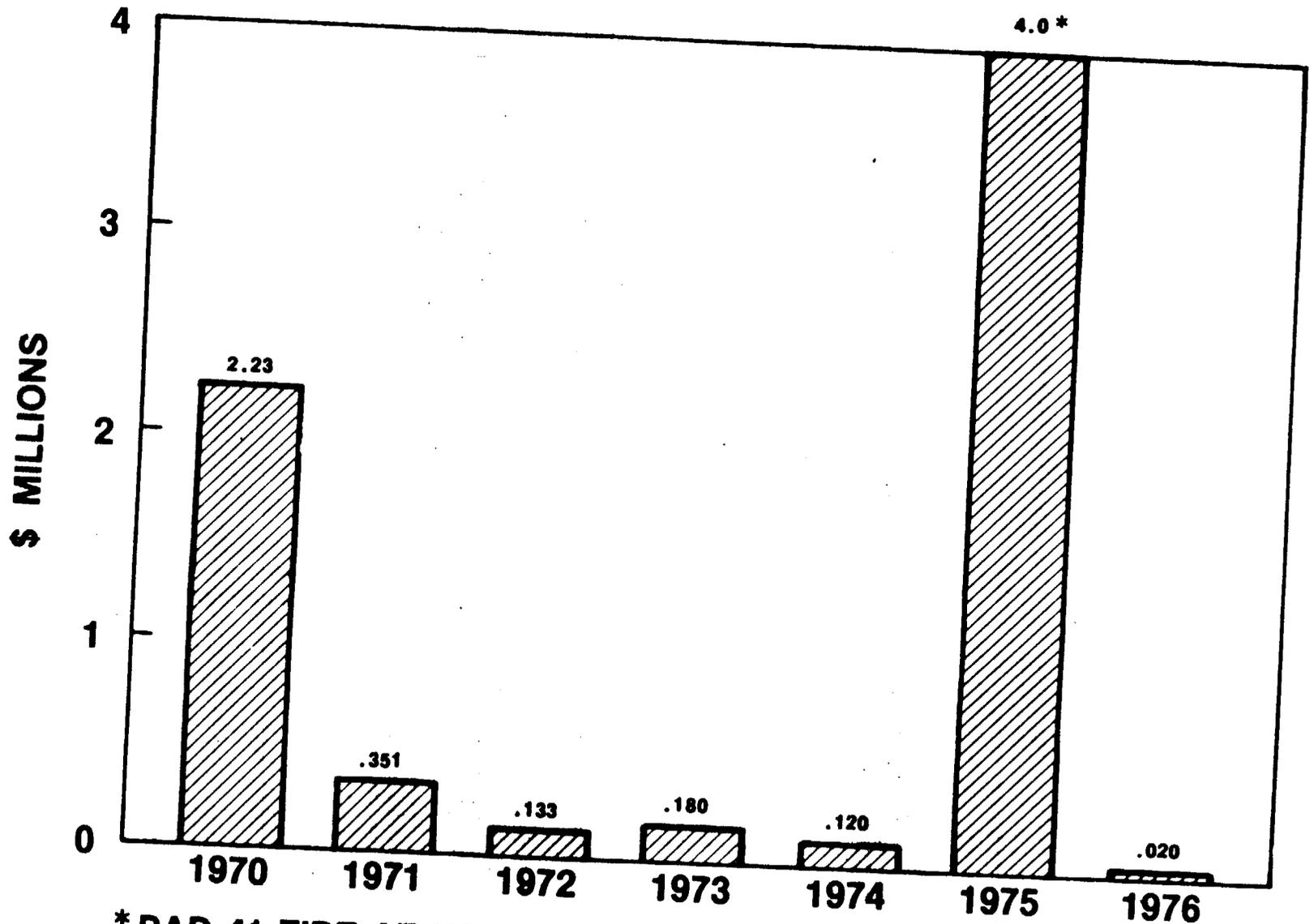
In consideration of other items, such as reduced funding levels, changes in occupancies, operations, and facilities, reduced staffing levels, and energy conservation, we must, in fact, reinforce and bolster our fire safety emphasis.

At this stage in the NASA mission, fire could have a more disastrous effect on our future than ever before.

Programs to provide fire detection and suppression systems and to require safe materials and construction must be continued. Fire prevention must start on the drawing board and continue through all phases of projects. Training and education of employees and professional development in the technology and state of the art for fire safety personnel must be expanded.

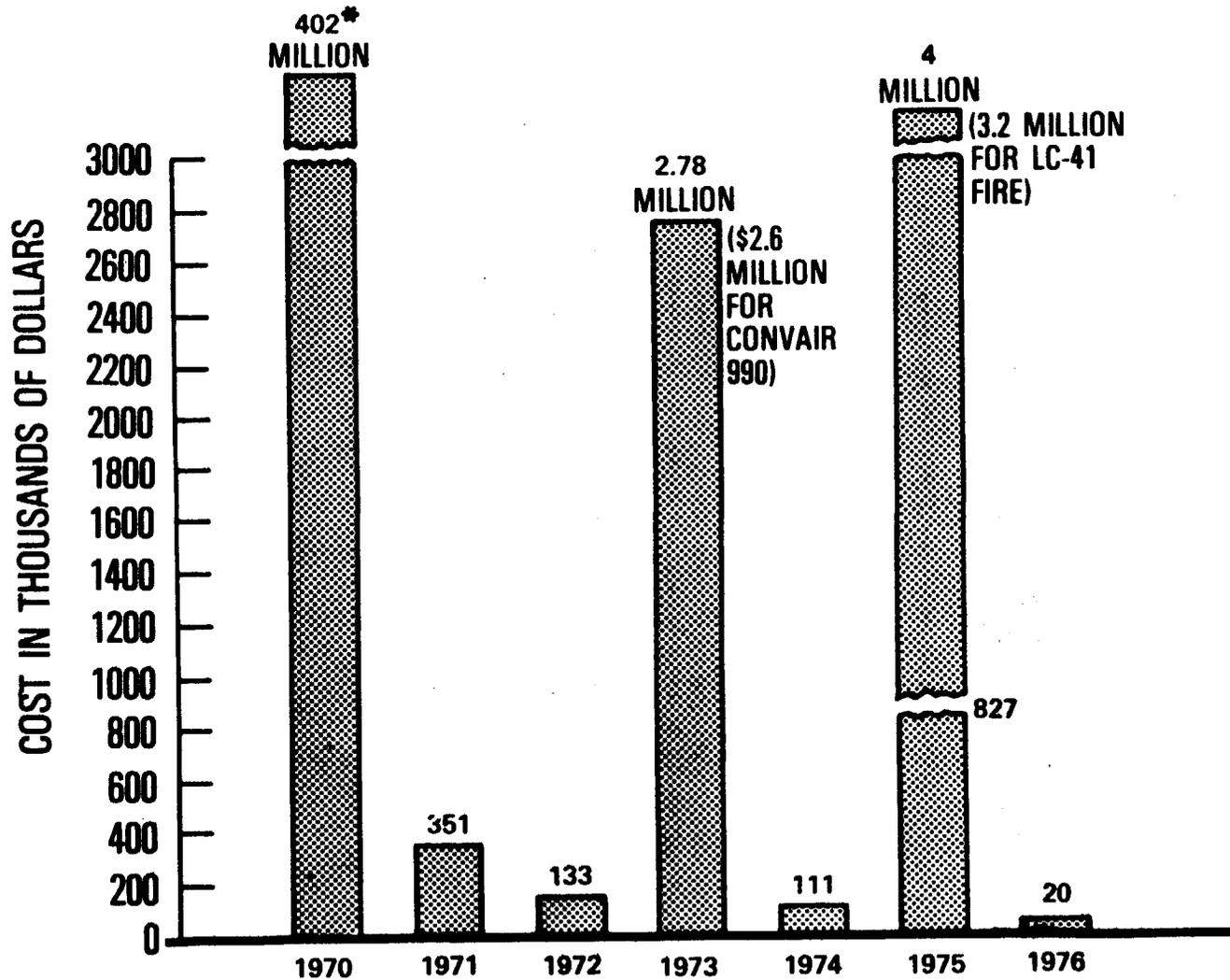
Attention to balanced risk surveys and development of fire safety master planning concepts will provide the tools to permit a level of fire safety to be achieved, which will justify the effort and further reduce fire mishaps and losses which threaten life safety, jeopardize the NASA missions, and waste resources.

NASA FIRE LOSSES 1970-1976

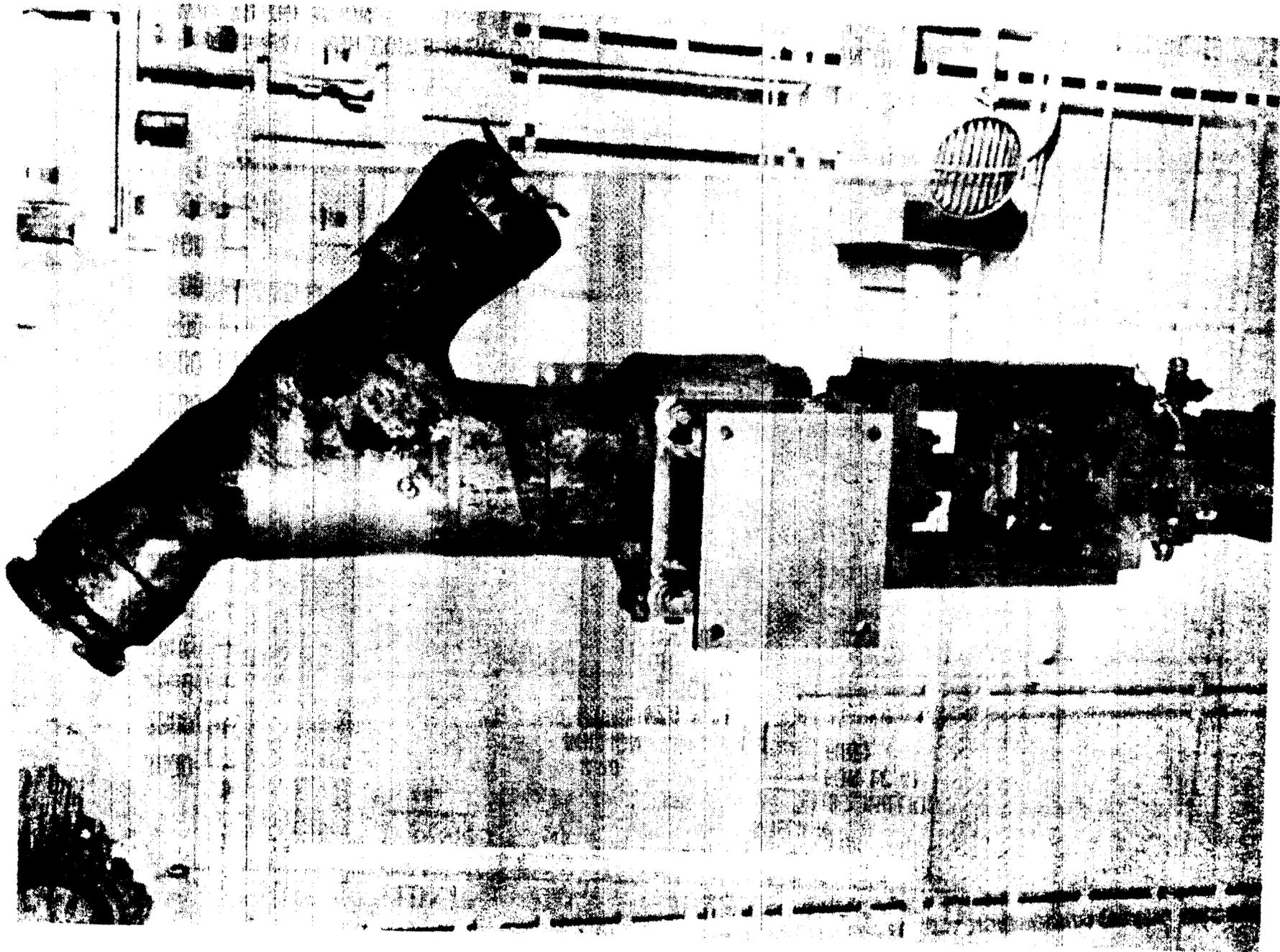


* PAD 41 FIRE AT KSC WAS \$3.2M

COST TO NASA FOR FIRE MISHAPS



* EXCEEDINGLY HIGH COSTS WERE DUE TO APOLLO 13 LOX EXPLOSION ON THE WAY TO THE MOON.



46

Burned through valve after turbopump failed and initiated a test stand fire

LOST TIME INJURY BRIEFS
1976

Burned through valve after turbopump failed and initiated a test stand fire

<u>INJURY</u>	<u>DAYS LOST</u>
Tightening a chuck on an indicator when chuck came off taper and jammed finger against heel of clamp.	1
Helping move desk and felt pain in lower back; strain, lower back.	7
While ascending steps foot slipped off step and fell, landing on left arm and left side; contusion left side of chest and left wrist.	2
While helping another employee carry a TV recorder, strained back; back strain.	3
Employee was supporting shaft of a stand. As the stand was raised by the crane the shaft dropped suddenly and jerked employee violently as it went down; Strain left side; burning sensation of left leg.	3
As employee was going up steps, his foot slipped on metal edge of the steps twisting his ankle; sprain, left ankle.	2
Employee tripped on trash can, fell against a desk, hurting his back; contusion, possible fracture, left rib.	3
Employee was moving extension ladder; while doing this the ladder became out of balance. In the process of trying to stabilize the ladder, employee experienced some minor back pain which became increasingly worse; possible back strain.	12
While using a regulator on an oxygen bottle, employee strained his back; back strain.	1
As employee was moving through the aisle, he tripped over a steel rod that was on the floor and fell against a steel angle plate that was in the rack; sprain, right wrist and right thumb.	4
After working around and adjusting ultraviolet lights for some testing purposes started having burning and pain in both eyes; ultraviolet radiation burns, both eyes.	3

INJURYDAYS LOST

During the course of the day, employee was moving and lifting drums (approx. 100 lbs.) while cleaning up. His back began to hurt later in day; strain of lower back. 1

As employee was going through shop door, she didn't step properly and twisted right ankle; sprain, right ankle. 3

As employee was turning corner at the intersection of Ames and Taylor road, the motor scooter he was riding turned over; contusion and abrasion, right shoulder, elbow and knee. Possible right inguinal hernia. 3

The employee was bending over holding a closed circuit TV monitor in a position to mount it in an instrument rack when he felt a tingling sensation in his left hip. The TV monitor weights about 40 lbs.; possible lower back strain. 32

Stairs were wet and as employee stepped from the landing to the first step his foot slipped and he fell to the bottom of the stairs; possible sprain, left ankle. 15

Employee was jacking a coupling off a shaft using a strong back and a 50-ton jack. As the coupling was being heated electrically, the coupling seized. The bolt broke and the strong back first hit a piece of plywood, then struck employee's left toe; contusion and laceration, left toe. 1

While observing a trainee pumping liquid nitrogen, employee turned about and bumped his head on a 2 x 4 that was part of a temporary shed; contusion, right side of head. 2

Employee was cutting balsa wood on a table saw. The wood jammed and his finger hit the saw; traumatic amputation, tip of left index finger. 1

Employee was lifting a box of chemicals (about 30 lbs.) and could not straighten up; lower back strain. 29

INJURYDAYS LOST

While removing old insulators and installing new ones, employee was carrying two at a time about 50 ft. each trip for a total of 24 trips during shift. That night his back started hurting. Work also continued next day; lower back strain. 8

Employee bent over to open bottom drawer of filing cabinet (conservafile) straining back; back strain. 18

While lifting 50 lb. weights, used as balance weights, from the floor to an off and on test panel, employee strained his back; possible mid and low back strain. 4

Employee hurt his back when his foot slipped off the ladder on the nacelle up stream of the blades in the 7 x 10 tunnel; back strain. 46

As employee stumbled over a pipe, he fell and strained his back; back strain, drug reaction to Parafon Forte. 3

Employee was cutting a piece of metal and it caught in the saw and jerked his finger; laceration, right thumb and index finger. 7

While employee was stooping to do a low job, something snapped loudly in his right knee; possible strained right knee; ruled out dislocation. 1

While working on a job, employee lifted several 50 lb. weights from 24 inches above ground level to about 4 ft. above ground level; back strain. 5

As employee was lifting a right angle block with routers (approx. 30 - 40 lbs.) onto a surface table, he felt a sensation in his left groin, then a stinging sensation followed. A small bulge appeared on his right. side; right inguinal hernia. 38

While operating a wood lathe, the piece of wood split causing the wood lathe to jerk backwards against employee injuring his left arm; sprained left arm and shoulder. 41

Struck elbow at work; recurrence of elbow injury; severe lateral epicondylitis, right elbow. 48

INJURYDAYS LOST

Filing forms in security folders for a period of 2 hrs. which involved stooping, bending, and reaching toward back of drawers. Tightness and soreness immediately; pain continued and became progressively worse; lower back strain. 125

Employee was rearranging tool crib. As he was moving some equipment he turned and struck his knee against a metal rack. Sprain, rt. knee. 211

Employee was carrying boxes of computer cards weighing approx. 25 lbs. She experienced pain in her back that afternoon and back hurting ever since. Back strain. 122

Walking from cafeteria, stepped on a rock turning ankle; sprained ankle. 1

For several hours during the morning, employee was working on loosening bolts in a valve. To do this he had to use a wrench and a sledge hammer. He also spent a long time bending over cleaning parts; Acute back strain. 49

Employee was walking on sidewalk when she slipped falling to ground and fractured a vertebrae. 26

Employee attempted to sit in a chair missed the chair and fell to floor suffering a contusion of the coccyx. 3

Employee was directing the loading of a vehicle while standing between a large crate and the rear of the vehicle. The driver's foot slipped off the brake (because of snow and ice on his shoe) and hit the accelerator, causing the vehicle to back up and catch the employee's leg between the vehicle and the crate. The employee suffered a severe contusion and cellulitis of the lower leg. 106

Employee was walking across a parking lot, when she slipped on ice and fell to the roadway fracturing her upper right femur. 4

Employee slipped and fell on an ice covered sidewalk near a building entrance and fractured his upper right femur. 29

INJURYDAYS LOST

Employee was working on a cooling tower when his foot slipped causing him to fall. As he fell, he tried to catch himself but his back struck a support beam causing a severe sprain/strain.	170
Employee was inspecting new construction work which involved use of epoxy paint and related solvents. After being in the poorly ventilated area for several hours, he began feeling bad in general, developing a headache, tightness in chest and slight nausea.	1
Employee was walking towards the entrance to a building when she bumped against some tubular welded frame scaffolding. She fell to the walk aggravating a previous back problem.	86
Employee was assisting in unpacking a rocket motor case and when a metal retaining bank was severed, it sprung open and cut his fingers.	2
Employee was moving file cabinets in his work area and suffered a sprain/strain of his lower back.	5
Employee was walking on a recently waxed floor when she slipped and fell striking her head and arm on the floor. She suffered only minor contusions.	2
Employee was moving a motor from a work bench to a job site when he lifted the motor and suffered a strain of his back.	3
Employee was wearing high platform shoes and when walking down steps she lost her balance and fell suffering a sprained ankle.	2
Employee was using a new hand chisel to cut a hole in a concrete wall. When he struck the chisel head with a hammer, a piece of the chisel broke, struck and punctured the employee's arm.	2
Employee was moving furniture in his work area all day and suffered a strained thigh muscle.	2