NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

July 5, 2012

Group Chairman's Factual Report

SURVIVAL FACTORS / OPERATIONS

WPR11MA454

A. ACCIDENT

Accident: WPR11MA454
Location: Reno, Nevada
Date: September 16, 2011
Time: 1626 Pacific daylight time[1]
Airplane: North American P-51D, Registration Number: N79111

B. SURVIVAL FACTORS / OPERATIONS GROUP

Group Chairman:	Joshua Cawthra National Transportation Safety Board (NTSB) Federal Way, WA
Member:	Christine Soucy Federal Aviation Administration (FAA) Washington, DC
Member:	Tom Gribbin Reno Air Racing Association (RARA) Reno, NV
Member:	Mike Scott Reno-Tahoe Airport Authority (RTAA) Reno, NV
Member:	William E. Harrison, MD Unlimited Class Owasso, OK

C. SUMMARY

On September 16, 2011, about 1626 Pacific daylight time, an experimental single seat North America P-51D, N79111, collided with the airport ramp in the spectator box seat area following a loss of control while maneuvering during an unlimited class gold heat race at the National Championship Air Races (NCAR) at Reno Stead Airport (RTS), Reno, Nevada. The airplane was registered to Aero-Trans Corp, Ocala, Florida, and operated by the pilot as Race 177, the Galloping Ghost, under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The commercial pilot and 10 people on the ground sustained fatal injuries; more than 60 people were treated for minor to serious injuries. The airplane fragmented upon impact with the ramp. Visual meteorological conditions prevailed, and no flight plan had been filed for the local air race flight, which departed RTS about 10 minutes before the accident.

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[1] All times are Pacific daylight time (PDT) based on a 24-hour clock, unless otherwise noted. Actual time of accident is approximate.

D. DETAILS OF THE INVESTIGATION

The survival factors group convened in September, 2011. The first meeting convened shortly after the accident date to review all race course design guidance, Federal Aviation Administration guidance, and emergency response planning and actions. Various meetings with group members were held during the following months to discuss the investigation and information received.

The Survival Factors Report consists of the following:

Section 1: Air Races and Course Design
Section 2: Emergency Response

SECTION 1: Air Races

1.0 Closed Course Air Racing Information

The National Championship Air Races (NCAR) is an annual event held at the Reno-Stead Airport in Reno, Nevada. The air races are comprised of seven different classes of aircraft including Unlimited, Jets, Super Sport, Sport, Biplane, Formula One, and T6. Each class conducts an aerial race within a closed course marked with various pylons.

The unlimited class is composed of various types of aircraft weighing in excess of 4,500 pounds, including North American P-51's, Hawker Sea Fury's, Grumman F8F's, Grumman F7F's, Yak 3 U's, Vought F4's, Curtis P-40's, and Focke Wulf 190's. Generally race speeds[2] of these aircraft range between 300 miles per hour to in excess of 500 miles per hour.

2.0 Air Race Closed Course Design

The Federal Aviation Administration (FAA) provides general guidance and samples of race course design within two separate publications, FAA Order 8900.1, *Flight Standards Information Management System*, Volume 3, Chapter 6, Section 3-151, and Advisory Circular (AC) 91.45C, Waivers: Aviation Events, Chapter 4.

FAA Order 8900.1 Volume 3, Chapter 6, Section 3-151, Item F, states that satisfactory pylon air race course design involves the shape of the course and its relationship to the area around the course, especially the spectator area(s). Both of these factors depend upon the maximum speed of the racing aircraft and the maximum g-loading[3] (acceleration forces) that the aircraft are expected to encounter when flying the racecourse in a normal manner. The maximum height at which the aircraft are expected to fly during the race is also a factor.

A maximum racing altitude of 250 feet is acceptable for aircraft weighing in excess of 1,000 pounds (lb) (presently, the AT-6/SNJ and the Unlimited class). A maximum racing altitude of 150 feet is acceptable for aircraft weighing 1,000 lb or less (presently the Formula One, Sport Biplane, and Formula V classes).

FAA guidance states that the maximum g-loading for a race aircraft flying the course in a normal manner should be 3.5 g's and notes that while maneuvering and when turbulence is encountered, momentary g-loads in excess of 3.5 g's would be expected. In addition, the angle of a turn or the change in course required to negotiate the turn should be planned to avoid forcing a race aircraft to make the turn too sharply and does not exceed 65 degrees of heading change was found to be satisfactory by the FAA. No definition on what constitutes a turn along the race course was found within both the FAA Order and AC.

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[2] Race speeds for aircraft are calculated using ground speeds based upon time to cover the ideal race course length.
[3] *G* is a unit of measurement that is equivalent to the acceleration caused by the earth's gravity (32.174 feet/second^2).

2.1 Minimum Turn Radius

Guidance further states that the aircraft speed and g-loads permit the calculation of the minimum radius turn that should be utilized in the design of the racecourse. The FAA provides a formula to calculate the minimum turn radius in both AC 91.45C and Order 8900.1.

AC 91.45C

$$R = \frac{V^2}{32.2 \times \sqrt{g^2 - 1}}$$

R= Minimum turn radius
V = Aircraft speed (ft/sec)
g = Max acceleration (ft/sec^2)
32.2 = Acceleration of gravity (ft/sec^2)

Order 8900.1

$$R = \frac{V^2}{32.2 \times \sqrt{g - 1}}$$

R= Minimum turn radius (feet)
V = Aircraft speed in ft/sec or
V = knots x 1.689
32.2 = Acceleration of gravity (ft/sec^2)
g = "*g*" force in turn

Figure 1: Minimum Turn Radius Calculation Formulas

A discrepancy was identified between the formulas used to calculate the minimum turn radius. As shown in Figure 1, the AC has a g-squared term in the denominator; whereas the formula within the Order does not.

2.2 Showlines

Both FAA Order 8900.1 and AC 91.45C discuss the distance required from the showline to the spectator area. The showline is defined as the edge of the raceway closest to the spectator area, in which no aircraft may cross while racing.

FAA Order 8900.1 Volume 3, Chapter 6, Section 3-151, Sub Section H, item 2, states, "...The minimum turn radius, the maximum turn angle, and the raceway width define the limits of a satisfactory race course. The race course relationship to the spectator areas or other populated area must also be defined. All racing classes require a distance of 500 feet between the primary spectator area and the showline."

In contrast, paragraph 54, item B in AC 91-45C states the following, "...Racing classes with a maximum speed of 250 miles per hour or less require a spacing of 500 feet between spectators and the showline. The unlimited racing class (or other new classes with speeds in excess of 250 miles per hour) requires a spacing of 1,000 feet between the spectator and the showline."

The showline specifications between the two documents differ by a factor of two. Whereas Order 8900.1 specifies a 500-foot distance between the primary spectator area and the showline for all race classes, AC 91.45C specifies two distances between spectators and the showline depending on race class operating speeds. The AC also does not distinguish between the primary spectator area and spectators in general.

2.3 Safety Distances

The guidance set forth within the FAA Order 8900.1 and AC 91.45C both state that additional safety areas are required to ensure that spectators are protected in the event debris leaves a race aircraft. Should this occur while the aircraft is in a turn, the debris will follow a path tangential to the turn from the moment it departs the aircraft. A theoretical straight-line distance to the point on the ground that debris will follow (ignoring air resistance) is based upon aircraft speed and altitude, and is defined as the scatter distance, which is outlined in Figure 2.

AC 91.45C

$$S = \mathrm{V} \times \sqrt{\frac{2 \times \mathrm{A}}{32.2}}$$

S = *Scatter Distance*
V = Aircraft speed (ft/sec)
A = Aircraft Altitude (AGL)
32.2 = Acceleration of gravity (ft/sec^2)

Order 8900.1

$$S = \mathrm{V} \times \sqrt{\frac{2 \times \mathrm{A}}{32.2}}$$

S = *Scatter Distance (feet)*
V = Aircraft speed (ft/sec)
(V = Knots x 1.689)
A = Maximum Aircraft Altitude (AGL) (150 or 250 feet)
32.2 = Acceleration of gravity (ft/sec^2)

Figure 2: Scatter Distance Formula

A theoretical location of all possible debris impact points from an aircraft that is in a turn is defined as a circle whose radius is the square root of the sums of the squares of the minimum turn radius and scatter distance. This is calculated using the scatter radius formula outlined in Figure 3. A typographical discrepancy was identified between the formulas used to calculate the safety radius. As shown in Figure 3, the AC has a Sr =; whereas the formula within the Order has S=.

AC 91.45C

$$Sr = \sqrt{(\mathrm{R}^2 + \mathrm{S}^2)}$$

Sr = Scatter Radius (feet)
R = Turn radius (feet)
S = Scatter distance (feet)

Order 8900.1

$$S = \sqrt{(\mathrm{R}^2 + \mathrm{S}^2)}$$

Sr = Scatter Radius (feet)
R = Turn radius (feet)
S = Scatter distance (feet)

Figure 3: Scatter Radius Formula

To provide an "acceptable margin of safety," the difference between the turn radius and scatter radius is multiplied by a safety factor of 1.5 and added to the turn radius to define the safety radius. This is calculated using the safety radius formula outlined in Figure 4.

AC 91.45C

$$Sfr = R + 1.5 \times (Sr - R)$$

Sfr = Safety radius (feet)
Sr = Scatter radius (feet)
R = Turn radius (feet)

Order 8900.1

$$Sfr = R + 1.5 \times (Sr - R)$$

Sfr = Safety radius (feet)
Sr = Scatter radius (feet)
R = Turn radius (feet)

Figure 4: Safety Radius Formula

2.4 Critical Turn

The FAA guidance in both the AC 91.45C and Order 8900.1 defines the critical turn with respect to the safety radius as the turn that enters the portion of the race course that is closest to the spectators.

The safety area is constructed by bisecting the course change angle for the critical turn. Order 8900.1 states that the minimum turn radius for the class of aircraft racing should be marked off, as shown in Figure 3-28A, from the pylon position to a point on the angle bisector; and draw an arc, whose radius is the safety radius.

The reference figure depicted within Order 8900.1 concerns aerobatic maneuvers, and is unrelated to race course design as shown in Figure 5. FAA personnel reported that the figure reference was a typographical error and should have referenced Figure 3-40 from FAA Order 8900.1.

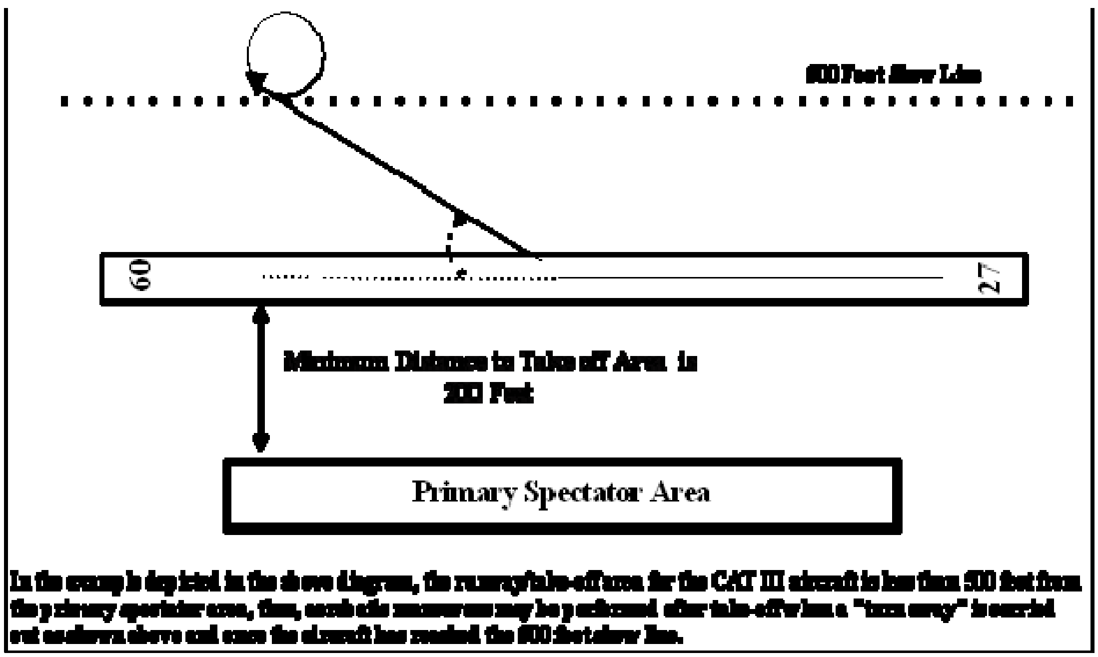

Figure 5: Figure 3-28A from FAA Order 8900.1

Both Order 8900.1 and AC91.45C stated that no spectators can be within this arc. A figure of this area, or safety radius, is provided within Order 8900.1 as shown within Figure 6.

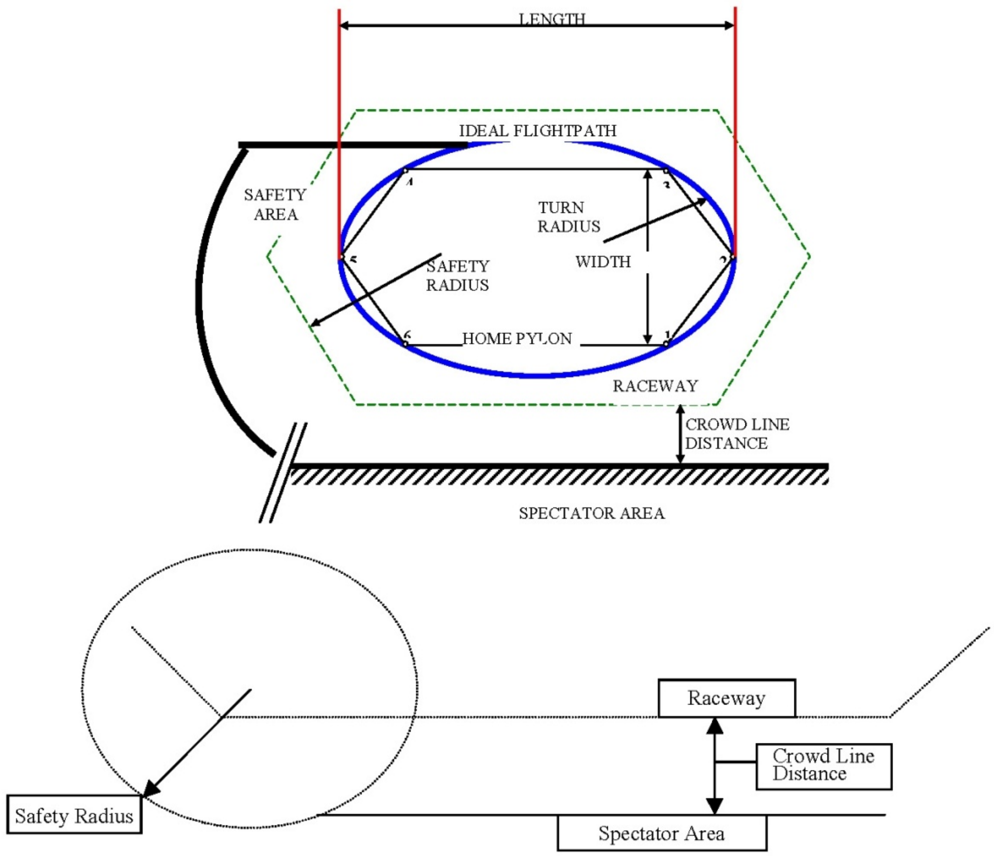

Figure 6: Figure 3-40 from FAA Order 8900.1

2.5 FAA Guidance

Further review of AC 91.45C and Order 8900.1 identified items that were outdated or missing. For example, the jet class and related specifications were within Order 8900.1, which was last revised in February, 2010, however, the AC, last revised in 1990, contained no discussion of the jet class, which was incorporated in 2002.

In addition, all references to speeds in Order 8900.1 and AC 91.45C are in miles per hour (mph), but neither document specifies if these speeds refer to groundspeed or airspeed. In addition, the NTSB notes that the FAA approved the NCAR unlimited race course based on an average aircraft operating speed of 500 mph; however, the Order and AC indicate maximum expected speed rather than average speed.

Throughout various correspondence with personnel from the FAA regarding Order 8900.1 and AC 91.45C, it was determined by the FAA that the guidance found within Order 8900.1 is the primary reference for race course design since its implementation in 2007 when it replaced the General Aviation Operations Inspector’s Handbook, 8700.1. In addition, FAA personnel stated that race course design information in Order 8900.1 was derived from 8700.1.

3.0 NCAR Race Course Design

The closed course design incorporated by the NCAR features four different course layouts for the various classes of race aircraft. Each course is marked with 7 to 10 pylons[4]. All four race courses share a similar path that extends along the southern edge of the race course area in front of the main spectator area, which includes the home pylon.

The unlimited race course features 10 pylons, including the home pylon[5] as depicted in Figure 7. The course distance is measured to be 8.4333 miles in length. Additional guide pylons are positioned between course pylons 3 and 4 and 6 and 7 to assist pilots in navigating the race course due to the longer lengths between these pairs of pylons.

Figure 7: NCAR Unlimited Race Course Overlaid onto Google Earth

[4] Course pylons are constructed out of a barrel mounted at the top of a telephone pole measured at a height of about 50-feet.
[5] Home pylon is a common pylon amongst all race courses that marks the end of a lap and finish of the race.

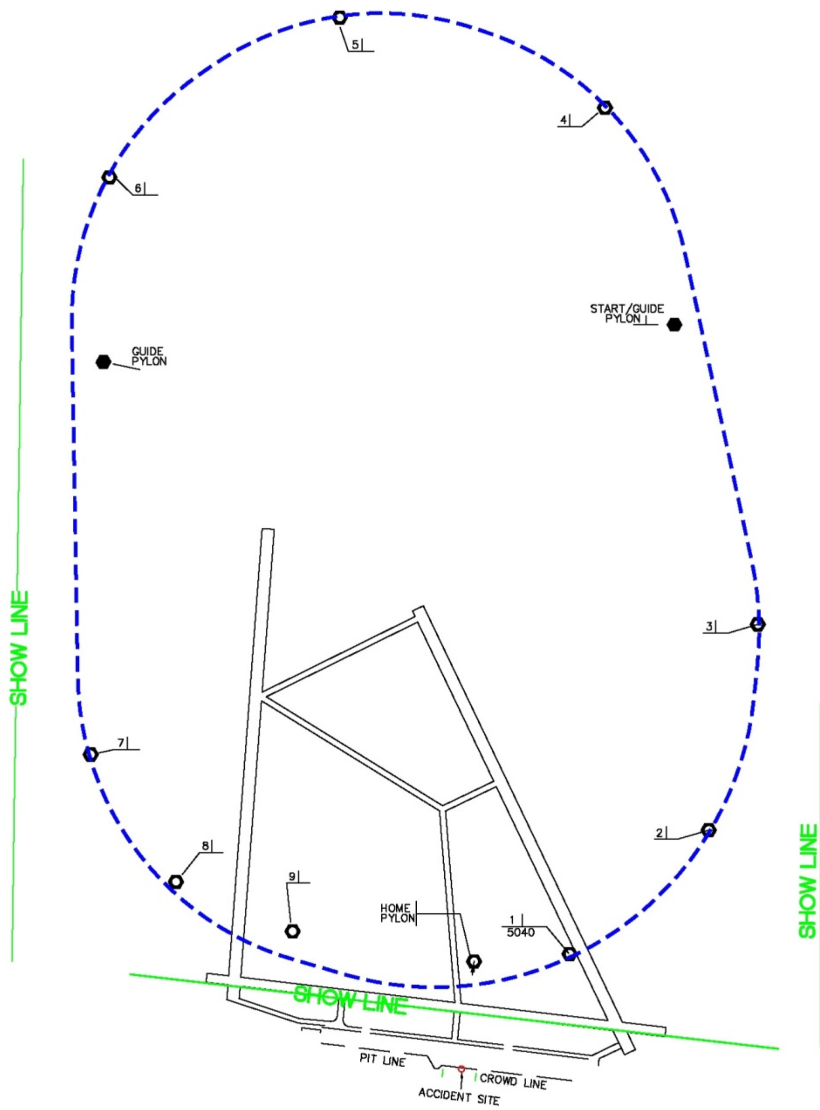

Figure 8: NCAR Unlimited Race Course.

3.1 Air Race Course Design Change History

Between 1982 and 2010, the NCAR race courses have underwent several documented [6]changes from being redesigned or modified for various reasons. The reasons included pylon relocation in order to reduce g-loads experienced by certain race classes, implementing additional safety areas due to new residential areas, and the implementation of new race classes. Additional changes were made to the measurement of the race courses as more accurate measurement equipment was used.

In 2003, RARA implemented the optimum race path (ORP) in order to obtain a more realistic average groundspeed throughout the course. RARA personnel stated that no changes were made

[6] No documented change history for the race course was produced prior to 1982.

to the location of pylons; however, the distance measured along the course was changed. Original distances were measured from pylon to pylon in a straight line. The implementation of the ORP provided a curved track that was found to be more representative of the actual path flown by the race aircraft.

The ORP was developed from using the calculated minimum turn radius for the specified class of aircraft. Due to the placement of the minimum turn radius being placed directly overhead the race pylons, the ORP incorporates a distance of five feet plus half of the wing span of the largest airplane in the particular race class from the center of the race pylon to assist in eliminating the possibility of pylon cutting and other penalties.

3.2 NCAR Race Course Design Safety Measures

The NCAR Unlimited race course incorporated minimum turn radius for aircraft at speeds of 500 miles per hour (mph) at 3.5 g's. However, safety areas for the race course were calculated by RARA and the NTSB using speeds of 550 miles per hour and the maximum race course altitude of 250 feet above ground level as shown in Figure 9 The safety radius for the unlimited race course throughout the three critical turn areas are shown in Figure 10, 11, and 12. The safety radius for pylons 5 and 6 as shown in Figure 12 extends over an area of vacant properties, which are clear of spectators during race operations.

Calculation Variables:	
Maximum Aircraft Altitude:	250 Feet Above Ground Level
Aircraft Speed (Miles Per Hour):	550 Miles Per Hour
G-Load:	3.5
Calculations Using FAA Guidance Formulas:	
Minimum Turn Radius:	6,024 feet
Scatter Distance:	3,178 feet
Scatter Radius:	6,812 feet
Safety Radius:	7,205 feet

Figure 9: Course Design Calculations for the 2011 NCAR Unlimited Race Course

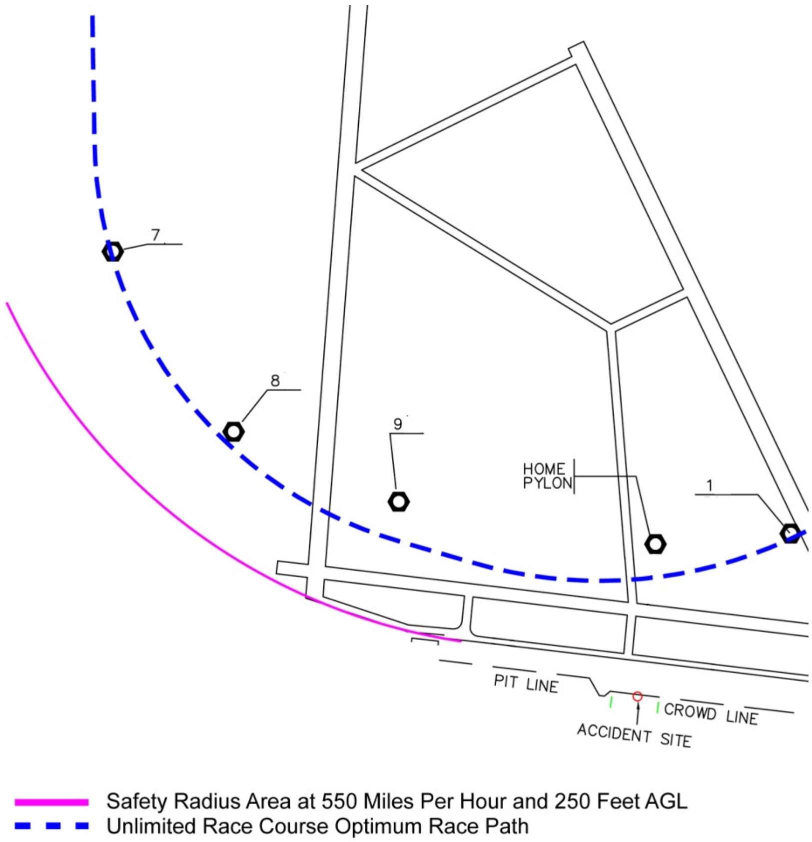

Figure 10: Critical Turn (Pylon 7-8-9) Safety Radius Plot

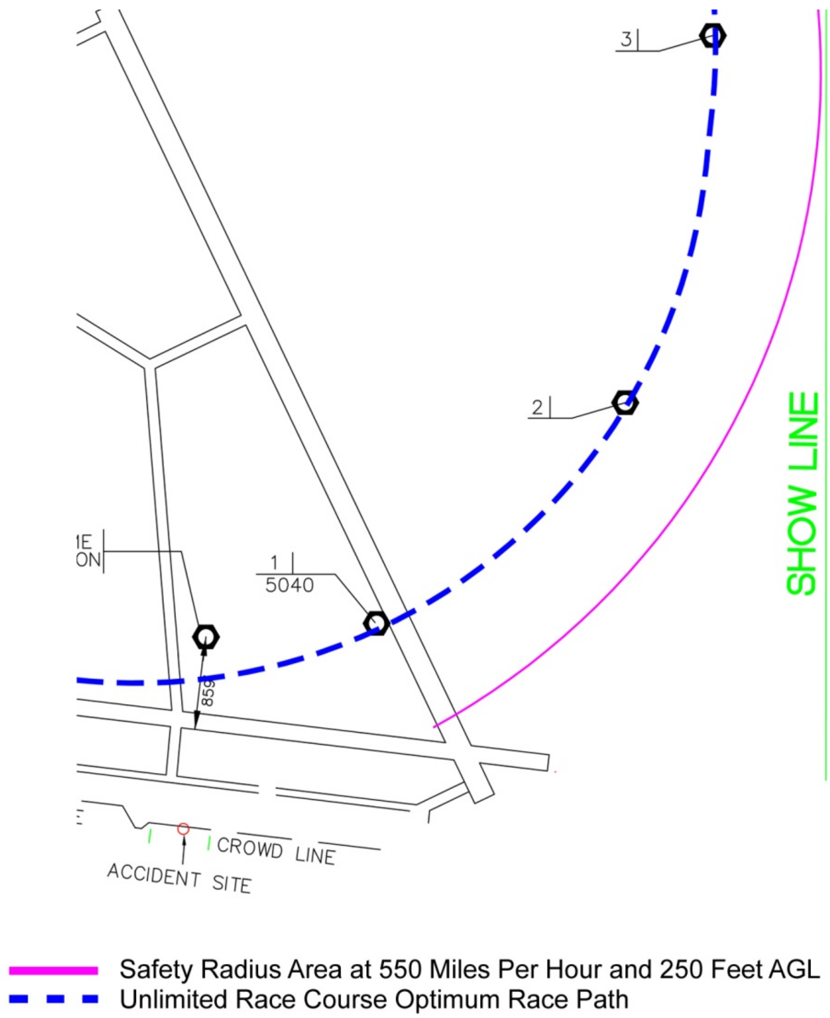

Figure 11: Pylon 1-2-3 Safety Radius Plot

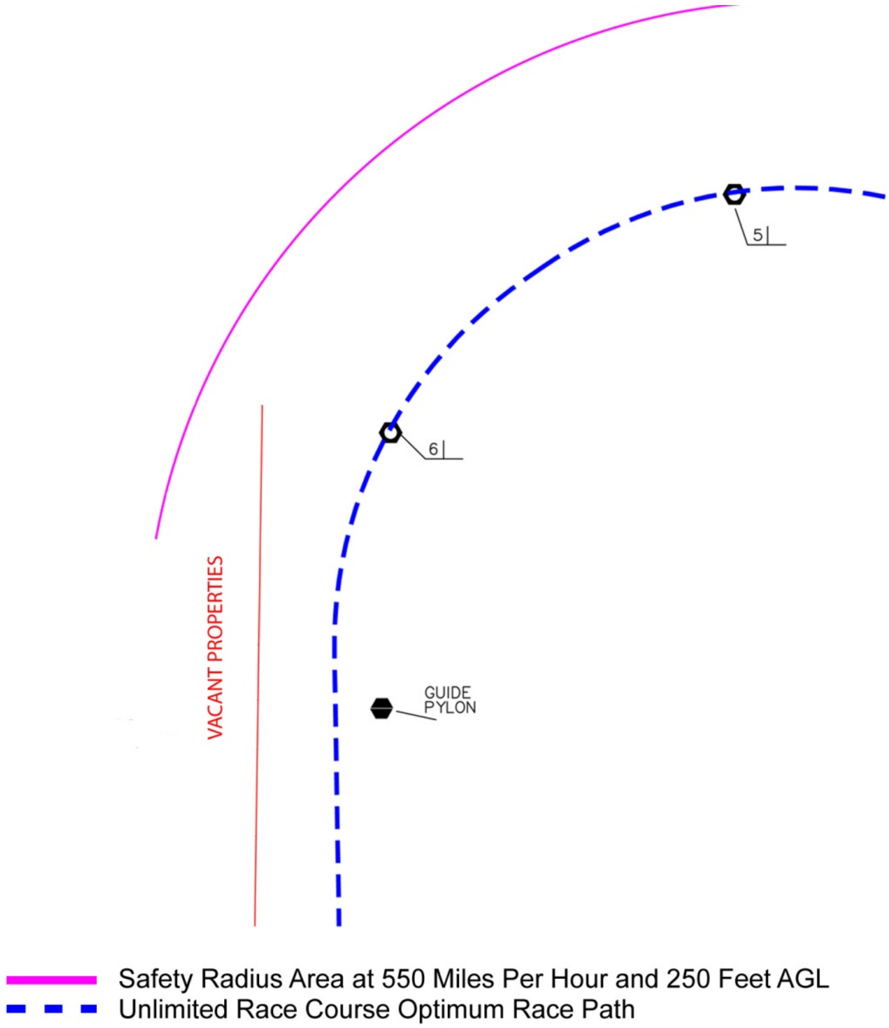

Figure 12: Pylon 5-6 Safety Radius Plot

3.3 Spectator Safety

During the 2011 NCAR event, the most northern edge of the main spectator area was positioned 874 feet from the showline. The edge of the pit area where many spectators were located was positioned 748 feet from the showline as depicted in Figure 13.

During the on-scene phase of the investigation, investigators also observed low-level metal fencing in front of the crew pits and between the box seating area and grandstand; only metal piping fitted with curtains is erected in front of the box seating area.

Investigators also observed the fuel truck for servicing unlimited class aircraft was parked on the ramp in front of the pit area west of the accident site, which was not damaged by debris.

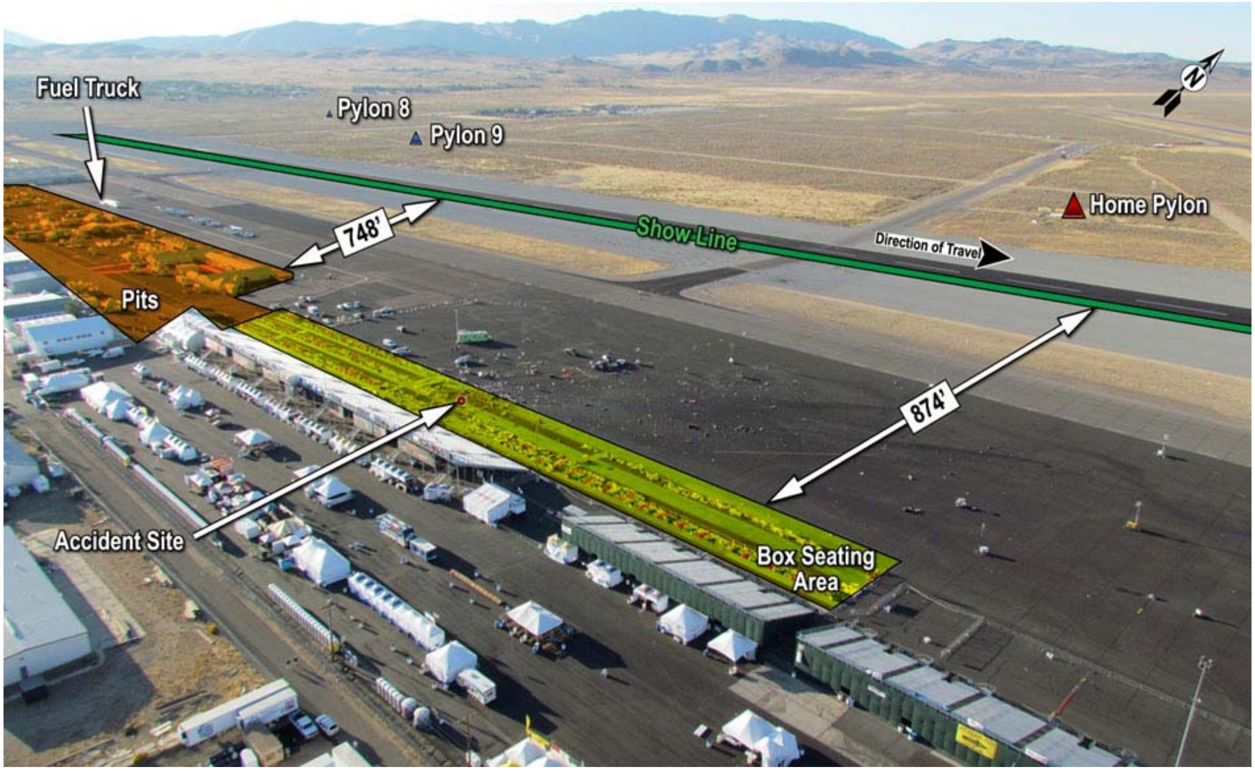

Figure 13: NCAR Ramp Area Layout

4.0 Federal Aviation Administration Air Race Waiver

The Certificate of Waiver or Authorization for the Reno Air Races was issued by the FAA on September 2, 2011. The waiver, outlined in FAA Form 7711-1, depicted the operations that were authorized. These included aerobatic demonstrations and closed course pylon racing within a 3 by 4 mile rectangle with the 3 mile side centered on and contiguous with a line parallel to and 250 feet north of the north edge of the main ramp of the Reno/Stead Airport, excluding the airspace above the spectators and congested areas. Aircraft speed in excess of 250 knots within a 5 mile radius of the home pylon for military and racing aircraft was authorized.

The FAA Waiver Attachment, FAA form 7711-2, notes that the following regulations were waived as part of the issued waiver:

91.111: Operating near other aircraft

(a) No person may operate an aircraft so close to another aircraft as to create a collision hazard.

91.117: Aircraft Speed

(a) Unless otherwise authorized by the Administrator, no person may operate an aircraft below 10,000 feet MSL at an indicated airspeed of more than 250 knots (288 m.p.h.).

(b) Unless otherwise authorized or required by ATC, no person may operate an aircraft at or below 2,500 feet above the surface within 4 nautical miles of the primary airport of a Class C or Class D airspace area at an indicated airspeed of more than 200 knots (230 mph.). This paragraph (b) does not apply to any operations within a Class B airspace area. Such operations shall comply with paragraph (a) of this section.

91.119: Minimum Safe Altitudes

(b) *Over congested areas.* Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

(c) *Over other than congested areas.* An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

91.121: Altimeter Settings

(a) Each person operating an aircraft shall maintain the cruising altitude or flight level of that aircraft, as the case may be, by reference to an altimeter that is set, when operating—

(1) Below 18,000 feet MSL, to—
(i) The current reported altimeter setting of a station along the route and within 100 nautical miles of the aircraft;
(ii) If there is no station within the area prescribed in paragraph (a)(1)(i) of this section, the current reported altimeter setting of an appropriate available station; or
(iii) In the case of an aircraft not equipped with a radio, the elevation of the departure airport or an appropriate altimeter setting available before departure; or

(2) At or above 18,000 feet MSL, to 29.92" Hg.

91.127: Operating on or in the vicinity of an airport in Class E airspace

(a) Unless otherwise required by part 93 of this chapter or unless otherwise authorized or required by the ATC facility having jurisdiction over the Class E airspace area, each person operating an aircraft on or in the vicinity of an airport in a Class E airspace area must comply with the requirements of §91.126.

(c) *Communications with control towers.* Unless otherwise authorized or required by ATC, no person may operate an aircraft to, from, through, or on an airport having an operational control tower unless two-way radio communications are maintained between that aircraft and the control tower. Communications must be established prior to 4 nautical miles from the airport, up to and including 2,500 feet agl. However, if the aircraft radio fails in flight, the pilot in command may operate that aircraft and land if weather conditions are at or above basic VFR weather minimums, visual contact with the tower is maintained, and a clearance to land is received. If the aircraft radio fails while in flight under IFR, the pilot must comply with §91.185.

91.303: Aerobatic Flight

(c) Within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport;

(d) Within 4 nautical miles of the center line of any Federal airway;

(e) Below an altitude of 1,500 feet above the surface; or

91.515: Flight Altitude Rules

(a) Notwithstanding §91.119, and except as provided in paragraph (b) of this section, no person may operate an airplane under VFR at less than—
(1) One thousand feet above the surface, or 1,000 feet from any mountain, hill, or other obstruction to flight, for day operations; and
(2) The altitudes prescribed in §91.177, for night operations.

Further review of the waiver revealed that items 43 through 53 within the special provisions attachment to the issued waiver stated in part that all flights conducted less than 1,000 feet agl shall be conducted north of the showline located on the south edge of runway 8/26 and within 1,000 feet horizontally of the depicted course. Race flight operations may be no closer than 500 feet horizontally from the primary spectator areas for all aircraft.

SECTION 2: Emergency Response

1.0 Emergency Response Plan

RARA incorporates an Emergency Services Manual (ESM) as part of their NCAR operations. The manual outlines general items such as daily briefing requirements, organization charts, communication methods, fire operations, emergency medical service operations, law enforcement operations, and logistical operations.

As part of RARA's Emergency Services Manual, a mass-causality event is discussed. The plan includes the pre-positioning of various resources and follows the established Washoe County Multi-Casualty Incident Plan. The response plan further outlines that in the event of a multi-casualty incident at the air races, the command structure and emergency resources are in place to immediately start managing the incident.

Daily briefings are conducted by the first responders as part of the emergency services plan. These briefings include discussions about training for a multi-casualty incident specific to the air races and the use of "SMART Triage.[7]"

[7] SMART Triage System incorporates the usage of red, yellow, green, and black tags or tarps to insure the correct patient is transported to the correct hospital for their medical needs. Red requires immediate response within 30 minutes, yellow requires care within 30 minutes to several hours, green requires care that may be delayed for several hours or days, and black is the fatally injured.

A multi-casualty table top exercise is conducted every other year with participating agencies and RARA. Additional resources pre-positioned on scene at the air races to assist with a multi-casualty incident include: Airport Authority Multi-Casualty Apparatus, Washoe County Coroner, Care Flight Medical Helicopter, Army National Guard, and Fallon Search and Rescue Helicopters, in addition to direct communications with regional dispatch and Regional Emergency Medical Services Authority (REMSA) dispatch centers,

1.1 Emergency Response Tabletop Exercise

As part of RARA's Emergency Operations Plan, a mass casualty response table top discussion was conducted on June 2, 2011, by representatives of RARA, FAA, Washoe County Fire Agencies, Washoe County Law Enforcement Agencies, Washoe County Coroner’s Office, Washoe County Emergency Management, Nevada Air and Army National Guard units, Regional Emergency Medical Services Authority (REMSA), and Washoe County hospitals.

The scenario for the exercise was for 23 fatalities with an additional 46 injured. As a result of the table top exercise and the request of the incident commander, the Nevada Highway Patrol decided that in the event of a mass casualty accident during the NCAR, State Highway 395 would be shut down to allow better travel time for multiple ambulances.

In addition, many of the same local agencies that participated in the table top discussion also attended and participated in the Reno Tahoe International Airport triennial full-scale emergency exercise, which was conducted on May 25, 2011.

2.0 Emergency Responders and Equipment Layout

The Emergency Service Manual discusses the positioning of first responders and their assigned duties. In the event of an accident, the Rapid Response Team is to work in coordination with the Emergency Service personnel on scene and under the direction of the Incident Commander (IC). Emergency response units are positioned throughout the airport as depicted in Figure 14.

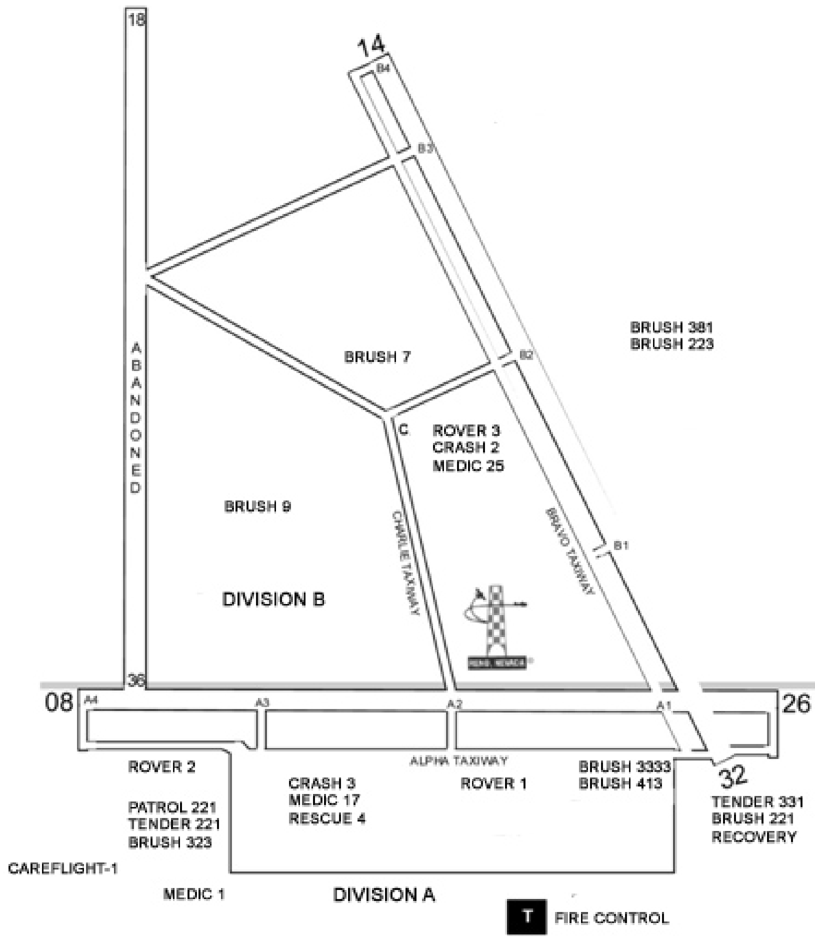

Figure 14: Emergency Equipment/Responder Locations

2.1 Fire Branch

The Fire Branch is divided into two divisions, Alpha and Bravo. Both divisions have the following geographical boundaries. Division Alpha handles incidents along the length of runway 08-26 and everything south. This includes the entire tarmac area, pits, fueling area, start-up area, static display, hangers, spectator area, grandstand, and vendor area. Division Bravo handles all incidents north of runway 8-26. This includes runway 14-32, the abandoned runway, taxiways Bravo and Charlie, and all race courses.

2.2 Rover Units

A Rover is an emergency response apparatus especially designed for quick response to emergencies involving race aircraft. The rover vehicle is a fast moving four wheel drive vehicle that is equipped with fire suppression equipment, forced entry tools, and self-contained breathing apparatus' for the two crew members. Rovers at the Reno Air Races are staffed with highly experienced first responders. During the air races, three or four rovers are staffed. Their primary objective is to get to a mayday race aircraft as soon as possible and provide response services as needed. A secondary objective for a Rover in Division Alpha is to move around the area and look for potential fire and or safety problems in the Division. According to RARA, Rovers have been very effective at the Reno Air Races reducing the average time of arrival at wheel stop of a mayday race aircraft to approximately 10 to 15 seconds or less. However, Rovers are not effective on large fires as a result of catastrophic crashes due to the Rover's limited fire suppression capability.

2.3 Mobile Medics

Medics on mobile modes of transportation (Segways) patrol all of the areas populated by the attendees to the event, and administer first aid as needed or requested.

2.4 Care Flight and other Helicopters

The Care Flight helicopter was stationed at the west end of the tarmac area. The helicopter may also be stationed at Reno-Stead Airport on standby during other times at the discretion of REMSA Dispatch. During the accident race, the Care Flight helicopter was pre-positioned at the Reno-Stead Airport. In addition, the Nevada Army National Guard may allow for a helicopter to be used in a mass casualty situation.

2.5 On Site Accident Response

In the event of an on-site accident north of the showline, including the minor damage of an aircraft or loss of parts from an aircraft, the responders shall comply with instructions from the on-scene IC to protect the scene of an accident or recover parts lost from an aircraft in flight. If local law enforcement agencies are on scene, they will be primary, and RARA security staff will assist them as requested.

In the event of a serious on-site aircraft emergency or accident within the NCAR race course or other controlled area, the Law Enforcement Branch Director[8] in the fire control tower shall assume control of the law enforcement response, and will coordinate the response of RARA security staff and law enforcement officers. The Law Enforcement Branch Director will consult with the Incident Commander with input from the Security Director regarding the need for offsite resources and will make the request directly or via the communications center. An additional law enforcement supervisor may respond directly to the aircraft emergency/mishap site when directed to do so by the IC.

The Security Director and security resources will work with law enforcement responders to assure the safety of emergency responders and integrity of the aircraft emergency/mishap site. Specific law enforcement personnel will be assigned perimeter security duties at the direction of the Law Enforcement Branch Director. RARA security staff, and motorcycle officers if on site, shall take positions on the ramp to prevent spectators, pit crews, and other non-essential personnel from responding to the aircraft emergency/mishap site. Ingress traffic should be

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[8] The Law Enforcement Branch Director is a Law Enforcement Officer assigned to the Fire Control Tower and works in close partnership with the Director of Security. The Law Enforcement Branch Director is responsible for law enforcement incident activities including the development and implementation of strategic decisions, and for the approving, ordering, and releasing law enforcement resources.

monitored to ensure that only essential personnel are permitted access to the aircraft accident site.

On-scene law enforcement officers will make every attempt to aid families and friends of an aircraft emergency/mishap victim as the situation warrants. No law enforcement or security officer shall respond to an aircraft emergency/mishap site unless specifically directed by the Law Enforcement Branch Director or Security Director.

2.6 Off-Site or Accidents Outside of the Controlled Areas

Emergency response of law enforcement personnel and RARA Security staff to an off-site accident will be coordinated through the Fire Control Tower. The IC and Law Enforcement Branch Director will monitor the response of other on-duty fire and law enforcement personnel and determine the extent and need of response by resources assigned to the air race event.

2.7 RARA Rapid Response Team

RARA has designated two Rapid Response Team(s) that are comprised of four individuals per team, two team's total. The teams will be made up of RARA officials. On aircraft accidents, on or off site, a single team shall respond to the accident while the other team remains at the air race site. The objectives of a Rapid Response Team are to secure the crash site, limit access to the site with barrier tape, marking of important items, preserving evidence for the FAA and NTSB, and relaying critical site information to RARA officials.

3.0 Initial Response

REMSA declared a Mass-Casualty Incident (MCI) at 1626. Within 62 minutes of the MCI declaration, all critical patients had been triaged and en route to hospitals. Initial treatment was being provided to those who were injured that still needed medical care at the scene. To assist in transportation of patients, State Highway 395 was partially shut down for ambulance traffic.

It was noted during the initial response that cell phone communications were intermittent due to the high frequency of cell phone usage following the accident. It was reported by REMSA that Verizon Cell Phones did not work for approximately 15 to 20 minutes during the initial response.

In addition, trauma blankets were distributed on scene from the RTAA mass casualty vehicle as well as other responder vehicles, which were yellow in color. Further review of videos supplied as part of the investigation revealed that spectators were removing the red and blue cloth drapes used within the box seating areas in an effort to assist the wounded.

An RTAA representative reported that within the months following the accident, the mass-casualty response vehicle was restocked with neutral color blankets.

Investigators on-scene noted that the initial response by first responders was done in a prompt, orderly manner. The incident commander reported that all prepositioned first responders immediately arrived on scene and vehicles remained on the outer perimeter of the wreckage debris area, thus preserving perishable wreckage and impact evidence.

In addition, investigators observed the announcing team, despite being in the immediate proximity of the accident site, appeared to have remained calm and provided clear guidance via the public announcement system to the spectators for evacuation procedures as well as provided assistance to first responders by requesting additional help from medical staff on scene.

Submitted by:

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