

行政院所屬各機關因公出國人員報告書

(出國類別：實習)

## BELL-412 模擬機複訓報告書

服 務 機 關：民用航空局

出 國 人 職 稱：約聘人員

姓 名：丁作德

出國地區：美國 德州

出國期間：89.12.17 – 89.12.23

報告日期：90.02.08

系統識別號:C09000651

公 務 出 國 報 告 提 要

頁數: 5 含附件: 是

報告名稱:

BELL-412模擬機複訓報告書

主辦機關:

交通部民用航空局

聯絡人／電話:

陳碧雲／(02)23496197

出國人員:

丁作德 交通部民用航空局 飛航標準組 約聘人員

出國類別: 實習

出國地區: 美國

出國期間: 民國 89 年 12 月 17 日 -民國 89 年 12 月 23 日

報告日期: 民國 90 年 02 月 08 日

分類號/目: H2／航空 H2／航空

關鍵詞: BELL-412模擬機複訓報告書

內容摘要: 依據民航法規航空人員檢定規則，規定駕駛員檢定證有效期限為一年，為維持效期俾利航務查核作業，須依規定實施複訓。本次訓練對模擬機之效能、教學方式與態度均有深刻之體認；為維護飛航安全，年度複訓制度確有其必要性；而模擬機訓練更是強化飛安之重要手段，宜善加運用及推廣。

本文電子檔已上傳至出國報告資訊網

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### 附件：

- 一、BELL-412 型機複訓期程表。(共 1 頁)
- 二、模擬機飛行訓練航跡圖。(共 1 頁)
- 三、學、術科訓練與考核紀錄。(共 4 頁)
- 四、BELL-412 型機複訓完訓證書。(共 2 頁)
- 五、座艙資源管理 (CRM) 參考資料。(共 4 頁)
- 六、飛行任務提示、歸詢卡。(共 2 頁)
- 七、美國 BELL-412 型直昇機失事案例。(共 14 頁)

## BELL-412 模擬機複訓報告書

### 壹、目的：

依據民航法規航空人員檢定規則第六條第二項第一款規定駕駛員檢定證有效期限為一年，本人因持有 BELL-412 型直昇機機種檢定證，為維持效期俾利航務查核作業而依規定實施複訓。

### 貳、過程：

一、奉准於八十九年度內運用本局經費接受 BELL-412 型直昇機之模擬機複訓。

二、協洽美國德州 FlightSafety 訓練中心安排受訓事宜，並確認 89.12.18 至 89.12.21 之受訓期程。

三、複訓課程包含地面學科及術科（模擬機）訓練二部分：

（訓練及考核紀錄如附件三）

（一）學科：合計 15.75 小時

1. 載重與平衡。
2. 飛機性能資料。
3. 飛行計畫。

4. 風切介紹與注意事項。
5. 座艙資源管理。
6. 飛機各項系統解說（含一般簡介、發動機系、電力系、滅火系、警告系、傳動系、液壓系、旋翼系、飛行操縱系、航電系及附屬裝備等）。
7. 學科測驗。
8. 飛行前任務提示。

（二）術科（模擬機訓練）：合計 4.5 小時

1. 一般操作：含滯空及正常起降課目。
2. 特殊場地操作：閉塞區及峰頂起降。
3. 緊急課目操作：包含單、雙發動機失效、火警、自動飛操失效、尾旋翼失效、液壓失效、電力失效等課目。
4. 儀器飛行：包含小轉彎、不正常動作改正、ILS 進場等課目。

四、完訓後，該訓練中心核發結業證書（如附件四）

參、心得：

- 一、小班制教學：本班次僅學員三人，可對課程充分研討及經驗交流以加強學習效果。
- 二、專業之教學方式：資深且學識、經驗均豐富之飛行教師以其專業之素養，將學理結合於實際操作情況，使學員充分瞭解、融會貫通。
- 三、授課內容精緻化：為期僅四日之複訓課程，卻能對學員施以系統且完整之密集訓練。
- 四、任務提示與歸詢之詳實：每於模擬機飛行前、後，教官均能針對當日操作課目實施詳細之解說與檢討。
- 五、模擬效果佳：該模擬機採六個自由度（前後、上下、左右、縱傾、橫擺與偏扭）之運動方式，且其音效及視訊均有良好之模擬效果，可針對實體機難以或無法模擬之特定或緊急狀況（如天候突變、裝備故障等）實施訓練或研討，以強化飛行員之緊急處置能力。
- 六、服務態度良好：該訓練中心配合提供學習參考資料，如附件五、六、七。

肆、建議：

國外飛行訓練機構訓練之紮實、效率化之教學等多項優點為眾所週知；在國內尚未建立類似國外專責飛行訓練機構前，國內直昇機飛行員均普遍仰賴公司自訓方式實施。為有效強化訓練，在航空公司狀況許可下（人力、經濟、語文能力），宜將各機種初訓及晉升正駕駛之飛行員送訓，以建立良好學、術科基礎及緊急狀況反應與操作能力。

附件：

- 一、BELL-412 型機複訓期程表。(共 1 頁)
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# C O U R S E S C H E D U L E W I T H S I M U L A T O R D E T A I L

Ft. Worth Bell Learning Center  
Flightsafety Texas, Inc.  
Course: 026RP Start Date: 12/18/00 Section: 0051 Date: 12/11/00  
Time: 11:27:24  
Simulator Detail: Y  
Ground School Detail: N

## BELL 412 PILOT RECURRENT

Day/Date/Time	Session	Instructor	Location	Customer Client
<b>Mon 12/18/00</b>				
07:30 - 08:00	Inbrief	Norris Woodruff	RM C12	Civil Aeronautics Administration ROC
08:00 - 12:00	Ground School	Norris Woodruff	RM C12	Tso-Te Ting
13:00 - 17:00	Ground School	Norris Woodruff		
<b>Tue 12/19/00</b>				
06:00 - 06:30	Brief	Norris Woodruff		Civil Aeronautics Administration ROC
06:30 - 08:00	Simulator	Norris Woodruff	SIM 409	Tso-Te Ting
08:00 - 08:30	Debrief	Norris Woodruff		Civil Aeronautics Administration ROC
09:30 - 11:30	Ground School	Norris Woodruff	RM C12	Tso-Te Ting
<b>Wed 12/20/00</b>				
06:00 - 06:30	Brief	Norris Woodruff		Civil Aeronautics Administration ROC
06:30 - 08:00	Simulator	Norris Woodruff	SIM 409	Tso-Te Ting
08:00 - 08:30	Debrief	Norris Woodruff		Civil Aeronautics Administration ROC
09:30 - 11:30	Ground School	Norris Woodruff	RM C12	Tso-Te Ting
<b>Thu 12/21/00</b>				
06:00 - 06:30	Brief	Norris Woodruff		Civil Aeronautics Administration ROC
06:30 - 08:00	Simulator	Norris Woodruff	SIM 409	Tso-Te Ting
08:00 - 08:30	Debrief	Norris Woodruff		Civil Aeronautics Administration ROC



Map Scale: 20.0 12 - 21 - 00 05 : 45 : 17



Master Index

Area Map

Track Erase

Map Ctr to A/C

Posn Storm

Runway Plot

T/O Plot

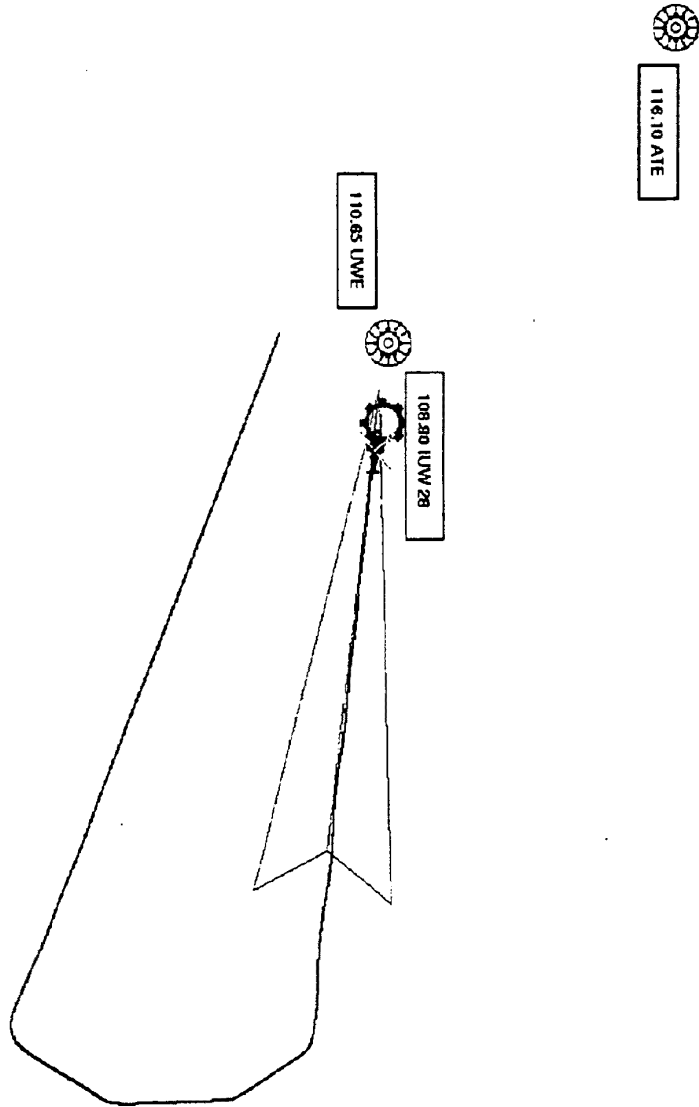
Appr Plot

Status

Map Control

Mail Summary

Help



Dec 21, 2000 05:33:06

# FlightSafety

## RECORD OF TRAINING / CHECKING

### Tso-Te Ting Civil Aeronautics Administration ROC

during the period December 18, 2000 through December 21, 2000 has completed

#### FlightSafety's BELL 412 PILOT RECURRENT Course

#### ACADEMIC CURRICULUM

Weight and Balance .....	X	Master Warning System .....	X
Performance .....	X	Powertrain/Hydraulics .....	X
Flight Planning .....	X	Main Rotor/Tail Rotor .....	X
Rotorcraft Flight Manual .....	X	Flight Controls/AFCS .....	X
Windshear Training .....	X	Ice and Rain Protection .....	X
Crew Resource Management .....	X	Environmental System/Avionics ...	X
Aircraft General .....	X	Kits and Accessories .....	X
Powerplant .....	X	Preflight .....	X
Air Management .....	X	Review and Exam .....	X
Fire Protection/Fuel System .....	X	Briefing .....	X
Electrical System/Lighting .....	X	Systems Integration .....	X
		Total Hours .....	15.75

#### FLIGHT TRAINING CURRICULUM

Simulator Hours:	Pilot Flying	4.50	Pilot Not Flying	.00
Aircraft Hours:	Pilot Flying	.00	Pilot Not Flying	.00

The proficiency required for this course has  
been demonstrated.

  
Manager

Ft. Worth Bell Learning Center

12/21/00

Date

## RECURRENT GROUND TRAINING RECORD

AIRCRAFT TYPE:

Bell 412

NAME: TING, TSO-TE (KEVIN)

CERTIFICATE NO.:

900.06.9454

CREW POSITION:

Pilot

COURSE:

026RP 18-21 DEC00

## GENERAL OPERATIONAL SUBJECTS

MODULE	DATE	INSTRUCTOR
A. Weight and Balance Module	12/19/00	Bob Under
B. Performance Module	12/19/00	Bob Under
C. Flight Planning Module	12/19/00	Bob Under
D. Approved Rotorcraft Flight Manual Module	12/19/00	Bob Under
E. Windshear Training Module	12/19/00	Bob Under
F. Crew Resource Management (CRM) Module	12/19/00	Bob Under

TIME 2.0

## SYSTEMS TRAINING

MODULE	DATE	INSTRUCTOR
A. Aircraft General	12/18/00	Bob Under
B. Powerplant	12/18/00	Bob Under
C. Air Management (412/212)	12/18/00	Bob Under
D. Fire Protection	12/18/00	Bob Under
E. Fuel System	12/18/00	Bob Under
F. Electrical System	12/18/00	Bob Under
G. Lighting	12/18/00	Bob Under
H. Master Warning System (412/212)	12/18/00	Bob Under
H. IIDS and Master Warning System (430)	N/A	
I. Powertrain	12/18/00	Bob Under
J. Main Rotor	12/18/00	Bob Under
K. Tail Rotor	12/18/00	Bob Under
L. Flight Controls/AFCS	12/18/00	Bob Under
M. Hydraulics	12/18/00	Bob Under
N. Ice and Rain Protection	12/19/01	Bob Under
O. Environmental System	12/19/00	Bob Under
P. Avionics	12/19/00	Bob Under
Q. Kits and Accessories	12/19/00	Bob Under
R. Preflight	12/19/00	Bob Under
S. Review, Examination and Critique	12/19/00	Bob Under
Final Grade <u>90</u>	Corrected to 100%	12/19/00 Bob Under

TIME 10

## SIMULATOR BRIEFING / DEBRIEFING

TIME 3.0

## SYSTEMS INTEGRATION MODULE

TIME 0.75

I CERTIFY I RECEIVED THE ABOVE TRAINING:

SIGNATURE

DATE

**RECURRENT**

COMPANY:	CIVIL AERONAUTICS ADM	COURSE	026RP
PILOT NAME:	TING, TSO-TE	ID NO:	900.06.9454

FLIGHT:		SIM 1	SIM 2	SIM 3	SIM 4	SIM 5	SIM 6	SIM 7
DATE:		12/19/03	12/20/03	12/21/03				
INSTRUCTOR:		Bob Burke	Bob Burke	Bob Burke				
PIC FLIGHT TIME:		1.5	1.5	1.5				
BRIEFING TIME:		1.0	1.0	1.0				

Flight / Pretaxi Procedures								
Performance / Limitations								
Engine Start								
Takeoff Checks								
VER TAXI	412 / 430							
Taxi								
Normal and Crosswind Takeoff								
nb, Normal								
nb, Crosswind	212 / 430							
Traffic Patterns	412							
Normal and Crosswind Landing								
Single Engine Landing								
Flight Controls (Normal, Abnormal)								
Fire Detection and Extinguishing (Normal, Abnormal)								
Navigation and Avionics Equipment (Normal, Abnormal)								
FCS, EFIS (As Applicable)								
Engine Systems (Normal, Abnormal)								
Confined Area Operations								
Rotorcraft/Platform Operation								
Rapid Deceleration								
Instrument Takeoff								
Maximum Performance Takeoff & Climb								
Single Engine Procedures (Enroute)								
Steep Turns								
Recovery from Unusual Attitudes								
Climbing with Power								
Sea Departure and Arrival								
Decision Approach (Coupled)	412 / 430							
Imprecision Approach								
Missed Approach								
Decision Approach	212							
Decision Approach with One Engine Inoperative								
Step Approach								
Slow Approach and Running Landing								
Around								
Landing								
Critical (AC and DC) (Normal, Abnormal)								
Anti-ice and De-ice Systems (Normal, Abnormal)								
Emergency Equipment (Normal, Abnormal)								
Loss of Tail Rotor Effectiveness (Oral Only)								

ACTIVITIES	SIM 1	AIM 2	SIM 3	SIM 4	SIM 5	SIM 6	SIM 7
Powerplant (Normal, Abnormal)	1/1		1/1				
Fuel System (Normal, Abnormal)	1/0		1/1				
Electrical (Normal, Abnormal)	1/1	1/1					
Hydraulics (Normal, Abnormal)	1/1		1/1				
In-flight Fire and Smoke Removal (Emergency)	1						
Transmission (Emergency)	1	1					
Tail Rotor (Emergency)		1					
Fuel System (Emergency)			1				
Engine Oil Systems (Emergency)			1				
Hydraulic System Failure (#1 or #2)	1		1				
After Landing / Parking	1	1	1				

#### MARKS:

MI #1: (VFR MALFUNCTIONS). AIRCRAFT CONTROL WAS ROUGH DURING THE FIRST 30 MINUTES OF THE PERIOD. HOWEVER, BY THE END OF THE PERIOD, PILOT'S AIRCRAFT CONTROL WAS VERY GOOD AND SMOOTH. INITIALLY HAD PROBLEMS IN THROTTLE CONTROL WITH ENGINE OVERSPEED / UNDER SPEED GOVERNOR FAILURES BUT WAS ABLE TO REFINE TECHNIQUE AFTER PERFORMING THE MANEUVERS THE SECOND TIME. DISCUSSED THE IMPORTANCE OF MAINTAINING AIRCRAFT CONTROL DURING MALFUNCTIONS, I.E., LOWER AIRSPEED AND HOLDING ASSIGNED ALTITUDE. AFTER BECOMING COMFORTABLE WITH THE PI, PILOT WAS ABLE TO MAINTAIN AIRSPEED / ALTITUDE WITHIN STANDARDS. ENGINE FAILURE AND ENGINE RE-START IN FLIGHT WAS GOOD. NO PROBLEMS IN IDENTIFYING ELECTRICAL FAILURES, XC & AC - 115/26.5 VAC). VERY GOOD SLOPE LANDING AND TAKEOFF. GOOD PERIOD, PILOT UNLOADED NORMAL TO ABOVE NORMAL PROGRESS.

MI #2: (VFR MALFUNCTIONS). AIRCRAFT CONTROL WAS MUCH BETTER - VERY GOOD. AUTOROTATION TA HOVER AND IN FLIGHT WERE GOOD... PRACTICED FOR MAIN DRIVE FAILURES & TAIL ROTOR DRIVE SHAFT FAILURES. INITIALLY, COLLECT FULL DOWN DURING MAIN DRIVE SHAFT FAILURE WAS SLOW AND NOT LOWERED TO FULL DOWN POSITION. SECOND MAIN DRIVE SHAFT FAILURE WAS PERFORMED WITHOUT ANY PROBLEMS... EXECUTED MALFUNCTION HOW THERCM. WAS DISTRACTED FROM / BY TRANSMISSION CHIP LIGHT DURING TAIL ROTOR (STUCK RIGHT) MALFUNCTION. HOWEVER, WAS ABLE TO PERFORM BOTH MALFUNCTION IN A SAFE AND TIMELY MANNER. DISCUSSED CRM DISTRACTIONS DURING DE-BRIEFING. OVERALL, SIM PERIOD WAS VERY GOOD, PROGRESS IS ABOVE NORMAL.

MI #3: (VFR OPERATION/MALFUNCTIONS) CLIENT REQUESTED VFR TRAINING; IFR NOT CONDUCTED. VERY GOOD SIM PERIOD! REVIEWED TAIL ROTOR MALFUNCTIONS, HIGH/LOW ENGINE GOVERNOR FAILURES, UPPER AIRWORK (SETTLING WITH POWER, STEEP TURNS, RECOVERY FROM UNUSUAL ATTITUDES), AND SINGLE ENGINE OPERATIONS WERE VERY GOOD. HYDRAULICS FAILURE WAS EXCELLENT. EXCELLENT AIRCRAFT CONTROL DURING AUTOROTATION AND WITH MAIN DRIVE SHAFT FAILURES. OVERALL, SIM PERIOD WAS EXCELLENT.

SIMULATOR TIME (Training): 4.5

SIMULATOR TIME (Checking): -

TOTAL SIMULATOR TIME: 4.5

TOTAL SIMULATOR BRIEFING TIME (Training): 3.0

I CERTIFY I RECEIVED THE ABOVE TRAINING:

SIGNATURE: \_\_\_\_\_

DATE: \_\_\_\_\_

**FlightSafety**  
international

*Certifies that*

**Tso-Te Ting**

*has satisfactorily completed a course of*

**BELL 412 PILOT RECURRENT**

21st day of December, 2000

  
MANAGER



*the best safety device in any aircraft is a well-trained pilot...*

# DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION



## Pilot Proficiency Award Program

This is to certify that

**Tso-Te Ting**

has satisfactorily completed the requirements to become eligible to wear  
the Pilot Proficiency Wings, Phase I attesting to this  
individual's dedication to aviation safety.

21 December 2000

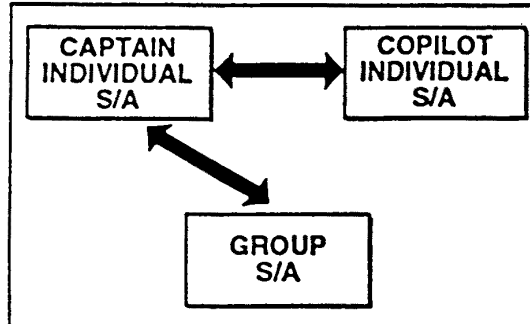
Date

Norris M. Woodruff  
Aviation Safety Counselor  
Ft. Worth Flight Standards District Office

A handwritten signature in black ink, appearing to read "Norris M. Woodruff", is written over a horizontal line.

Signature

## SITUATIONAL AWARENESS IN THE COCKPIT



Remember

$$2 + 2 = 2$$

— or —

$$2 + 2 = 5$$

(Synergy)

**IT'S UP TO YOU!**

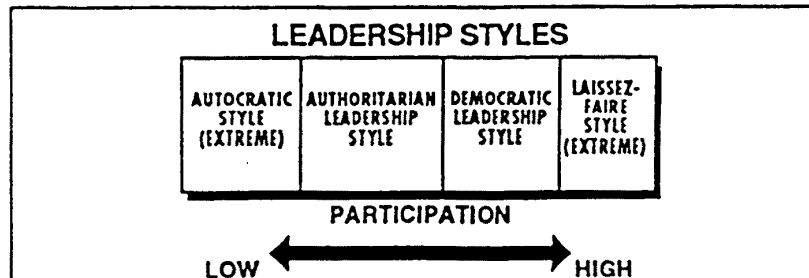
### CLUES TO IDENTIFYING:

- Loss of Situational Awareness
- Links In the Error Chain

OPERATIONAL	1. FAILURE TO MEET TARGETS
	2. UNDOCUMENTED PROCEDURE
HUMAN	3. DEPARTURE FROM SOP
	4. VIOLATING MINIMUMS OR LIMITATIONS
	5. NO ONE FLYING AIRPLANE
	6. NO ONE LOOKING OUT WINDOW
	7. COMMUNICATIONS
	8. AMBIGUITY
	9. UNRESOLVED DISCREPANCIES
	10. PREOCCUPATION OR DISTRACTION
	11. CONFUSION OR EMPTY FEELING
	12.

## COMMAND AND LEADERSHIP

### LEADERSHIP STYLES

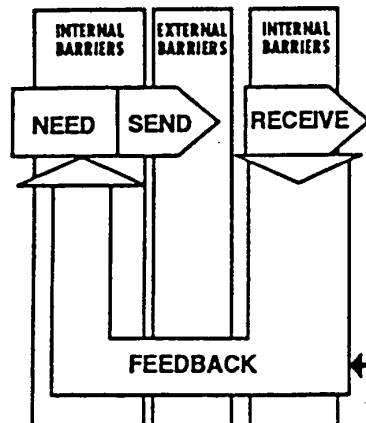


**Command** — Designated by Organization  
— Cannot be Shared

**Leadership** — Shared among Crewmembers  
— Focuses on "What's right, " not "Who's right"



## COMMUNICATION PROCESS



### THINK:

- Solicit and give feedback
- Listen carefully
- Focus on behavior, not people
- Maintain focus on the goal
- Verify operational outcome is achieved

### ADVOCACY: to increase others' S/A

- State Position
- Suggest Solutions
- Be Persistent and Focused
- Listen Carefully

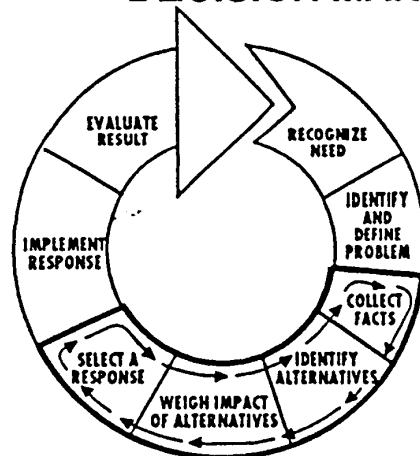
### INQUIRY: to increase your own S/A

- Decide What, Whom, How to ask
- Ask Clear, Concise Questions
- Relate Concerns Accurately
- Draw Conclusions from Valid Information
- Keep an Open Mind

### — REMEMBER —

Questions enhance communication flow  
Don't give in to the temptation to ask questions when Advocacy is required  
Use of Advocacy or Inquiry should raise a "red flag".

## DECISION MAKING PROCESS



### HINTS:

- Identify the problem:
  - Communicate it
  - Achieve agreement
  - Obtain commitment
- Consider appropriate SOP's
- Think beyond the obvious alternatives
- Make decisions as a result of the process
- Resist the temptation to make an immediate decision and then support it with facts

## Crew Performance Standards

### SITUATIONAL AWARENESS

- a. Accomplishes appropriate pre-flight planning.
- b. Sets and monitors targets.
- c. Stays ahead of the aircraft by preparing for expected or contingency situations.
- d. Monitors weather, aircraft systems, instruments, and ATC communications.
- e. Shares relevant information with the rest of the crew.
- f. Uses advocacy/inquiry to maintain/regain situational awareness.
- g. Recognizes error chain clues and takes action to break links in the chain.
- h. Communicates objectives and gains agreement when appropriate.
- i. Uses effective listening techniques to maintain/regain situational awareness.

### STRESS

- a. Recognizes symptoms of stress in self and others.
- b. Maintains composure, calmness, and rational decision making under stress.
- c. Adaptable to stressful situations/personalities.
- d. Uses stress management techniques to reduce effects of stress.
- e. Maintains open, clear lines of communication when under stress.
- f. Manages low stress situations to prevent complacency and boredom.

### COMMUNICATION

- a. Establishes open environment for interactive communications.
- b. Conducts adequate briefings to convey required information.
- c. Recognizes and works to overcome barriers to communications.
- d. Operational decisions are clearly stated to other crew members and acknowledged.
- e. Crewmembers are encouraged to state their own ideas, opinions and recommendations.
- f. Crewmembers are encouraged to ask questions regarding crew actions. Decisions and answers are provided openly and non-defensively.
- g. Assignment of blame is avoided. Focuses on **WHAT** is right, not **WHO** is right.
- h. Keeps feedback loop active until operational goal/decision is achieved.
- i. Conducts debriefings to correct substandard/inappropriate performance and to reinforce desired performance.

#### **SYNERGY AND CREW CONCEPT**

- a. Ensures that group climate is appropriate to operational situation.
- b. Coordinates flight crew activities to achieve optimum performance.
- c. Uses effective team building techniques.
- d. Demonstrates effective leadership and motivation techniques.
- e. Uses all available resources.
- f. Adapts leadership style to meet operational and human requirements.
- g. Encourages input/participation from all crewmembers.

#### **WORKLOAD MANAGEMENT**

- a. Communicates crew duties and receives acknowledgement.
- b. Sets priorities for crew activities.
- c. Recognizes and reports overloads in self and in others.
- d. Eliminates distractions in high workload situations.
- e. Maintains receptive attitude during high workload situations.
- f. Uses other crewmember.
- g. Avoids being a "one man show."

#### **DECISION MAKING**

- a. Anticipates problems in advance.
- b. Uses SOPs in decision making process.
- c. Seeks information from all available resources when appropriate.
- d. Avoids biasing source of information.
- e. Considers and weighs impact of alternatives.
- f. Selects appropriate courses of action in a timely manner.
- g. Evaluates outcome and adjusts/reprioritizes.
- h. Recognizes stress factors when making decisions and adjusts accordingly.
- i. Avoids making a decision and then going in search of facts that support it.

#### **ADVANCED/AUTOMATED COCKPITS**

- a. Follows automation related SOPs.
- b. Specifies pilot and copilot duties and responsibilities with regard to automation.
- c. Verbalizes and acknowledges entries and changes in flight operation.
- d. Verifies status and programming of automation.
- e. Selects appropriate levels of automation.
- f. Programs automation well in advance of maneuvers.
- g. Recognizes automation failure/invalid output indications.

# **BRIEFING GUIDE**

- **Technical Objectives**
- **Human Factors Objectives**
- **Personal Objectives**
- **Establish Realism**

- **Basic Flight Scenario**
- **Flight Data**
  - **Route and Approaches**
  - **Weather**
  - **Passenger Load**
  - **Fuel Requirements**

- **Relate System/Procedure to Flight Profile**
- **Relate System/Procedure to CRM Performance**
- **Use Guided Discussion**

- **Review Objectives**
- **Gain Commitment to Perform (Client and Instructor)**
- **Set Positive Tone**

- **TOLD Card**
- **File Flight Plan**
- **Order Fuel**
- **Crew Briefing**

# ***DEBRIEFING GUIDE***

- ***Set Time Limits***
- ***Agree on Topics***

- ***What Went Well?***
- ***What Needs Improvement?***
- ***Guide Discussion to Self-Discovery***
- ***Stress the Positive***

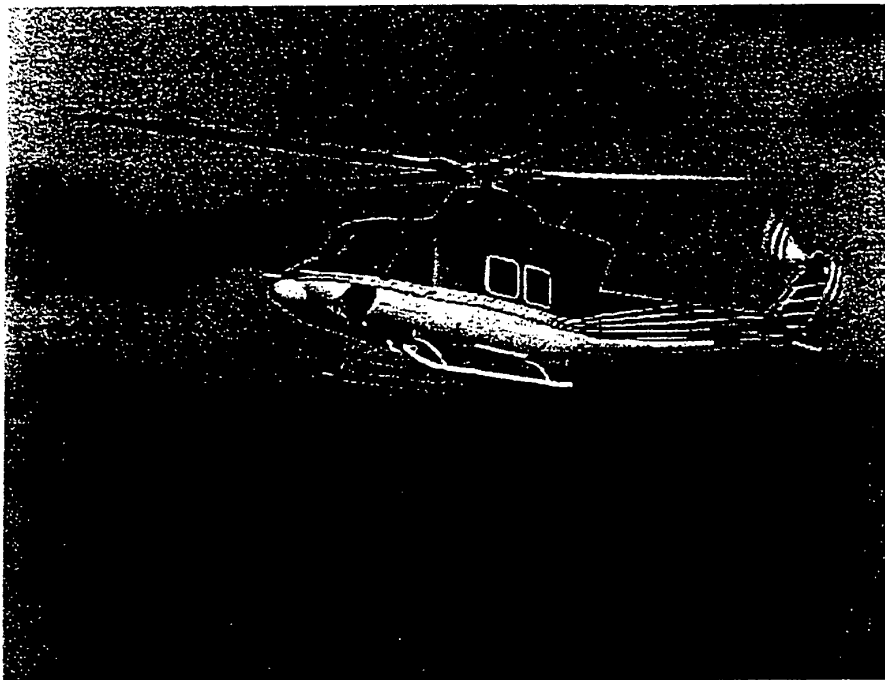
- ***Use Maps and Video to Organize and Illustrate***
- ***Use ATP Practical Test Standards***
- ***Use CRM Crew Performance Standards***
- ***Use CRM Posters***

- ***Objective and Performance-Oriented***
- ***Clarify Any Questions***

## ***PROVIDE SUMMARY OF LESSONS***

- ***Summarize Key Lessons***
- ***Progress Report***
- ***Action Items for Next Flight***

## **Accident Report**



**Bell 412SP  
N70AM  
Bluefield, WV  
April 22, 1994**

This space for bonding

<b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b>		NTSB ID: BFO94FA071		Aircraft Registration Number: N70AM	
		Occurrence Date: 04/22/94		Most Critical Injury: FATAL	
		Occurrence Type: Accident		Investigated By: NTSB	
<b>Location/Time</b>					
Nearest City/Place	State	Zip Code	Local Time	Time Zone	
BLUEFIELD	VA	24605	1445	EDT	
Accident Location: Off Airport		Distance From Landing Facility: 7 SM		Direction From Airport: 230 Deg Mag	
<b>Aircraft Information Summary</b>					
Aircraft Manufacturer		Model/Series		Type of Aircraft	
BELL		412/SP		Airplane	
Sightseeing Flight: No			Air Medical Transport Flight: UNK/NA		
<b>Narrative</b>					
Brief narrative statement of facts, conditions, and circumstances pertinent to the accident/incident:					
<p><b>HISTORY OF FLIGHT</b></p> <p>On April 22, 1994, at 1445 eastern daylight time, a Bell 412 helicopter, N70AM, owned and operated by Air Methods Corporation of Denver, Colorado, collided with mountainous terrain during an instrument approach to Mercer County/Bluefield Airport Bluefield, West Virginia. All four occupants aboard the aircraft, the pilot, the co-pilot, and two flight nurses, received fatal injuries. The helicopter was destroyed. The flight originated in Winston Salem, North Carolina at 1347 hours and was arriving at its destination to pick up a patient. Instrument meteorological conditions prevailed and an instrument flight plan was filed. The flight was operated under 14 CFR Part 91.</p> <p>The pilot, co-pilot, and two flight nurses departed North Carolina Baptist Hospital to pick up a patient at the airport in Bluefield, West Virginia. The pilot received air traffic control services from a radar controller at the Indianapolis Air Route Traffic Control Center (ARTCC), and he requested vectors to ILS runway 23. The last transmission between the pilot and the controller was for the flight to maintain seven thousand feet until established on approach, and to fly heading two four zero. The flight was also cleared for the instrument landing system (ILS) approach to runway 23 at Mercer County, an uncontrolled airport. The pilot was instructed to contact the specialist at the Bluefield Flight Service Station (FSS) and reportedly made "normal" transmissions, with no indication of a problem. The helicopter impacted a mountain located 7 1/2 miles from the departure end of runway 23 at the 3400 foot level.</p> <p>There were several witnesses who heard the helicopter overfly their homes, but could not see it due to the fog. One of the witnesses reported that, "I could not see anything then I heard</p>					
(Continued on Next Page)					
<b>FACTUAL REPORT - AVIATION</b>					
Page 1					

National Transportation Safety Board  
**FACTUAL REPORT**  
**AVIATION**

NTSB ID: BFO94FA071  
 Occurrence Date: 04/22/94  
 Occurrence Type: Accident

**Narrative (Continued)**

this low noise I thought maybe it was going to land." Another witness stated that the helicopter was flying parallel with the mountain. "...It sounded like it was very low. The fog was below the tree line on the mountain....I said to myself you better get it up if you plan to clear the mountain. Then I heard a tree break then an explosion."

The accident occurred at daylight, about 37 degrees 18 minutes North latitude and 81 degrees 12 minutes West longitude.

**PILOT INFORMATION**

The pilot, age 45 years, held an airline transport pilot (ATP) certificate for helicopter operations. At the time of the accident, company records indicate that he had accumulated approximately 4094 total flying hours, of which 969 were in the Bell 412. He was issued a first class medical certificate with no limitations on December 16, 1993. In accordance with 14 CFR Part 135 requirements, he completed his last proficiency check on February 14, 1994 and he received his last recurrent training on February 1, 1994.

The co-pilot, age 32 years, held a commercial pilot certificate for helicopter operations, and a private pilot certificate with single engine land rating for airplane. At the time of the accident, company records indicate that he accumulated approximately 1412 total flying hours, of which 712 were in the Bell 412. He was issued a first class medical certificate with no limitations on April 12, 1993. In accordance with 14 CFR Part 135 requirements, he completed his last proficiency check on December 21, 1993 which included a check of instrument proficiency.

**AIRCRAFT INFORMATION**

The 1989 year model Bell 412/SP, serial no 33206, was equipped with two Pratt & Whitney PT6T-3B engines, serial nos. CPP 63179 and CPP 63180 respectively. The aircraft had over 2086 hours including 10 hours since the last annual inspection on April 19, 1994.

**METEOROLOGICAL CONDITIONS**

The 1450 hour surface weather observation for Bluefield Flight Service Station, about 7 miles east of the accident site was as

(Continued on Next Page)



National Transportation Safety Board <b>FACTUAL REPORT</b> <b>AVIATION</b>	NTSB ID: BFO94FA071	
	Occurrence Date: 04/22/94	
	Occurrence Type: Accident	
<b>Narrative (Continued)</b>		
<p>follows:</p> <p>"Sky condition, 500 feet overcast; visibility, 2 miles in fog and drizzle; temperature, 44 degrees (F); dew point, 44 degrees (F); wind condition, 010 degrees at 5 knots; and altimeter, 30.10 inches."</p> <p><b>WRECKAGE AND IMPACT INFORMATION</b></p> <p>The main wreckage lay inverted in a 25 foot diameter crater approximately 150 yards from the top of East River Mountain at the 3600 foot level. The wreckage was tied to a tree to avoid it from rolling down the 30-40 degree downslope. It was oriented on a magnetic heading of 335 degrees and strewn a distance of about 200 feet. The initial impact point (IIP) was with trees at the 3400 foot level. At the IIP, paint chips, glass and plexiglass were found that matched the plexiglass from the helicopter.</p> <p>A four foot section of the right skid tube forward section with a section of the front cross tube outboard saddle separated. The rotor head, main rotor blade mast, main transmission and associated flight control sump case separated and were located about 54 feet from the main wreckage. A one foot section of the main drive shaft with the data plate separated and was located about 33 feet from the main wreckage. The left and right horizontal stabilizer separated. A two foot section of the aft tail boom, 42 degree gearbox, vertical fin and 90 degree gearbox, and inboard portion of the output shaft separated and were located about 150 feet from the main wreckage. A two foot section of the tail rotor drive input shaft to the 42 degree gearbox separated.</p> <p>The tail rotor and hub with a section of the output shaft and crosshead assembly separated.</p> <p>Control continuity of the drive train was confirmed by rotating the rotor in the direction of rotation. The engine to transmission drive shaft gears teeth, and the drive shaft to the 90 degree gearbox sheared. Control continuity of the tail rotor drive shaft and the drive shaft to the 90 degree gearbox was confirmed.</p> <p>The cyclic control separated from the pilot's cyclic control stick at the base. The pilot's collective pitch control separated at the joint between the number one and two engines.</p> <p style="text-align: right;">(Continued on Next Page)</p>		
<b>FACTUAL REPORT - AVIATION</b>		Page

National Transportation Safety Board <b>FACTUAL REPORT</b> <b>AVIATION</b>	NTSB ID: BFO94FA071	
	Occurrence Date: 04/22/94	
	Occurrence Type: Accident	
Narrative (Continued)		
<p>The wreckage was transported to Summitt Helicopters in Roanoke, Virginia. The engine was examined and there was no evidence of any mechanical malfunction that would have precluded operation.</p> <p><b>MEDICAL AND PATHOLOGICAL INFORMATION</b></p> <p>An examination was done by Dr William Massello III, Office of the Chief Medical Examiner in Roanoke, Virginia, on April 24, 1994. Toxicological tests did not detect alcohol, drugs, or carbon monoxide.</p> <p><b>TESTS AND RESEARCH</b></p> <p>The navigation instruments for the pilot and co-pilot including the VOR/localizer receiver and marker beacon receiver were sent to Allied Signal in Olathe, Kansas for examination. The examination included retrieving the frequencies and codes from non-volatile memory. Both VOR/localizers for the pilot and co-pilot were tuned to the localizer frequency of 109.5, with 110.0 for the Bluefield Vortac on the standby mode. The marker beacon sensitivity in the LO sense mode was within specifications. The sensitivity in the HI sense mode was 300 microvolts. The specification according to Allied Signal is for 200 microvolts. There was a BHT label on the case of the unit which indicated that the HI sensitivity was set to 300 microvolts. The test could not reveal the position of the marker beacon switch due to impact damage.</p> <p><b>ADDITIONAL INFORMATION</b></p> <p>Wreckage Release: The aircraft wreckage was released to Marshall B. Dean of the USAIG insurance company, the owner's insurance representative on October 15, 1994.</p>		
FACTUAL REPORT - AVIATION		Page

National Transportation Safety Board  
Washington, D.C. 20594

Brief of Accident

Adopted 05/10/1995

BFO94FA071  
FILE NO. 1521 04/22/94 BLUEFIELD, VA AIRCRAFT REG. NO. N70AM TIME (LOCAL) - 14:45 EDT

MAKE/MODEL - BELL 412/SP  
ENGINE MAKE/MODEL - P4W PT6T-3B  
NUMBER OF ENGINES - 2  
OPERATING CERTIFICATES - On-demand air taxi  
TYPE OF FLIGHT OPERATION - Positioning  
REGULATION FLIGHT CONDUCTED UNDER - 14 CFR 91

AIRCRAFT DAMAGE - Destroyed  
CREW  
FATAL 2  
SERIOUS 0  
MINOR/NONE 0

LAST DEPARTURE POINT  
DESTINATION - WINSTON SALEM, NC  
- Same as Accident  
AIRPORT PROXIMITY - Off airport/airstrip  
AIRPORT NAME - MERCER COUNTY  
RUNWAY IDENTIFICATION - 23  
RUNWAY LENGTH/WIDTH (Feet) - Unk/Nr  
RUNWAY SURFACE - Unk/Nr  
RUNWAY SURFACE CONDITION - Unk/Nr  
CONDITION OF LIGHT - Daylight  
WEATHER INFO SOURCE- Weather observation facility  
BASIC WEATHER - Instrument (IMC)  
LOWEST CEILING - 500 Ft Overcast  
VISIBILITY - 0002.000 SM  
WIND DIR/SPEED - 010 /005 KTS  
TEMPERATURE (F) - 44  
OBSTR TO VISION - Fog  
PRECIPITATION - Drizzle

PILOT-IN-COMMAND AGE - 45  
CERTIFICATES/RATINGS  
Airline transport  
Helicopter  
INSTRUMENT RATINGS  
Helicopter  
FLIGHT TIME (Hours)  
TOTAL ALL AIRCRAFT - 4094  
LAST 90 DAYS - 56  
TOTAL MAKE/MODEL - 969  
TOTAL INSTRUMENT TIME - 339

THE FLT HAD DEPARTED THE NORTH CAROLINA BAPTIST HOSPITAL IN WINSTON SALEM. IT ARRIVED FROM THE NE AND WAS VECTORED FOR THE ILS RY 23 APCH. THE LAST VECTOR WAS 240 DEG, WHICH WAS INADEQUATE TO INTERCEPT THE LCLZ. THE FLT WAS CLEARED FOR AND INSTRUCTED TO MAINTAIN 7000 FT UNTIL ESTABLISHED ON THE APCH. RECORDED RADAR DATA SHOWS THE FLIGHT DID NOT INTERCEPT THE LCLZ BUT PARALLELED ON A SW COURSE, A MILE LEFT OF THE LCLZ, WHILE MAINTAINING 7000 FT. THE FLT CONTINUED THIS COURSE UNTIL ABEAM OF THE RY DEPARTURE END, BEGAN TO DESCEND, TURNED NW, CROSSED THE EXTENDED RY CENTERLINE, AND THEN PROCEEDED OUTBOUND FROM THE RY ON APRX 230 DEG COURSE UNTIL THE LAST RECORDED POSITION ABOUT 5 MI SW OF THE ARPT AT 4100 FT ALTITUDE. THE ACCIDENT SITE WAS ON A MOUNTAIN ABOUT 7.5 MI SW OF THE ARPT AT 3400 FT MSL. A WITNESS REPORTED THAT BEFORE HE HEARD THE CRASH HE COULD NOT SEE THE ACFT BECAUSE THE MOUNTAIN WAS OBSCURED BY FOG. BOTH NAV RADIOS WERE SET TO THE LCLZ FREQ. THE PUBLISHED IAP SHOWS A GLIDESLOPE INTERCEPT ALT OF 5000 FT, AND THE DH WAS 3157 FT. ACFT WAS OPERATED BY AIR METHODS CORPORATION.

FILE NO. 521

04/22/94

BLUEFIELD, VA

AIRCRAFT REG. NO. N70AM

TIME (LOCAL) - 14:45 EDT

Occurrence# 1 IN FLIGHT COLLISION WITH TERRAIN/WATER  
Phase of Operation APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings

1. - WEATHER CONDITION - DRIZZLE
2. - WEATHER CONDITION - LOW CEILING
3. - WEATHER CONDITION - FOG
4. - IFR PROCEDURE - IMPROPER - PILOT IN COMMAND
5. - ARTCC SERVICE - INADEQUATE - ATC PERSONNEL(ARTCC)

The National Transportation Safety Board determines that the Probable Cause(s) of this Accident was:  
THE PILOT'S FAILURE TO INTERCEPT THE FINAL APPROACH COURSE, AND HIS IMPROPER EXECUTION OF THE INSTRUMENT APPROACH  
PROCEDURE. FACTORS WHICH CONTRIBUTED TO THE ACCIDENT WERE: THE WEATHER CONDITIONS, AND THE FAILURE OF THE AIR TRAFFIC  
CONTROLLER TO ADEQUATELY VECTOR THE FLIGHTCREW TO INTERCEPT THE FINAL APPROACH COURSE AT THE APPROACH GATE, AS SPECIFIED  
IN THE ATC HANDBOOK.

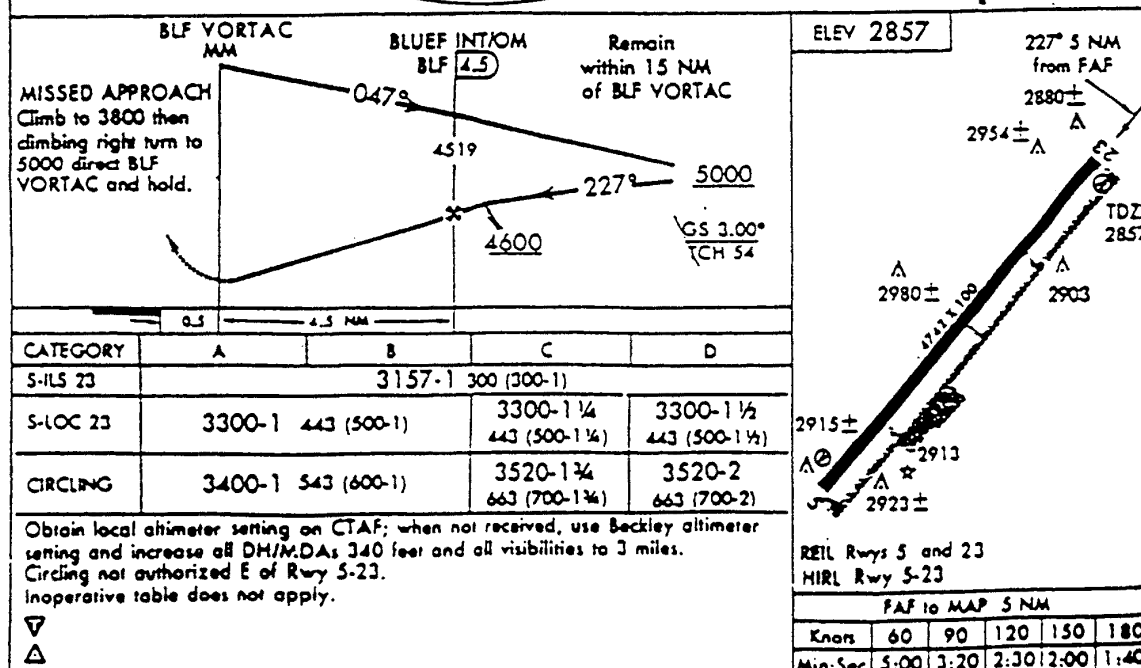
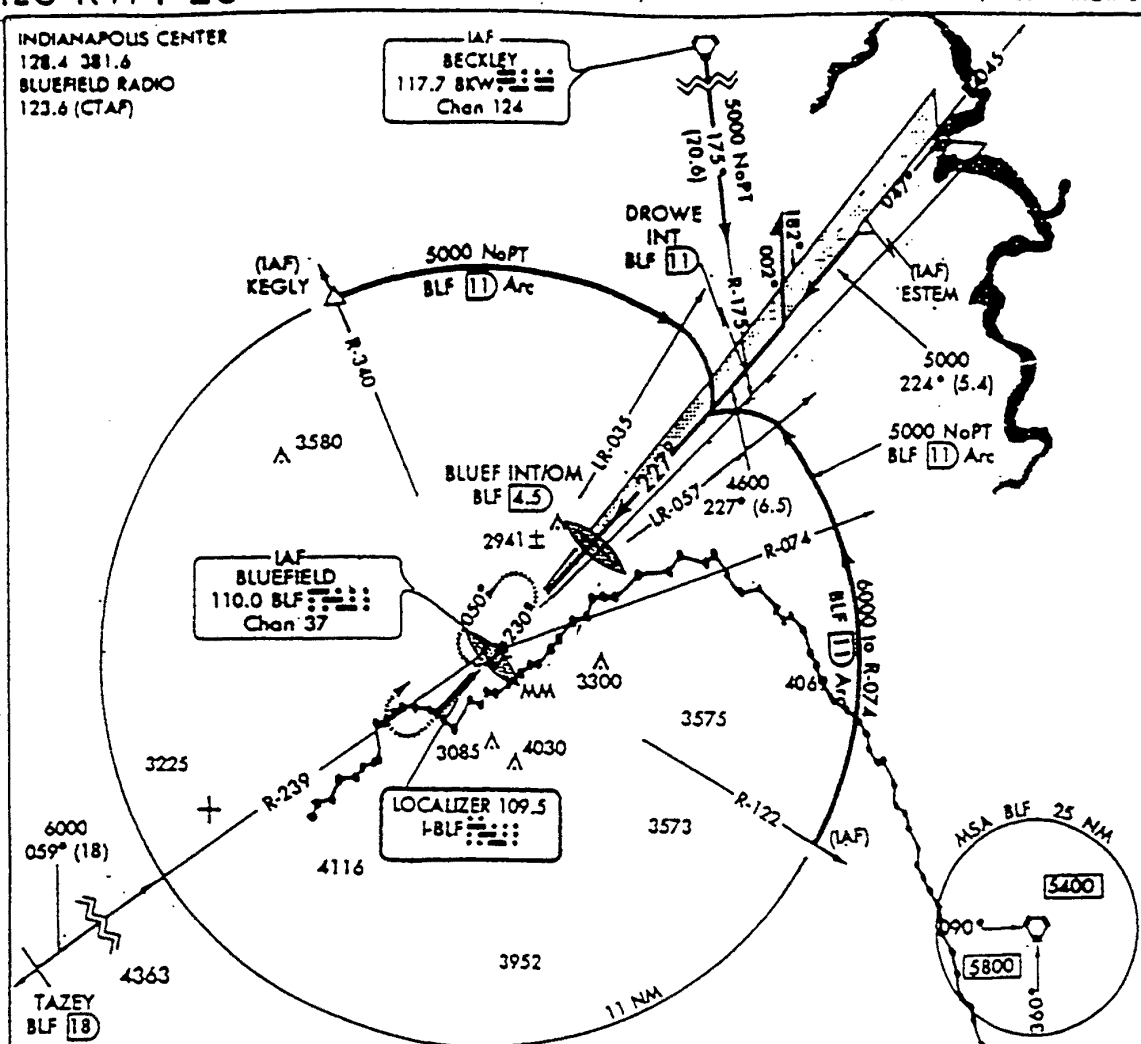
Format Revision 7/95

Amdt 138 94118

ILS RWY 23

AL-787 (FAM)

BLUEFIELD/MERCER COUNTY (BLF)  
BLUEFIELD, WEST VIRGINIA



ILS RWY 23

37°18'N - 81°12'W

BLUEFIELD, WEST VIRGINIA  
BLUEFIELD/MERCER COUNTY (BLF)

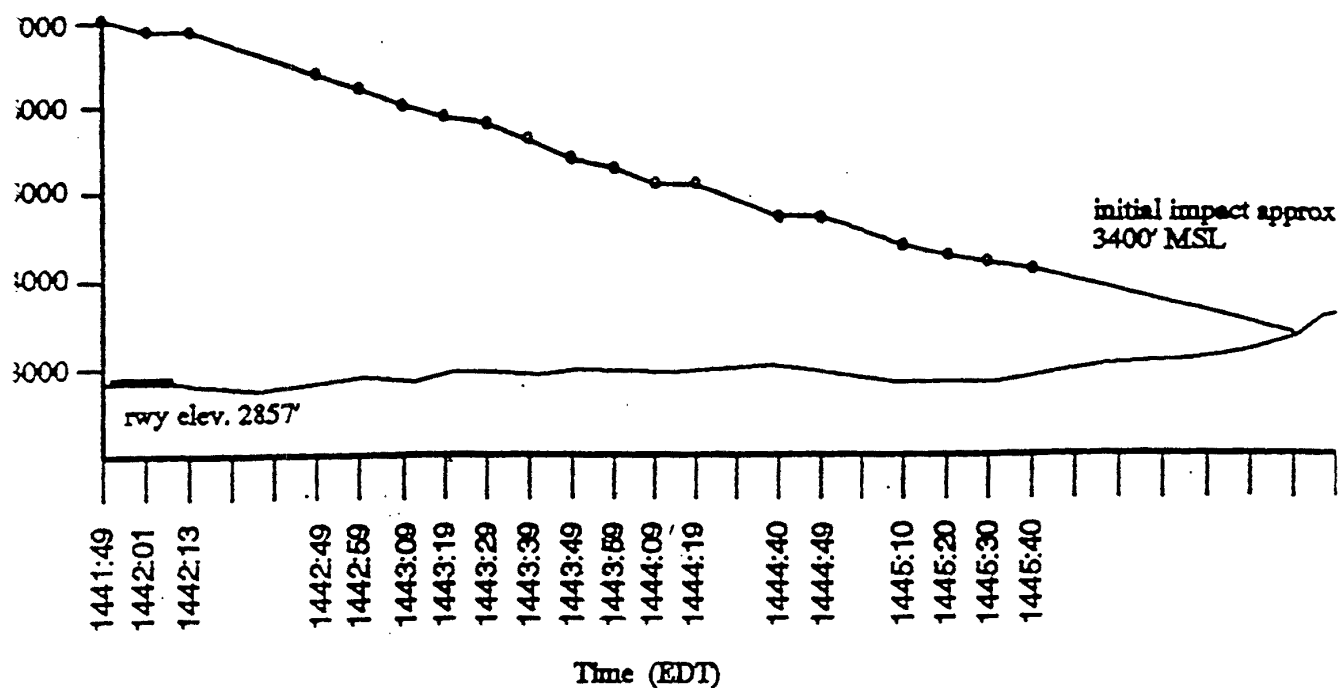


Fig. 4 N70AM vertical flight path profile after leaving 7000' MSL for the approach. Note that descent the approach began when the aircraft was already over the airport. Derived from ATC radar data. Flight path distances not to scale.



U.S. Department  
of Transportation  
Federal Aviation  
Administration

# Memorandum

ARTCC - Indianapolis, IN

Subject: Transcription concerning the Accident  
involving LN70AM on April 22, 1994  
at 1854 UTC

Date:

From: Indianapolis ARTCC

Reply to  
Attn. of:

To: This transcription covers the Indianapolis ARTCC Hazard Sector Radar  
position for the time period from April 22, 1994, 1815 UTC  
until April 22, 1994, 1856 UTC.

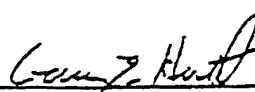
## Agencies Making Transmissions

Indianapolis ARTCC Hazard Radar Controller  
Atlanta ARTCC Spring Radar Position  
Lifeguard November Seven Zero Alpha Mike  
Roanoke Approach Control

## Abbreviations

AZQ R  
SPR R  
LN70AM  
ROA A/C

I hereby certify that the following is a true transcription of the  
recorded conversations pertaining to the subject aircraft accident  
involving LN70AM:

  
\_\_\_\_\_  
Gary E. Hartel  
Quality Assurance Specialist  
May 9, 1994

1815  
1816  
1817  
1818  
1819  
1820

1820:34 SPR R Hazard Sixty Eight

1820:42 AZQ R Hazard

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1820:43 SPR R Yeah Lifeguard Zero Alpha Mike is requesting priority handling into Bluefield and the Carolina Fifty One Fifty Six looks like he's going to be there about four or five minutes before him I told him he might have a have to have a delay or else he could hurry and get in there quick it will be your choice though at INDY Center they're both you're control whatever you want to do with him

1821  
1821:00 AZQ R Thank you K L

1821:01 SPR R \*(I N)

1821:37 SPR R Hazard sixty eight again

1821:42 AZQ R Hazard

1821:43 SPR R Yeah that Lifeguard said he wouldn't mind a couple minute delay if you wanted to take the Carolina in before him the Carolina's stopped at ten now your control for descent reference Zero Alpha Mike

1822  
1823  
1823:45 SPR R Hazard sixty eight line (unintelligible) put the Carolina in (unintelligible)

1823:50 AZQ R Hazard say again

1823:51 SPR R Yeah (unintelligible)

1824  
1825  
1825:17 LN70AM Indianapolis Center Lifeguard Helicopter Seven Zero Alpha Mike with you at eight thousand feet

1825:22 AZQ R Lifeguard Seven Zero Alpha Mike Indy Center roger Bluefield altimeter three zero one zero

1825:27 LN70AM Three Zero One Zero



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1826

1827

1827:42 AZQ R Lifeguard Seven Zero Alpha Mike I have the Bluefield weather if you'd like it

1827:49 LN70AM Yes Sir \*(Seven Alpha Mike) go ahead (unintelligible)

1827:54 AZQ R Lifeguard Seven Zero Alpha Mike ah Bluefield one eight zero eight observation estimated ceiling five hundred broken three thousand overcast visibility three with fog wind zero five zero at nine altimeter three zero one zero

1828

1828:12 LN70AM (Unintelligible) Sir we stepped on part of your transmission understand five hundred broken three hundred overcast two miles with fog wind zero five (unintelligible)

1828:33 AZQ R Lifeguard Seven Zero Alpha Mike it was ah estimated ceiling of five hundred broken and three thousand overcast

1828:40 LN70AM Roger understand that thank you (unintelligible)

1829

1829:30 AZQ R Lifeguard Seven Zero Alpha Mike ah I believe Atlanta Center was already talking to you about the ah inbound ahead of you there he's already joined the arc on the ILS Approach to Bluefield and what type of approach are you requesting

1829:43 LN70AM OK understand about the other aircraft and no problem with that like to proceed on the ILS runway two three approach vectors please

1829:51 AZQ R Lifeguard Seven Zero Alpha Mike roger

1829:55 LN70AM And ah (unintelligible) no need to ah bring us in to close to the outer marker

1830

1830:04 AZQ R Lifeguard Zero Alpha Mike roger turn right heading of three four zero vectors for the approach

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1830:08 LN70AM Roger three four zero \*(Seven Alpha Mike)  
1831  
1832  
1833  
1834  
1834  
1834:13 AZQ R Lifeguard Zero Alpha Mike descend and maintain  
seven thousand.

1834:16 LN70AM \*(Seven Alpha Mike) out of eight thousand for seven  
thousand

1834:53 AZQ R Lifeguard Zero Alpha Mike turn left heading three  
three zero

1834:58 LN70AM Left to three three zero \*(Seven Alpha Mike)  
1835  
1836  
1836:47 AZQ R Lifeguard Zero Alpha Mike turn left heading three  
zero zero

1836:50 LN70AM Left to three zero zero \*(Seven Alpha Mike)  
1837  
1837:58 AZQ R November Zero Alpha Mike turn left heading two  
seven zero  
1838  
1838:02 LN70AM Left to two seven zero \*(Seven Alpha Mike)

1838:15 AZQ R Lifeguard Zero Alpha Mike turn left heading ah  
disregard that please

1838:23 AZQ R Lifeguard Zero Alpha Mike seven miles east of  
Bluefield Airport maintain seven thousand until  
established on approach fly heading two four  
zero and ah cleared ILS runway two three approach  
to Bluefield

1838:37 LN70AM OK turning left heading two four zero \*(Seven-Alpha  
Mike) maintain seven thousand until established  
cleared for the approach  
1839  
1839:28 AZQ R Lifeguard Zero Alpha Mike frequency change  
approved good day

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1839:32 LN70AM \*(Seven Alpha Mike) roger  
1840  
1841  
1842  
1843  
1844  
1845  
1845:40 AZQ R Roanoke Hazard on twenty line  
  
1845:54 AZQ R Roanoke Hazard twenty line  
1846  
1846:01 ROA A/C Roanoke  
  
1846:02 AZQ R Ah Lifeguard Seven Zero Alpha Mike and the  
Carolina are both clear of your airspace  
  
1846:06 ROA A/C Thank you G M  
  
1846:07 AZQ R K L  
1847  
1848  
1849  
1850  
1851  
1851:09 AZQ R Lifeguard Seven Zero Alpha Mike Center  
1852  
1853  
1854  
1855  
1856

End of Transcript

\* This portion of the recording is not entirely clear, but this represents the best interpretation possible under the circumstances.