

# MTS

Manned Underwater Vehicles Committee

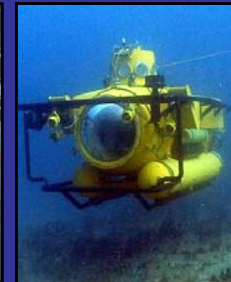


## ***SAFETY STATISTICS OF MANNED SUBMERSIBLE OPERATION A History from 1964 to Present***

Underwater Intervention 2006

### **MTS Manned Submersibles**

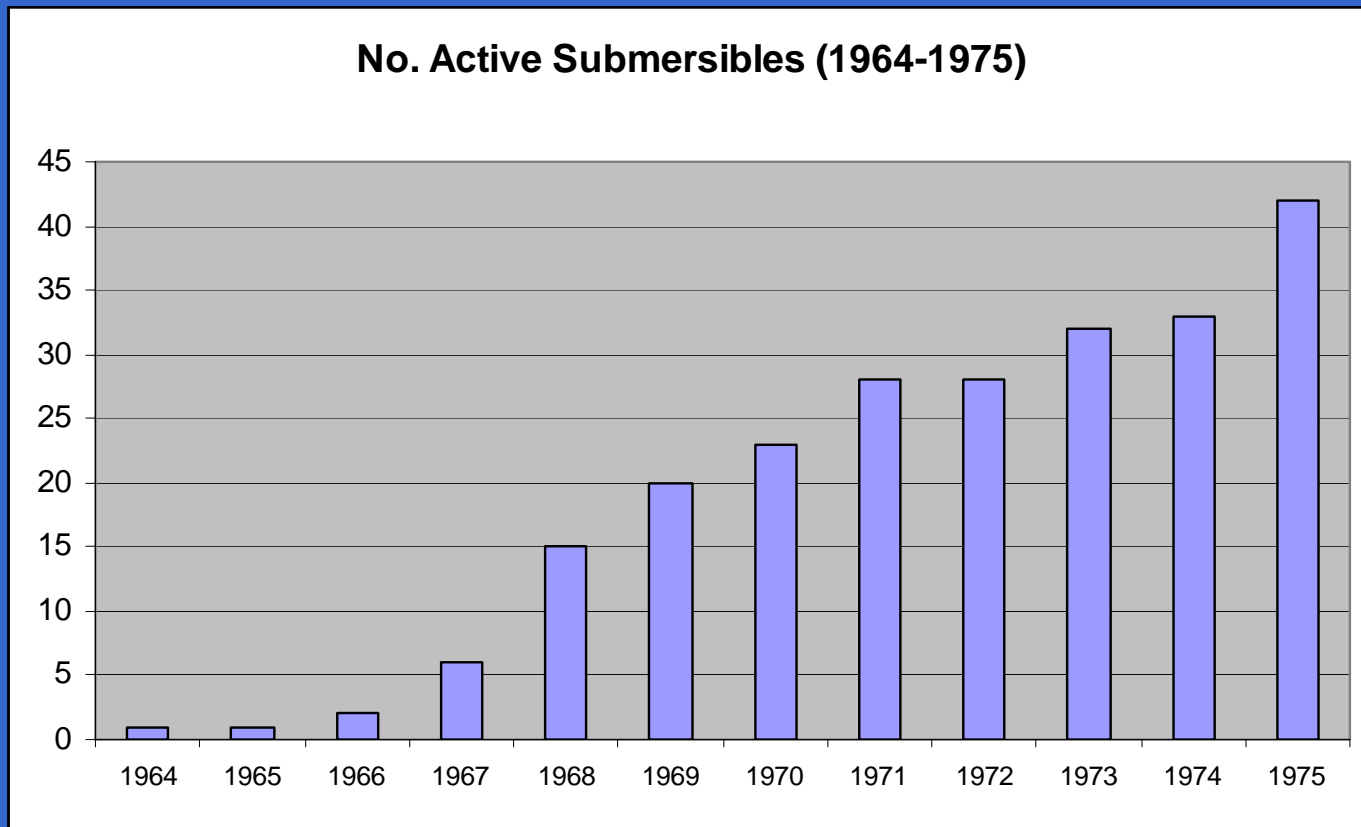
William Kohlen, Chair MTS MUV Committee



# Overview

1. History of Fatal Accidents
2. Manned Submersible Activity 1964-2005
3. Comparison to National Transport Statistics

# Early Period Activity

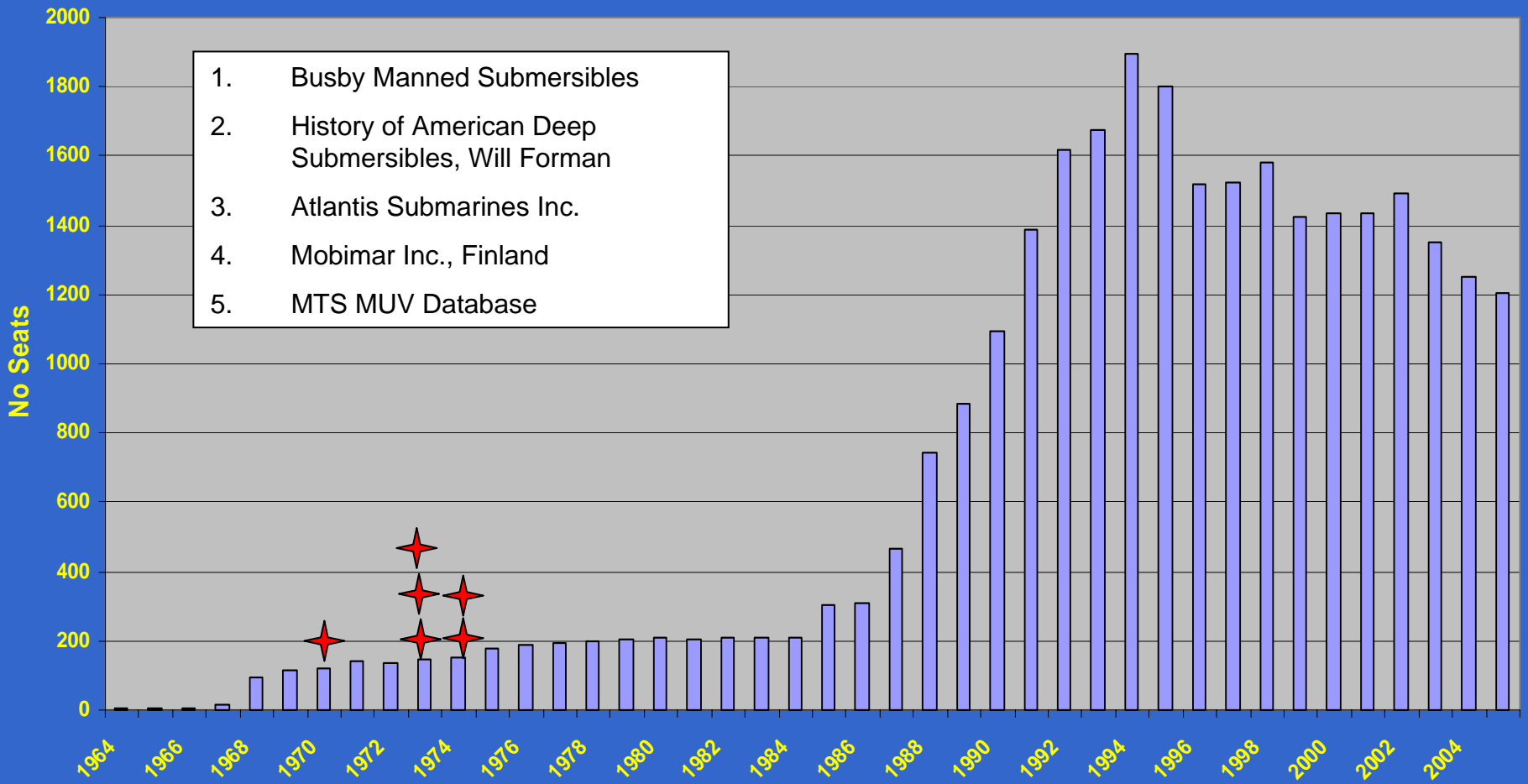


<b>No Subs.</b>	1	1	2	6	15	20	23	28	28	32	33	42
<b>Year</b>	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975

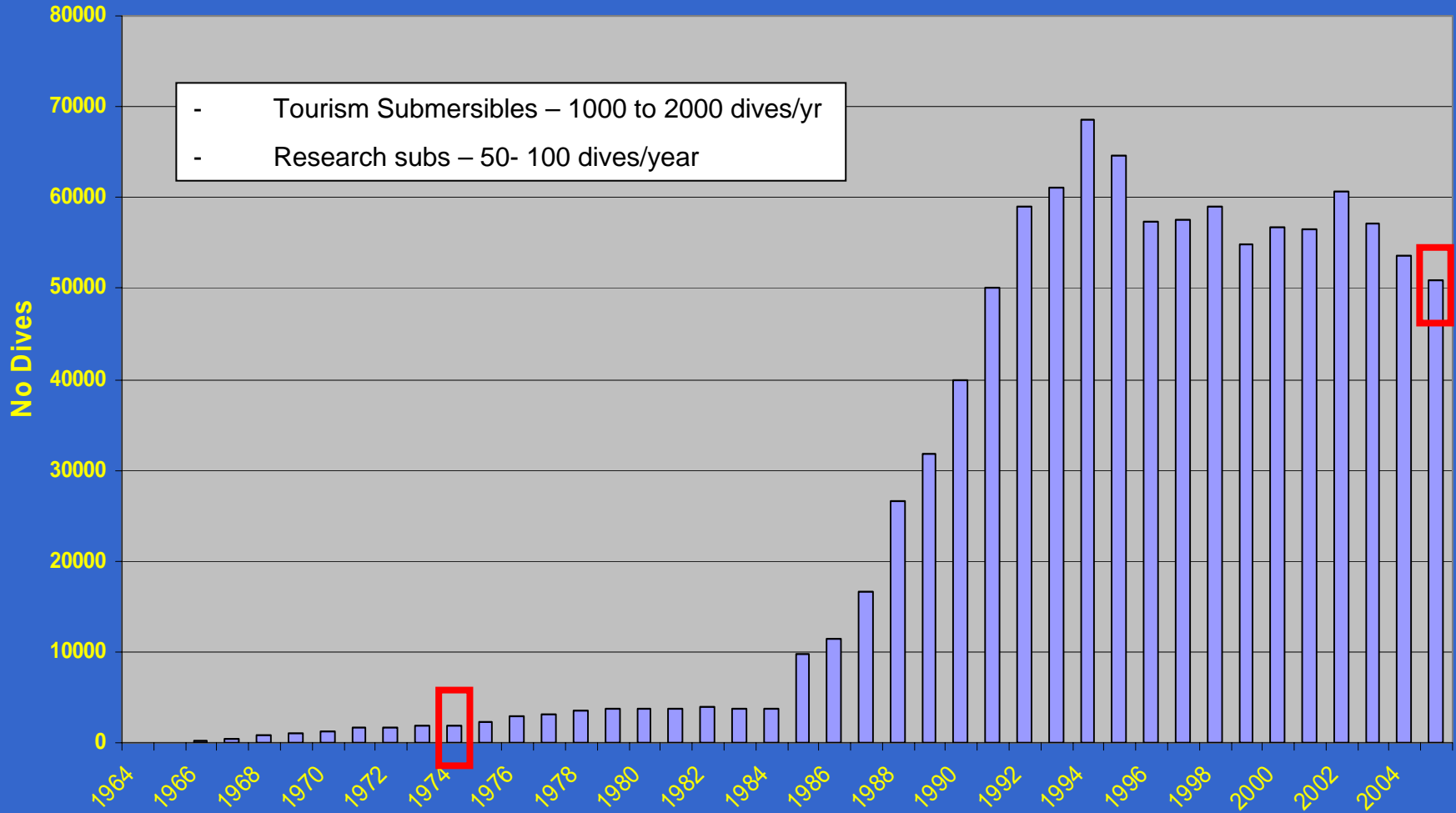
# Early Period Activity

	<b>Date</b>	<b>Submersible</b>	<b>Location</b>	<b>Fatalities</b>	<b>Description</b>
<b>1</b>	<b>Sept 1970</b>	<b>Nekton Beta</b>	<b>California</b>	<b>1</b>	Sub flooded after sportboat wreck broke free from salvage barge lift line and shattered sub's viewport. Pilot escaped, observer died.
<b>2</b>	<b>Summer 1973</b>	<b>BEAVER IV</b>	<b>California</b>	<b>1</b>	Towing line broke pad eye on the submersible and shackle fatally injured crew on deck
<b>3</b>	<b>June 1973</b>	<b>Johnson Sea Link</b>	<b>Florida</b>	<b>2</b>	Entanglement at 365 feet. Two people died in lockout chamber from Cold and toxic CO2 levels.
<b>4</b>	<b>June 1974</b>	<b>UZUSHIO</b>	<b>Japan</b>	<b>2</b>	Electrical Fire in Bell from Vinyl coated cable Insulation. Both crew died from toxic fumes.

## Manned Submersible Capacity



## Manned Submersible Dives per Year (1964 - 2005)



- There has been no fatal incident in the operational of manned submersibles since 1974
- In the period from 1974 to today, there has been a 25 fold increase in No. Dives per year.

(1974)	~ 1900	dives/year
(2005)	~ 50,000	dives/year
- ATLANTIS Statistics Claims having carried 10,530,900 guests and performed 352,000 dives with their 12 submersibles alone.
- World operates a total of 88 Vehicles: 41 Tourism, 19 Research and 28 Commercial Submersibles,

## US Dept. Transportation

**Table 2-41: Waterborne Transportation Safety and Property Damage Data Related to Vessel Casualties**

	1970	1975	1980	1985	1990	1991	<sup>R</sup> 1992	<sup>R</sup> 1993	<sup>R</sup> 1994	<sup>R</sup> 1995	<sup>R</sup> 1996	<sup>R</sup> 1997	<sup>R</sup> 1998	<sup>R</sup> 1999	2000
<b>Fatalities<sup>a</sup></b>	178	243	206	131	85	30	96	114	78	51	52	50	71	57	32
<b>Injured persons</b>	105	97	180	172	175	110	162	166	174	145	223	121	135	131	125
<b>Accidents<sup>b</sup></b>	2,582	3,310	4,624	3,439	3,613	2,222	3,238	3,412	3,970	4,298	4,264	4,198	4,374	4,036	3,791
<b>Vessels<sup>c</sup></b>	4,063	5,685	7,694	5,694	5,494	3,514	4,789	5,137	6,204	6,724	6,694	6,464	6,400	5,732	5,400
<b>Property damage (current \$ millions)</b>	U	U	U	U	U	U	199.5	173.6	263.3	157.8	190.1	156.4	223.3	155.2	146.9

**KEY:** R = revised; U = data are not available.

<sup>a</sup> Fatalities include the number of people who died or were declared missing subsequent to a marine accident.

<sup>b</sup> Accidents in this table include the number of "marine casualty cases" reported to the U.S. Coast Guard in accordance with 46 U.S.C. 4.05.

<sup>c</sup> More than one vessel may be involved in a marine accident.

### NOTES

All deaths and injuries cited result from vessel casualties, such as groundings, collisions, fires, or explosions. The data are for all commercial vessels under U.S. jurisdiction, including U.S. flag vessels anywhere in the world and foreign flag vessels

1992-2000 data come from the Marine Safety Management Information System. Data for prior years may not be directly comparable.

### SOURCE

U.S. Department of Transportation, U.S. Coast Guard, Data Administration Division (G-MRI-1), personal communication, May 15, 2002.



# US COAST GUARD RESPONSE

## DATA

**Table 2-45: U.S. Coast Guard Search and Rescue Statistics, Fiscal Year**

	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Cases	60,775	53,097	52,782	53,294	53,026	53,899	49,704	43,553	41,096	37,218	39,844	40,214	39,475
Responses <sup>a</sup>	70,237	64,971	66,409	69,856	69,784	70,337	63,679	55,710	52,141	46,602	50,622	48,226	49,344
Sorties <sup>a</sup>	88,449	84,033	84,872	88,388	88,147	108,758	110,267	98,423	91,722	83,307	89,635	57,697	58,854
Search and Rescue resource hours <sup>b</sup>	U	108,282	109,351	108,639	107,441	102,749	93,984	85,150	80,507	80,116	84,635	80,533	85,008
<b>Lives saved</b>	<b>6,497</b>	<b>4,407</b>	<b>5,465</b>	<b><sup>f</sup>17,543</b>	<b>5,826</b>	<b><sup>f</sup>23,211</b>	<b>4,453</b>	<b>5,047</b>	<b>3,897</b>	<b>3,194</b>	<b>3,743</b>	<b>3,400</b>	<b>4,009</b>
<b>Lives lost, total</b>	<b>1,335</b>	<b>1,085</b>	<b>1,116</b>	<b>939</b>	<b>1,215</b>	<b>931</b>	<b>772</b>	<b>978</b>	<b>744</b>	<b>606</b>	<b>533</b>	<b>1,018</b>	<b>710</b>
Lives lost before notification <sup>c</sup>	259	622	748	540	800	593	468	611	454	418	353	<sup>g</sup> 779	413
Lives lost after notification <sup>d</sup>	1,076	463	368	399	415	338	304	367	290	188	180	239	297
Persons otherwise assisted	138,791	117,327	113,704	121,826	119,069	116,912	101,357	85,869	75,357	66,138	70,255	54,866	65,158
<b>Value of property lost (\$ million)<sup>e</sup></b>	<b>424.3</b>	<b>368.5</b>	<b>213.6</b>	<b>314.5</b>	<b>316.2</b>	<b>435.5</b>	<b>222.6</b>	<b>273.8</b>	<b>414.8</b>	<b>84.3</b>	<b>262.3</b>	<b>415.2</b>	<b>441.0</b>
Value of property assisted (\$ million)	2,376.8	2,044.9	2,282.4	1,951.4	2,491.8	2,891.2	4,467.2	3,494.2	1,762.1	1,288.2	1,235.0	778.8	1,501.0
<b>Property loss prevented (\$ million)</b>	<b>905.4</b>	<b>1,673.4</b>	<b>1,799.3</b>	<b>1,550.1</b>	<b>2,144.7</b>	<b>2,628.4</b>	<b>3,882.8</b>	<b>3,087.3</b>	<b>1,353.5</b>	<b>996.8</b>	<b>1,019.0</b>	<b>84.3</b>	<b>73.0</b>

KEY: U = data are not available.

<sup>a</sup> Responses are the number of U.S. Coast Guard units involved. Sorties are the number of trips made by boat, aircraft, or cutter.

<sup>b</sup> Search and Rescue resource hours represent the time that Coast Guard assets (i.e., aircraft, boats, and cutters) perform Search and Rescue operations.

<sup>c</sup> Those persons whose lives were lost before the U.S. Coast Guard was notified of an incident.

<sup>d</sup> Those persons whose lives were lost in an incident to which the U.S. Coast Guard was responding, but who were alive at the time the U.S. Coast Guard was notified of the incident.

<sup>e</sup> Includes several out of the normal high cost incidents.

<sup>f</sup> The Search and Rescue management Information System's reporting policy has been revised and now requires complete reporting on all lives saved. This policy also includes reporting on "lives saved" in connection with Coast Guard Law Enforcement Activity

<sup>g</sup> The Egypt Air (217 fatalities) and Alaska Air (88 fatalities) crashes account for the increase.

### SOURCES

All data except Search and Rescue resource hours:

1985-2001: U.S. Department of Transportation, U.S. Coast Guard, Search and Rescue Management Information Systems (SARMIS II) Database, available at <http://www.uscg.mil/hq/g-o/g-opr/92-01summary.htm> as of Aug. 8, 2002.

Search and Rescue resource hours:

1990-2001: U.S. Department of Transportation, U.S. Coast Guard, Office of Command and Control Architecture, personal communication, Aug. 21, 2002.

**Table 2-4: Distribution of Transportation Fatalities by Mode**

	1999		2000	
	Number	Percent	Number	Percent
<b>TOTAL of all modes<sup>a</sup></b>	<b>44,036</b>	<b>100.0</b>	<sup>R</sup> <b>44,313</b>	<b>100.0</b>
Passenger car occupants	20,862	47.4	<sup>R</sup> 20,699	46.7
Light-truck occupants	11,265	25.6	<sup>R</sup> 11,526	26.0
Pedestrians struck by motor vehicles	4,939	11.2	<sup>R</sup> 4,763	10.7
Motorcyclists	2,483	5.6	<sup>R</sup> 2,897	6.5
Large-truck occupants	759	1.7	<sup>R</sup> 754	1.7
Recreational boating	734	1.7	701	1.6
Pedalcyclists struck by motor vehicles	754	1.7	<sup>R</sup> 693	1.6
General aviation	619	1.4	<sup>R</sup> 593	1.3
Railroad trespassers <sup>b</sup> (excluding grade crossings)	479	1.1	463	1.0
Other and unknown motor vehicle occupants	447	1.0	<sup>R</sup> 450	1.0
Other nonoccupants struck by motor vehicles <sup>c</sup>	149	0.34	<sup>R</sup> 141	0.32
Air carriers	12	0.03	92	0.21
Waterborne transportation (nonvessel-related)	86	0.20	87	0.20
Heavy rail transit (subway)	84	0.19	80	0.18
Air taxi	38	0.09	71	0.16
Grade crossings, not involving motor vehicles <sup>d</sup>	57	0.13	64	0.14
Private grade crossings, with motor vehicles	36	0.08	55	0.12
Waterborne transportation (vessel-related)	57	0.13	32	0.07
Light rail transit	17	0.04	30	0.07
Railroad employees on duty and contractors	38	0.09	25	0.06
Bus occupants (school, intercity, and transit)	59	0.13	22	0.05
Gas distribution pipelines	19	0.04	22	0.05
Railroad-related, not otherwise specified	10	0.02	20	0.05
Gas transmission pipelines	2	<0.01	15	0.03
Transit buses, fatalities not related to accidents <sup>e</sup>	12	0.03	8	0.02
Commuter air	12	0.03	5	0.01
Passengers on railroad trains	3	<0.01	4	<0.01

## SUMMARY

1. The 1960's and 1970's showed a clear "LEARNING CURVE" on operation of Manned Submersible
2. These experiences greatly contributed to the development of codes and standards for better vehicles, but also better procedures
3. The Present volume of underwater travel is unprecedented and has an excellent safety record compared to other modes of transport.
4. Manned Submersible Travel is a safe Technology