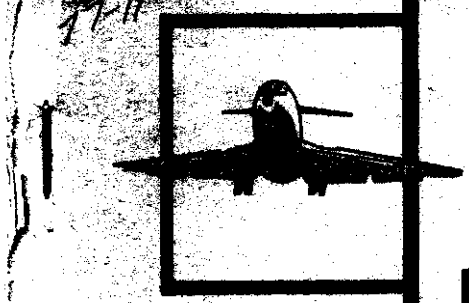

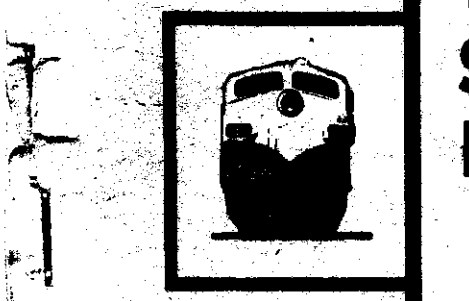

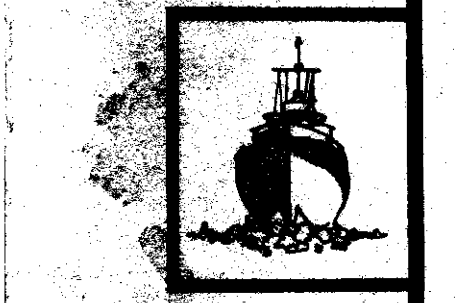

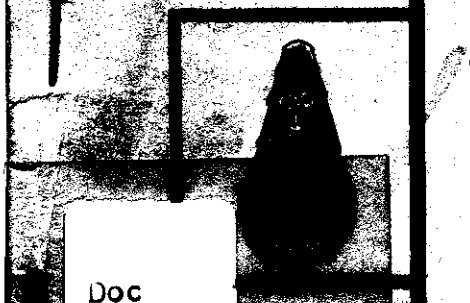

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

WNOB HILL INC.,
CESSNA-421, N999MB

NOGALES, ARIZONA

JANUARY 22, 1977

REPORT NUMBER: NTSB-AAR-77-11

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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16. Abstract A Cessna 421, N999MB, crashed near Nogales, Arizona, about 0841, m.s.t., January 22, 1977, while on an IFR flight to Fresno, California. After takeoff, radar contact with the aircraft was acquired north of Nogales at 9,000 ft. The controller advised the pilot to turn immediately because of a mountain peak directly in front of him. The pilot stated that he was turning, but radar contact was lost shortly thereafter. The aircraft was destroyed and both occupants were killed.

The National Transportation Safety Board determines that the probable cause of the accident was the controllers' issuance of an improper departure clearance, climb restriction, and altitude clearance. The controllers' lack of knowledge and noncompliance with standard ATC procedures placed the aircraft in proximity to high terrain and the pilot lost control of the aircraft for unknown reasons while executing an emergency, controller-directed turn.

Contributing to the accident were (1) the inadequacy of official guidelines concerning the use of the published IFR departure procedures, (2) the failure of the departure controller to provide appropriate services, (3) the inability of the flight service specialist to insert the pilot's requested departure route into the ATC flight data computer, and (4) the failure of the pilot to check the new departure clearance and route for proper terrain clearance altitudes.

17. Key Words	18. Distribution Statement
IFR departure route; lack of knowledge; change of route; VFR flight; high terrain; inability to maintain control; avoidance turn; improper ATC clearance; inadequate official guidelines.	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: October 27, 1977

KNOB HILL, INC.
CESSNA-421A, N999MB
NOGALES, ARIZONA
JANUARY 22, 1977

SYNOPSIS

About 0832 m.s.t., January 22, 1977, a Cessna 421A, N999MB, departed Nogales, Arizona, on a noncommercial business flight to Fresno, California. The aircraft crashed in mountainous terrain about 21 nmi north of Nogales. The aircraft was operating on an IFR flight plan.

The pilot was cleared, as filed, to maintain 10,000 ft, to climb VFR until reaching 9,000 ft, and to contact the Tucson departure control. The pilot contacted Tuscon departure control, reported going through 9,000 ft, and stated that he was still VFR. Radar contact had not been established, and the controller cleared the pilot to climb to 11,000 ft in VFR conditions. The pilot stated that he could not climb VFR to that altitude and subsequently stated that he was IFR and would have to descend. Radar contact with the aircraft was then acquired and the controller advised the pilot to turn immediately to avoid the mountain peak in front of him. The pilot stated that he was turning and radar contact was lost shortly thereafter. The aircraft was destroyed and both occupants were killed.

The National Transportation Safety Board determines that the probable cause of the accident was the controllers' issuance of an improper departure clearance, climb restriction, and altitude clearance. The controllers' lack of knowledge and noncompliance with standard ATC procedures placed the aircraft in proximity to high terrain and the pilot lost control of the aircraft for unknown reasons while executing an emergency, controller-directed turn.

Contributing to the accident were (1) the inadequacy of official guidelines concerning the use of the published IFR departure procedures, (2) the failure of the departure controller to provide appropriate services, (3) the inability of the flight service specialist to insert the pilot's requested departure route into the ATC flight data computer, and (4) the failure of the pilot to check the new departure clearance and route for proper terrain clearance altitudes.

1. FACTUAL INFORMATION

1.1 History of the Flight

About 0832 m.s.t. 1/, on January 22, 1977, Cessna 421A, N999MB, took off from Nogales International Airport, Arizona. The aircraft was en route to Fresno, California, on an IFR flight plan with the pilot and one passenger onboard.

Before departure the pilot contacted the Tucson, Arizona, Flight Service Station (FSS) by radio and told the specialist that he wanted to file an IFR flight plan to Fresno, California. The FSS specialist copied the proposed flight plan as follows: Direct from Nogales (OLS) to Flats Intersection, to intercept Victor airway 66 (V66) to Gila Bend, Arizona, and then via airways to Fresno. The requested initial leveloff altitude was 10,000 ft. 2/

The FSS specialist asked the pilot to repeat the first fix (Flats) in his requested flight route and the pilot complied. The specialist then asked if the pilot wanted to take off VFR or pick up his clearance while he was on the ground. The pilot stated that he would prefer to get his clearance before departing because, "its VFR here, high ceiling, I'll probably get into it pretty shortly afterward."

At 0800:40 the FSS specialist informed the pilot that he could not find Flats Intersection on his chart, and, "...We may have to put that into the computer from Nogales direct to Tucson, however, when you get airborne and talk to the controller he can give you a radar vector then right over to Victor six six and put you en route then. I don't know if we can get this Flats into the computer or not, over." The pilot's response to this transmission was unintelligible, and the FSS specialist then informed the pilot, "We (unintelligible) Victor six six does not touch Nogales so we'd have to put Nogales direct Tucson, and then Victor six six however the controller would...you wouldn't have to come all the way up here, he would cut you across the corner and take you on Victor six six after you contact him, over."

The pilot replied, "Okay fine Mike Bravo."

At 0827:37, the Tucson FSS called the Davis-Monthan RAPCON for N999MB's clearance. The flight data controller at the RAPCON read the computer-derived flight strip which showed the departure routing to be Nogales direct Tucson, then via airways to Fresno at 10,000 ft. He asked the facility's assistant chief to assist him in issuing a clearance, and at 0828:51, based on the assistant chief's advice, he issued the following clearance for relay through the Tucson FSS:

1/ All times herein are mountain standard based on the 24-hour clock.
2/ All altitudes herein are mean sea level.

"Nine Mike Bravo is cleared as filed to maintain one zero thousand, maintain VFR until reaching niner thousand and contact Tucson approach on one one eight point five when he's airborne."

At 0829:28, the following clearance was relayed to N999MB:

"ATC clears November triple nine Mike Bravo as filed, maintain one zero thousand, depart VFR and maintain VFR until nine thousand. Contact Tucson approach control one one eight point five after departure. Squawk zero seven seven three, and how's your copy."

The ATC transcript disclosed that parts of the pilot's readback were unintelligible, and, at 0830:25 the FSS specialist told the pilot, "Roger, and that was maintain VFR until reaching nine thousand, that's maintain VFR till nine thousand." At 0830:26 the pilot responded, "We just got it, thank you."

The flight departed Nogales about 0832.

At 0837:15, N999MB's pilot established radio contact with the RAPCON and told the departure controller that he was climbing through 9,000 ft. The controller asked if he was still VFR and the pilot stated that he was; the aircraft was not in radar contact. At 0837:31, the controller cleared the flight to maintain VFR and to climb to 11,000 ft; 12 seconds later the pilot stated the he would not be able to do that. At 0837:45, the controller asked N999MB, "How about one zero thousand five hundred, that's the minimum altitude I can use over Nogales." The pilot responded, "Ten, that's ten thousand five hundred, over." The controller again cleared the flight to maintain VFR.

At 0838:22, the pilot informed the controller that he was unable to maintain VFR. At 0838:27, the controller acknowledged and stated that he could not "approve IFR at that low an altitude over Nogales, maintain VFR." At 0838:35, the pilot stated that he would have to descend. The controller acknowledged and asked if he was heading north toward Tucson. At 0838:42, the pilot responded that he was proceeding toward Tucson on a heading of 360° magnetic and was 11 nmi DME (distance measuring equipment) from Nogales. At 0838:52, about 1.5 seconds after the pilot finished his position report, the controller stated that he had radar contact 31 nmi south of Tucson. The controller asked the pilot to confirm that he was VFR, and then told him that there was a peak "directly in front of you, 5 miles." At 0839:05, the pilot said he was not VFR, and, at 0839:10 the controller cleared the flight to, "turn left immediately, heading one eight zero and maintain VFR. At 0839:16 the pilot answered, "left one eight zero, maintain VFR." At 0839:23, the controller again advised the pilot, "there's a peak in excess of nine thousand directly in front of you." At 0839:27, the pilot responded, "Turning to one eight zero."

At 0840:10, the controller asked, "Twin Cessna nine Mike Bravo how do you hear me?" At 0840:15, the pilot responded, "Mike Bravo just left, (unintelligible)." At 0840:20, the controller asked the pilot if he could "maintain VFR there." There was no response. The controller attempted to contact the pilot at 0840:31 and at 0841:30. There was no response to either attempt. The 0840:15 message was the last known transmission from the flight.

The aircraft wreckage was found in a box canyon at an elevation of 5,600 feet, about 5 statute miles south of Mt. Wrightson. The plane crashed during daylight hours. The coordinates of the crash site are 31°37'40" north, 110°51'30" west.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Other
Fatal	1	1	0
Serious	0	0	0
Minor/None	0	0	0

1.3 Damage to Aircraft

The aircraft was destroyed

1.4 Other Damage

None

1.5 Personnel Information

The pilots were certificated for the flight in accordance with current regulations. The air traffic control and flight service station specialists were certificated and trained in accordance with current regulations. (See Appendix B.)

1.6 Aircraft Information

The aircraft was certificated and maintained in accordance with current regulations. The aircraft's tanks were filled before departure, and the pilot reported in his clearance request that he had 5 hours of fuel on board. (See Appendix C.)

1.7 Meteorological Information

The pilot obtained a preflight weather briefing from the Tucson FSS by telephone. He was also given a destination weather forecast and the freezing level en route before he received his ATC clearance.

The forecast for Utah and Arizona called for clouds in merging layers with tops at 20,000 to 25,000 ft; the mountains were to be mostly obscured by clouds. There were no surface weather observations taken at Nogales. The 0800 and 0900 Tucson surface observations disclosed scattered clouds at 2,200 ft, overcast at 5,000 ft, and visibilities 20 to 25 miles.

The pilot of a Cessna 182 which landed at Nogales about 0850 stated that the mountains to the north and northwest were covered with clouds. He estimated that the cloud base was about 5,000 to 6,000 ft.

Witnesses in the Rio Rico, Arizona, area, about 10 nmi northwest of Nogales and at an elevation of 3,446 ft, stated that there were low clouds in the area and that the mountain tops were obscured by clouds between 0715 and 0900.

1.8 Aids to Navigation

There were no known discrepancies or malfunctions of the ground navigational aids used by N999MB. Postaccident ground checks of the Nogales VOR/DME 3/ and the Tucson VORTAC were completed by the FAA. All meter readings were found to be normal and were so certified on the applicable facility maintenance logs. No postaccident flight checks were conducted. The Nogales VOR/DME is located on the airport and transmits on 108.2 MHz and Channel 12.

1.8.1 Departure Procedures

The FAA has established IFR departure procedures to assist pilots in avoiding obstructions during climbout to minimum en route altitudes. These procedures are established only at locations where instrument approach procedures are published and when required because of obstructions. Nogales International Airport has a published departure procedure which is displayed in the National Ocean Survey (NOS) charts and Jeppesen instrument approach procedures publications. (See Appendix D.)

The Nogales departure procedure is, in part, as follows:

> "Climb visually within 2 NM of the airport to cross the OLS VOR at 4,600 or above, then climb via OLS R-316 (316° radial) to Flats Int.. .."

Flats Intersection is formed by either the intersection of Nogales 316° radial and Tucson 194° radial; the Nogales 316° radial, 21-mile DME fix 4/; or the Tucson 194° radial, 27.5-mile DME fix. The minimum altitude at Flats Intersection is 9,000 ft.

3/ Very high frequency omnidirectional radio/distance measuring equipment.
4/ A geographic position determined by reference to a navigational aid which provides distance and azimuth information.

There is no low altitude airway between Nogales and Tucson. The Jeppesen and NOS low-altitude en route charts show neither a minimum altitude nor the highest terrain between these two points; there is no requirement that this information be included in these publications.

Mt. Wrightson is the highest terrain between Nogales and Tucson--9,453 ft. The mountain is situated on the Nogales 350° radial, about 17 nmi from the facility.

1.8.2 Radar

Davis-Monthan RAPCON is equipped with airport surveillance radar-5. This radar provides azimuth and range information at lower levels of flight within about a 50-mile radius of the airport. The equipment is owned and maintained by the FAA, and its antenna is located at Davis-Monthan Air Force Base.

The radar system has been programmed to incorporate the automated radar terminal system III (ARTS-111). Controllers at the facility can identify and track discretely and nondiscretely coded beacon targets. N999MB was equipped with DME and a transponder with 4096-code capability; a full data block was displayed on the radarscope before the target of N999MB went into coast. 5/ The video display was centered and set at a range of 50 miles.

The departure controller stated that he had no operational problems with his radar equipment on the day of the accident. At 0838:52, he obtained radar contact with N999MB 31 nmi south of the Tucson VORTAC; he asked the pilot if he was VFR, and he told him of the peak 5 miles ahead of him. The aircraft was at 9,000 ft. He issued a clearance for an immediate left turn to 180°, he saw the aircraft in a left turn, and did not see any altitude loss on the data block before the turn began. He saw the full data block go into coast mode and then he lost contact about 0840. He heard N999MB acknowledge a subsequent radio check and he saw the data block with an 8,600-ft altitude readout 6 or 7 miles south of Mt. Wrightson for one scan. Mt. Wrightson is depicted on the video display, but the radar equipment was not modified to incorporate terrain warning features.

The flight data processing computer at Davis-Monthan W C O N is not programmed to continuously store and retrieve flight data; therefore, a radar flight plot could not be constructed.

5/ When a beacon target is lost or too weak to correlate, the track is placed in a coast status. The computer moves the data block along its predicted path based on stored history of target position and velocity, and the letters CST are displayed in the data block in place of the Mode C derived altitude. If the target fails to recorrelate within three successive scans, the data block is dropped and the aircraft identification is placed in the coast suspend list.

The RAPCON facility has a chart which displays minimum obstruction clearance altitudes (MOCA) and the minimum vectoring altitudes (MVA) within 30 nmi of the RAPCON. The MVA between the 152° and **181"** radials **of** the Tucson VORTAC is 10,500 ft and the MOCA is **11,000** ft. Mt. Wrightson is situated on 172° radial of the Tucson VORTAC at 26 nmi.

1.9 Communications

There were no communication difficulties encountered by N999MB. There is no tower at Nogales International Airport, and all communications are conducted with the Tucson FSS by radio on 122.4 **MHz.** The Tucson FSS is the nearest FSS to Nogales and is listed in the Airman's Information Manual (AIM) as the facility to provide flight assistance and communication service for Nogales. The Tucson FSS uses a remote transmitter located in the terminal building at the Nogales International Airport.

1.10 Aerodrome Information

Not applicable

1.11 Flight Recorders

Flight recorders were not installed in N999MB, and none were required.

1.12 Aircraft Wreckage

N999MB crashed on the slope of a narrow box canyon, about 375 feet below the canyon rim at an elevation of 5,600 ft. The aircraft hit in a right wing-low, noseup attitude and on a 095° heading. The aircraft was destroyed by the impact and fire.

The impact crater contained the remainder of the nose section, the instrument panel, and the cockpit. The wing center section, inboard wing panels, flaps, and main landing gear were located about 5 ft down the slope from the crater. The rest of the aircraft was fragmented, and pieces of the wreckage had cascaded about 125 yds down the slope. The continuity of the aircraft's control system could not be established, and cockpit control settings and displays could not be determined.

The propeller blades of both engines evidenced heavy damage because of impact and fire. There were numerous bends, large nicks, and chordwise scratches in the propeller blades.

1.13 Medical and Pathological Information

The medical examiner stated that autopsies and toxicological studies could not be performed on the pilot and passenger.

1.14 Fire

Fire erupted on impact and was confined to the impact crater and the wing center section of the airplane. There was no evidence of sooting or smoke damage on the fragmented wreckage downslope of the crater. The fire extinguished itself.

1.15 Survival Aspects

This was not a survivable accident.

1.16 Tests and Research

None

1.17 Additional Information

1.17.1 Air Traffic Control

Numerous provisions of the Airman's Information Manual, the FAA Handbook, "Air Traffic Control" (ATC Handbook 7110.65), and several Federal Aviation Regulations (FAR) were applicable to the conduct of the ATC personnel and the pilot. Pertinent sections of these publications and the regulations are cited below:

ATC Handbook 7110.65

ATC controller procedures and phraseology are contained in this handbook. The purpose of the publication and the controller's discretionary authority are contained in paragraph 1 of the foreword which states:

> "This handbook prescribes air traffic control procedures and phraseology for use'by personnel providing air traffic control services. Controllers are required to be familiar with the provisions of this handbook which pertain to their operational responsibility and to exercise their best judgement if they encounter situations not covered by it."

Paragraph 236 states, in part:

> "Clear aircraft at an altitude at or above MEA or MCA for any part of airway or route within your area of specialization and the first part of the airway or route into an adjacent area of specialization or adjacent facility's area, except when one of the following applies:

d. Where MEA's have not been established, clear an aircraft at or above the minimum altitude for IFR operations prescribed by FAR. (R)
236.D. Reference.-Minimum altitudes for IFR operations, FAR 91.119."

Paragraph 350.d. states:

"When IFR departure procedures are published for a location and pilot compliance is necessary to insure separation, include the published departure as part of the **ATC** clearance."

Paragraph 350.e. states, in part:

"Compatability with a procedure issued may be verified by asking the pilot if items obtained/solicited will allow him to comply with local traffic pattern, terrain or obstruction avoidance. (N)

"350.e. Note.-If a published IFR departure procedure is not included in an **ATC** clearance, compliance with such a procedure is the pilot's prerogative and responsibility."

Paragraph 491.a. states, in part:

"You may clear aircraft to maintain VFR conditions if...

(1) The pilot has requested the clearance."

Paragraph 680.c. states:

"Vector IFR aircraft at or above minimum vectoring altitudes except as authorized for departures, radar approaches, and missed approaches."

Paragraph 1550 states:

"When you believe an emergency exists or is imminent, select and pursue a course of action which appears to be most appropriate under the circumstances and which most nearly conforms to the instructions in this manual. If you are in doubt that a given situation constitutes a potential emergency, handle it as though it were an emergency. (N)

"1550. Note.-Because of the infinite variety of possible situations, specific procedures cannot always be prescribed for every situation which might be considered an emergency. As a rule of thumb, an emergency includes any situation which places an aircraft in danger; i.e., uncertainty, alert, being lost, or in distress."

Airman's Information Manual (AIM)

The AIM is a pilot's operational manual, and Part I, Basic Flight Information and ATC Procedures, contains the basic fundamentals for flying in the U.S. National Airspace System. Pertinent provisions of the January 1977 edition are as follows:

In a paragraph headed, "VFR Restrictions" The AIM, states, in part.. .

"1. ATC will not issue a clearance to an IFR flight specifying that climb, descent, or any portion of the flight be conducted in VFR conditions unless one of the following exists:

a. The pilot requests the VFR restriction.

b. For noise abatement purposes where part of the IFR departure route does not conform with an FAA approved noise abatement route or altitude.

"2. *****

"3. If after receiving a VFR restriction you find that compliance with the clearance is not feasible, maintain VFR and request an amended clearance."

The AIM, page 1-59, contains a discussion of IFR takeoff minimums and departure procedures, and the manner in which these published IFR departure procedures are presented to the pilot. (See Appendix E.) The publication then states:

"e. Each pilot prior to departing an airport on an IFR flight should consider the type terrain and other obstructions on or in the vicinity of the departure airport and take the following action.

"(1) Determine whether a departure procedure has been established for obstruction avoidance.

"(2) Determine if the obstruction avoidance can be maintained visually or that the departure procedure should be followed.

"(3) At airports where instrument approach procedures have not been established, hence no departure procedure, determine for himself what action will be necessary and take such action that will assure a safe departure."

The AIM, page *1-48,* states:

"When an air traffic clearance has been obtained under either Visual or Instrument Flight, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained. The addition of a VFR or other restriction, i.e., climb/descent point or time, crossing altitude, etc., does not authorize a pilot to deviate from the route of flight or any other provision of the air traffic control clearance."

Federal Aviation Regulations

The State of Arizona is designated a mountainous area in *14* CFR 95.15.

14 CFR 91.119 states, in part:

"(a) Operation of aircraft at minimum altitudes. Except when necessary for takeoff or landing, or unless otherwise authorized by the Administrator, no person may operate an aircraft under IFR below.

"(1) The applicable minimum altitudes prescribed in Parts 95 and 97 of this chapter; or

"(2) If no applicable minimum altitudes is prescribed in those parts-

"(i) In the case of operations over an area designated as a mountainous area in Part 95 an altitude of 2,000 feet above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown."

The minimum standards for flight visibility are presented in tabular form in *14* CFR 91.105. The table discloses that within controlled airspace the following minimums are applicable:

More than 1,200 feet above the surface but less than 10,000 feet m.s.1.--Flight visibility is 3 statute miles, and the distance from clouds is; 500 feet below, 1,000 feet above, and 2,000 feet horizontal.

More than 1,200 feet above the surface and at or above 10,000 feet m.s.1.-- Flight visibility is 5 statute miles, and the distance from clouds is; 1,000 feet below, 1,000 feet above, and 1 mile horizontal.

14 CFR 91.115 states in part:

"No person may operate an aircraft in controlled airspace under IFR unless--

"(a) He has filed an IFR flight plan: and

"(b) He has received an appropriate ATC clearance."

14 CFR 91.75 states, in part:

"(a) When an ATC clearance has been obtained no pilot in command may deviate from that clearance, except in an emergency, unless he obtains an amended clearance....

"(b) Except in an emergency, no person may, in an area in which air traffic control is exercised, operate an aircraft contrary to an ATC instruction."

14 CFR 91.3 states, in part:

"(a) The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.

"(b) In an emergency requiring immediate action, the pilot in command may deviate from any rule of this subpart or of Subpart B to the extent required to meet the emergency."

14 CFR 91.5 states, in part:

"Each pilot in command shall, before beginning a flight familiarize himself with all available information concerning that flight. . ."

1.17.2 Controller Testimony

In depositions, the FSS specialists, and the RAPCON's controllers and assistant chief testified that they had little experience with IFR departures from Nogales. Most aircraft depart VFR and pick up their IFR clearance after takeoff. The flight data controller stated that N999MB was the first IFR departure from Nogales he had ever handled during his 5 years at the RAPCON, which was the reason he requested advice from his superior before relaying the clearance to the FSS specialist. The departure controller stated that it was the first IFR departure from Nogales that he had ever handled.

The FSS specialists stated that before the accident they had received no training on how to insert Flats Intersection into the ATC computer. After the accident, they discovered that the intersection could be inserted through use of radials and DME distance from the Nogales and Tucson VORTAC's.

The FSS specialist, who originally handled the clearance request, stated that he inserted Tucson into the computer to expedite acceptance of the clearance, and that he believed the pilot would fly west toward the airway. He told the pilot to expect radar vectors after takeoff but did not coordinate this with the Davis-Monthan RAPCON.

The FSS specialists and ATC controllers stated that they were familiar with the Tucson-Nogales area and its terrain; however, the assistant chief did not know that it was a designated mountainous area. The FSS specialists and flight data controller stated that they had little specific knowledge of the published IFR departure procedure for Nogales.

The assistant chief stated that he cleared N999MB at 10,000 ft because, "that was his requested altitude." He said that 10,000 ft would have been a safe altitude because he "visualized the aircraft climbing out towards the northwest." He said that, "he was generally aware of a departure procedure from Nogales that required a climb to the northwest," and he expected the pilot to comply with the procedure even if it was not included in the clearance.

The departure controller stated that he was generally familiar with the Nogales IFR departure routing but that he did not know the specific data contained in the published procedure. He stated that he didn't know if the pilot was flying the published departure route, but based on the routing contained on the flight progress strip, he believed that the pilot might proceed on a direct route from Nogales to Tuscon; and therefore, while he hoped that the aircraft was coming, "out on another route," he anticipated that the pilot might fly from Nogales to Tucson direct. Since the altitudes contained in the departure clearance did not provide proper terrain clearance, he felt that there was a "potential existing for there to be a problem."

When the pilot reported that he was at 9,000 ft in VFR conditions, he cleared the pilot to remain VFR and climb to 11,000 ft. He did not clear the pilot to climb IFR, because he didn't believe he could provide the aircraft with the proper terrain clearance during the climb. He said, "Therefore, the situation (that) was best in my mind was VFR, keep him VFR, and let him accomplish the altitude in that manner since he was on an unpublished route."

The departure controller believed that the emergency procedures contained in ATC Handbook **7110.65** were adequate. He stated that the flight became a problem "from the standpoint of his being in an unsafe position when I (radar) identified him...."

2. ANALYSIS

The pilot and his aircraft were properly certificated for the flight; the controllers and flight service specialists were properly certificated. There were no reported difficulties or malfunctions of the ground navigation aids, including the RAPCON radar and communications equipment.

The evidence disclosed that there are few pretakeoff IFR clearances issued to aircraft departing Nogales. Those IFR clearances that are issued are usually picked up by the pilot after takeoff. However, FSS specialists and air traffic controllers are required to have knowledge of the navaids, airways, published procedures, and terrain in their areas of responsibility. While the exact courses, fixes, and altitudes of a rarely used published IFR departure procedure might recede from their immediate recall, it is difficult to explain the inadequate knowledge which the FSS specialist demonstrated with Flats Intersection. This Intersection is not only part of the published IFR departure procedure, but also is part of two approach procedures to Nogales; it is the holding fix for two approaches. The inability of the specialist to insert the pilot's requested route into the computer, and his assurance to the pilot that the departure controller could vector the aircraft back toward his original route caused the pilot to accept the **FSS** specialist's suggested routing which took him direct to Tucson instead of Flats Intersection. The direct route traversed terrain elevations in excess of 9,000 ft, whereas the minimum altitude at Flats Intersection was 9,000 ft. This action by the FSS specialist was the beginning of the chain of events which led to the accident.

The ATC computer derived flight progress strip was conveyed to the Davis-Monthan RAPCON. The flight data controller questioned N999MB's departure routing and sought the advice of his superior. After a short consultation and **on** the advice of his superior, the clearance was issued to N999MB with the following restrictions, "maintain one zero thousand, maintain VFR until reaching niner thousand...." Since the pilot had not asked for a VFR climb, the Safety Board concludes that the issuance of the VFR climb restriction did not comply with the provisions of ATC Handbook **7110.65.**

The evidence disclosed an area of confusion regarding the use of the published IFR departure procedures. Directives contained in the ATC Handbook 7110.65 can be interpreted to support the controllers' contention that at airports which have a published IFR departure procedure a pilot can fly the departure procedure without indicating his intention to do so on his filed flight plan, and without otherwise informing ATC; and, the pilot may do this even when the IFR departure procedure is not specified in the pilot's flight plan.

The AIM's explanation of the purpose and use of the published IFR departure procedures is unclear as to how the pilot shall implement the procedure should he decide to use it. The AIM, which is a pilot's operational and informational manual, does not state, per se, that the pilot must indicate his intention to use a departure procedure either in his filed flight plan, or by otherwise advising ATC. However, a pilot's responsibility to adhere to his ATC clearance is defined in 14 CFR 91.75, which forbids a pilot from deviating from an obtained clearance except in an emergency.

The evidence in this accident disclosed that the controllers were not certain if the pilot was proceeding to Tucson direct, or flying the published IFR departure procedure which varied from the direct route by about 12 nmi. The evidence is conclusive that the pilot was following the routing stated in his ATC clearance and was flying to Tucson direct.

The assistant chief stated that the 10,000 ft altitude assignment was based on both the pilot's requested altitude, and the assumption that the pilot would comply with the departure procedure and climb toward the northwest. Under these circumstances 10,000 ft would have been a safe altitude. The ATC Handbook notes that in those instances where a published IFR departure procedure is not included in an ATC clearance the pilot has the prerogative and responsibility to comply with it. Since, based on the controllers' contention that the pilot need not inform them of his intention to use it, and since other traffic was not a factor, there was no need for the controller to know if the pilot intended to use the departure procedure or intended to fly the route depicted on his flight progress strip, i.e., Tucson direct. Nevertheless, the Safety Board believes prudent practice dictated that the controller should have either questioned the pilot as to his intended route prior to assigning him the altitude; or, he should have assigned him an altitude that would have assured the pilot proper terrain clearance over the highest terrain located on the two possible routes the pilot could use. The route contained in the ATC clearance traversed the higher terrain with elevation over 9,000 ft, and it was an unpublished route with no prescribed MEA. The 10,000 ft altitude assignment did not comply with the provisions of the ATC Handbook 7110.65, and 14 CFR 91.119.

As a result of the routing and altitude flown by the pilot, the departure controller was presented with a problem. After radio contact with N999MB was established he suspected that the assigned IFR altitude on the clearance might not afford the aircraft proper terrain clearance. This suspicion was based on the possibility that the aircraft was was flying to Tucson direct and was probably climbing toward a mountain peak; and, he anticipated that this was happening. He did not know the aircraft's exact position relative to the peak, and consequently he did not know how much time would be available to him to correct the potentially disastrous situation.

The controller prevented the pilot from striking the peak, however, the Safety Board believes that, during the 2 minutes from initial radio contact until he cleared the pilot to turn away from the mountain, the controller did not provide the pilot with appropriate services.

Essentially, a controller handles his traffic in the horizontal and vertical axes, and it is in the latter axis that the Safety Board believes that the controller did not provide the best service. Based **on** the conditions existing at the moment of initial radio contact, it was the controller's judgment that the best solution to his problem was to request the pilot to maintain VFR and to climb to a safe altitude in VFR conditions, even though this clearance was not in accordance with the provisions **of** the ATC Handbook which does not permit an unsolicited VFR restriction to be issued on an IFR clearance. The ensuing events demonstrated that the extension of the VFR restriction did not correct the problem. The extension aggravated the pilot's dilemma by preventing him from climbing to a higher altitude, and extending his exposure to the encroaching terrain. **It** also delayed the controller's decision that the aircraft had reached an unsafe position, and his consideration of other possible courses **of** action.

The events also disclosed that the controller would have been better advised to have requested a position report from the pilot at initial contact. Had that been done, he could have determined the aircraft's position relative to the terrain, and then kept it clear **of** the mountain by either amending the route of flight, or altitude or both, without resorting to extending the VFR restriction.

The controller's decision that the aircraft was in an unsafe positionwas based **on** his determination by radar of the aircraft's position relative to the mountain, however the situation had probably become critical **30** seconds earlier when the pilot reported that he was unable to maintain VFR conditions, and assumed even more critical proportions when the pilot reported he would have to descend in order to comply with the VFR restriction. Since there was **no** conflicting traffic in the area, and in view of the precipitous terrain, the controller should have cleared the aircraft to climb in IFR conditions and should

have taken the necessary measures to assure it would remain clear of any other traffic which could get in its way. However, once the controller made the decision that the aircraft was in an unsafe position, he did not hesitate to exercise his emergency authority and vector the aircraft even though it was below his MVA, and was not VFR. The vector was timely; the evidence disclosed that the pilot did turn to avoid the peak and its associated high terrain.

The Safety Board is unable to determine what effect the request to maintain VFR had on the pilot's conduct of the flight after he received the vector to 180". Had the aircraft crashed **on** a heading approximating the 180" vector and at an altitude and distance approximating a controlled descent under instrument conditions, further analysis in this area might be warranted; however it did not. The aircraft's altitude at impact, the elevation of the accident site, and its location when compared with its position when the controller issued the vector to 180" suggest a different course of events.

N999MB was about **5** nmi south **of** Mt. Wrightson when the vector to reverse course was issued, and the controller saw the aircraft start a left turn on his radar. He saw the aircraft's data block 1 minute later, and it was further south of the position he had originally acquired the aircraft's target. Its altitude readout was 8,600 ft. The aircraft impacted on a heading of 095° in a right wing low and noseup attitude. The crash site was about the same distance from Mt. Wrightson as the point where the controller issued the vector, and its elevation was 3,400 feet below the altitude at which the turn to avoid the peak was started.

The evidence indicates that the aircraft continued to turn rather than proceeding on a 180" heading. The evidence is conclusive that the aircraft turned 270°, or perhaps more, and descended *3,400* ft during the turn. The **loss** of radar contact with the aircraft, and the pilot's failure to respond to the controller's attempts to contact him indicates that the turn and descent occurred within 53 seconds to **2** minutes **3** seconds after the pilot said he was turning to 180".

The location of the crash site further corroborates the fact that the vector was issued in time to allow the aircraft to turn and avoid the peak. Based on the above evidence, the Safety Board concludes that the pilot either became spatially disoriented during the left turn or allowed his aircraft to enter a spiral during the turn, or both, and the aircraft crashed during an attempted recovery maneuver either on instruments or after it emerged from the base of the clouds.

The pilot's original request to fly the route of the published departure procedure and the fact that he had operated into and out of the airport several times appears to indicate that he had some knowledge of the terrain; however, the published departure route also represented

the most direct route toward his destination. Therefore, a conclusion concerning his level of terrain awareness cannot be made. In addition, the **FSS** specialist's assurance that he would not have to proceed to Tucson probably promoted the belief that he would be vectored to the northwest toward the airway before reaching Tucson. Regardless, the regulations required the pilot to familiarize himself with, "all available information concerning the flight," before takeoff. He should have familiarized himself with the height of the terrain in the Nogales-Tucson area and along his new route. Despite the assurance that he would be vectored "across the corner," he did not know the exact point **on** the new route these vectors would be issued, and how far north of Nogales that point would be.

The clearance delivered to the pilot changed his originally requested route of flight. The pilot accepted the change to the clearance before takeoff, and the amended clearance was delivered to him 27 minutes later. There was more than enough time for him to check his new routing for terrain clearance. It was the pilot's responsibility to assure himself that the new routing he received did not endanger his aircraft. The Safety Board previously has contended that controllers should be responsible for terrain awareness in the exercise of their duties; however, the pilot must be charged with an even greater responsibility in this area since he should also be familiar with the terrain, and must be presumed to have a greater knowledge than the controller of his aircraft's capability to climb and avoid the terrain.

The pilot tried to comply with the controller's clearance to maintain VFR flight conditions. During this part of the flight the controller's discussion of the minimum IFR and vectoring altitudes should have realerted him to the terrain he was approaching. Thus, when he lost visual meteorological flight conditions and stated that he had to descend to regain them, he should have reversed course and returned in the direction he had just safely traversed at lower altitudes. Failing that, he should have invoked his emergency authority and informed the controller that he intended to either maintain his present altitude or climb. The pilot's responsibility to exercise the emergency authority granted him in ***14*** CFR **91** is certainly equal to that granted to the controller by ATC Handbook 7110.65.

The entry and conduct of a flight in controlled airspace is produced by an interaction between a pilot and a controller. The FSS personnel's lack of knowledge and noncompliance with the procedures contained in their handbook resulted in the issuance of a departure clearance which placed the pilot and departure controller in a situation which rapidly accelerated into an emergency, and one which placed the major burden for correcting it **on** the departure controller.

The Safety Board believes that while neither the pilot nor the ATC personnel exercised their assigned responsibilities properly during the formulation, delivery, and acceptance of the IFR departure clearance, the evidence indicates that the greater responsibility for the result of these failures must be borne by the ATC personnel. Because of these breakdowns optimum performances on the part of the pilot and departure controller were required to avert an accident. Unfortunately, the required level of performance was not forthcoming from either. The controller did prevent the aircraft from hitting the peak, but his efforts to achieve this may have confused, and probably increased, the stress on the pilot. While the pilot was dependent on the controller during this portion of the flight, had he fully familiarized himself with the terrain he might have been able to help the departure controller by telling him what he thought must be done rather than merely telling the controller what he was unable to do. The evidence of this accident illustrates that the safe conduct of a flight in controlled airspace is a dual responsibility which can only be exercised properly when both the pilot and the controller have complete knowledge of their individual duty requirements.

The Safety Board has, in previous accident reports, voiced its concern over the dangers created by breakdowns in communications between pilots and controllers, and the failure of pilots and controllers to exchange information both accurately and completely. This accident demonstrates that the failure to communicate, or to exchange information, is not limited to the area of oral communications. The directives and official guidelines contained in the applicable publications created an area of confusion concerning the use of the published IFR departure procedure. The controller's belief that the pilot would fly the route contained in the departure procedure evidently contributed to his assignment of an altitude which did not provide the required obstacle clearance. The Safety Board believes that the procedures and guidelines contained in the AIM and the ATC Handbook are unclear and lead to interpretations which are not consistent with the requirements of *14* CFR *91.75.* The Safety Board believes that these factors led to the foregoing misunderstanding, and, accordingly has recommended that the FAA initiate action to remedy this deficiency.

3. Conclusions

3.1 Findings

1. The pilots, FSS specialists, and air traffic controllers were certificated in accordance with current regulations. The aircraft was certificated and maintained in accordance with current regulations.

2. The pilot's requested departure route was from Nogales to Flats Intersection. The FSS specialists did not know the proper method to insert Flats Intersection into the center's flight data computer.

3. The FSS specialist suggested a change to the pilot's requested route of flight in order to permit the flight data computer to accept the clearance. The pilot was aware of and accepted the change. The route of flight was changed to Nogales direct to Tucson.

4. The issuance of the VFR climb restriction was not in accordance with the contents of the AIM and ATC Handbook 7110.65, Paragraph 351.

5. The 10,000-foot IFR altitude assignment did not meet the 2,000-foot terrain clearance requirements of 14 CFR 91.119.

6. The terminology contained in the AIM describing the use of published IFR departure procedures is unclear as to whether the pilot is required to inform air traffic control of his intent to use a published IFR departure procedure, or whether he can fly the procedure without specific air traffic control authorization.

7. If a published IFR departure procedure is not included in an ATC clearance, the terminology of paragraph 350e, ATC Handbook 7110.65 creates a situation wherein the controller may not know the exact routing the pilot is using to depart the airport, nor does it require that he request it.

8. The pilot was responsible to familiarize himself with the terrain features in the Nogales area.

9. The departure controller instructed the pilot to maintain VFR flight conditions. Since the pilot did not request a VFR restriction the controller's action did not comply with the provisions of ATC Handbook 7110.65.

10. The departure controller exercised his emergency authority and vectored N999MB to reverse course. The course reversal was timely, since the aircraft successfully avoided the high terrain which was directly on its course.

11. The departure controller did not provide appropriate services to the pilot. The pilot should have been cleared to climb when he reported he could not maintain VFR flight conditions.

12. The pilot did not execute the avoidance turn successfully, and lost control of his aircraft either in or just after the turn.

3.2 Probable cause

The National Transportation Safety Board determines that the probable cause of the accident was the controllers' issuance of an improper departure clearance, climb restriction, and altitude clearance. The controllers' lack of knowledge and noncompliance with standard ATC procedures placed the aircraft in proximity to high terrain and the pilot lost control of the aircraft for unknown reasons while executing an emergency, controller-directed turn.

Contributing to the accident were (1) the inadequacy of official guidelines concerning the use of the published IFR departure procedures, (2) the failure of the departure controller to provide appropriate services, (3) the inability of the flight service specialist to insert the pilot's requested departure route into the ATC flight data computer, and *(4)* the failure of the pilot to check the new departure clearance and route for proper terrain clearance altitudes.

4. RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board recommended, on November 7, 1977, that the Federal Aviation Administration:

> "Revise the Airman's Information Manual and issue or revise other official guidance materials to clarify pilots' and controllers' responsibilities in implementing an IFR departure from an airport which has a published IFR departure procedure. (A-77-69.)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ KAY BAILEY
Acting Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ JAMES B. KING
Member

Philip A. Hogue, Member, filed the following dissent:

MEMBER Philip Allison Hogue, dissenting:

My dissent is a matter of emphasis. I concur that the air traffic controller issued an improper departure clearance and that the controller's lack of knowledge and compliance with standard ATC procedure stood the aircraft into danger. Nonetheless, the pilot had more than 5,000 hours of flying experience and with 5 miles between him and the mountain peak, it is my considered judgment that he should have executed the ATC-directed 180° turn safely. From my point of view, the last possible opportunity to have prevented this accident was in the hands of the pilot.

/s/ PHILIP A. HOGUE
Member

October 27, 1977

5. APPENDIXES

APPENDIX A

1. Investigation

The National Transportation Safety Board's Los Angeles, California, Field Office was notified of the accident at 1600 P.s.t., on January 22, 1977. Parties to the investigation included the Federal Aviation Administration, the Professional Air Traffic Controllers Association, and the National Association of Air Traffic Specialists.

2. Depositions

The National Transportation Safety Board deposed the controllers at the Federal Aviation Administration's RAPCON facility, Davis-Monthan Air Force Base, Arizona. Parties present during these depositions were the Federal Aviation Administration, the Professional Air Traffic Controllers Association, and the National Association of Air Traffic Specialists.

APPENDIX B

AIRMAN INFORMATION

Pilots

Mario Bonfante, 62, held Private Pilot Certificate No. 1342721, with airplane single engine, multi-engine land and instrument ratings. His Third Class Medical Certificate was issued April 15, 1976, with no waivers or limitations. The pilot's log book was not located and it is believed it was consumed by fire. According to the FAA Airman Certificate Branch at Oklahoma City, Oklahoma, he listed 5,000 hours total on his latest medical application.

Ronald J. Ohanesian, 34, held Student Pilot Certificate No. AA4736118, with airplane single engine land rating. His Third Class Medical Certificate was issued June 13, 1976, with no waivers or limitations. Mr. Ohanesian's log book was not located and his flying time is unknown.

Controllers

Eugene W. Murry, Flight Service Station Specialist, holds a FSS Journeyman Certificate and a Pilot Briefing Certificate. He has been employed by the FAA for 9 years and has served in the Tuscon Flight Service Station for about 9 years. Mr. Murry took the initial clearance information from N999MB and was relieved by another specialist before N999MB received a clearance.

Edward A. Santiago, Flight Service Station Specialist, holds a FSS Journeyman Certificate and a Pilot Briefing Certificate. He has been employed by the FAA for about 5 years and has been assigned to the Tuscon FSS about 3 years. Mr. Santiago relieved Mr. Murry and delivered the clearance to N999MB.

David T. Sherman has an Air Traffic Control Certificate and is a Journeyman Air Traffic Control Specialist. He was working the flight data controller position at the Davis-Monthan RAPCON. He obtained the departure strip from the computer and requested instructions from the assistant chief prior to relaying the clearance to the FSS for delivery to N999MB.

Joe R. Partridge has an Air Traffic Control Certificate and has been rated as a Journeyman Air Traffic Controller. He has been employed by the FAA for 18 years and has been assigned to the Davis-Monthan WCON for about 18 months. He was serving as assistant chief. He consulted with Mr. Sherman before issuing N999MB's clearance.

Roger Dean Ray has an Air Traffic Control Certificate and has been rated as a Journeyman Air Traffic Controller. He has been employed by the FAA about 6 years and was assigned to the Davis-Monthan RAPCON about 2 years. He was the radar controller handling N999MB just before the crash.

APPENDIX C

AIRCRAFT INFORMATION

Cessna 421A, N999MB was owned by the Knob Hill General Stores, Inc., of Gilroy, California. The aircraft had accumulated about 1563 hours in service. It had undergone a 100-hr inspection on January 3, 1977, and an annual inspection was carried out October 17, 1976.

The engine times are identical with the aircraft times cited above.

APPENDIX D

AERODROME NAME	TAKE-OFF MINIMUMS	AERODROME NAME	TAKE-OFF MINIMUMS

WESTERN UNITED STATES
(Continued from page 6)

MODESTO CITY-COUNTY-HARRY SHAM FIELD
Modesto, California . . Rwys 10L/R, 28L/R, 300-1*
*Or standard (¾ mile Rwy 28R (FAR 135)) with minimum climb of 300' per NM to 500'. Climb direct Stockton, Calif. VORTAC.

MOHAVE COUNN . . . .Rwys 7, 17, 21, **25,** 2100-2
Kingman, Arizona
Climb via IGM R-010 to cross Milki Int at 80W or above. (This departure requires a minimum climb rate of 180' per NM until reaching 7000.

MONTEREY PENINSULA
Monterey, California
Rwys 6, 10, 24. 700-1, category A and B; 1000-2 category C and D. Rwys 6, 10 turn left; Rwy 24 turn right. All aircraft climb to 3000 on 321° bearing from RY LMM before proceeding on course, or comply with published MRY SIDs.

MONTGOMERY FIELD.. . . . . .Rwy 23, 200-1
San Diego, California
Rwyr 5, 10L/R, turn right; Rwys 28L/R, turn left; climb dired MZB VORTAC. Rwy 5 departure requires a climb rate of 270' per NM to 2000

MURRAY FIELD . . . . . .Rwys 7, 11, 25, 700-1
Eureka, California
All aircraft climb on heading 290° to intercept FOT R-341 (V27).

NAPA COUNTY.. . . . . .Rwys 6, 36L/R, 700-1
Napa, California
Rwys 6, 18L/R, turn right; Rwys 24, 36L/R, turn left; proceed via R-050 to cross APC VORTAC at or above 1000, or comply with published Napa County SIDs.

NEEDLES . . . . . .Rwys 19, 28, 2100.2
Needles, California
Climb direct EED VORTAC. thence on course, E bound V12, MCA 2600.

NEWPORT MUNI . . . . . .Rwy 16, 400-1
Newport, Oregon
Rwys 2, 34 turn left, Rwy 16 turn right. Climb on ONP R-216 to cross VORTAC at or above E bound V-452 1200; S bound V22-287W 1000.

NOGALAS INTL . . . . . .Rwys 3, 21, 7W-1
Nogales, Arizona
Climb visually within 2 NM of the airport to cross OLS VOR at 4600 or above, then climb via OLS R-316 to Flats Int, or if proceeding to Mexican Border. climb on OLS R-200.

NORTH BEND MUNI . . . . . .Rwy 4 600-1
North Bend, Oregon Rwy 31, 300-1
Rwyr 4, 31 and 34 turn left; Rwyr 16.13 and 22 turn right; intercept and climb westbound on OTH R-250 to 500; return to VORTAC via R-250 so as to cross VORTAC at or above 1000; or comply with published North Bend SID.

NUT TREE . . . . . Rwy 19, 700-1
Vacaville, California
Climb to 2000 direct to Travis VOR.

OAKDALE.. . . . . .Rwy 10, 28, 200-1
Oakdale, Calif.
Climb to 2000 direct to SCK VORTAC.

OCEANSIDE MUNI . . . . . .Rwy 24, 300-1
Oceanside, California Rwy 6, 600-1*
*or standard with minimum climb of 310 per NM to 600.
Climb direct OCN VORTAC.

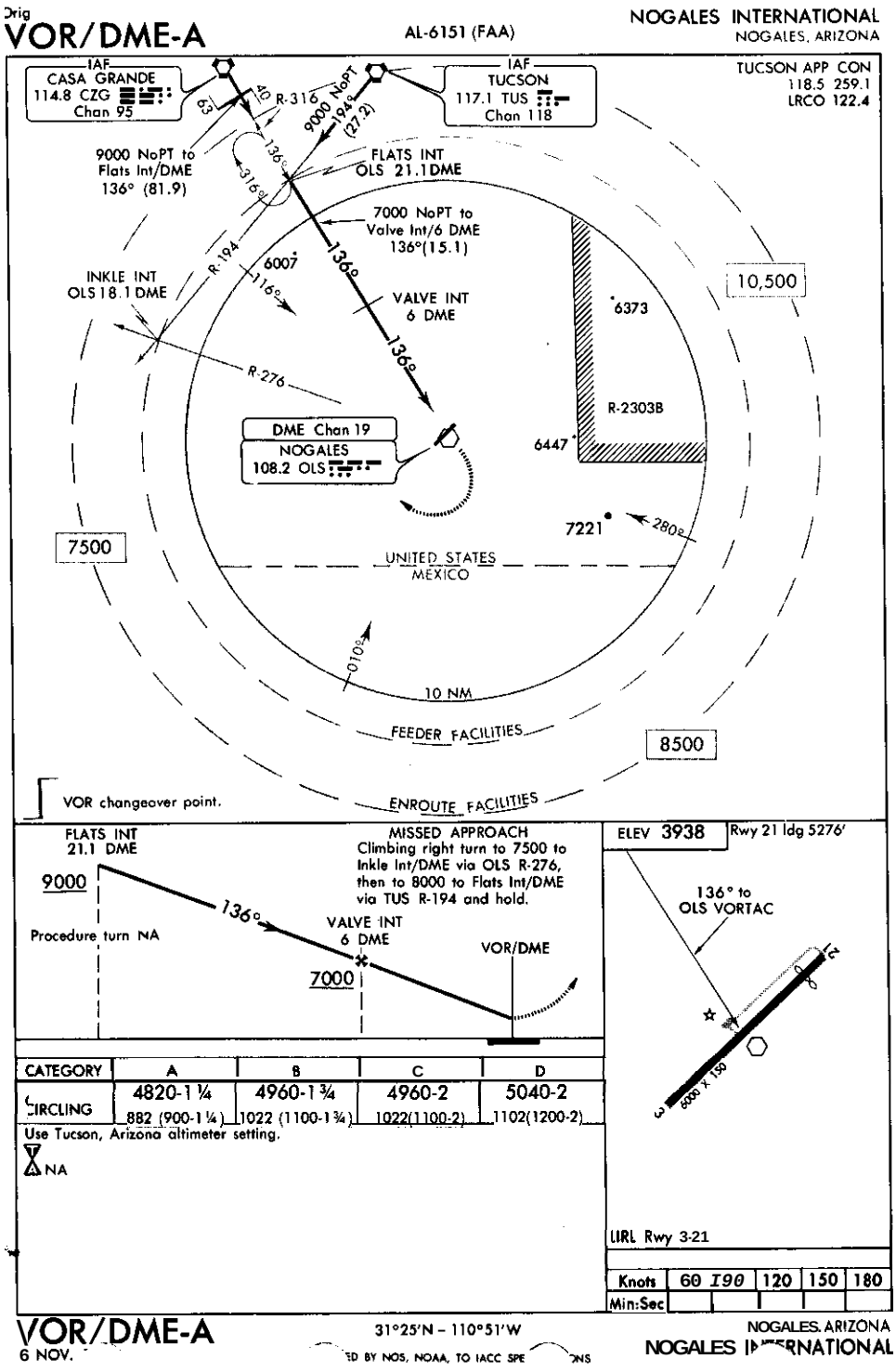
OGDEN MUNI . . . . . .Rwy 3, 300-1
Ogden, Utah Rwy 16, 300-1½
Toke-off Rwy 7 not authorized. Climb dired to OGD VORTAC, continue climb in holding pattern Wed of the VORTAC, right turns, 098° in bound so as to depart OGD at or above; V6/E-bound, 10,700; V101 and V-21/NW bound, 6600'; V6/W bound, 7200'; V-236/SW bound, 5700'. For V-21/101/S bound, after take-off, climb on heading 218° to intercept OGD R-150. Continue climb S-bound to assigned altitude. CAUTION: High terrain 3.5 NM E. of airport.

OLYMPIA MUNI . . . . . Rwys 8, 26, 35, 200-1
Olympia, Washington Rwy 17, 200-1*
*or standard ½ mile authorized (FAR 135) with minimum climb of 275' per NM on runway heading to 600. Rwy 17, turn left; climb on OLM R-348 within 10 NM to cross OLM VORTAC at or above minimum altitude for direction of flight. W-bound V204, 1500; E bound V204, 1200.

OMAK *2200-2*
Omak, Washington
Climb visually over the airport to 3500, then 155° bearing from Omak NDB to enroute altitude.

ONTARIO INTL . . . . . Rwy 25, RVR/24*
Ontario, California Rwy 7, ½ mile*
Rwyr 3, 7 turn right within 1 NM; Rwys 21, 25 turn lek, climb direct to ONT VORTAC or comply with published ONT SIDs.
*(FAR 135)

(Continued on page 8)



"ILLUSTRATION ONLY - NOT TO BE USED FOR NAVIGATIONAL PURPOSES"

APPENDIX E

his position; or, a handoff is made to another radar controller with further surveillance capabilities.

3. Controllers will inform pilots of the departure control frequencies and, if appropriate, the transponder code before take-off. Pilots should not operate their transponder until ready to start the take-off roll or change to the departure control frequency until requested.

INSTRUMENT DEPARTURES

1. STANDARD INSTRUMENT DEPARTURES (SIDS)

a. A standard Instrument Departure (SID) is an air traffic control coded departure procedure which has been established at certain airports to simplify clearance delivery procedures.

b. Pilots of civil aircraft operating from locations where SID procedures are effective may expect ATC clearances containing a SID. Use of a SID requires pilot possession of at least the textual description of the approved effective SID. If the pilot does not possess a preprinted SID description or for any other reason does not wish to use a SID, he is expected to advise ATC. Notification may be accomplished by filing "NO SID" in the remarks section of the filed flight plan or by the less desirable method of verbally advising ATC.

c. All effective SIDs are published in textual and graphic form by the National Ocean Survey in East and West SID booklets.

2. OBSTRUCTION CLEARANCE DURING DEPARTURE

a. IFR departure procedures have been established to assist the pilots conducting IFR flight in avoiding obstructions during climbout to minimum enroute altitude. These procedures are established only at locations where instrument approach procedures are published and when required due to obstructions.

b. These procedures may be a weather ceiling and visibility requirement due to obstructions close in to the airport, or detailed flight maneuvers particularly at locations in mountainous terrain. In many cases obstruction avoidance procedures are incorporated into established SIDs and the SID is referenced as the obstruction avoidance procedure. In this case when a pilot desires to utilize the SID, it should be filed in the flight plan as the first item of the requested routing.

c. Crossing restrictions used in a SID may be established for traffic separation or to assist the pilot in obstacle avoidance. When a crossing restriction is established for either reason, pilots are expected to cross the fix as charted and continue to make good a minimum climb of 152 feet per mile after crossing the fix until reaching the MEA or assigned altitude. A SID without a crossing restriction or an accelerated climb requirement will have no penetrations of the 40:1 departure surface (152'/mile) overlying the departure area.

d. Instrument take-off minimums and departure procedures are published with U.S. Government instrument approach procedure charts. These are described in airport listings on separate pages included with each area approach chart book. Only those airports having nonstandard take-off minimums or prescribed departure procedures are listed. The approach charts for such airports will display the symbol ▽| in the space beneath the minimums section to indicate that the separate listing should be consulted. (Following is an example of this listing.)

Instrument Approach Procedures (Charts)
Northeast United States

▽| IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES

FAR 91.116(c) prescribes take-off rules and establishes standard take-off minimums as follows:

(1) Aircraft having two engines or less—one statute mile.

(2) Aircraft having more than two engines—one-half statute mile.

Aerodromes within this geographical area with IFR take-off minimums other than standard are listed below alphabetically by aerodrome name. Departure procedures and/or ceiling visibility minimums are established to assist pilots conducting IFR flight in avoiding obstructions during climb to the minimum enroute altitude.

Take-off minimums and departure procedures apply to all runways unless otherwise specified.

AERODROME NAME	TAKE-OFF MINIMUMS
AUGUSTA STATE	Rwy 17, 200–1*
Augusta, Maine	Rwy 26, 300–1**

*or standard with a minimum climb of 320' per NM to 800.
**or standard with a minimum climb of 200' per NM to 800.
Rwy 17 climb on 150° heading to 1000 before turning W bound.

BALTIMORE-WASHINGTON INTL	Rwy 10, RVR/18*
Baltimore, Maryland	Rwy 15R, ½ mile*
*(FAR 135)	Rwy 28, RVR/40*

BAR HARBOR	Rwys 4, 29, 35, 300–1
Bar Harbor Maine	Rwys 11–29, 17–35, Night NA

Climb on 218° heading to 1200, climbing right turn to 2700 direct NDB*. Climb in the holding pattern to MEA for direction of flight.
*BH NDB, LOC Rwy 22; LME NDB, NDB-B

BARNES MUNI
Westfield, Massachusetts
Rwy 20 requires 225' per NM rate of climb to 1200'. Rwy 15 800–1 day, 800–2 night; right turn to 210° as soon as practicable. Rwys 2, 33 700–1 day, 800–2 night.

BEAVER COUNTY	Rwy 10, 200–1
Beaver Falls, Pennsylvania	

e. Each pilot, prior to departing an airport on an IFR flight should consider the type of terrain and other obstructions on or in the vicinity of the departure airport and take the following action.

(1) Determine whether a departure procedure has been established for obstruction avoidance.

(2) Determine if obstruction avoidance can be maintained visually or that the departure procedure should be followed.

(3) At airports where instrument approach procedures have not been established, hence no departure procedure, determine for himself what action will be necessary and take such action that will assure a safe departure.