

UNITED STATES AIR FORCE  
**AIRCRAFT ACCIDENT INVESTIGATION**  
**BOARD REPORT**



**TARS, T/N 4220**  
**MARFA, TEXAS**



**LOCATION: MARFA, TEXAS**

**DATE OF ACCIDENT: 14 FEBRUARY 2012**

**BOARD PRESIDENT: LT COL SCOTT S. COLE**

**Conducted IAW AFI 51-503, *Aerospace Accident Investigations***

**EXECUTIVE SUMMARY**  
**AIRCRAFT ACCIDENT INVESTIGATION**  
**TARS, T/N 4220, Marfa, Texas**  
**14 February 2012**

The Tethered Aerostat Radar System (TARS) is a program managed by Air Combat Command's Acquisition Management and Integration Center. ITT Exelis is the contractor responsible for operating and maintaining the Marfa TARS, which is manned solely by ITT personnel.

The mishap aerostat (MA) was launched on 14 Feb 12 from the Marfa TARS Site, Texas at 0421 Zulu (Z) (2321 local time), Flight #535, and remained aloft until recovery operations that culminated in the mishap. At 2115Z the Mishap Flight Director 1 (MFD 1) received an erroneous surface wind warning cancellation from the Mishap Telemetry and Control 1 (MT&C 1). This was not a cancellation, but an upgrade from a watch to a warning. The MFD 1 had knowledge of, and was briefed, on the upper level turbulence and pending high surface level winds from an electronic briefing received at 2300Z. At 2344Z, upper level winds and turbulence caused the MFD 1 to begin an adjustment. At 2350Z this adjustment became a recovery.

The Mishap Flight Crew 1/2 (MFC 1,2) that attempted recovery was a combined team of both the outgoing "B" crew and the incoming "A" crew. The joint MFC began recovery of the MA during shift changeover. At 0016:34Z the MA was hit by 55.2 knots (kts) of wind at 5720' MSL. The surface winds at this time were SSW at 22 kts. Due to the severe winds on the MA the Mishap Winch Operator 1 (MWO 1) made the decision to rapidly outhaul the MA. During this outhaul the MA began the pitch-over which culminated with impact into the ground at 0017:13Z. The MA ruptured and completely destroyed the airframe and associated equipment.

The total loss and damage was estimated at \$8,819,488.00. There were no injuries or significant damage to private property. Less than 1 gallon of diesel fuel spilled and was immediately cleaned up and disposed of at a cost of \$147.00.

The AIB President found by clear and convincing evidence that the cause of the mishap was a delayed decision to recover the MA. Additionally, the AIB president found by a preponderance of the evidence, that the lack of training for the flight directors on weather data interpretation and their lack of training on weather equipment use, as well as the erroneous surface wind warning cancellation were significant contributing factors to the mishap.

*Under 10 U.S.C. § 2254(d), any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.*

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**SUMMARY OF FACTS AND STATEMENT OF OPINION**  
**TARS, T/N 4220**  
**14 February 2012**

**TABLE OF CONTENTS**

<b>TABLE OF CONTENTS .....</b>	<b>i</b>
<b>COMMONLY USED ACRONYMS &amp; ABBREVIATIONS.....</b>	<b>iii</b>
<b>SUMMARY OF FACTS .....</b>	<b>1</b>
<b>1. AUTHORITY AND PURPOSE .....</b>	<b>1</b>
a. Authority .....	1
b. Purpose .....	1
<b>2. ACCIDENT SUMMARY .....</b>	<b>1</b>
<b>3. BACKGROUND .....</b>	<b>2</b>
a. Units and Organization.....	2
(1) Air Combat Command (ACC).....	2
(2) Acquisition Management and Integration Center (AMIC).....	2
(3) ITT Exelis .....	2
(4) Marfa TARS Site.....	2
B. AEROSTAT: TETHERED AEROSTAT RADAR SYSTEM .....	3
(1) Mission.....	3
(2) Features.....	3
(3) Flight Crew Recovery Positions.....	4
<b>4. SEQUENCE OF EVENTS .....</b>	<b>5</b>
a. Summary of Previous Missions .....	6
b. Planning.....	6
c. Pre-flight.....	6
d. Summary of Accident.....	6
e. Impact.....	8
f. Egress and Aircrew Flight Equipment .....	8
g. Search and Rescue .....	8
h. Recovery of Remains .....	8
<b>5. MAINTENANCE.....</b>	<b>8</b>
a. Forms Documentation .....	8
b. Inspections.....	9
(1) Aerostat Preventive Maintenance Inspection (PMI) .....	9
(2) Mishap Tether .....	9
c. Maintenance Procedures .....	10
d. Maintenance Personnel and Supervision.....	10
e. Fuel, Hydraulic and Oil Inspection Analysis .....	10
f. Unscheduled Maintenance .....	10

<b>6. AIRCRAFT AND AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS.....</b>	<b>10</b>
a. Condition of Systems .....	10
b. Engineering Evaluations and Analyses .....	10
<b>7. WEATHER .....</b>	<b>11</b>
a. Forecast Weather .....	11
b. Observed Weather .....	12
c. Operations .....	13
<b>8. CREW QUALIFICATIONS .....</b>	<b>14</b>
<b>9. MEDICAL.....</b>	<b>14</b>
a. Qualifications .....	14
b. Health .....	14
c. Pathology.....	14
d. Lifestyle.....	14
e. Crew Rest and Crew Duty Time.....	14
<b>10. OPERATIONS AND SUPERVISION .....</b>	<b>15</b>
a. Operations .....	15
b. Supervision.....	15
<b>11. HUMAN FACTORS ANALYSIS .....</b>	<b>15</b>
a. AV 002 Violation – Routine/Widespread .....	16
b. AE201 Risk Assessment – During Operation:.....	16
c. AE301 – Error due to Misperception: .....	16
d. PC504 - Misperception of Operation Conditions: .....	17
e. PC505 – Misinterpreted/Misread Instrument: .....	17
f. PP106 – Communicating Critical Information: .....	17
g. PP109 – Mission Planning: .....	17
h. PP112 – Miscommunication: .....	18
i. SI003 – Local Training Issues/Programs: .....	18
j. SV004 – Currency: .....	18
k. OP004 – Organizational Training Issues/Programs: .....	18
<b>12. GOVERNING DIRECTIVES AND PUBLICATIONS.....</b>	<b>19</b>
a. Primary Operations Directives and Publications .....	19
b. Known or Suspected Deviations from Directives or Publications .....	19
<b>13. ADDITIONAL AREAS OF CONCERN .....</b>	<b>19</b>
<b>STATEMENT OF OPINION.....</b>	<b>20</b>
<b>1. OPINION SUMMARY .....</b>	<b>20</b>
<b>2. DISCUSSION OF OPINION .....</b>	<b>21</b>
a. Cause .....	21
b. Substantially Contributing Factor .....	21
<b>3. CONCLUSION.....</b>	<b>21</b>

## COMMONLY USED ACRONYMS & ABBREVIATIONS

§	Section	MFC	Mishap Flight Crew
A <sub>o</sub>	Operational Availability	MFD	Mishap Flight Director
ACC	Air Combat Command	MSM	Mishap Site Manager
AFI	Air Force Instruction	MWO	Mishap Winch Operator
AFTO 95	Air Force Technical Order Form 95	MOA	Minimum Operating Altitude
AIB	Accident Investigation Board	MSL	Mean Sea Level
AMIC	Acquisition Management and Integration Center	NM	Nautical Miles
AMOC	Air Marine Operations Center	OWS	Operational Weather Squadron
APGS	Airborne Power Generation System	PMI	Preventive Maintenance Inspection
CH1	Close Haul (Port Side) Operator	OI	Operating Instruction
CH2	Close Haul (Starboard) Operator	RDD	Rapid Descent Device
CDRL	Contract Data Requirements List	REC	Recorder
DAR	Daily Activity Report	SBIO	Safety Board Investigating Officer
DPM	Deputy Program Manager	SBP	Safety Board President
DS7i	DataStream 7i	SM	Site Manager
FAE	Functional Area Expert	SOP	Standard Operating Procedure
FD	Flight Director	T&C	Telemetry and Control
FMS	Fixed Mooring Site	TARS	Tethered Aerostat Radar System
FP	Fin Pressure	TCC	TARS Control Center
GMW	General Maintenance Worker	TFD	Tether Footage Deployed
GPS	Global Positioning System	TSC	TARS Support Center
GSHS	Ground State of Health System	TPM	TARS Program Manager
JTP	Job Training Package	TX	Transmit
LA	Legal Advisor	UPS	Uninterruptable Power System
MA	Mishap Aerostat	U.S.	United States
MBS	Minimum Break Strength	USAF	United States Air Force
MCH1	Mishap Close-haul (Port Side) Operator	UTC	Universal Time Coordinated
MCH2	Mishap Close-haul (Starboard) Operator	WO	Work Orders
		Z	Zulu or Greenwich Mean Time

The above list was compiled from the Summary of Facts, the Statement of Opinion, the Index of Tabs, and Witness Testimony (Tab V).

All times listed in this report are in Zulu (Z) time (Greenwich Mean Time). For Zulu times listed in this accident report, the local Marfa, Texas time is Zulu time minus 6 hours. Additionally, altitudes are listed in mean sea level (MSL). The Marfa TARS Site elevation is 4,702 feet MSL.

## SUMMARY OF FACTS

### 1. AUTHORITY AND PURPOSE

#### a. Authority

On 8 March 2012, Lieutenant General William J. Rew, Vice Commander, Air Combat Command (ACC), appointed Lieutenant Colonel Scott S. Cole as the Accident Investigation Board (AIB) President to investigate the 14/15 February 2012 mishap of a Tethered Aerostat Radar System (TARS), Tail Number (T/N) 4220. An AIB was conducted at Laughlin Air Force Base, Texas, from 13 March 2012 to 4 April 2012, pursuant to Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*. A Legal Advisor (LA), Recorder (REC), TARS Advisor, and Weather Functional Area Expert were also appointed (Tabs Y-3 and Y-5).

#### b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the aircraft or aerospace accident, to prepare a publicly-releasable report and to gather and preserve all available evidence for use in litigation, claims, disciplinary actions, administrative proceedings, and for other purposes.

### 2. ACCIDENT SUMMARY

The mishap aerostat (MA) was launched for Flight #535 at 0421Z on 14 February 2012 (2321L on 13 February) from the Marfa TARS site in Marfa, Texas and remained aloft until recovery operations on 15 February 2012 that ended with the mishap (Tab K-8 - K-11). From 12-15 February 2012 a pre-frontal trough, ahead of a low pressure system moving southeast, caused significant surface and upper level winds at the Marfa, Texas TARS site (Tab F-18). At 2100Z the mishap Flight Director 1 (MFD 1) made an uneventful adjustment from 9,700' MSL to 8,900' MSL due to turbulence (Tab K-10). At 2344Z the MFD 1 directed another adjustment which subsequently changed to a recovery at 2350Z due to winds and turbulence (Tabs K-10 and V-2.3). At 0016:34Z the MA was hit with 55kt winds and surface winds started an increase up to 30kts (Tab K-6). At 0016:47Z the inhaul for recovery was stopped by the mishap Winch Operator 1 (MWO 1) and an outhaul was commenced due to excessive tether tension and winds aloft (Tab V-4.5). At this time the MA begin a left roll and a pitch-down (Tab K-6). At 0017:07Z the MA was in a 40left roll and a 60° nose low attitude (Tab K -6). It was in this attitude that the MA impacted the ground at 0017:13Z (Tabs S-9 and K-6). The total cost for the destroyed MA, payload, and aerostat equipment is approximately \$8,819,488.00 (Tab P-3). There was no significant damage to private property (Tab P-5). Clean-up cost for the spill of less than 1 gallon of diesel fuel is estimated at \$147.00 (Tab P-3).

### 3. BACKGROUND

#### a. Units and Organization

##### (1) Air Combat Command (ACC)

Air Combat Command is the primary force provider of combat airpower to America's war fighting commands (Tab CC-5). To support global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management and electronic-combat aircraft (Tab CC-5). It also provides command, control, communications and intelligence systems and conducts global information operations (Tab CC-5).



##### (2) Acquisition Management and Integration Center (AMIC)

AMIC is headquartered at Joint Base Langley-Eustis, VA and acts as a single leadership focal point for oversight of command service acquisition programs (Tab CC-12). AMIC aligns program management, functional support, quality assurance, and contracting in a single organization to produce mission-focused acquisitions (Tab CC-12). The TARS program is government managed by AMIC (Tab CC-20).

##### (3) ITT Exelis

ITT Exelis is a diversified, top-tier global aerospace, defense and information solutions company with strong positions in enduring and emerging global markets. Exelis is a leader in networked communications, sensing and surveillance, electronic warfare, navigation, air traffic solutions and information systems with growing positions in cyber security, composite aerostructures, logistics and technical services (Tab CC-35 to CC-36). ITT Exelis was awarded the TARS Program contract and took responsibility for operating and maintaining all TARS sites in October 2008 (Tab CC-16).



##### (4) Marfa TARS Site

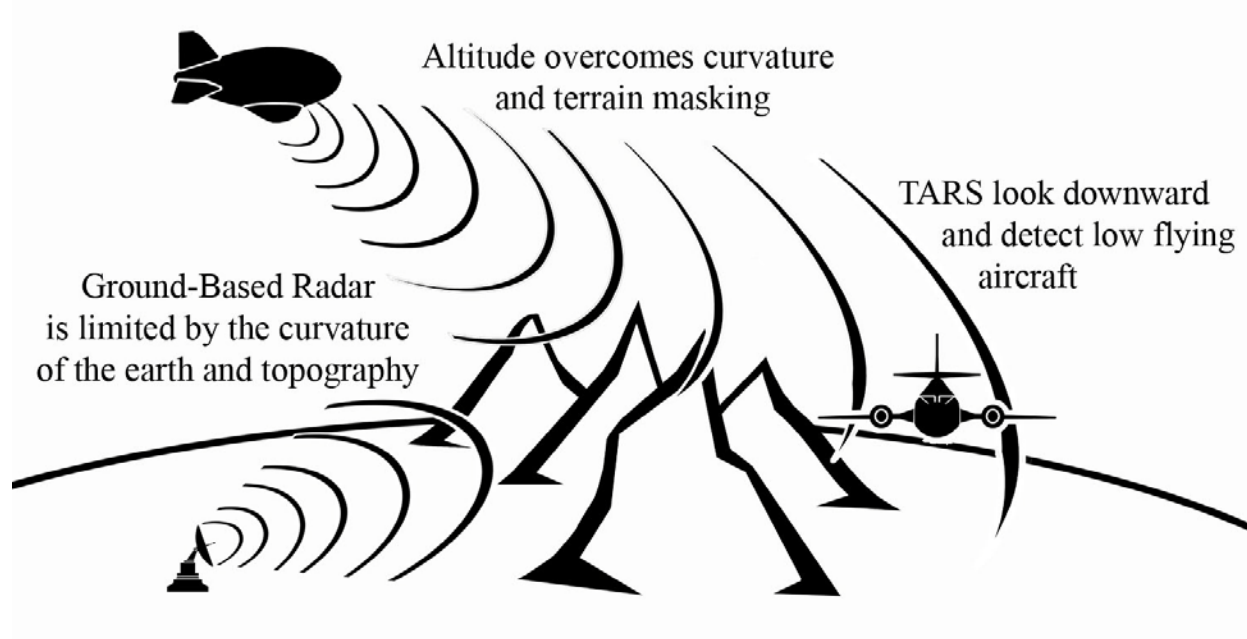
The Marfa TARS site is located on a 23-acre parcel of land in Presidio County, Texas, approximately twenty miles northwest of the city of Marfa (Tab CC-37). The property on which the equipment is sited is privately-owned by a local rancher (Tab CC-29). The use of the land and the operation of Marfa TARS is accomplished in accordance with the provisions outlined in a 2008 Lease Agreement between the landowner and the United States Air Force. The TARS site is operated and maintained by contractor, ITT Exelis (Tab CC-20).



## b. Aerostat: Tethered Aerostat Radar System

### (1) Mission

The TARS is an aerostat-borne, surveillance program (Tab CC-3). Using the aerostat as a stationary airborne platform for surveillance radar, the system is capable of detecting low-altitude aircraft at the radar's maximum range by mitigating curvature of the earth and terrain masking limitations (Tab CC-3). The TARS provides detection and monitoring capability along the U.S.-Mexico border, the Florida Straits and a portion of the Caribbean in support of the Department of Defense Counter-drug Program (Tab CC-3). The primary agencies using the TARS surveillance data include U.S. Northern Command in support of Customs and Border Protection (Air and Marine Operations Center and Caribbean Air and Marine Operations Center) and U.S. Southern Command in support of Joint Interagency Task Force-South (Tab CC-3). In addition to its counter-drug mission, TARS surveillance data also supports North American Aerospace Defense Command's air sovereignty mission for the continental United States (Tab CC-3).



Tab U-328

### (2) Features

The TARS consists of four major parts: the aerostat and airborne support equipment, the radar payload, the tether and winch system, and the ground station (Tab CC-3). The aerostat used on the TARS program is a large fabric envelope filled with helium and air (Tab CC-3). The hull of the aerostat contains two chambers separated by a gas tight fabric partition. The upper chamber is filled with helium, which provides the aerostat its lifting capability and the lower chamber is a pressurized air compartment (air ballonet) (Tab CC-3). The aerostat hull is constructed of a lightweight Tedlar fabric that is resistant to environmental degradation, minimizes helium

leakage and provides structural strength to the aerostat (Tab CC-3). There is also a pressurized windscreen compartment underneath the aerostat that contains and protects the radar (Tab CC-3). A sophisticated system of sensors, blowers and valves controls the air pressure within the air ballonet, maintaining the aerostat's aerodynamic shape (Tab CC-3).

The TARS program uses two different sizes of aerostats, categorized by volume (Tab CC-3). The 275,000 cubic foot, or 275K, aerostat is 186 feet long and 62.5 feet in diameter and the 420,000 cubic foot, or 420K, aerostat is 208.5 feet long and 69.5 feet in diameter (Tab CC-3). The 420K aerostat is the size in operation at Marfa (Tab D-3). These aerostats can rise up to 15,000 feet mean sea level (MSL), while tethered by a single nylon and polyethylene constructed tether (Tab CC-3). The normal operating altitude varies by site, but the norm is approximately 12,000 feet MSL (Tab CC-3). Aerostat power is developed by an on-board, Airborne Power Generation System (APGS) 400 Hertz generator (Tab CC-3).

The TARS program currently uses a Lockheed Martin L-88A or L-88(V)3 radar (Tab CC-3). The Marfa site operates an L-88A (Tab D-3). All radar data is transmitted to the ground station then digitized and fed to the various control centers for display (Tab CC-3). The ground station is where a flight director, seated before banks of meters and television screens, monitors the aerostat's performance (Tab CC-3). A Doppler weather radar, wind profiler and ground weather station are installed at each site to support flight operations (Tab CC-3). Each site also obtains forecasts and weather warnings from the servicing Operational Weather Squadron (OWS) and a sub-contracted weather provider, GEOMET (Tabs U-326, W-119).

Operators launch the aerostat from a large circular launch pad containing a mooring system (fixed or mobile), depending on the site configuration (Tab CC-3). The Marfa site uses a fixed mooring system (FMS) (Tab CC-21). The mooring system contains a large winch capable of holding 23,500 feet of tether cable (Tab CC-3). When the aerostat is lowered, it is secured to a mooring tower. While moored, the aerostat weathers with the wind (Tab CC-4).

### (3) Flight Crew Recovery Positions

The basic crew positions required to recover an aerostat from flight are flight director, winch operator, two close-haul operators, and telemetry & control (T&C) operator. The basic responsibilities of the positions during a recovery are outlined below (Tab U-327).

**Site Manager:** The Site Manager's basic duties include but are not limited to management of site operations and personnel. Site managers may also be trained as flight directors (Tab U-327).

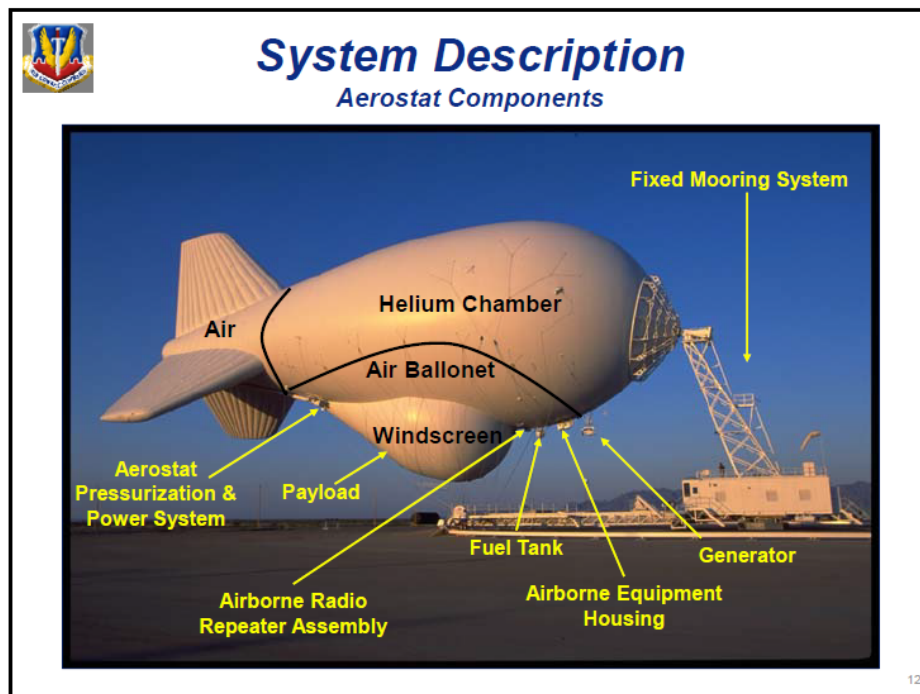
**Flight Director:** Basic duties during recovery include but are not limited to announcing aerostat recovery and sending notifications to TARS Control Center (TCC), conducting recovery briefings, managing pad crew operations, maintaining communication with flight crew, and evaluating weather conditions. Flight director doubles as the nose rope operator at FMS sites and attaches the messenger cable to the nose rope and commands operation of the nose winch (Tab U-327).

Winch Operator: The winch operator duties are to observe the flight director/nose rope operator for directions on how fast and what direction to inhaul and outhaul the tether. The winch operator is ultimately responsible for moving the aerostat via the tether to the designated operating altitude or inhaul for mooring (Tab U-327).

Close-haul 1 Operator: The close-haul operator 1 (aerostat port side) duties include but are not limited to attaching the aerostat close-haul ropes to the close winch and monitoring close-haul line during in haul. Operator may also have duties to monitor levelwind tether reel in rear of FMS (Tab U-327).

Close-haul 2 Operator: The close-haul operator 2 (aerostat starboard side) duties include but are not limited to attaching the aerostat close-haul ropes to the close winch and monitoring close-haul line during in haul. Operator may also have duties to monitor levelwind tether reel in rear of FMS (Tab U-327).

T&C Operator: The T&C operator duties during recovery include but are not limited to monitoring weather conditions via the Ground Safety and Health System (GSHS), weather radar, and Lightning Protection System alarms. They must also monitor the movements of the aerostat via five site cameras until recovery operations are complete. All areas monitored will be relayed to the flight director by the T&C operator (Tab U-327).



Tab CC-22

#### 4. SEQUENCE OF EVENTS

#### **a. Summary of Previous Missions**

Over the previous 90 days, 38 flights were conducted uneventfully (Tab T-95 to T-100). Over the previous 90 days, the Marfa, Texas site has averaged a 54.3% in-use rate with 82.5% of the downtime due to weather (Tab U-141 and U-146).

#### **b. Planning**

On 14 February 2012 at 0421Z, the MA began Flight #535 (Tab K-8). The MA was launched to provide low-level radar surveillance for the United States-Mexico Border in support of USNORTHCOM's Counterdrug/Counter-Narco Terrorism missions. In addition surveillance data supports North American Aerospace Defense Command's air sovereignty mission for the Continental United States. Surveillance of low, slow flying aircraft and surface targets within its area of coverage is provided to the Western Air Defense Sector and the U.S. Customs and Border Protection's Air Marine Operations Center (Tab CC-3 and CC-19).

#### **c. Pre-flight**

The Mishap Flight Director 2 (MFD2) and the flight crew on duty from 2300Z to 1100Z on 13/14 February 2012 conducted pre-flight and launch of Flight #535 in accordance with Contract Data Requirements List A001 – Operating Instruction TARS Flight Operations Red Book (Red Book) (Tab BB-17 to BB-18). Pre-flight and launch were uneventful (Tab K-8).

#### **d. Summary of Accident**

At 1705Z on 14 February 2012 the GEOMET TARS Weather Center issued a 6 hour forecast stating the following:

Clear skies and dry conditions are expected across most of Western Texas today ahead of a low pressure trough that will pass just north of the site on Wednesday. Ahead of this system winds have shifted to the southwest at all levels and will steadily increase at all levels throughout the day. Winds will average 10-25 kts below 6,000 ft for this afternoon and aloft will increase to 25-45 kts with higher gusts possible at all levels. Light to moderate turbulence aloft is likely for this afternoon and could begin to mix into the lower levels by sunset as winds further increase due to the approaching low pressure system. There is a moderate to high chance of redline exceedance for this afternoon due to the chance of breezy to gusty winds at all levels with turbulence expected mainly aloft.

This forecast drove a 6-hour weather threat condition of Orange (chance of redline exceedance) (Tab F-2). The MFD 1 does not recall receiving this forecast ( Tab V-2.11). The list of current and outstanding 25 OWS weather watches and warnings were also available via the 25 OWS webpage and telephone. The Storm Prediction Center forecast outlook and state of Texas radar view from the National Weather Service were also available online (Tab W-74 to W-77).

MFD 1's data in hand and perception at this time led him to believe he had a later window to recover the MA (Tab V-2.3). At 2100Z the MFD 1 made a tether adjustment from 9,700' MSL to 8,900' MSL due to turbulence (Tab K-10).

At 2115Z a weather watch for surface winds of greater than or equal to 35 kts but less than 50 kts was upgraded to a warning, valid from 2300Z to 1500Z (Tab W-3). The mishap T&C 1 (MT&C 1) incorrectly interpreted this upgrade from watch to warning as a cancellation, and passed this erroneous cancellation to the MFD 1 (Tab V-2.9, V-3.4 to V-3.5).

At 2300Z the GEOMET TARS Weather Center issued another 6 hour forecast stating the following:

Strong low pressure trough will pass just north of the site overnight into Wednesday allowing for partly cloudy skies and dry conditions for tonight. Winds will remain from the southwest at all levels and will increase to 25-40 kts below 6,000 ft and aloft will average 40-55 kts. Moderate to high turbulence will develop at all levels for tonight and will remain in place into Wednesday. There is a high chance of redline exceedance for this evening due to the chance of breezy to gusty winds and turbulence at all levels.

This forecast drove a 6-hour weather threat condition of Red (High chance of redline exceedance) (Tab F-4).

At 2344Z MFD 1 directed another tether adjustment due to turbulence (Tab K-10). At 2350Z the MFD 1 made a decision to change the adjustment to a recovery due to increased turbulence and winds (Tabs K-10, V-2.5) MFD 2 and mishap flight crew 2 (MFC 2) arrived on station at this time and were briefed; then deployed to the pad to assist with the MA recovery (Tab V-1.5). MFD 2 stayed inside to work T&C assisted by MT&C 1. MFD 2 monitored the GSHS data while MT&C 1 monitored the cameras.

At the recovery site MFD 1 controlled the recovery with mishap flight crew 1 (MFC 1) which consisted of mishap winch operator 1 (MWO 1), mishap levelwind 1 (MLW 1), and mishap close haul 1 (MCH 1). Mishap flight crew 2 was also on the site to assist the recovery and consisted of MCH 2, MLW 2, MWO 2, and MT&C 2 (Tab V-1.5).

Between 2349:54Z and 0017:13Z (time of MA impact) surface winds were between 11.8 to 37.0 kts out of the SSW and winds at altitude were 21.0 to 55.2 kts, increasing strength as time progressed (Tabs K-3 to K-6, W-23 to W-24). As the MA approached 5750' MSL (1048' AGL) tether tension increased and the MA began pitch and roll oscillations prompting the MWO 1 to begin an outhaul at 0016:47Z (Tab K-3 to K-6). As the MA was buffeted by the winds aloft it began a 40° left roll and pitched down to 60.2° nose low. From 0016:47Z to 0017:13Z tether tension increased up to 24080 lbs and made a rapid descent into the ground (Tabs K-6, S-9). Upon impact the tether snapped from the MA and whipped back to the recovery pad (V-7.3). Personnel took cover and none were injured (Tab V-7.3). Within 1 minute of impact the MFD 2 contacted the TCC and reported the crash (Tab V-1.6). The crash site was secured and less than 1 gallon of diesel fuel was discovered to have leaked from the fuel tank (Tabs B-1 and P-3). This hazmat was immediately gathered and was properly disposed (Tabs B-1 and P-5). No damage was assessed to the private property upon which the MA crashed (Tabs B-1 and P-5).

#### **e. Impact**

At 0017:13Z on 15 Feb 12, the MA impacted the ground approximately 100 yards northeast of the Marfa TARS in a cattle rancher's field (Tabs B-1, K-6, and S-9). The landowner was contacted and authorized the Marfa site to secure the scene on his property (Tab B-1). Local sheriff, fire, and border patrol were notified and provided initial support with securing the site (Tab B-1) The total cost for the destroyed MA and payload is approximately \$8,819,488.00 (Tab P-3).

There was no significant damage to private property (Tab P-5).

Environmental costs include clean up and soil sampling from less than 1 gallon of diesel fuel. Cost are estimated at \$147.00 (Tab P-3).

#### **f. Egress and Aircrew Flight Equipment**

This section is not applicable for mishaps involving aerostats.

#### **g. Search and Rescue**

This section is not applicable for mishaps involving aerostats.

#### **h. Recovery of Remains**

This section is not applicable for mishaps involving aerostats.

### **5. MAINTENANCE**

#### **a. Forms Documentation**

The accumulated MA flying hours recorded as of 0000Z on 14 Feb 12 was 4,335.9 hours (Tab U-309). The site had just completed its 200-hour required service milestone on APGS, serial number (S/N) C-060, on 11 Feb 12 (Tab U-235). The APGS accumulated engine hours were 9722.0 hours as of 0000Z on 14 Feb 12 (Tab U-235).

A detailed review of active and historical MA Air Force Technical Order Form 95s, *Significant Historical Data* (AFTO 95), revealed no maintenance discrepancies. No mechanical or flight control anomalies existed on the MA at the time of its 14 Feb 12 launch (Tab U-326). A thorough review of the aerostat AFTO 95s for the 90 days preceding the mishap indicated mechanical, structural and electrical systems to be fully functional and ready for flight (Tab U-326). The computer-based DataStream 7i (DS7i) work order records for the 90 days prior to the mishap were used to validate and confirm all form entries. No open work orders restricted the MA from flying (Tab U-275 to U-289).

The MA flew a total of 39 flights in the 90 days prior to the mishap (Tab T-94 to T-99). The MA experienced two tether re-termination actions during that time (Tab U-309). The

re-termination procedure requires cutting off the old eye splice and specified lengths from the end of the tether for minimum break strength (MBS) testing by the manufacturer, and manufacturing a new tether eye splice. MBS testing is used to ensure the tether still meets minimum tension requirements (Tab U-169). In accordance with Operating Instruction (OI) Tether Inspection Program guidance, tether break test samples were sent to the manufacturer for testing. Aerostat operations are permitted to continue during the MBS testing process (Tab U-176). Out of four samples, three samples met and exceeded the MBS threshold. Sample number two of four failed MBS testing on 31 Jan 12 (Tab U-203 to U-205). Samples three and four of four subsequently passed MBS testing which allowed flight operations to continue (Tab U-176, U-207 to U-209). All four post-mishap tether samples met and exceeded the MBS threshold (Tab U-3 to U-9).

There were no maintenance discrepancies that would have prevented the MA from accomplishing Flight #535. A detailed records review revealed no recurring maintenance problems with the MA (Tab U-255 to U-307, U-325 to U-326).

## **b. Inspections**

### **(1) Aerostat Preventive Maintenance Inspection (PMI)**

PMIs are regularly scheduled maintenance actions performed on Air Force aircraft and equipment at prescribed intervals. The last aerostat inspection before Flight #535 was a Helium Purity Check (PMI A01-W-002) (Tab U-211 to U-225, U-237 to U-239). The inspections were accomplished in accordance with applicable guidance (Tab U-211 to U-225, U-237 to U-239). At 0421Z on 14 Feb 12, the MFD 2 performed the pre-flight checklist and launched the MA to begin Flight #535. The launch was routine and uneventful (Tab K-6).

### **(2) Mishap Tether**

The MA's tether, S/N 137, had an initial Quality Control oversight accomplished on 11 Mar 09 following its manufacture (Tab U-313 to U-324). Initial break tests exceeded minimum break strength requirements (Tab U-313 to U-324). The tether arrived on site on 2 Apr 09 with no discrepancies noted (Tab U-241). Tether installation on the FMS was completed at Marfa on 29 Apr 11 (Tab U-241).

During the 12 months prior to Flight #535 the tether experienced 8 tether re-terminations (Tab U-241 to U-247, U-309). A tether re-termination is required to create a new eye splice which allows the tether to be reconnected to the aerostat's flying lines. Some examples of re-termination reasons include but are not limited to 75 flights or 1,500 operating hours, exceeding a tether tension red line limit, repairs or cutting samples for break strength testing. Due to stress placed on the aerostat, a common reason for re-termination is repair of a neck down. A neck down is an observed tether area that has a noticeably reduced diameter and/or the exterior jacket has gathered forming an accordion appearance (Tab U-180).

Based on established tether replacement considerations (i.e., inspection status, break strength, remaining length of tether), tether S/N 137 was within approved guidelines for use on

Flight #535 (Tab U-176).

**c. Maintenance Procedures**

A detailed review of recent and historical AFTO 95s revealed no deviations from established maintenance procedures (Tab U-326). The DS7i records for the 90 days prior to the mishap were used to validate and confirm all form entries (Tab U-237, U-255 to U-307).

**d. Maintenance Personnel and Supervision**

Aerostat maintenance was performed by properly trained and qualified personnel (Tab U-325 to U-327).

**e. Fuel, Hydraulic and Oil Inspection Analysis**

This section is not applicable for this mishap.

**f. Unscheduled Maintenance**

The AIB reviewed all maintenance activities and work orders associated with the MA and tether since completion of the last scheduled PMI. The MA was recovered on 11 Feb 12 due to turbulence and to facilitate T&C training. During the aerostat downtime, the site completed two scheduled maintenance/inspection activities (Tab U-211 to U-212). No unscheduled maintenance occurred following last MA and tether PMIs (Tab U-255 to U-307).

**6. AIRCRAFT AND AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS**

**a. Condition of Systems**

The MA was destroyed when it impacted nose down with the ground and ruptured. The associated ancillary equipment and payload were also destroyed upon impact (Tab P-3). After the mishap, one section of tether was recovered at the crash site attached to the aerostat and another section remained attached to the FMS. Both tether sections were damaged due to contact with the perimeter tether anti-fouling cable (Tab V-6.3, V-8.3 to V-8.4).

**b. Engineering Evaluations and Analyses**

The four sections of tether were sent to manufacturer for MBS testing. All four sections taken from both the FMS drum and aerostat crash site exceeded the MBS threshold (Tab U-4 to U-5, U-8 to U-9).

The MA's Rapid Descent Device (RDD) system was not sent for testing. Since the tether did not break prior to impact, the Rapid Descent Device (RDD) was not armed via GSHS-A3 Panel nor activated via GSHS Command Software, RDD Destruct Page (Tab V-1.6).



## 7. WEATHER

### a. Forecast Weather

The Marfa TARS receives weather from two main sources: GEOMET Technologies, LLC, based out of Germantown, MD and the 25 OWS, based at Davis-Monthan AFB, AZ. A product from GEOMET was received at 1612Z on 14 Feb 12 (Tab F-2 to F-3), and gave a 6-24 hour forecast with a valid time of 1705Z indicating weather threat condition “Orange (chance of redline exceedance)”:

- Partly cloudy skies and dry conditions are expected overnight into Wednesday morning as a low pressure trough passes north of the site over the next 24 hours. Winds will shift slightly to the west to northwest overnight but will continue to increase at all levels averaging 20-35 kts below 5,000 ft and aloft increasing to 40-60 kts. Moderate to high turbulence is expected at all levels overnight through Wednesday with winds not expected to weaken until very late Wednesday afternoon. Dry conditions will hold across the regions as this low moves across the area but winds will remain strong for at least 24 hours. There is high chance of redline exceedance anticipated through late Wednesday afternoon due to the strong chance of gusty winds and turbulence at all levels due to the passage of a strong low pressure trough (Tab F-2 to F-3).

A second product from GEOMET was received at 2300Z on 14 Feb 12 (Tab F-4 to F-5), and gave a 6 hour forecast with a valid time from 2300Z to 0500Z indicating weather threat condition “Red (High chance of redline exceedance)”:

- Strong low pressure trough will pass just north of the site overnight into Wednesday allowing for partly cloudy skies and dry conditions for tonight. Winds will remain from the southwest at all levels and will increase to 25-40 kts below 6,000 ft and aloft will average 40-55 kts. Moderate to high turbulence will develop at all levels for tonight and will remain in place into Wednesday. There is a high chance of redline exceedance for this evening due to the chance of breezy to gusty winds and turbulence at all levels.

A Marfa TARS Discussion/Planning Weather Forecast was received at approximately 1100Z, 14 Feb 12 from the 25 OWS, valid from 1100Z-2300Z (Tab F-8). This forecast indicated a “Cold front moving through NM with the tail end extending into west Texas causing gusty winds,” max wind speeds for the day forecast to be 35 kts, and possible warnings or advisories for moderate turbulence and winds greater than or equal to 35 kts between 1100Z-2300Z (Tab F-8).

Another Marfa TARS Discussion/Planning Weather Forecast was received at approximately 1100Z, 14 Feb 12 from the 25 OWS, valid from 2300Z-1100Z (Tab F-9). This forecast indicated a “Frontal Boundary approaching from west with winds of 40 kts associated. Expect light precip and turbulence,” max wind speeds for the day forecast to be 35 kts, and possible warnings or advisories for moderate turbulence between 2300Z-1100Z (Tab F-9).

According to the program the 25 OWS uses to issues weather watches, warnings and advisories, The Integrated Weather Warning Capability, at 1321Z, the 25 OWS issued a weather watch (ID number 02-006) for the potential for surface winds greater than or equal to 35 kts, but less than 50 kts with a valid time from 2000Z on 14 Feb 12 until 0200Z 15 Feb 12 (TabW-3). Then at 1910Z, a weather warning (ID number 02-007) was issued for forecast moderate or greater

turbulence below 10,000 feet above ground level (AGL) with a valid time from 1900Z on 14 Feb 12 until 1500Z 18 Feb 12 (TabW-3). At 2115Z, the 25 OWS upgraded weather watch 02-006 to a weather warning (ID number 02-010) for forecast surface winds greater than or equal to 35 kts, but less than 50 kts with a valid time from 2300Z 14 Feb 12 until 1500Z 15 Feb 12 (TabW-3). Records from the Flight Director TARS log indicate the receipt of all watches and warnings (Tab T-103).

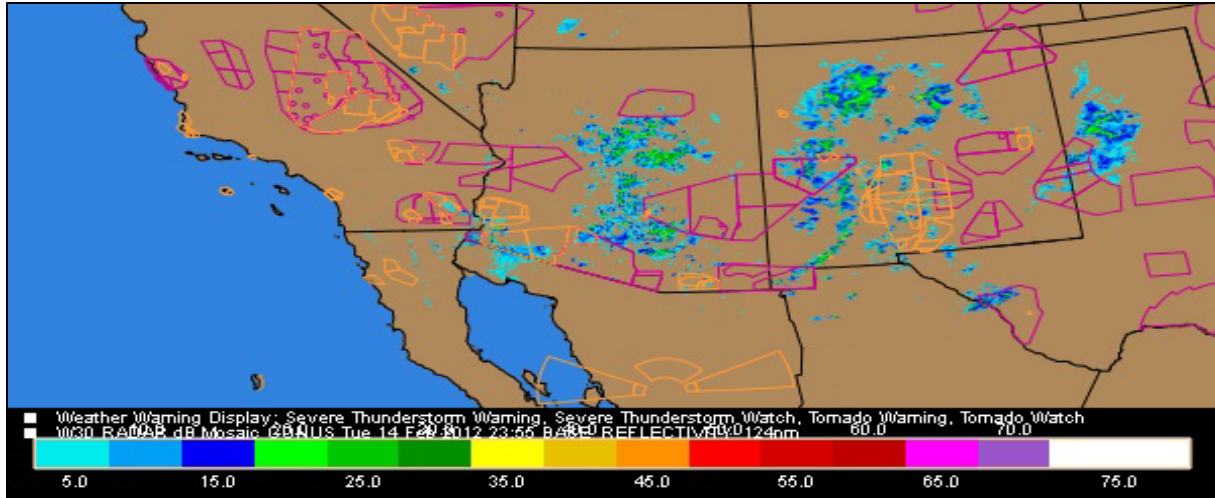
**b. Observed Weather**

The Marfa TARS maintains an Hourly Weather Updates log (Tab W-9). This weather log indicates observed conditions on the surface and aloft, including average and minimum winds. This log indicates observed conditions on the surface were averaged between 10-20 kts all day with the exception of 2400Z where the winds on the surface were recorded as greater than 35 kts. Winds aloft greater than 35 kts were never recorded in the Hourly Weather Updates log (Tab W-9, Table 7.1).

Zulu Time	ALT (1000' MSL)	Wind Speed, Knots (Aloft)	Wind Speed, Knots (Surface)	Wind Dir, Degrees (Surface)
1300	9.7	25.7	12.7	109
1400	9.7	31.7	10.9	110
1500	9.7	29.5	19.6	256
1600	9.7	27.8	7.5	149
1700	9.7	27.7	21.3	239
1800	9.7	24.4	20.5	239
1900	9.7	19.7	23.4	262
2000	9.7	26.7	23.2	253
2100	8.9	34	25	255
2200	8.9	26.5	20.5	230
2300	8.9	28	21.4	190
2400	No Record	No Record	37.8	228

**Table 7.1. Hourly Weather Log**

The Marfa TARS is equipped with a Doppler Radar. A Doppler Radar picture indicates approaching rain showers located to the northwest of Marfa TARS, moving southeast. (Tab W-76, Figure 7.1) Although none of the thunderstorm clouds reach the Marfa TARS, virga (rain that does not reach the ground) could be seen in the distance on video to the northwest (Tabs S-55, V-8.3)



**Figure 7.8 NEXRAD Composite Reflectivity**

**c. Operations**

The GEOMET and 25 OWS forecast combined with the 25 OWS watch, warning and advisory notifications indicated a strong chance for gusty winds and turbulence aloft (Tabs F-2 to F-9, W-3). According to the Marfa TARS wind profiler, winds aloft were steady at 10-15 kts from 1100Z to 1400Z, but began to pick up around 1500Z (Tab W-21). The MFD 1 made the first tether adjustment at 2100Z (Tab K-10). Recorded GSHS data showed wind conditions on the surface and aloft beginning to increase almost an hour before the mishap (Tab K-3 to K-6). The MFD 1 directed another tether adjustment at 2344Z, by then winds aloft were 36.1 kts (Tabs F-20, K-10, Table 7.2). Select wind data from the GSHS data is summarized below (Tab K-3 to K-6):

Zulu Time	ALT (1000' MSL)	Wind Speed, Knots (Aloft)	Max Winds, Knots (Aloft)	Wind Speed, Knots (Surface)	Max Winds, Knots (Surface)
2330	8.95	23.5	32.8	9.2	24.8
2345	8.95	36.1	36.1	12.7	24.8
2346	8.92	20.3	36.1	18.8	37.0
2349	8.45	29.2	36.1	37.0	37.0
2355	7.73	27.3	37.1	11.8	37.0
0000	7.28	41.1	41.1	23.1	37.0
0006	6.62	37.4	41.4	28.3	37.0
0010	6.43	30.0	48.0	16.2	37.0
0013	6.05	38.6	48.0	20.5	37.0
0015	5.75	51.6	51.6	21.4	37.0
0016	5.72	55.2	55.2	17.0	37.0

**Table 7.2 Recorded GSHS Data**

The MFD 1 continued conducting adjustment operations until 2350Z, before making the decision to recover (Tab K-10). Gusty wind conditions aloft and on the surface continued to increase triggering the mishap sequence (Tab W-118).

## **8. CREW QUALIFICATIONS**

The mishap site manager (MFD 2) had been with the TARS program for five years, with five years at the Marfa TARS (Tab V-1.4). She had experience in all flight crew positions with the exception of winch operator (Tab U-325 to U-326). She was also certified as a flight director (Tab U-325 to U-327).

MFD 1 began with the TARS program in 2005 (Tab V-2.2). He was certified as a solo flight director in 2006 (Tab U-325 to U-327). He was certified in flight crew positions nose rope handler, T&C operator and winch operator (Tab U-325 to U-327). Review of MFD 1 training records identified a flight director training start/end date of January 2010 (Tab U-325 to U-326). The exact training completion/certification date cannot be verified by MFD 1's training records (Tab U-325 to U-327).

Training records indicate the mishap flight crews 1/2 (MFC) for Flight #535 were qualified and proficient in their assigned flight crew duties with the exception of initial and annual weather refresher training (Tab U-325 to U-326). The MFCs had a wide breadth of experience, having held previous trade and flight crew positions, and together had a combined 70 years of TARS experience (Tabs U-325 to U-326, V-1.4, V-2.2, V-3.2 to V-3.3, V-4.2, V-5.2, V-6.2, V-7.2, V-8.2 to V-8-3, V-9.2).

## **9. MEDICAL**

### **a. Qualifications**

There were no known health issues for the MFC.

### **b. Health**

There were no known health issues for the MFC.

### **c. Pathology**

In accordance with the TARS Performance Work Statement, the MFCs were tested for the presence of drugs or alcohol. Drug and alcohol tests were negative (Tab X-5).

### **d. Lifestyle**

No lifestyle factors were found to be relevant to this mishap.

### **e. Crew Rest and Crew Duty Time**

A review of the Crew Duty Schedule shows no discrepancies (Tab U-326).

## 10. OPERATIONS AND SUPERVISION

### a. Operations

Operations tempo was investigated and found not to be a factor in this mishap (Tab K-8 to K-14).

The number of flights and site tasks were investigated and found not to be a factor in this mishap (Tab K -8 to K-14). The MFCs had anywhere from 22 months to 20 years experience in the TARS program and at the Marfa, Texas site (Tabs U-325 to U-326, V-1.4, V-2.2, V-3.1 to V-3.2, V-4.1 to V-4.2, V-5.1 to V-5.2, V-6.1, V-7.2, V-8.1 to V-8-2, V-9.2). The MWO 1 specifically had 14 years of experience (Tab V-4.2). Flight crew experience was not a factor in the mishap (Tabs U-325 to U-326, V-1.4, V-2.2, V-3.1 to V-3.2, V-4.1 to V-4.2, V-5.1 to V-5.2, V-6.1, V-7.2, V-8.1 to V-8-2, V-9.2).

Observed lack of flight crew weather training and baseline knowledge of weather equipment, patterns, and an incomplete understanding of the significance of weather data was found to be a factor in this mishap (Tab W-118). MFC showed an over reliance on anecdotal experience versus data from expert weather sources (Tab W-118). Procedures for obtaining weather data are not consistent and standardized, which leads to missed forecasts relevant to this mishap (Tabs V-2.10, W-118).

### b. Supervision

The Marfa TARS operations supervision consists of one dual role Site Manager (SM)/Flight Director (FD) and a second FD (Tab V-1.4, V-2.2). The SM reports directly to the Operations and Maintenance Manager (Tab U-325). The FD is responsible for all decisions related to aerostat flying operations (Tab BB-15 and BB-55). The MFD 1 has been a current and qualified FD for six years (Tabs U-325 to U-326, V-2.2). The SM was the MFD 2 and has been a certified FD with approximately three years of experience as FD at the Marfa TARS (Tab V-1.4). The SM has worked at the Marfa TARS in other crew positions for five years (Tabs U-325 to U-326, V-1.4). The MFD 2 was on-site and played an active role and supported the MFD 1 working T&C and monitoring GSHS data during the recovery operations (Tab V-1.5).

## 11. HUMAN FACTORS ANALYSIS

The Department of Defense Human Factors Analysis and Classification System (DoD-HFACS) is a systematic and comprehensive tool that is comprised of a list of potential human factors that can be contributory or causal to a mishap. The DoD-HFACS classification taxonomy is contained in AFI 91-204, *Safety Investigations and Reports*, Attachment 5 (24 September 2008), and describes four main tiers of human factors including Acts, Pre-Conditions, Supervision, and Organizational Influences, which are briefly described below:

*Acts* are those factors that are most closely tied to the mishap, and can be described as active failures or actions committed by the operator that result in human error or unsafe situation.

*Preconditions* are factors in a mishap if active and/or latent preconditions such as conditions of the operators, environmental, or personnel factors affect practices or actions of individuals and result in human error or an unsafe situation.

*Supervision* is a factor in a mishap if the methods, decisions, or policies of the supervisory chain of command directly affect practices, conditions, or actions of individuals and result in human error or an unsafe situation.

*Organizational Influences* are factors in a mishap if the communications, actions, omissions or policies of upper-level management directly or indirectly affect supervisory practices, conditions or actions of the operator(s) and result in system failure, human error, or an unsafe situation.

11 human factors were identified as potential factors in this mishap:

**a. AV 002 Violation – Routine/Widespread:** Violation - Routine/Widespread is a factor when a procedure or policy violation is systemic in a unit/setting and not based on a risk assessment for a specific situation. It needlessly commits the individual, team, or crew to an unsafe course-of-action. These violations may have leadership sanction and may not routinely result in disciplinary/administrative action. Habitual violations of a single individual or small group of individuals within a unit can constitute a routine/widespread violation if the violation was not routinely disciplined or was condoned by supervisors (Tab BB-3).

Flight crew members had not received the Initial or Annual Refresher Weather Training required by TARS PWS, Section A, Para 4.2.6. This is documented in the ITT Exelis audit conducted 10 Feb 12, and had not been corrected by the time of the mishap (Tab U-249, U-325).

**b. AE201 Risk Assessment – During Operation:** Risk Assessment – During Operation is a factor when the individual fails to adequately evaluate the risks associated with a particular course of action and this faulty evaluation leads to inappropriate decision and subsequent unsafe situation. This failure occurs in real-time when formal risk-assessment procedures are not possible (Tab BB-3).

MFD 1 did not recover the MA in a timely matter due to a misunderstanding/misinterpretation of the risk associated with the approaching pre-frontal trough (Tab W-118). The action of continuing to fly the MA with the impending winds led to the unsafe situation, and ultimately the mishap (Tab W-118).

**c. AE301 – Error due to Misperception:** Error due to Misperception is a factor when an individual acts or fails to act based on an illusion; misperception or disorientation state and this act or failure to act creates an unsafe situation (Tab BB-3).

MFD 1 failed to recover the MA in a timely manner based on the misperception of the weather reports received. The MFD 1's misperception of the GEOMET and 25 OWS forecasts as well as the misperception of the data provided by the Doppler radar and wind profiler led him to believe

he had a later window to recover the MA than was available (Tab V-2.3). This misperception of the weather data led to the unsafe situation and ultimately the mishap (Tab W-118).

**d. PC504 - Misperception of Operation Conditions:** Misperception of Operational Conditions is a factor when an individual misperceives or misjudges altitude, separation, speed, closure rate, road/sea conditions, aircraft/vehicle location within the performance envelope or other operational conditions and this leads to an unsafe situation (Tab BB-3).

MFD 1 misperceived the meteorological environment associated with the information provided in the GEOMET and 25 OWS weather forecast and observed local conditions. (Tabs W-118, V-2.3). This misperception led MFD 1 to believe he had a later window to recover the MA (Tab V-2.3). This delay led to the unsafe situation that culminated in the mishap (Tab W-118).

**e. PC505 – Misinterpreted/Misread Instrument:** Misinterpreted/Misread Instrument is a factor when the individual is presented with a correct instrument reading but its significance is not recognized, it is misread or is misinterpreted (Tab BB-3).

MFD 1 and MFD 2 demonstrated a basic understanding, but not full knowledge of the weather equipment and data available to them (Tab W-118). Misinterpretation of the data observed on the Doppler radar and wind profiler, as well as the forecasts provided by the 25 OWS and GEOMET, contributed to the unsafe situation that led to the mishap (Tab W-118).

**f. PP106 – Communicating Critical Information:** Communicating critical information is a factor when known critical information was not provided to appropriate individuals in an accurate or timely manner (Tab BB-3).

MT&C 1 incorrectly provided to MFD 1 a cancellation of a high surface winds warning (Tab V-2.7, V-3.3). Records show that the gusty surface winds were upgraded from a watch to a warning during the time period specified by MT&C 1's testimony (Tab W-3). This inaccurate communication contributed to the incorrect set of facts for the MFD 1 as part of his total data set in regards to the weather (Tab V-2.7). This set of facts contributed to the delay in the recovery of the MA and led to the unsafe situation that culminated in the mishap (Tab W-118).

**g. PP109 – Mission Planning:** Mission planning is a factor when an individual, crew or team failed to complete all preparatory tasks associated with planning the mission, resulting in an unsafe situation. Planning tasks include information collection and analysis, coordinating activities within the crew or team and with appropriate external agencies, contingency planning, and risk assessment (Tab BB-3).

The MFD 1's lack of collection and misanalysis of weather data prior to recovery of the MA contributed to the unsafe situation that resulted in the MA crash (Tab W-118). The MFD 1 did not seek out standard forecast products from GEOMET, nor did the MFD 1 research local airfield observations to obtain real time upstream weather data (Tab V-2.10 to V-2.11). Without standard GEOMET forecast products, MFD 1 did not have sufficient data to accurately analyze and predict the pending winds due to the pre-frontal trough (Tab W-118).

**h. PP112 – Miscommunication:** Miscommunication is a factor when correctly communicated information is misunderstood, misinterpreted, or disregarded (Tab BB-3).

The 25 OWS correctly upgraded a gusty wind watch to a warning at 2115Z (Tab W-3). The MT&C 1 incorrectly heard and misunderstood this upgrade as a cancellation and passed this incorrect cancellation onto the MFD 1 (Tabs V-2.7, V-3.3). This inaccurate communication contributed to the incorrect set of facts for the MFD1 as part of his total data set in regards to the weather (Tab W-118). This set of facts contributed to the delay in the recovery of the MA and led to the unsafe situation that culminated in the mishap (Tab W-118).

**i. SI003 – Local Training Issues/Programs:** Local Training Issues/Programs are a factor when one-time or recurrent training programs, upgrade programs, transition programs or any other local training is inadequate or unavailable (etc) and this creates an unsafe situation (Tab BB-3).

Local annual weather refresher training for FDs is a simple powerpoint brief on a SharePoint site provided by GEOMET (Tab W-118). These slides do not provide in-depth instruction sufficient to teach the FDs where to find or how to interpret data required to make timely accurate decisions for recovery operations (Tabs U-325, W-118). Follow-on instruction in refresher training for Flight Crews is word of mouth instruction provided by the FDs (Tab W-118). This instruction is also inadequate for day to day flight operations (Tabs U-325, W-118). Additionally, there is no instruction on the proper use of the weather equipment at the site other than word of mouth on the job training (Tabs U-325, W-118). This is inadequate and leads to poor habit patterns and incomplete use of the weather equipment, which provides inaccurate data from which FDs base their decisions (Tabs U-325, W-118).

**j. SV004 – Currency:** Currency is a factor when an individual has not met the general training requirements for his job/weapon system and is considered “non-current” and supervision/leadership inappropriately allows the individual to perform the mission element for which the individual is non-current (Tab BB-3).

Members of the MFC had not had initial/recurring weather training (Tab U-249, U-325). The MFD 1 and 2 allowed the MFC to perform duties without completing the initial/recurring training requirements (Tabs K-8, U-249).

**k. OP004 – Organizational Training Issues/Programs:** Organizational Training Issues/Programs are a factor when one-time or initial training programs, upgrade programs, transition programs or other training that is conducted outside the local unit is inadequate or unavailable (etc) and this creates an unsafe situation (Tab BB-3).

ITT Exelis does not provide weather training to FDs sufficient to interpret weather data and use weather equipment effectively to make timely and accurate flight decisions (Tabs U-325, U-356, U-357, W-118 ). Local annual refresher training for FDs is a simple PowerPoint brief on a SharePoint site provided by GEOMET (Tab W-118). FDs are not able to view weather patterns and correctly diagnose pending hazardous weather conditions (Tabs U-356, W-118). FDs do not



understand the proper utilization and characteristics of weather equipment to include: Doppler radar; limitations such as radar degradation and cone of silence associated with radar beam positioning; validity of model data (initialization and verification); interpretation of radar returns; and the difference between cloud-to-cloud and cloud-to-ground lightning (Tabs U-325, U-356, W-117 to W-118). Additionally, there is no written instruction or checklists on the proper use of the weather equipment at the site other than word of mouth on-the-job training (Tabs U-356, W-118).

## **12. GOVERNING DIRECTIVES AND PUBLICATIONS**

### **a. Primary Operations Directives and Publications**

CDRL A001 – OI TARS FLIGHT OPERATIONS RED BOOK, Revision 4, 16 February 2011 (Tab BB-5 to BB-62)

Tethered Aerostat Radar System (TARS) Performance Work Statement (PWS) P00021, Rev-4, 2 Dec 09 (Tab U-327 to U-388)

Air Force Instruction 51-503, *Aerospace Accident Investigations*, 26 May 2010

Air Force Instruction 91-204, *Safety Investigations and Reports*, 24 September 2008, DOD HFACS

### **b. Known or Suspected Deviations from Directives or Publications**

Per TARS PWS, Section A, Para 4.2.6.: The contractor shall provide all weather training and document the training in the individual training records (Tab U-356). Newly reported personnel are missing initial weather training (Tab U-249, U-325 to U-326).

## **13. ADDITIONAL AREAS OF CONCERN**

Review of supplemental equipment AFTO 95 data has revealed that Doppler weather radar overhauls of the original equipment manufacturer (OEM) sub-systems have been accomplished three times since 2009. OEM correspondence indicates time change requirements for these items every two years (Tab W-116). These items must be replaced/calibrated as a group as part of regularly scheduled servicing (Tab W-116). ITT Exelis only replaced these items on an as-needed basis when determined inoperable (Tab W-116). According to AFTO 95 records, the receiver-transmitter had been replaced once in Oct 10 and again in Dec 10 (Tab U-230). The antenna pedestal was replaced in Dec 10 (Tab U-230).

4 April 2012

//signed//  
SCOTT S. COLE, Lt Col, USAF  
President, Accident Investigation Board

TARS, T/N 4220, 14 February 2012

**STATEMENT OF OPINION  
TARS T/N 4220 ACCIDENT  
14 February 2012**

*Under 10 U.S.C. § 2254(d), any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.*

**1. OPINION SUMMARY:**

I find by clear and convincing evidence that the cause of the mishap was the late decision to recover the Mishap Aerostat (MA). This decision was based on faulty and inaccurately perceived weather data that delayed inhaul and recovery action on the MA. Had the recovery been finished prior to the onset of winds forecast to begin at 2300Z, the severe winds at altitude and on the surface would not have struck the MA.

At 1705Z on 14 Feb 12, a weather forecast from GEOMET predicted gusty winds and light to moderate turbulence. This forecast predicted there is a “moderate to high chance of redline exceedance due to the chance of breezy to gusty winds at all levels with turbulence expected mainly aloft.” A shortwave trough was proceeding towards Marfa from the west. There was a deepening low pressure center located in the south (Mexico) and another one north of the site. There was also a high pressure area to the east. The pre-frontal trough associated with the shortwave trough was pushed towards Marfa and held up by the high pressure in the east and funneled by the system in the north. The low pressure center from the south aided in deepening the pre-frontal trough contributing to gusty and persistent winds over the Marfa TARS on the surface and at altitude.

A 2115Z a weather watch was upgraded to a warning by the 25 OWS forecasting winds to be greater than or equal to 35 but less than 50 kts on the surface at the Marfa TARS valid from 2300Z to 1500Z. At 2300Z the GEOMET 6 hour forecast stated “winds will remain from the southwest at all levels and will increase to 25-40 kts below 6,000 ft and aloft will average 45-55 kts.” “There is a high chance of redline exceedance for this evening due to the chance of breezy to gusty winds and turbulence at all levels.”

At 2344Z the MFD 1 directed an inhaul adjustment due to turbulence aloft, during this inhaul the MFD 1 made a decision at 2350Z to continue to a recovery. At this time the MFC was briefed and sent to recover the MA by MFD 2. During the inhaul to recovery, cable tension exceeded limits on multiple occasions and the MA was hit by 55 kt winds. At the surface winds were from the southwest and varied in strength from 11 kts gusting up to 37 kts. Due to the winds at altitude, the MFC did not stop the recovery and chose to continue the inhaul since the surface winds were within redbook limits. As the tether tension increased and the MA continued to be buffeted by increasing winds, the MWO 1 made the decision to begin an outhaul, which was immediately requested thereafter by the MFD 1.

During the rapid outhaul, the turbulence and winds on the MA were severe causing a 40° left roll and a 60° nose low pitch over. This coupled with the severe cable tension caused the aerostat to nosedive and impact the ground at 0017:13Z, rupturing the MA and destroying all associated equipment.

## **2. DISCUSSION OF OPINION:**

### **a. Cause**

The MFD 1 did not have the weather knowledge and correct data to make a timely decision to recover the MA. The Marfa TARS had access to consistent and appropriate weather forecasts and data from the GEOMET and 25 OWS forecasters that matched the real time data displayed by the GSHS and wind profiler. The MFD 1 relied upon his life experience and local knowledge to make the inhaul and recovery decisions. The training provided by ITT Exelis for annual weather refresher training was not sufficient for the MFD 1 to make timely accurate decisions and ultimately led to the destruction of an \$8.8 million USAF asset. Additionally the procedures in place for obtaining and compiling weather data are not standardized. This caused the MFD 1 to miss the 1705Z forecast which detailed the pre-frontal trough. Standardized training on the weather equipment located at the site was non-existent and the FDs relied on previous experience and on-the-job training to obtain their knowledge. Additionally, local airfield observations from the surrounding area were not obtained and the weather data sought after and used by the MFD 1 was inadequate. Despite all of these factors, enough data was available, though not used or perceived correctly, for the MFC to recover the MA safely. The lack of training, lack of proper data gathering, and misinterpretation of the data available culminated in the delayed decision to recover the MA and the ultimate destruction of the MA.

### **b. Substantially Contributing Factor**

The 25 OWS 2105Z upgrade from a weather watch to warning was misperceived by the MT&C 1 as a cancellation. This misperceived cancellation was passed to the MFD 1 and is a substantially contributing factor to the MFD 1's belief that more time was available to safely recover the MA. This factor, coupled with the missed forecast developed an unsafe path for the MFC. Additionally the MFD's inadequate training for weather data interpretation and weather equipment use were substantially contributing factors.

## **3. CONCLUSION**

I find by clear and convincing evidence that the cause of the mishap was the delayed decision to recover the MA. I have also determined that a preponderance of the evidence shows that the flight directors lack significant training on weather data interpretation and weather equipment use. Additionally I find that a surface wind warning was misperceived as a cancellation. I find that the lack of training and the erroneous cancellation substantially contributed to the mishap.

4 April 2012

//signed//  
SCOTT S. COLE, Lt Col, USAF  
President, Accident Investigation Board

TARS, T/N 4220, 14 February 2012