# SURVIVAL FACTORS GROUP FACTUAL REPORT
**(23 Pages)**

**National Transportation Safety Board**
**Office of Highway Safety**
**Washington, DC 20594**

# Survival Factors Group Factual Report

## A. ACCIDENT

**NTSB File # HWY-08-MH-012**

| | |
|---|---|
| Date and Time: | January 6, 2008 at 8:02 p.m. MST |
| Accident Type: | Motorcoach Run off Roadway and Overturn |
| Accident Location: | Southbound US Rt. 163, near MP29<br>Mexican Hat, San Juan County, Utah |
| Vehicle #1: | 2007 MCI Model J4500, 56-Passenger Motorcoach |
| Motor Carrier #1: | BUSCO, Inc, DBA Arrow Stage Lines |
| Fatalities: | 09 |
| Injuries: | 44 |

## B. SURVIVAL FACTORS GROUP


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## C. ACCIDENT SUMMARY

On January 6, 2008 about 3:30 p.m. MST a 2007 MCI 56-passenger motorcoach with 52 passengers on-board departed Telluride, CO. enroute to Phoenix, AZ., as part of a 17-motorcoach charter. The motorcoach was returning from a three-day weekend of skiing. The motorcoaches were diverted to an alternate route that included US Route 191 and 163 in Utah, due to the closure of Colorado State Route 145 because of snow. Colorado State Route 145 is the normal route used from Telluride to Phoenix.

At about 8:02 p.m. MST the motorcoach was traveling southbound descending a 6 percent grade leading to a curve to the left, 1,800 feet north of milepost 29, at a driver reported speed of 65 mph. After entering the curve the motorcoach departed the roadway at a shallow angle striking the guardrail with the right rear wheel about 61 feet before the end of the guardrail.

The motorcoach began rotating in a counter clockwise direction as it descended an embankment. The motorcoach began to overturn and struck several rocks in a creek bed at the bottom of the embankment. The motorcoach came to rest on its wheels after overturning 360 degrees. During the rollover sequence the entire roof of the motorcoach separated from the body, and 51 of the 53 occupants were ejected. As a result, nine passengers were fatally injured, 43 passengers and the driver received various degrees of injuries from minor to serious.

The weather was cloudy and the roadway was dry at the time of the accident.

## D. DETAILS OF THE INVESTIGATION

The Survival Factors Group investigation focused on the following; documentation of the exterior and interior damage to the bus, emergency response, and the San Juan County Emergency Management.

## 1. INVOLVED VEHICLE

The accident involved a 2007 Motor Coach Industries (MCI) Model J4500, 56-passenger Coach Bus. The motorcoach was equipped with a driver's bucket seat with fifteen rows of two position seats behind the driver and thirteen rows of two-position seats on the right side.

## 2. 2007 MCI MOTORCOACH MODEL J4500

### 2.1 EXTERIOR DAMAGE

The roof of the motorcoach became completely detached from the body during the rollover event. According to the Utah Highway Patrol and the Highway Group Chairman, the motorcoach rotated about its' longitudinal axis, rolling over

360 degrees to its' right, and approximately 180 degrees about its' vertical axis, ending up on its' wheels at final rest facing in an easterly direction. At some point during the rollover, the roof of the motorcoach, at the lower edge of the window sill (sash rail) on the right side and vertical support post for the window, became separated from the body. At final rest the motorcoach was right side up with the roof lying on the ground near the motorcoach, top side down.

The roof of the vehicle sustained catastrophic damage from rolling over. As previously mentioned, the roof became detached from the body at the sash rail (See *Figure #2)* along the entire right side and vertical support post of the window on the left side, pushing the majority of the left passenger sidewall outward.

The windshield glazing was completely broken out. All the windows along both sides were completely broken out.

To date there are no roof crush and/or rollover standards for motorcoaches in the United States, although the Safety Board has previously issued recommendations (H-99-050[1] and H-99-51)[2] to the National Highway Traffic Safety administration (NHTSA).

However, in August 2007, the NHTSA placed a document titled, "*NHTSA's Approach to Motorcoach Safety"* in the Docket 2007-28793. On page 12 of that document, the NHTSA outlines their approach towards investigating roof integrity in motorcoaches using two test protocols. The test conducted will be the Federal Motor Vehicle Safety Standard 220 and Economic Commission for Europe Regulation 66 (ECE-R66), to determine if either, both, or a combination of the two or neither is best suited for motorcoach applications in the United States. Neither test is currently applicable to motorcoaches manufactured for the United States. Results of these tests are set to be publicized by late summer or the fall of 2008.

## 2.2 ROOF AND SIDEWALL STRUCTURE

According to an MCI representative, this series motorcoach and other series motorcoaches they manufacture are constructed using a monocoque (mono-cock) type frame. Monocoque construction is best described as a light-weight type of construction, commonly utilized in motorcoaches, van-type semitrailers, and NASCAR vehicles, where the sides of the vehicle bear a substantial part of the load

[1] This recommendation is on the NTSB's "Most Wanted" list of Safety improvements.
[2] H-99-050 The NTSB recommends that the National Highway Traffic Safety Administration: in two years, develop performance standards for motorcoach roof strength that provide maximum survival space for all seating positions and that take into account current typical motorcoach window dimensions. H-99-051 The NTSB recommends that the National Highway Traffic Safety Administration: once performance standards have been developed for motorcoach roof strength, require newly manufactured motorcoaches to meet those standards

in shear[3] which is transmitted to the upper coupler and undercarriage assemblies through side rails, cross members, and end structures.

The roof panel was made of aluminum and was secured to the stainless steel roof bows using structural adhesive, however the edges of the panel and the periphery of the roof hatches were riveted. The roof had 5 longitudinal supports running from the front upper structure to the rear upper structure (See *Figure #1*). The roof was supported by 8 stainless steel post on each side, which extended from the belt rail to the roof rail (See *Figure #2*). The stainless steel tube vertical posts were welded at the belt rail and again at the roof rail (See *Figure #2*). Although not a single continuous tube, these 8 vertical posts continue across the roof becoming roof bows.

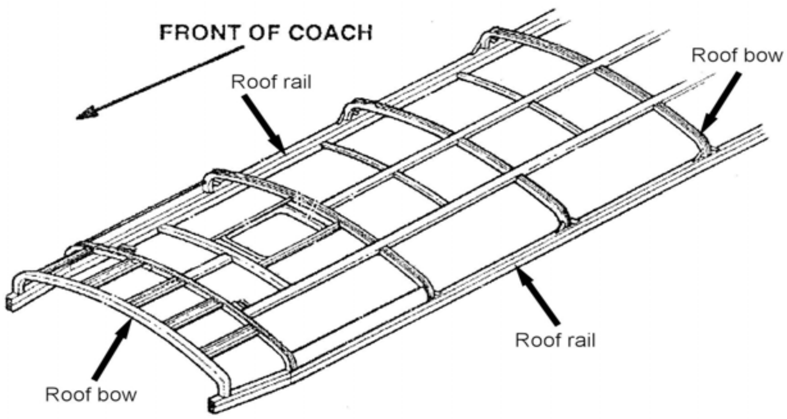



*Figure #1* Roof Structure

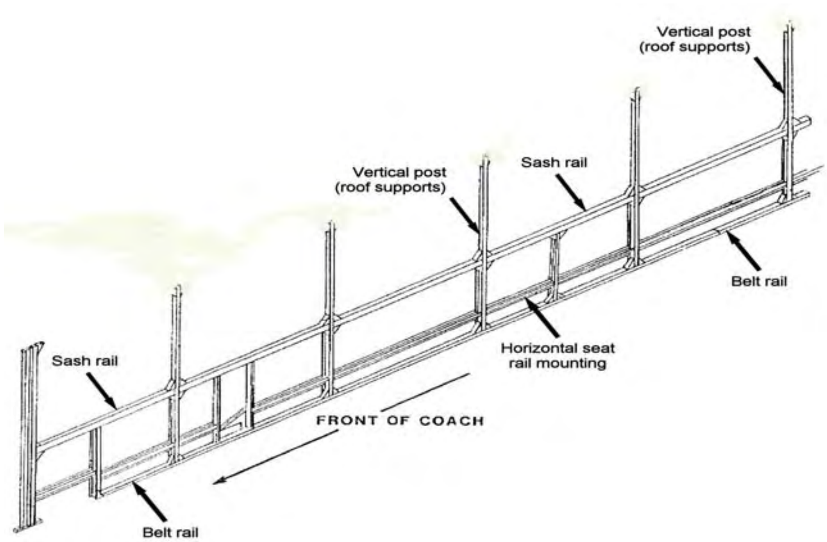



*Figure #2*. Side wall structure

[3] (physics) a deformation of an object in which parallel planes remain parallel but are shifted in a direction parallel to themselves

## 2.3 2007 MCI COACH INTERIOR DAMAGE

Based on the on-scene photos, the interior damage was minor despite the fact that the roof became detached during the rollover. Based on post-crash police photos, the significant interior damage occurred when the wrecker service lifted the roof off the ground with an end-loader and pushed it down on top of the seatbacks and headrest. The overhead light and air console with TV monitors along both sides were completely destroyed when the roof came off. Both privacy panels, behind the driver seat and the entry way sustained severe damage.

Due to mud and debris inside the cabin, the interior inspection revealed no obvious occupant contacts to the seat backs.

The Safety Board has investigated an accident in Turrell, Arkansas involving a 1988 MCI motorcoach, in which the roof became partially detached during a rollover event. Additionally, the Safety Board has looked at motorcoach crashworthiness issues in past and recent investigations with several recommendations being made and reiterated. Specific issues in this accident include but are not limited to Roof Crush Stiffness and three-point belt restraints.

## 2.2 SEATING

The motorcoach was equipped with a bucket seat with cushion springs for the driver. Behind the driver's seat were fifteen rows of two-person seats and thirteen rows of two-person seats on the right side manufactured by Amaya Corporation. Numerous seat backs, at the top (headrest area), were muddied and compressed downward. As previously mentioned, compression of the head rest were as a result of a front end loader placing the detached roof on top of the motorcoach interior and pushing it down to help secure it prior to towing it away from the scene.

An inspection of the seat anchors along the floor and side wall showed that all the seat anchors remained securely attached. The seats were anchored by a single pedestal with 2 T-bolt fasteners at the floor base and attached by 2 T-bolt fasteners along the side wall.

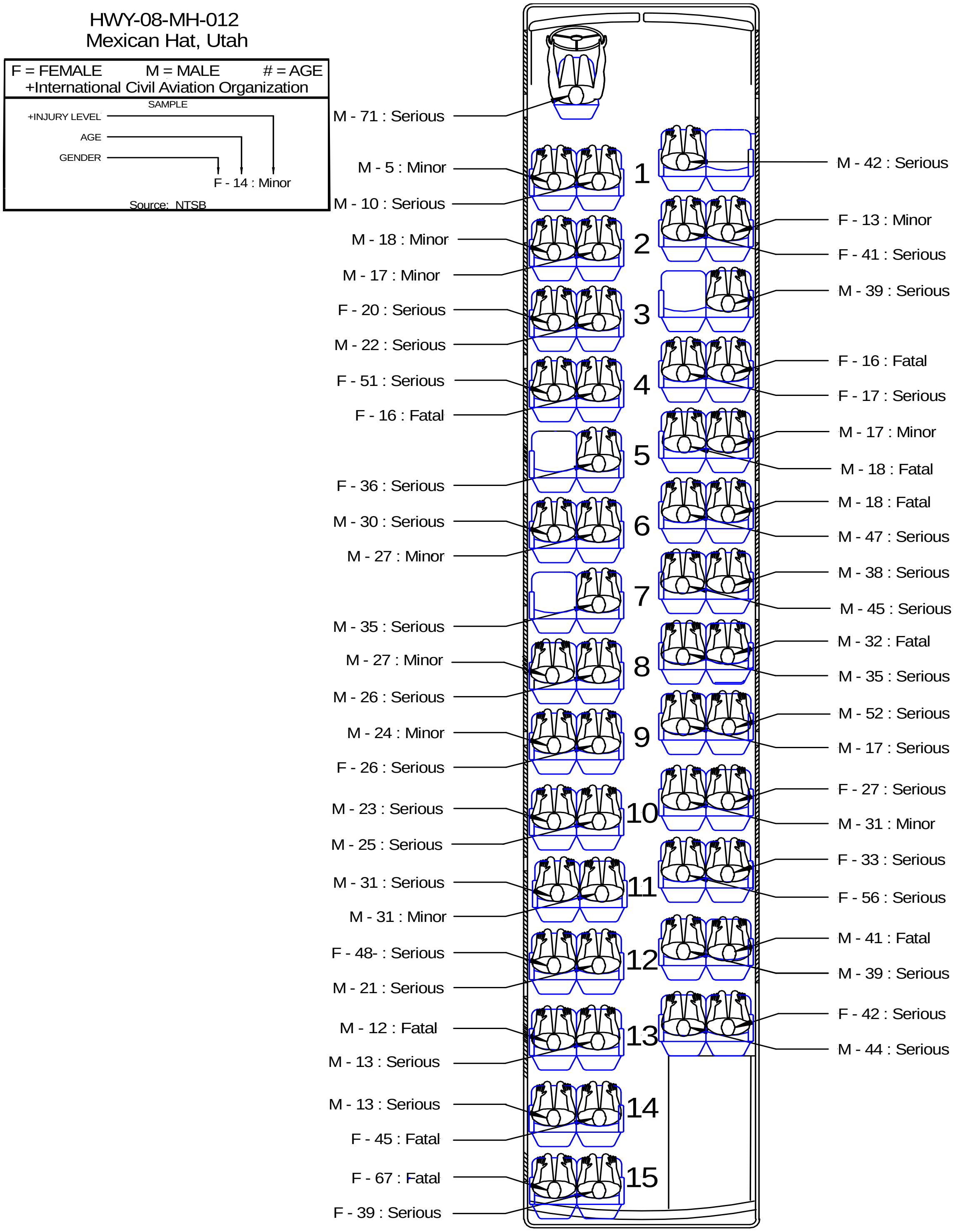
## 2.4 SAFETY EQUIPMENT AND EGRESS

Safety equipment found in the motorcoach during the interior inspection consisted of a First Aid kit and a Kidde 8 lb. Dry Chemical fire extinguisher (Model # YM-120794), which according to the attached gauge, was fully-charged. The fire extinguisher was located under the second row seat on the right (passenger) side secured in its holding bracket.

The vehicle was equipped with a lap and shoulder belt in the driver seat position only. An inspection of the driver's seat belt and interior video was inconclusive for usage due to damage and mud on the components. The driver’s seat belt buckle did show some markings from previous usage. In addition the inspection showed that the muddied seat belt webbing was partially extended from its’ normal resting place. According to the State Police Accident Report, the motorcoach driver was wearing his seat belt.

## 2.5 SEATING CHART

Seat positions are based on passenger interviews and a passenger manifest found inside the motorcoach, which listed passengers names and seat numbers.



## 3. MEDICAL AND PATHOLOGICAL INFORMATION

**INJURY ICAO[4] CODES[5]**

| INJURIES | DRIVER | PASSENGERS | TOTAL |
|---|---|---|---|
| **FATAL** | 0 | 9 | 9 |
| **SERIOUS** | 1 | 33 | 34 |
| **MINOR** | 0 | 10 | 10 |
| **NONE** | 0 | 0 | 0 |
| **TOTAL** | 1 | 52 | 53 |

Ambulance transport records and medical records have been obtained for the majority of for the surviving passengers.

### 3.1 HOSPITAL INFORMATION

Seven of occupants were pronounced dead at the scene of the accident and were transported to two mortuaries. Another passenger died prior to being airlifted out at 3:36 am while another passenger died just after reaching St. Mary's Hospital at 9:05 am the next morning. Autopsies were not conducted on any of the victims. The remaining occupants were treated at twelve hospitals/medical centers and one clinic with some occupants being treated and released and others being hospitalized. The facilities are as follows:

Allen Memorial Hospital - Pending Trauma IV Designation
719 West 400 North
Moab, Utah 84532
(435) 259-7191
Received 5 passengers

San Juan Hospital - No Trauma Designation
364 West 100 North
Monticello, Utah 84535
(435) 678-2830
Originally received 26 passengers from scene
Several of these transferred to other hospitals

[4] International Civil Aviation Organization
[5] 49 CFR 830.2 defines a fatal injury as: any injury that results in death within 30 days of the accident. A serious injury as: an injury which requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; results in a fracture of any bone (except simple fractures of the fingers, toes, or nose); causes severe hemorrhages, nerve, muscle, or tendon damage; involves any internal organ; or involves second or third degree burns, or any burns affecting more than 5 percent of the body surface.

San Juan Regional Medical Center – Designated as a Level III Trauma Center
801 West Maple
Farmington, New Mexico 87401
(505) 609-2000
Received 3 passengers

Flagstaff Medical Center – Designated as a Level 1 Trauma Center
1200 N Beaver St
Flagstaff, Arizona 86001
928 779-3366
Received 2 passengers

St. Mary’s Hospital – Level II Trauma Center
2635 North 7th Street
Grand Junction, Colorado 81502-1628
970-244-2273
Received 10 passengers - Several transferred to Salt Lake City, Utah hospitals

Primary Children’s Hospital – Level 1 Trauma Center for Children
100 N. Mario Capecchi Dr.
Salt Lake, Utah 84113
(801)-662-1000
1 passenger was transferred here

University Hospital – Level 1 Trauma Center
50 North Medical Drive
Salt Lake City, Utah 84132
(801)581-2121
1 passenger transferred here

Blanding Family Practice – - No Trauma Designation
799 S 200 W
Blanding, Utah 84511
435-678-3601
At least 13 passengers were taken here originally from scene. Some treated and released while others were transferred to San Juan Hospital

Banner Good Samaritan Hospital – Level 1 Trauma Center
1111 E. McDowell Road
Phoenix, Arizona 85006
(602) 239-2000
Received 4 passengers that were transferred from San Juan Hospital via Life-flight the following day

Kayenta Medical Clinic – No Trauma Designation
Navajo Nation Shopping Center, Suite E – PO Box 1496
Kayenta, Arizona (Navajo Nation)
928-697-3201
At least 2 passengers originally taken here

Chinle Comprehensive Healthcare Facility – No Trauma Designation
Hwy 191 Hospital Dr
Chinle, Arizona (Navajo Nation) 86503
(928) 674-7001
At least 2 passengers originally taken here

Sage Memorial Hospital - No Trauma Designation
Tuba City, Arizona (Navajo Nation) 86045
(928) 654-3209
At least 2 passengers originally taken here

Intermountain Healthcare (Central Office)
LDS Hospital - Level 1 Trauma Center
36 So. State Street Floor 22
Salt Lake City, Utah 84111
(801)- 408-1100
At least 1 transferred here

## 3.2 OCCUPANT INJURIES

None of the nine fatally injured passengers had autopsies performed. According to mortuary personnel, all that was recorded was that they sustained blunt force trauma to their heads and torso's.

Based on passenger interviews, medical records and ambulance transport records, thirty-four of the fifty-three occupants sustained serious injuries. Of the twenty-four occupants seated on the right side of the motorcoach sixteen sustained serious injuries. Five of the nine fatally injured occupants were seated on the right side and four of the five were seated next to the window. Three of the four fatally injured occupants on the left side were seated in the last three rows.

Thirteen of the thirty-four seriously injured occupants sustained both spinal fractures and extremity and/or torso fractures. Twelve of the remaining twenty-one seriously injured occupants sustained torso and extremity fractures. The remaining seriously injured occupants sustained brain and internal injuries. The remainder of injured occupants that sustained minor injuries had lacerations that required stitches along with multiple abrasions and contusions to their extremities, face, and torso.

### 3.3 EJECTIONS

According to passengers interviewed by the investigating Sergeant with the Utah Highway Patrol, fifty-one of the fifty-three occupants were ejected from the motorcoach. One of the two remaining occupants on the motorcoach was the motorcoach driver and the other a passenger that was entrapped between seats on the right side between rows 12 and 13.

Interviewees reported that at least two and possibly as many as four passengers were found on the left (north) side of the motorcoach at final rest. The majority of the ejected occupants were found on the right (south) side of the motorcoach with several either underneath the roof or body of the motorcoach. According to first responder and passenger interviews, at least one person was found under the motorcoach body on the left (north) side and at least three passengers were found fully or partially trapped underneath the roof of the motorcoach, which was on the right (south) side. Of these four trapped occupants two survived.

Research has shown that currently there are no laws requiring seat belt use on motorcoaches even if they are equipped with them.

## 4. EMERGENCY RESPONSE

The San Juan County dispatcher was notified of the accident through the 911 system at 8:38 p.m[6]. The first call from dispatch went out to the Utah Highway Patrol at 8:38. The first deputy with the San Juan County Sheriff's Office was dispatched at 8:48 p.m. and arrived on-scene at 9:19 p.m. According to the Chief of the Bluff volunteer Fire Department, who was also the Incident Commander (IC) for this accident, he heard radio traffic on his scanner and departed for the scene at 8:33 p.m.[7] and arrived on-scene at 8:56 p.m. The Bluff volunteer FD rescue unit was enroute at 8:45 p.m. and arrived on-scene at 9:00 p.m. followed by their ambulance unit at 9:01 p.m.

A Classic Lifeguard helicopter from Page, Arizona was requested but due to the weather conditions in Northern Arizona, they remained grounded. A life-flight crew from St. Mary's Hospital in Grand Junction, Colorado was also requested and grounded due to weather conditions. At 11:24 p.m. San Juan County Hospital in Monticello, requested St. Mary's hospital in Grand Junction, Colorado send an ALS ambulance. St. Mary's hospital responded by driving approximately 166 miles with their flight crew, which included a flight nurse, paramedic and physician by ambulance to San Juan Hospital in Monticello, Utah. They then picked-up 2

[6] A call was received by the San Juan County 911 dispatcher at 8:04 p.m. reporting a bus accident but when the dispatcher asked for a location the call was lost.
[7] Time may not be accurate due to clocks not being synchronized.

critically injured passengers and returned back to St. Mary's in Grand Junction, Colorado. One of the critically injured passengers expired on the way.

Numerous critically injured passengers were driven from the accident scene to San Juan Hospital, a distance of approximately 80 miles. Several of these critically injured passengers were triaged and then transported to Allen Memorial Hospital in Moab, Utah, a distance of approximately 37 miles where they were then transported by a fixed wing life-flight ambulance to trauma hospitals in Salt Lake City. The weather conditions in the area were so poor for flying that fixed wing medical life flights could only land at an airport equipped with a precision instrument landing system. Canyonlands Field Airport (KCNY), Moab, UT, was the closest airport to the accident site that would allow a precision instrument approach (in this case, a GPS-based instrument approach). The closest airport to the accident site, Monticello Airport, did not have any type of instrument landing system.

Southwest Memorial Hospital in Cortez, Colorado, which is approximately 60 miles away, sent 2 Advanced Life Support (ALS) ambulances with 1 paramedic in each to San Juan Hospital in Monticello, Utah to help transport injured out. In addition, a physician accompanied one of the ambulances to Monticello in order to assist their Emergency Room. The two ambulances picked-up several more critically injured passengers and drove to St. Mary's in Grand Junction, Colorado. Grand County, Utah EMS dispatched 3 ambulances to San Juan Hospital to also help with transporting injured passengers out.

The San Juan County EMS requested a task force from the Utah State Bureau of EMS, which is a division of the State Department of Health. That task force relieved the San Juan County ambulance services for 48 hours while they rested and rehabilitated their crews.

Both the Utah Highway Patrol and San Juan County Sheriff's office sent four officers and deputies, respectively, to the scene.

## **Agencies that responded to the scene in order to transport injured passengers**[8]

- San Juan County EMS[9] - 8 ambulances, 1 transport ambulance and three 15-passenger vans to transport the walking wounded to the Blanding medical clinic
- Kayenta EMS (Navajo Nation) includes Chinle, Shiprock, Red Mesa, Tuba City, and Kayenta 4 mutual aid ambulances
- Moab - Grand County EMS 3 ALS units
- Mesa County in Colorado sent 2 mutual aid ambulances

[8] None of the responding ambulances from San Juan County were advanced life support capable.
[9] San Juan County has no licensed Paramedics only Basic and Intermediate EMT's and all are volunteers,

- Southwest Memorial Hospital sent 2 mutual aid ambulances from Durango, Colorado

## 4.1 SAN JUAN COUNTY EMERGENCY MANAGEMENT

A review of the San Juan County's Emergency Operations Plan for handling disasters and Mass Casualty Incidents (MCI) revealed that although the county does have an Emergency Operations Plan, due to the vastness of the County's size, and the lack of available resources within the county, there is no formal MCI plan.

San Juan County's Emergency Operations Plan has Annex's that cover Rescue and Emergency Medical Services, Mass Fatalities, and Shelter/Mass Care for. The listed Annexes all have sections titled Situations and Assumptions and Concept of Operation which primarily outline what to do and who to contact in case a disaster were to occur. The Assumption portion in the Rescue and Emergency Service Annex points out that any large scale emergency would increase the demands of the volunteer EMS and any mass casualty event would overwhelm the limited response capabilities of San Juan County.

The state of Utah has an Emergency Disaster Plan. The Emergency Disaster Plan is not specific on the timely movement of patients. In the Utah Department of Health Emergency Operations plan there is a section titled "*Request for State and Federal Assistance*". This states that State and Federal healthcare assets must be formally requested through the Utah Department of Health. The State Bureau of EMS is a participant in the Emergency Medical Assistance Compact, which is a signed state to state mutual aid agreements.

The State of Utah and San Juan County are using the National Incident Management System (NIMS). According to the San Juan County EMS Director, both the State and the County have received most of their NIMS training from FEMA. It has become a requirement of the state that all first responders be trained in the NIMS IS 700. According to the San Juan County EMS Director, the majority of their people have already been trained. The county also tries to have the first responders take an IS 100 and Basic IS 200 class so they can be more familiar with the Incident Command System.

## 4.2 SAN JUAN COUNTY EMERGENCY RESPONSE INFORMATION

San Juan County is the largest county in the state of Utah and is located in the southeast corner of the state. San Juan County has a total area of 7,933 square miles of which 7,820 square miles of it is land with the remaining 113 square miles being water. As of the census of 2000, there were 14,413 people in the county or roughly 2 residents per square mile.

San Juan County has a total of 8 ambulances throughout the county with none of them being Advance Life Support (ALS) capable due to there being no licensed paramedics only certified intermediate or basic EMT's. The nearest Trauma hospital to the scene of the accident was St. Mary's Hospital in Grand Junction, Colorado, which is approximately 229 miles away.

### 4.3 RURAL VERSUS URBAN EMS RESPONSE AND FATALITIES

Research has shown significant differences in urban versus urban EMS response as well as fatality rates. The major disadvantage rural U. S. residents have is the time and distance to a trauma facility compared to urban residents.

According to a 2003 report written by the National Safety Council titled, *Injuries in America*, nearly 60% of all trauma deaths occur in rural areas despite the fact that only 20% of the nation's population live in these areas.

Nearly 85 percent of U. S. residents can reach a level one or level two trauma center within an hour compared to only 24 percent of residents living in rural areas. Dr. Michael Rotondo[10]stated at the 2007 National Conference of State Legislatures that although only 20 percent of the nation's population lives in rural areas, nearly 60 percent of all trauma deaths occur in rural areas. Moreover, the death rate in rural areas is inversely related to the population density. Consider these facts about rural injury;

- The relative risk of a rural resident dying in a motor vehicle accident is 15 times higher than in urban areas, after adjusting for accident statistics, age, and gender.
- Injury related deaths are 40 percent higher in rural communities than in urban areas.
- 87 percent of rural pediatric trauma deaths did not survive to reach the hospital

Another issue affecting rural areas is the large number of EMS personnel being volunteers and the difficulty in recruiting and training them. Dr. Nels Sanddal[11] stated at the same 2007 National Conference of State Legislatures that, 80 percent of EMS personnel in rural areas are reported to be volunteers. According to the EMS Director of San Juan County, all the EMS personnel in the entire county are volunteers.

A Technical Report issued in December, 2005 by the DOT's National Highway Traffic Safety Administration (NHTSA) , titled "*Contrasting Attributes*

[10] Michael Rotondo, M. D., F.A.C.S, Professor and Chairman, Chief of Trauma and Surgical Critical Care, Department of Surgery, Brody School of Medicine, East Carolina University
[11] Nels Sanddal, M.D., President, Critical Illness and Trauma Foundation, Montana

*Between Rural and Urban Crashes 1994-2003"*[12] provided a reference tool for researchers to examine rural and urban fatal crashes based on Fatal Accident Reporting System (FARS) data.

One fact stated in the report was that considerably more accidents occur in rural areas compared to urban areas, rural accidents are more severe, cause greater injuries, and pose a stiffer challenge to the highway safety community than do urban accidents.

Some of the highlights from the NCSA report based on FARS data on rural versus urban fatal accidents are;

- The time for EMS to reach the scene of an accident, once they have been notified, is usually longer in rural areas than in urban areas
- Vehicle rollover accidents occur in 24 percent of rural fatal accidents, but only 10 percent of urban fatal accident
- Rural accidents result in multiple deaths 11 percent of the time, whereas urban fatal accidents result in multiple deaths 7 percent of the time
- Rural roadways with a 55 mph speed limit account for 50 percent of rural fatal accident while urban roadways with 35 mph speed limit account for 19 percent of fatal accidents
- There are approximately 35 percent more accidents, vehicles involved, individuals involved, and deaths in rural areas than in urban areas. However, there are fewer vehicle miles traveled
- 17 percent of individuals are ejected in rural fatal accidents compared to 8 percent that are ejected in urban accidents

Safety Board staff also conducted an analysis that focused on rural and urban fatal accidents involving large buses. SEE Data Report on '*Large Bus Accidents and Injuries in Rural and Urban Areas'* for further detailed information."

## 4.4 AASHTO STRATEGIC HIGHWAY SAFETY PLAN

The American Association of State Highway and Transportation Officials **(**AASHTO) Strategic Highway Safety Plan[13] identifies 22 key emphasis areas (goals) that affect highway safety and focuses attention on selected strategies. The objective of the plan is to reduce the amount of fatalities on the roadways. State and federal safety and transportation officials are aiming to reduce the fatality rate from 1.5 to no more than 1.0 fatality per 100 million vehicle miles traveled.

[12] U.S. Department of Transportation, National Highway Traffic Safety Administration Technical Report DOT HS 809 896, *Contrasting Rural and Urban Fatal Crashes, 1994 – 2003* (Washington, DC: NHTSA, 2005)"

[13] http://safety.transportation.org/elements.aspx

One of the 22 goals, is titled, *Enhancing Emergency Medical Capabilities to Increase Survivability* (#20). This consists of five areas that are to be researched with the results being evaluated over a 2-year period. If found effective for the funding, they will be expanded nationally. The five areas that are to be researched are titled;

- Strategy20A: Develop and implement a model comprehensive approach that will ensure appropriate and timely response to the emergency needs of crash victims
- Strategy 20B: Develop and implement a plan to increase education and involvement of EMS personnel in the principles of traffic safety
- Strategy 20C: Develop and implement an emergency prepardness model in three high-incident interstate highway settings (urban, rural, and wilderness)
- Strategy 20D: Implement and/or enhance trauma systems
- Strategy 20E: Develop and support integrated EMS/public health/public safety information and program activities

### 4.5 SAFETEA-LU and High Risk Rural Roads

The U.S. Department of Transportation's Federal Highway Administration (FHWA) targets rural road safety through the High Risk Rural Road Program funded by the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). SAFETEA-LU established a new core FHWA Highway Safety Improvement Program (HSIP). The purpose of HSIP, according to FHWA, is to "achieve a significant reduction in traffic fatalities and serious injuries on public roads"[14] through highway safety improvement projects. Rural road safety improvements are funded by the SAFETEA-LU's High Risk Rural Roads Program and are treated as a candidate HSIP.[15]

SAFETEA-LU establishes, in law, the requirements and funding for highway safety programs at the Federal and State levels. HSIPs are specified in Title 23 Code of Federal Regulations (CFR) section 148 with separate funding of more than $5 billion in FY2006 – FY2009. Highway safety improvement projects can be defined in a number of ways, but must correct or improve a hazardous highway location or feature, or address a highway safety problem. Many of these safety improvements target highway infrastructure, and can span a wide range of improvements, including lane and shoulder widening, rumble strips, skid-resistant road surfaces, traffic calming, or removal of a roadside obstacle. Not all projects must be related to infrastructure improvement or highway construction; one type of HSIP can be "Improvement in the collection and analysis of crash data."[16]

SAFETEA-LU requires each State to develop and to implement a Strategic Highway Safety Plan (SHSP) that includes all HSIPs. The purpose this strategic

[14] 23 CFR 148 section (b)(2)
[15] 23CFR148 section (a)(3)(B)(xxi).
[16] 23 CFR 148 section (a)(3)(B)xvi

plan is to identify and analyze a State's highway safety problems and opportunities, and it must incorporate a data-driven, analytic approach to highway safety. The strategic highway safety plan will contain the HSIP projects and strategies that a State will use to reduce the identified safety problems. Each State must produce an annual SHSP and submit it to Secretary of Transportation for review and approval. The legislation outlines what should be included in each State's strategic highway plan, [17] including:

- A crash data system that can be used to identify safety problems and analyze them,
- An analysis that identifies hazardous locations, roadway sections, and road elements,
- Criteria that a State determines to be appropriate to establish the relative severity of locations based on accidents, injuries, fatalities, traffic volumes, and other relevant data,
- Priorities for the correction of hazardous locations, sections, or features based on crash data analysis, including identifying opportunities for preventing the development of such hazardous conditions, and
- A data-driven means for evaluating the effectiveness of HSIPs in reducing the number and severity of accidents and potential accidents.

As previously discussed, safety improvements to rural roads are treated as a candidate HSIP.[18] Since SAFETEA-LU's High Risk Rural Roads Program is a component of the HSIP, a State's response is in the form of a HSIP that targets high risk rural roads. The Program defines a high risk rural road as any roadway functionally classified as a rural major, rural minor collector, or a rural local road:

- on which the accident rate for fatalities and incapacitating injuries exceeds the statewide average for those functional classes of roadway; or
- That will likely have increases in traffic volume that are likely to create an accident rate for fatalities and incapacitating injuries that exceeds the statewide average.[19]

In its published guidance, FHWA outlines a 2-step process for identifying high risk rural roads and selecting projects.[20] The first step requires a State to identify eligible roadways that have accident rates for fatalities and incapacitating injuries that exceed statewide averages for respective roadway functional classifications. Accident rates must be based on crash data and exposure data. Vehicle miles traveled (VMT), average daily traffic (ADT), and lane miles are

[17] 23CFR148 section (c)(2).
[18] 23CFR148 section (a)(3)(B)(xxi).
[19] 23 CFR 148 section (a)(1). More details are available at http://safety.fhwa.dot.gov/safetealu/factsheet1401hrrr.htm.

[20] FHWA guidance on the High Risk rural Roads Program is available at http://safety.fhwa.dot.gov/safetealu/hrrrpattachment.htm

typical exposure data, although States working towards a comprehensive statewide data system may use other sources for exposure data. States may also consider roads with a potential for increased traffic volumes that could result in an increase in accidents and fatalities.

Characterizing a road as rural is a fundamental part of the selection and prioritization process. Consequently, an accurate characterization of the functional classification of a road segment is important in the process. FHWA functionally classifies roads using a population census definition. In that classification, an urban road is defined as any road or street within the boundaries of an urban area with a population of 5,000 or more, and a rural road is any road not classified as urban. The boundaries of urban areas are fixed by State highway departments, subject to the approval of the FHWA, for purposes of the Federal-Aid Highway Program. Studies of rural and urban roads use the FHWA functional classification to identify rural roads.

The second step in the identification and selection process requires a State to use the eligible set of roadways identified in the first step to determine appropriate safety improvements and select projects. These projects form the basis for the High Risk Rural Road Program HSIPs that appear in a State's Strategic Highway Safety Plan.

## 4.6 TRANSPONDERS[21], VEHICLE TRACKING SYSTEMS, and SARSAT[22] IN TRANSPORTATION

According to the San Juan dispatch, a 911 call came in at approximately 8:04 p.m. but after the caller reported there being a bus accident and the dispatcher asking for a location, the call was lost. The remote and rural location of the accident and the absence of a cell phone tower (i.e., repeater) in the immediate area resulted in there being very little if any cell phone service. Other than a Satellite phone, the only way for citizens in these remote rural areas to contact 911 in case of an emergency is by a hard line telephone. In this accident, passengers had to wait for another vehicle to come upon the scene and ask them to go to the next town, approximately eight miles south, and call 911 from a service station. This added approximately another 30 minutes to the response time.

Had the motorcoach been equipped with a transponder, vehicle tracking system, or a SARSAT system, notification and emergency response would have been automatic once the transponder was activated in the accident. Transponders are used in several other modes of transportation such as aviation, marine, and rail. These other modes of transportation have transponders because they regularly travel

[21] Wikipedia - A transponder is an electronic device used to wirelessly receive and transmit electrical signals. Fittingly, its name is equally derived from the words "transmitter" and "responder".
[22] Search And Rescue Satellite Aided Tracking

in remote areas and in emergency situations the transponders are able to signal for help as well as give their location.

Good examples of automotive vehicles having transponders are the SYNC systems in Ford vehicles and the ONSTAR system in GM vehicles. When the vehicles air bags are deployed in an accident and not only relay the vehicles location using a Global Positioning System (GPS)[23]. Unfortunately, both systems are cellular activated.

Simple active transponders are employed in location, identification, and navigation systems for commercial and private aircraft. An example is an RFID (radio-frequency identification) device that transmits a coded signal when it receives a request from a monitoring or control point. The transponder output signal is tracked, so the position of the transponder can be constantly monitored. The input (receiver) and output (transmitter) frequencies are pre-assigned. Transponders of this type can operate over distances of thousands of miles.

A vehicle tracking system is an electronic device installed in a vehicle to enable the owner or a third party to track the vehicle's location. Most modern vehicle tracking systems use Global Positioning System (GPS) modules for accurate location of the vehicle. Many systems also combine a communications component such as cellular or satellite transmitters to communicate the vehicle’s location to a remote user. Vehicle information can be viewed on electronic maps via the Internet or specialized software.

Current vehicle tracking systems have their roots in the shipping industry. Corporations with large fleets of vehicles required some sort of system to determine where each vehicle was at any given time. Vehicle tracking systems can now also be found in consumers vehicles as a theft prevention and retrieval device. Police can follow the signal emitted by the tracking system to locate a stolen vehicle.

Many vehicle tracking systems are now using or a form of automatic vehicle location[24] (AVL) to allow for easy location of the vehicle. The GPS satellite system was built and is maintained by government and is available at no cost to civilians. This makes this technology very inexpensive. Many police cruisers around the world have a form of AVL tracking as standard equipment in their vehicles.

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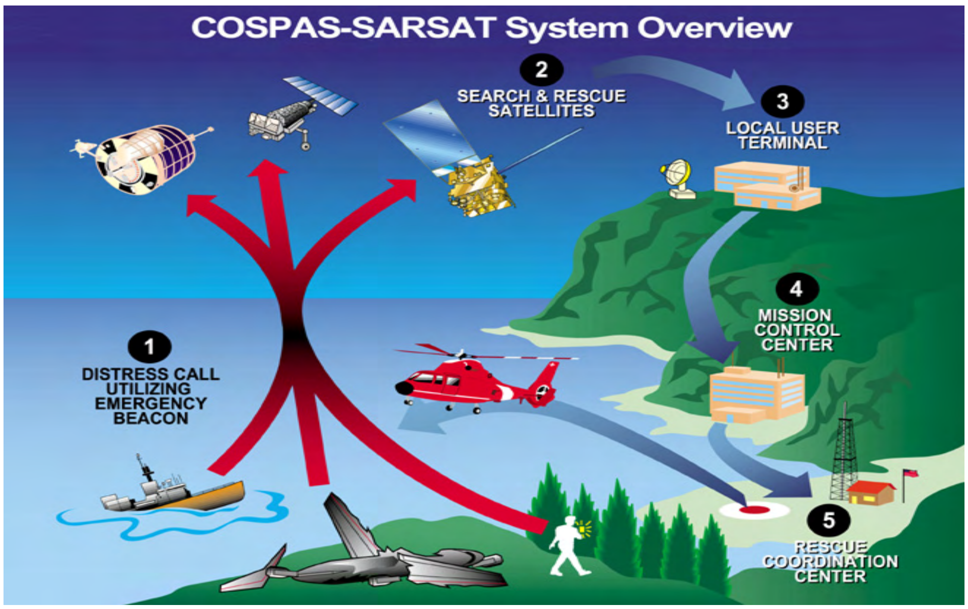
[23] Wikipedia - The Global Positioning System (GPS) is the only fully functional Global Navigation Satallite System (GNSS). Utilizing a constellation of at least 24 Medium Earth Orbit satellites that transmit precise microwave signals, the system enables a GPS receiver to determine its location, speed, direction, and time.

[24] Wikipedia - Automatic vehicle location or AVL is a means for determining the geographic location of a vehicle and transmitting this information to a point where it can be used. Most commonly, the location is determined using GPS, and the transmission mechanism is a satellite, terrestrial radio or cellular connection from the vehicle to a radio receiver, satellite or nearby cell tower.

The COSPAS[25]-SARSAT system uses National Oceanic and Atmospheric Administration (NOAA) satellites in low-earth and geostationary orbits to detect and locate aviators, mariners, and land-based users in distress. The satellites relay distress signals from emergency beacons to a network of ground stations and ultimately to the U.S. Mission Control Center (USMCC) in Suitland, Maryland. The USMCC processes the distress signal and alerts the appropriate search and rescue authorities to who is in distress and, more importantly, where they are located.

The newest 406 MHz beacons incorporate GPS receivers that transmit highly accurate positions of distress almost instantly to SAR[26] agencies via satellites.




Cospas-Sarsat began tracking the two original types of distress radio beacons in 1982. Specifically, these were:

- EPIRBs (Emergency Position-Indicating Radio Beacons), which signal maritime distress; and
- ELTs (Emergency Locator Transmitters), which signal aircraft distress
- PLBs (Personal Locator Beacons), are for personal use and are intended to indicate a person in distress who is away from normal emergency services (i.e. 9-1-1)

The four founding countries[27] led development of the 406 MHz marine EPIRB for detection by the system. The EPIRB was seen as a key advancement in SAR technology in the perilous maritime environment. The aviation community

[25] Cospas is a Russian acronym for "Space System for Search of Vessels in Distress"
[26] Wikipedia – Satellite Access Request
[27] The four nations, United States, Canada, France and the Soviet Union banded together in 1979 to form Cospas-Sarsat.

had already been using the 121.5 MHz frequency for distress, so ELTs for general aviation were created using 121.5 MHz, a frequency listened to by the airlines. Military beacons using the 243.0 MHz frequency could also be detected by the system.

An ELT is a device that can be automatically or manually activated to transmit a distress signal to a satellite. ELTs that activate automatically typically have a "G" or gravity switch that triggers the ELT when it senses that a crash has occurred.

**COSPAS-SARSAT Rescues as of[28] April 11, 2008:**

**Number of Persons Rescued (To Date) in the United States:** 94

- Rescues at sea: **71** people rescued in **18** incidents
- Aviation rescues: **2** people rescued in **2** incidents
- PLB rescues: 2**1** people rescued in **13** incidents

- Worldwide **– Over 22,058** People Rescued *(since 1982)*
- United States **– 5,842** People Rescued *(since 1982)*

**Numbers from 2007**

**353** people rescued in **130** incidents in the United States

- Rescues at sea: **235** people rescued in **73** incidents
- Aviation rescues: **30** people rescued in **19** incidents
- PLB rescues: **88** people rescued in **38** incidents

## 5. INTERVIEWS

Interviews were conducted with the Fire Chief of the Bluff volunteer Fire Department who was the Incident Commander (IC), the San Juan County EMS director that arrived on scene, and the first Utah State Trooper to arrive on scene. In addition, interviews were conducted with eleven passengers.

### 5.1 FIRST RESPONDER INTERVIEWS

The following paragraph is a synopsis of first responder interviews obtained while on-scene. For complete first responder interviews and interviews with passengers follow (See Attachment #1).

[28] http://www.sarsat.noaa.gov/

The first responders that arrived on scene all mentioned that a passerby, that was already on scene, had set up a generator and lighting that happened to be in the back of his pick-up truck. In addition the passerby also had a heavy duty jack he brought out to help people trapped under the bus roof. The responders said they used the headlights of their vehicles to help further illuminate the accident scene until the Blanding Fire department arrived and set-up more spot lights. They also commented that cell phone reception was nearly impossible. The first responders were able to start triage on all of the more seriously injured bus occupants while the walking wounded waited for transportation to a clinic in Blanding. Once more spot lights and extrication equipment arrived, the remainder of the rescue and triage process went efficiently. However, transporting the injured was delayed due to the distance most of the ambulances had to travel to the scene.

## 5.2 PASSENGER INTERVIEWS

The following is a narrative that the majority of passengers stated during their interview;

The bus departed Telluride between 3 and 3:30 p.m. As the caravan of buses got to the outskirts of town the majority of buses stopped to take off their chains but the accident bus continued for another 10 to 30 minutes prior to pulling over and unchaining. The removal of the chains took close to 30 minutes and one or two of the other buses stopped to assist the driver. In addition, prior to the other buses stopping, several passengers got out to try and assist the bus driver. After de-chaining, they continued driving for several hours until they stopped in Blanding for the bus driver to go to the restroom. From Blanding the accident bus followed another bus and a snowplow until they got south of town and the snowplow pulled off the road. Several interviewees mentioned that the accident bus passed the bus ahead of them and continued southbound. In addition, several interviewees mentioned that the bus driver ran off on to the shoulder running over the rumble strips and just prior to the accident had a incident where the driver swerved hard enough that things inside the bus shifted and one of the passengers yelled out to the driver to, “Slow down”.

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