

Chapter 7

Helicopter Instrument Procedures

Introduction

This chapter presents information on IFR helicopter operations in the National Airspace System. Advances in avionics technology installed in helicopters such as Global Positioning System (GPS) and Wide Area Augmentation System (WAAS) are bringing approach procedures to heliports around the country.

The ability to operate helicopters under IFR increases their utility and safety. Helicopter IFR operators have an excellent safety record due to the investment in IFR-equipped helicopters, development of instrument approach procedures (IAPs), and IFR-trained flight crews. The safety record of IFR operations in the Gulf of Mexico is equivalent to the safety record of the best-rated airlines. Manufacturers are working to increase IFR all-weather capabilities of helicopters by providing slower minimum instrument airspeeds (V_{MINI}), faster cruising speeds, and better autopilots and flight management systems (FMS). As a result, in October 2005, the first civil helicopter in the United States was certified for flight into known icing conditions. [Figure 7-1]

97.3 Symbols and Terms Used in Procedures

b) (1) "Copter procedures" means helicopter procedures with applicable minimums as prescribed in §97.35 of this part. Helicopters may also use other procedures prescribed in Subpart C of this part and may use the Category A minimum descent altitude (MDA) or decision height (DH). The required visibility minimum may be reduced to 1/2 the published visibility minimum, but in no case may it be reduced to less than one-quarter mile or 1,200 feet RVR

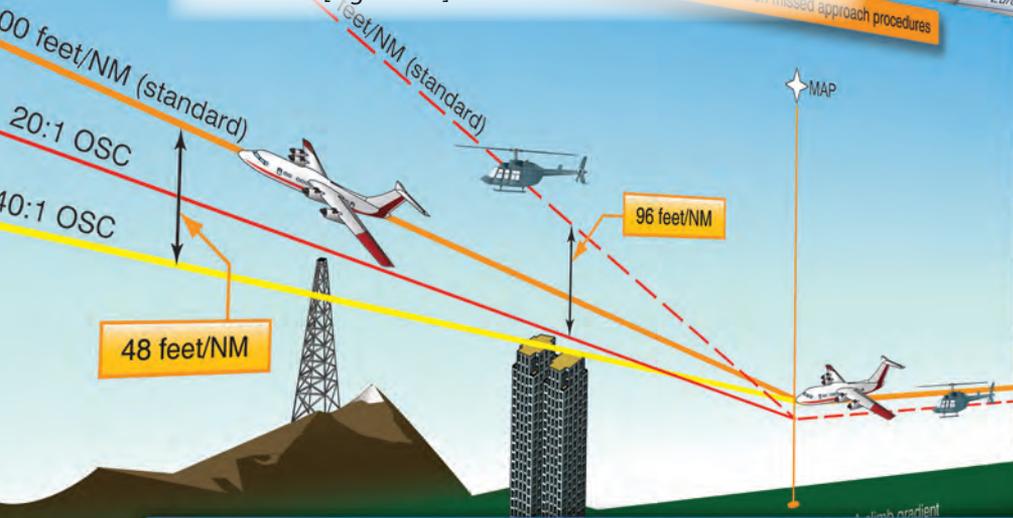
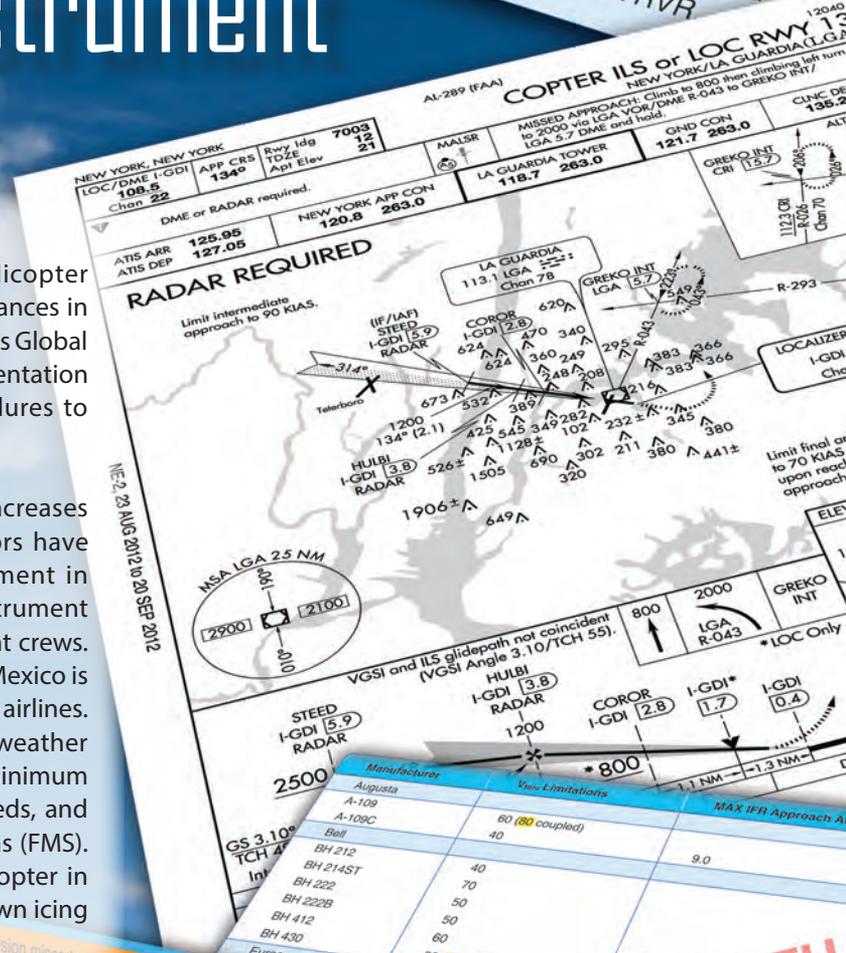


TABLE NOT FOR ACTUAL USE

Manufacturer	Model	Max IFR Approach Altitude
Augusta	A-109	60 (80 coupled)
Bell	BH 212	40
Bell	BH 214ST	40
Bell	BH 222	70
Bell	BH 222B	50
Bell	BH 412	50
Bell	BH 430	60
Eurocopter		50 (65 coupled)

Condition	Non-Mountainous		Mountainous (14 CFR Part 95)	
	Local	Cross Country	Local	Cross Country
Day	500-1	800-2	500-2	800-3
Night—High Lighting Conditions	500-2	1000-3	500-3	1000-3
Night—Low Lighting Conditions	800-3	1000-5	1000-3	1000-5



Figure 7-1. Icing tests. To safely provide an all-weather capability and flight into known icing conditions that would otherwise delay or cancel winter flight operations, the digital control of the S-92 Rotor Ice Protection System (RIPS) determines the temperature and moisture content of the air and removes any ice buildup by heating the main and tail rotor blades. The system is shown here during testing.

Helicopter Instrument Flight Rule (IFR) Certification

It is very important that pilots be familiar with the IFR requirements for their particular helicopter. Within the same make, model, and series of helicopter, variations in the installed avionics may change the required equipment or the level of augmentation for a particular operation. The Automatic Flight Control System/Autopilot/Flight Director (AFCS/AP/FD) equipment installed in IFR helicopters can be very complex. For some helicopters, the AFCS/AP/FD complexity requires formal training in order for the pilot(s) to obtain and maintain a high level of knowledge of system operation, limitations, failure indications, and reversionary modes. For a helicopter to be certified to conduct operations in instrument meteorological conditions (IMC), it must meet the design and installation requirements of Title 14 Code of Federal Regulations (14 CFR) Part 27, Appendix B (Normal Category) and Part 29, Appendix B (Transport Category), which is in addition to the visual flight rule (VFR) requirements.

These requirements are broken down into the following categories: flight and navigation equipment, miscellaneous requirements, stability, helicopter flight manual limitations, operations specifications, and minimum equipment list (MEL).

Flight and Navigation Equipment

The basic installed flight and navigation equipment for helicopter IFR operations is listed under 14 CFR Part 29, § 29.1303, with amendments and additions in Appendix B of 14 CFR Parts 27 and 29 under which they are certified. The list includes:

- Clock
- Airspeed indicator
- Sensitive altimeter (A “sensitive” altimeter relates to the instrument’s displayed change in altitude over its range. For “Copter” Category (CAT) II operations, the scale must be in 20-foot intervals.) adjustable for barometric pressure.
- Magnetic direction indicator
- Free-air temperature indicator
- Rate-of-climb (vertical speed) indicator
- Magnetic gyroscopic direction indicator
- Stand-by bank and pitch (attitude) indicator
- Non-tumbling gyroscopic bank and pitch (attitude) indicator
- Speed warning device (if required by 14 CFR Part 29)

Miscellaneous Requirements

- Overvoltage disconnect
- Instrument power source indicator
- Adequate ice protection of IFR systems
- Alternate static source (single-pilot configuration)
- Thunderstorm lights (transport category helicopters)

Stabilization and Automatic Flight Control System (AFCS)

Helicopter manufacturers normally use a combination of a stabilization and/or AFCS in order to meet the IFR stability requirements of 14 CFR Parts 27 and 29. These systems include:

- Aerodynamic surfaces, which impart some stability or control capability that generally is not found in the basic VFR configuration.
- Trim systems provide a cyclic centering effect. These systems typically involve a magnetic brake/spring device and may be controlled by a four-way switch on the cyclic. This system requires “hands on” flying of the helicopter.
- Stability Augmentation Systems (SAS) provide short-term rate damping control inputs to increase helicopter stability. Like trim systems, SAS requires “hands-on” flying.

- Attitude Retention Systems (ATT) return the helicopter to a selected attitude after a disturbance. Changes in attitude can be accomplished usually through a four-way “beep” switch or by actuating a “force trim” switch on the cyclic, which sets the desired attitude manually. Attitude retention may be a SAS function or may be the basic “hands off” autopilot function.
- Autopilot Systems (APs) provide for “hands off” flight along specified lateral and vertical paths. The functional modes may include heading, altitude, vertical speed, navigation tracking, and approach. APs typically have a control panel for mode selection and indication of mode status. APs may or may not be installed with an associated FD. APs typically control the helicopter about the roll and pitch axes (cyclic control) but may also include yaw axis (pedal control) and collective control servos.
- Flight Directors (FDs) provide visual guidance to the pilot to fly selected lateral and vertical modes of operation. The visual guidance is typically provided by a “single cue,” commonly known as a “vee bar,” which provides the indicated attitude to fly and is superimposed on the attitude indicator. Other FDs may use a “two cue” presentation known as a “cross pointer system.” These two presentations only provide attitude information. A third system, known as a “three cue” system, provides information to position the collective as well as attitude (roll and pitch) cues. The collective control cue system identifies and cues the pilot what collective control inputs to use when path errors are produced or when airspeed errors exceed preset values. The three-cue system pitch command provides the required cues to control airspeed when flying an approach with vertical guidance at speeds slower than the best-rate-of-climb (BROC) speed. The pilot manipulates the helicopter’s controls to satisfy these commands, yielding the desired flightpath or may couple the autopilot to the FD to fly along the desired flightpath. Typically, FD mode control and indication are shared with the autopilot. Pilots must be aware of the mode of operation of the augmentation systems and the control logic and functions in use. For example, on an instrument landing system (ILS) approach and using the three-cue mode (lateral, vertical, and collective cues), the FD collective cue responds to glideslope deviation, while the horizontal bar cue of the “cross-pointer” responds to airspeed deviations. However, the same system when operated in the two-cue mode on an ILS, the FD horizontal bar cue responds to glideslope deviations. The need to be aware of the FD mode of operation is particularly significant when operating using two pilots.

Pilots should have an established set of procedures and responsibilities for the control of FD/AP modes for the various phases of flight. Not only does a full understanding of the system modes provide for a higher degree of accuracy in control of the helicopter, it is the basis for crew identification of a faulty system.

Helicopter Flight Manual Limitations

Helicopters are certificated for IFR operations with either one or two pilots. Certain equipment is required to be installed and functional for two-pilot operations and additional equipment is required for single-pilot operation.

In addition, the Helicopter Flight Manual (HFM) defines systems and functions that are required to be in operation or engaged for IFR flight in either the single or two-pilot configurations. Often, in a two-pilot operation, this level of augmentation is less than the full capability of the installed systems. Likewise, a single-pilot operation may require a higher level of augmentation.

The HFM also identifies other specific limitations associated with IFR flight. Typically, these limitations include, but are not limited to:

- Minimum equipment required for IFR flight (in some cases, for both single-pilot and two-pilot operations)
- V_{MINI} (minimum speed—IFR) [Figure 7-2]
- V_{NEI} (never exceed speed—IFR)
- Maximum approach angle
- Weight and center of gravity (CG) limits
- Helicopter configuration limitations (such as door positions and external loads)
- Helicopter system limitations (generators, inverters, etc.)
- System testing requirements (many avionics and AFCS, AP, and FD systems incorporate a self-test feature)
- Pilot action requirements (for example, the pilot must have hands and feet on the controls during certain operations, such as an instrument approach below certain altitudes)

Final approach angles/descent gradient for public approach procedures can be as high as 7.5 degrees/795 ft/NM. At 70 knots indicated airspeed (KIAS) (no wind), this equates to a descent rate of 925 fpm. With a 10-knot tailwind, the descent rate increases to 1,056 fpm. “Copter” Point-in-space (PinS) approach procedures are restricted to helicopters with a maximum V_{MINI} of 70 KIAS and an IFR approach angle that enables them to meet the final approach angle/descent gradient. Pilots of helicopters with

Manufacturer	V _{MINI} Limitations	MAX IFR Approach Angle	G/A Mode Speed
Augusta			
A-109	60 (80 coupled)		
A-109C	40	9.0	
Bell			
BH 212	40		
BH 214ST	70		
BH 222	50		
BH 222B	50		
BH 412	60	5.0	
BH 430	50 (65 coupled)	4.0	
Eurocopter			
AS-355	55	4.5	
AS-365	75	4.5	
BK-117	45 (70 coupled)	6.0	
EC-135	60	4.6	
EC-155	70	4.0	
Sikorsky			
S-76A	60 (AFCS Phase II)	3.5	75 KIAS
S-76A	50 (AFCS Phase III)	7.5	75 KIAS
S-76B	60	7.5	75 KIAS
S-76C	60		
SK-76C++	50 (60 coupled)	6.5	

NOTE: The V_{MINI}, MAX IFR Approach Angle and G/A Mode Speed for a specific helicopter may vary with avionics/autopilot installation. Pilots are, therefore, cautioned to refer only to the Rotorcraft Flight Manual limitations for their specific helicopter. The maximum rate of descent for many autopilots is 1,000 FPM.

LEGEND

In some helicopters with the autopilot engaged, the V_{MINI} may increase to a speed greater than 70 KIAS, or in the “go around” mode requires a speed faster than 70 KIAS.

Figure 7-2. V_{MINI} limitations, maximum IFR approach angles and G/A mode speeds for selected IFR certified helicopters.

a V_{MINI} of 70 KIAS may have inadequate control margins to fly an approach that is designed with the maximum allowable angle/descent gradient or minimum allowable deceleration distance from the missed approach point (MAP) to the heliport. The “Copter” PinS final approach segment is limited to 70 KIAS since turn containment and the deceleration distance from the MAP to the heliport may not be adequate at faster speeds. For some helicopters, engaging the autopilot may increase the V_{MINI} to a speed greater than 70 KIAS, or in the “go around” (G/A) mode, require a speed faster than 70 KIAS. [Figure 7-2] It may be possible for these helicopters to be flown manually on the approach or on the missed approach in a mode other than the G/A mode.

Since slower IFR approach speeds enable the helicopter to fly steeper approaches and reduces the distance from the heliport that is required to decelerate the helicopter, you may want to operate your helicopter at speeds slower than its established V_{MINI}. The provision to apply for a

determination of equivalent safety for instrument flight below V_{MINI} and the minimum helicopter requirements are specified in Advisory Circulars (AC) 27-1, Certification of Normal Category Rotorcraft and AC 29-2, Certification of Transport Category Rotorcraft. Application guidance is available from the Rotorcraft Directorate Standards Staff, ASW-110, 2601 Meacham Blvd., Fort Worth, Texas, 76137-4298, (817) 222-5111.

Performance data may not be available in the HFM for speeds other than the best rate of climb speed. To meet missed approach climb gradients, pilots may use observed performance for similar weight, altitude, temperature, and speed conditions to determine equivalent performance. When missed approaches utilizing a climbing turn are flown with an autopilot, set the heading bug on the missed approach heading, and then at the MAP, engage the indicated airspeed mode, followed immediately by applying climb power and selecting the heading mode. This is important since the autopilot roll rate and maximum

bank angle in the Heading Select mode are significantly more robust than in the NAV mode. Figure 7-3 represents the bank angle and roll limits of the S76 used by the FAA for flight testing. It has a roll rate in the Heading Select mode of 5 degrees per second with only 1 degree per second in the NAV mode. The bank angle in the Heading Select mode is 20 degrees, with only 17 degrees in the NAV Change Over mode. Furthermore, if the Airspeed Hold mode is not selected on some autopilots when commencing the missed approach, the helicopter accelerates in level flight until the best rate of climb is attained, and only then will a climb begin.

Autopilot Mode	Bank Angle Limit (Degrees)	Roll Rate Limit (Degrees/Sec)
Heading hold	<6	None specified
VOR/RNAV (Capture)	+/-22	5
VOR/RNAV (On Course)	+/-13	1 5 VOR/RNAV Approach
Heading Select	+/-20	5
VOR/RNAV (Course Change Over Station/Fix)	+/-17	1

Figure 7-3. Autopilot bank angle and roll rate limits for the S-76 used by the William J. Hughes Technical Center for Flight Tests.

WAAS localizer performance (LP) lateral-only PinS testing conducted in 2005 by the FAA at the William J. Hughes Technical Center in New Jersey for helicopter PinS also captured the flight tracks for turning missed approaches. [Figure 7-4] The large flight tracks that resulted during the turning missed approach were attributed in part to operating the autopilot in the NAV mode and exceeding the 70 KIAS limit.

Operations Specifications

A flight operated under 14 CFR Part 135 has minimums and procedures more restrictive than a flight operated under 14 CFR Part 91. These Part 135 requirements are detailed in their operations specifications (OpSpecs). Helicopter Air Ambulance (HAA) operators have even more restrictive OpSpecs. Shown in Figure 7-5 is an excerpt from an OpSpecs detailing the minimums for precision approaches. The inlay in Figure 7-5 shows the minimums for the ILS Runway 3R approach at Detroit Metro Airport. With all lighting operative, the minimums for helicopter Part 91 operations are a 200-foot ceiling, and 1,200-foot runway visual range (RVR) - one-half airplane Category A visibility but no less than 1/4 SM/1,200 RVR. However, as shown in

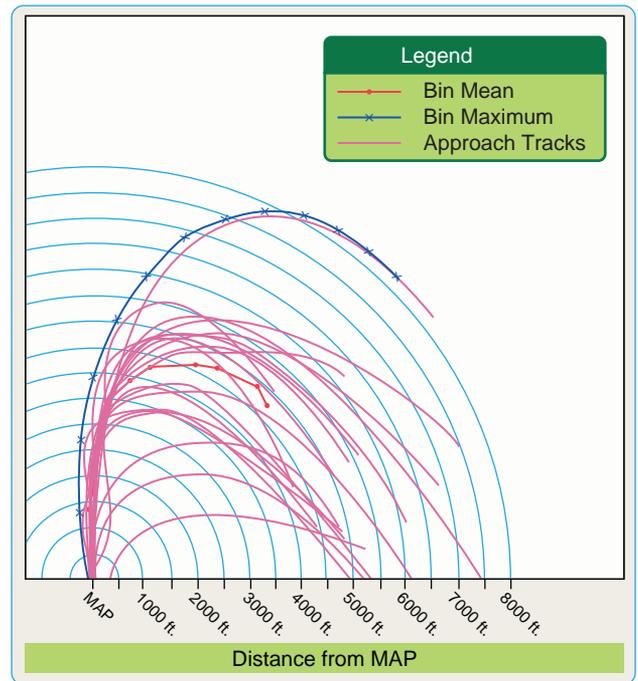


Figure 7-4. Flight tests at the William J. Hughes Technical Center point out the importance of airspeed control and using the correct technique to make a turning missed approach.

the OpSpecs, the minimum visibility this Part 135 operator must adhere to is 1,600 RVR. Pilots operating under 14 CFR Part 91 are encouraged to develop their own personal OpSpecs based on their own equipment, training, and experience.

Minimum Equipment List (MEL)

A helicopter operating under 14 CFR Part 135 with certain installed equipment inoperative is prohibited from taking off unless the operation is authorized in the approved MEL. The MEL provides for some equipment to be inoperative if certain conditions are met. [Figure 7-6] In many cases, a helicopter configured for single-pilot IFR may depart IFR with certain equipment inoperative provided a crew of two pilots is used. Under 14 CFR Part 91, a pilot may defer certain items without an MEL if those items are not required by the type certificate, CFRs, or airworthiness directives (ADs), and the flight can be performed safely without them. If the item is disabled, removed, or marked inoperative, a logbook entry is made.

Pilot Proficiency

Helicopters of the same make and model may have variations in installed avionics that change the required equipment or the level of augmentation for a particular operation. The complexity of modern AFCS, AP, and FD systems requires a high degree of understanding to safely

H117. Straight-in Category I Precision Instrument Approach Procedures - All Airports

HQ Control: 11/22/00
HQ Revision: 000

- a. Except as provided in this paragraph, the certificate holder shall not use any Category I IFR landing minimum lower than that prescribed by any applicable published instrument approach procedure. The IFR landing minimums prescribed in this paragraph are the lowest authorized (other than Airborne Radar approaches) for use at any airport. Provided that the fastest approach speed used in the final approach segment is less than 91 knots, the certificate holder is authorized to conduct straight-in precision instrument approach procedures using the following:
 - (1) The published Category A minimum descent altitude (MDA) or decision height (DH), as appropriate.
 - (2) One-half of the published Category A visibility/RVR minimum or the visibility/RVR minimums prescribed by this paragraph, whichever is higher.
- b. **Straight-In Category I Precision Approach Procedures.** The certificate holder shall not use an IFR landing minimum for straight-in precision approach procedures lower than that specified in the following table. Touchdown zone RVR reports, when available for a particular runway, are controlling for all approaches to and landings on that runway. (See NOTE 2.)

Precision Approaches Approach Light Configuration	HAT	Full ILS (See NOTE 1), MLS, or PAR			
		Helicopters Operated at Speeds of 90 Knots or Less		Helicopters Operated at Speeds More Than 90 Knots	
		Visibility In SM.	TDZ RVR In Feet	Visibility In SM.	TDZ RVR In Feet
No Lights or ODALS or MALS or SSALS	200	3/4	3500	3/4	4000
MALSR or SSALR or ALSF-1 or ALSF-2	200	1/4	1600	1/2	2400
MALSR with TDZ and CL or SSALR with TDZ and CL or ALSF-1/ALSF-2 with TDZ and CL	200	1/4	1600	1/2	1800

NOTE 1: A full ILS requires an operative LOC, GS, and OM fix, an NDB, VOR, DME fix, or a published minimum GSIA for

NOTE 2: The Mid RVR and Rollout RVR reports (if available) provide the most accurate information. The Mid RVR report may be substituted for the TDZ RVR report if the TDZ RVR report is not available.

- c. **Special Limitations and Provisions for Instrument Approach** certificate holder is authorized operations at foreign airports:
 - (1) Foreign approach lighting systems equivalent to U.S. and nonprecision approaches. Sequenced flashing light equivalence of a foreign lighting system to U.S. standard.
 - (2) For straight-in landing minimums at foreign airports, the lowest authorized MDA or DH shall be obtained as follows:

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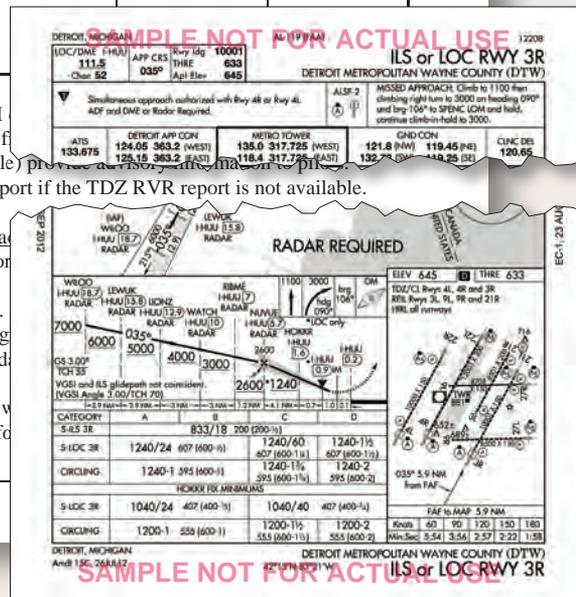


Figure 7-5. Operations Specifications.

U.S. DEPARTMENT OF TRANSPORTATION		MASTER MINIMUM EQUIPMENT LIST	
FEDERAL AVIATION ADMINISTRATION		REVISION NO: 3	PAGE:
AIRCRAFT: BH-206/407 SERIES		DATE: 12/22/2008	28-1
SYSTEM & SEQUENCE NUMBERS	ITEM	1.	2. NUMBER INSTALLED
		3. NUMBER REQUIRED FOR DISPATCH	4. REMARKS OR EXCEPTIONS
28 FUEL			
1.	Fuel Quantity Gauge		DELETED.
2.	Auxiliary Fuel Tank	D	- 0
***			May be inoperative provided:
			a) Flight is not predicated upon the use of the system, and
			b) Auxiliary tank fuel is considered in weight and balance computations.
3.	Fuel Low Warning Caution Light System(206A and 206B only)		DELETED.
	(206L series and407 only)		DELETED.
4.	Solenoid Drain Valve System	D	- 0
***			(0) May be inoperative provided the manual drain valve is verified closed prior to flight.
5.	Fuel Boost Pump(Twin engine models only)	B	4 3
			One aft boost pump may be inoperative.
6.	Fuel Flow Indicator (Twin engine models only)	B	2 0

Figure 7-6. Example of a Minimum Equipment List (MEL).

and efficiently control the helicopter in IFR operations. Formal training in the use of these systems is highly recommended for all pilots.

During flight operations, you must be aware of the mode of operation of the augmentation system and the control logic and functions employed. [Figure 7-2]

Helicopter VFR Minimums

Helicopters have the same VFR minimums as airplanes with two exceptions. In Class G airspace or under a special visual flight rule (SVFR) clearance, helicopters have no minimum visibility requirement but must remain clear of clouds and operate at a speed that is slow enough to give the pilot an adequate opportunity to see other aircraft or an obstruction in time to avoid a collision. Helicopters are also authorized (14 CFR Part 91, appendix D, § 3) to obtain SVFR clearances at airports with the designation NO SVFR on the sectional chart or in the Chart Supplement (CS). Figure 7-7 shows the visibility and cloud clearance requirements for VFR and SVFR. However, lower minimums associated with Class G airspace and SVFR do not take the place of the VFR minimum requirements of either Part 135 regulations or respective OpSpecs.

Knowledge of all VFR minimums is required in order to determine if a PinS approach can be conducted or if a SVFR clearance is required to continue past the (MAP). These approaches and procedures are discussed in detail later.

Helicopter IFR Takeoff Minimums

14 CFR Part 91 imposes no takeoff minimums on the helicopter pilot. However, Rotorcraft Flight Manuals may require the helicopter to attain at least V_{mini} before entering IMC. For most helicopters, this requires a distance of approximately 1/2 mile and an altitude of 100 feet. If departing with a steeper climb gradient, some helicopters may require additional altitude to accelerate to V_{MINI} . To maximize safety, always consider using the Part 135 operator standard takeoff visibility minimum of 1/2 statute mile (SM) or the charted departure minima, whichever is higher. A charted departure that provides protection from obstacles has either a higher visibility requirement, climb gradient, and/or departure path. Part 135 operators are required to adhere to the takeoff minimums prescribed in the instrument approach procedures (IAPs) for the airport.

Helicopter IFR Alternates

The pilot must file for an alternate if weather reports and forecasts at the proposed destination do not meet certain minimums. These minimums differ for Part 91 and Part 135 operators.

Helicopter VFR Minimums		
Airspace	Flight visibility	Distance from clouds
Class A	Not applicable	Not applicable
Class B	3 SM	Clear of clouds
Class C	3 SM	500 feet below 1,000 feet above 2,000 feet horizontal
Class D	3 SM	500 feet below 1,000 feet above 2,000 feet horizontal
Class E Less than 10,000 feet MSL	3 SM	500 feet below 1,000 feet above 2,000 feet horizontal
At or above 10,000 feet MSL	5 SM	1,000 feet below 1,000 feet above 1 statute mile horizontal
Class G 1,200 feet or less above the surface (regardless of MSL altitude)		
Day, except as provided in §91.155(b)	1/2 SM	Clear of clouds
Night, except as provided in §91.155(b)	None	Clear of clouds
More than 1,200 feet above the surface but less than 10,000 feet MSL		
Day	1 SM	500 feet below 1,000 feet above 2,000 feet horizontal
Night	3 SM	500 feet below 1,000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface and at or above 10,000 feet MSL	5 SM	1,000 feet below 1,000 feet above 1 statute mile horizontal
B, C, D, E, Surface Area Airspace SVFR Minimums		
Day	None	Clear of clouds
Night	None	Clear of clouds

Figure 7-7. Helicopter VFR minimums.

Part 91 Operators

Part 91 operators are not required to file an alternate if, at the estimated time of arrival (ETA) and for 1 hour after, the ceiling is at least 1,000 feet above the airport elevation or 400 feet above the lowest applicable approach minima, whichever is higher, and the visibility is at least 2 SM. If an alternate is required, an airport can be used if the ceiling is at least 200 feet above the minimum for the approach to

be flown and visibility is at least 1 SM, but never less than the minimum required for the approach to be flown. If no instrument approach procedure has been published for the alternate airport, the ceiling and visibility minima are those allowing descent from the MEA, approach, and landing under basic VFR.

Part 135 Operators

Part 135 operators are not required to file an alternate if, for at least one hour before and one hour after the ETA, the ceiling is at least 1,500 feet above the lowest circling approach minimum descent altitude (MDA). If a circling instrument approach is not authorized for the airport, the ceiling must be at least 1,500 feet above the lowest published minimum or 2,000 feet above the airport elevation, whichever is higher. For the IAP to be used at the destination airport, the forecasted visibility for that airport must be at least 3 SM or 2 SM more than the lowest applicable visibility minimums, whichever is greater.

Alternate landing minimums for flights conducted under 14 CFR Part 135 are described in the OpSpecs for that operation. All helicopters operated under IFR must carry enough fuel to fly to the intended destination, fly from that airport to the filed alternate, if required, and continue for 30 minutes at normal cruising speed.

Helicopter Instrument Approaches

Many new helicopter IAPs have been developed to take advantage of advances in both avionics and helicopter technology.

Standard Instrument Approach Procedures to an Airport

Helicopters flying standard instrument approach procedures (SIAP) must adhere to the MDA or decision altitude for Category A airplanes and may apply the 14

97.3 Symbols and Terms Used in Procedures

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Figure 7-8. Part 97 excerpt.

CFR Part 97.3 (d-1) rule to reduce the airplane Category A visibility by half but in no case less than 1/4 SM or 1,200 RVR. [Figure 7-8] The approach can be initiated at any speed up to the highest approach category authorized; however, the speed on the final approach segment must be reduced to the Category A speed of less than 90 KIAS before the MAP in order to apply the visibility reduction. A constant airspeed is recommended on the final approach segment to comply with the stabilized approach concept since a decelerating approach may make early detection of wind shear on the approach path more difficult. [Figure 7-9]

When visibility minimums must be increased for inoperative components or visual aids, use the Inoperative Components and Visual Aids Table (provided in the front cover of the U.S. Terminal Procedures) to derive the Category A minima before applying any visibility reduction. The published visibility may be increased above the standard visibility minima due to penetrations of the 20:1 and 34:1 final approach obstacle identification surfaces (OIS). The minimum visibility required for 34:1 penetrations is 3/4 SM and for 20:1 penetrations 1 SM, which is discussed in chapter 5 of this handbook. When there are penetrations of the final approach OIS, a visibility credit for approach lighting systems is not allowed for either airplane or helicopter procedures that would result

Helicopter Use of Standard Instrument Approach Procedures			
Procedure	Helicopter Visibility Minima	Helicopter MDA/DA	Maximum Speed Limitations
Standard	The greater of: one half the Category A visibility minima, ¼ statute mile visibility or 1,200 RVR unless annotated (Visibility Reduction by Helicopters NA.)	As published for Category A	The helicopter may initiate the final approach segment at speeds up to the upper limit of the highest Approach Category authorized by the procedure, but must be slowed to no more than 90 KIAS at the MAP in order to apply the visibility reduction.
Copter Procedure	As published	As published	90 KIAS when on a published route/track.
GPS Copter Procedure	As published	As published	90 KIAS when on a published route, track, or holding, 70 KIAS when on the final approach or missed approach segment. Military procedures are limited to 90 KIAS for all segments.

Figure 7-9. Helicopter use of standard instrument approach procedures.

in values less than the appropriate 3/4 SM or 1 SM visibility requirement. The 14 CFR Part 97.3 visibility reduction rule does not apply, and you must take precautions to avoid any obstacles in the visual segment. Procedures with penetrations of the final approach OIS are annotated at the next amendment with "Visibility Reduction by Helicopters NA."

Until all the affected SIAPs have been annotated, an understanding of how the standard visibilities are established is the best aid in determining if penetrations of the final approach OIS exists. Some of the variables in determining visibilities are: decision altitude (DA)/MDA height above touchdown (HAT), height above airport (HAA), distance of the facility to the MAP (or the runway threshold for non-precision approaches), and approach lighting configurations.

The standard visibility requirement, without any credit for lights, is 1 SM for non-precision approaches and 3/4 SM for precision approaches. This is based on a Category A airplane 250–320 feet HAT/HAA; for non-precision approaches a distance of 10,000 feet or less from the facility to the MAP (or runway threshold). For precision approaches, credit for any approach light configuration; for non-precision approaches (with a 250 HAT) configured with a Medium Intensity Approach Lighting System (MALSR), Simplified Short Approach Lighting System (SSALR), or Approach Lighting System With Sequenced Flashing Lights (ALSF)-1 normally results in a published visibility of 1/2 SM.

Consequently, if an ILS is configured with approach lights or a non-precision approach is configured with MALSR, SSALR, or ALSF-1 lighting configurations and the procedure has a published visibility of 3/4 SM or greater, a penetration of the final approach OIS may exist. Also, pilots are unable to determine whether there are penetrations of the final approach OIS if a non-precision procedure does not have approach lights or is configured with ODALS, MALS, or SSALS/SALS lighting since the minimum published visibility is 3/4 SM or greater.

As a rule of thumb, approaches with published visibilities of 3/4 SM or more should be regarded as having final approach OIS penetrations and care must be taken to avoid any obstacles in the visual segment.

Approaches with published visibilities of 1/2 SM or less are free of OIS penetrations and the visibility reduction in Part 97.3 is authorized.

Copter Only Approaches to An Airport or Heliport

Pilots flying Copter SIAPs, other than GPS, may use the published minima with no reductions in visibility allowed. The maximum airspeed is 90 KIAS on any segment of the approach or missed approach. Figure 7-10 illustrates the COPTER ILS or LOC RWY 13 approach at New York/La Guardia (LGA) airport.

Copter ILS approaches to Category (CAT) I facilities with DAs no lower than a 200-foot HAT provide an advantage over a conventional ILS of shorter final segments and lower minimums (based on the 20:1 missed approach surface). There are also Copter approaches with minimums as low as 100-foot HAT and 1/4 SM visibility. Approaches with a HAT below 200 feet are annotated with the note: "Special Aircrew & Aircraft Certification Required" since the FAA must approve the helicopter and its avionics, and the flight crew must have the required experience, training, and checking.

The ground facilities (approach lighting, signal in space, hold lines, maintenance, etc.) and air traffic infrastructure for CAT II ILS approaches are required to support these procedures. The helicopter must be equipped with an AP, FD, or head up guidance system, alternate static source (or heated static source), and radio altimeter. The pilot must have at least a private pilot helicopter certificate, an instrument helicopter rating, and a type rating if the helicopter requires a type rating. Pilot experience requires the following flight times: 250 pilot in command (PIC), 100 helicopter PIC, 50 night PIC, 75 hours of actual or simulated instrument flight time, including at least 25 hours of actual or simulated instrument flight time in a helicopter or a helicopter flight simulator, and the appropriate recent experience, training and check. For Copter CAT II ILS operations below 200 feet HAT, approach deviations are limited to 1/4 scale of the localizer or glide slope needle. Deviations beyond that require an immediate missed approach unless the pilot has at least one of the visual references in sight and otherwise meets the requirements of 14 CFR Part 91.175(c). The reward for this effort is the ability to fly Copter ILS approaches with minima that are sometimes below the airplane CAT II minima. The procedure to apply for this certification is available from your local Flight Standards District Office (FSDO).

Copter GPS Approaches to an Airport or Heliport

Pilots flying Copter GPS or WAAS SIAPs must limit the speed to 90 KIAS on the initial and intermediate segment of the approach and to no more than 70 KIAS on the final and missed approach segments. If annotated, holding may also be limited to 90 KIAS to contain the helicopter within the small airspace provided for helicopter holding patterns.

NEW YORK, NEW YORK

AL-289 (FAA)

12040

LOC/DME I-GDI 108.5 Chan 22	APP CRS 134°	Rwy Idg TDZE Apt Elev 7003 12 21
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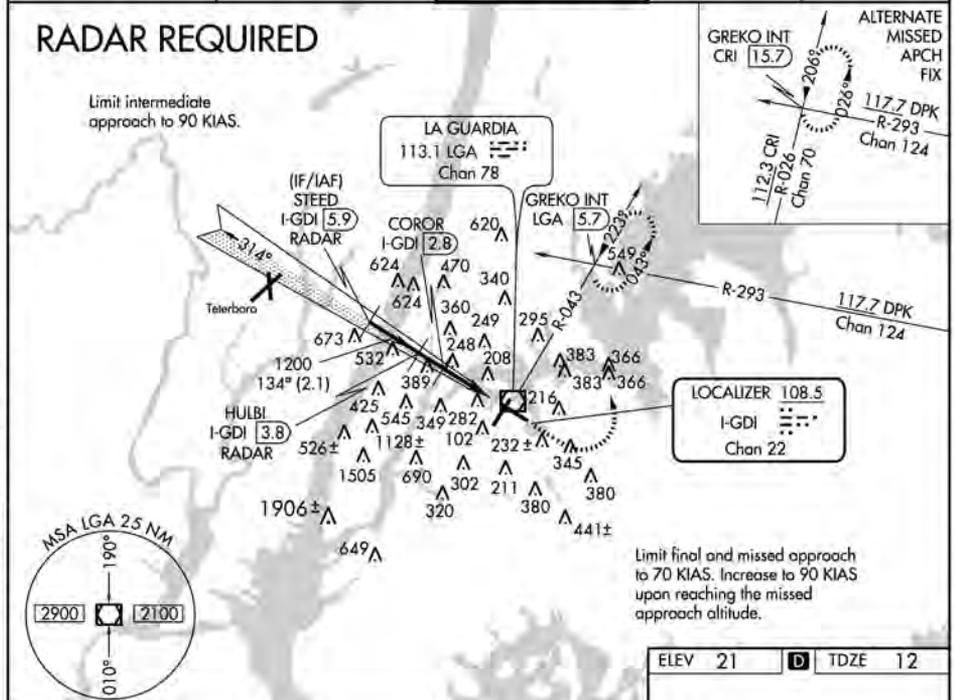
COPTER ILS or LOC RWY 13

NEW YORK/LA GUARDIA (LGA)

DME or RADAR required.		MALSR	MISSED APPROACH: Climb to 800 then climbing left turn to 2000 via LGA VOR/DME R-043 to GREKO INT/LGA 5.7 DME and hold.		
ATIS ARR ATIS DEP	125.95 127.05	NEW YORK APP CON	120.8 263.0	LA GUARDIA TOWER	118.7 263.0
		GND CON	121.7 263.0	CLNC DEL	135.2

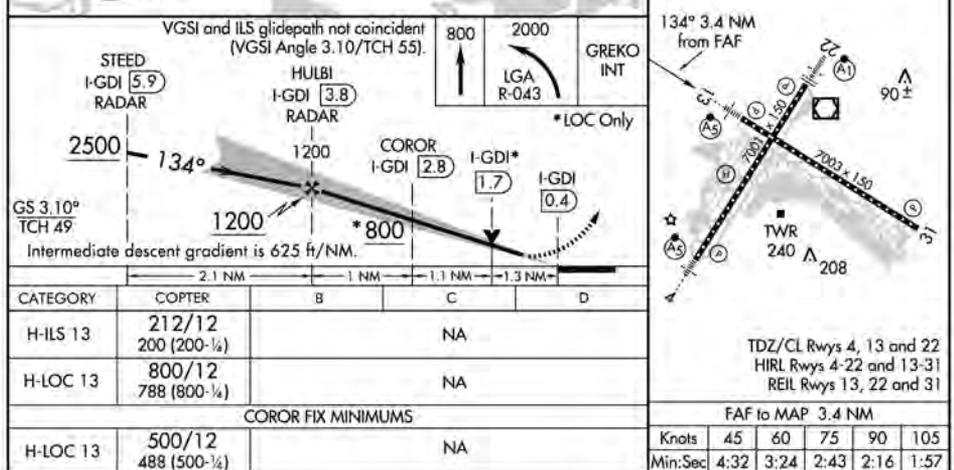
RADAR REQUIRED

Limit intermediate approach to 90 KIAS.



NE-2, 23 AUG 2012 to 20 SEP 2012

NE-2, 23 AUG 2012 to 20 SEP 2012



NEW YORK, NEW YORK
Orig 18NOV10

40°47'N-73°52'W

COPTER ILS or LOC RWY 13

NEW YORK/LA GUARDIA (LGA)

Figure 7-10. The COPTER ILS or LOC RWY 13 approach at New York/La Guardia (LGA) airport.

INDIANAPOLIS, INDIANA

AL-6835 (FAA)

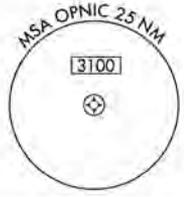
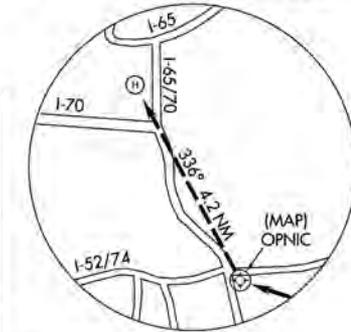
APP CRS	Rwy Idg	N/A
291°	TDZE	N/A
	Apt Elev	732

COPTER RNAV (GPS) 291° INDIANAPOLIS DOWNTOWN HELIPORT (8A4)

NA When local altimeter setting not received, use Indianapolis Intl altimeter setting and increase MDA 40 feet. Limit final and missed approach airspeed to 70 KIAS. DME/DME RNP-0.3 NA. ACTIVATE High Intensity Pad Lights-CTAF.

MISSED APPROACH: Climb to 1500 then climbing right turn to 3000 direct VHP VORTAC and hold.

AWOS-3 118.250	INDIANAPOLIS APP CON 125.275 317.8	UNICOM 123.05 (CTAF) 0
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Knots	45	60	75	90	105	CATEGORY	COPTER
Min:Sec						H-291°	1340-3/4 516 (600-3/4)

INDIANAPOLIS, INDIANA
Orig 08045

INDIANAPOLIS DOWNTOWN HELIPORT (8A4)
COPTER RNAV (GPS) 291°
39°46'N - 86°09'W

EC-2, 23 AUG 2012 to 20 SEP 2012

EC-2, 23 AUG 2012 to 20 SEP 2012

Figure 7-11. COPTER RNAV (GPS) 291° at Indianapolis Downtown Heliport.

During testing for helicopter holding, the optimum airspeed and leg length combination was determined to be 90 KIAS with a 3 NM outbound leg length. Consideration was given to the wind drift on the dead reckoning entry leg at slower speeds, the turn radius at faster airspeeds, and the ability of the helicopter in strong wind conditions to intercept the inbound course prior to the holding fix. The published minimums are to be used with no visibility reductions allowed. Figure 7-11 is an example of a Copter GPS PinS approach that allows the helicopter to fly VFR from the MAP to the heliport.

The final and missed approach protected airspace providing obstacle and terrain avoidance is based on 70 KIAS, with a maximum 10-knot tailwind component. It is absolutely essential that pilots adhere to the 70 KIAS limitation in procedures that include an immediate climbing and turning missed approach. Exceeding the airspeed restriction increases the turning radius significantly and can cause the helicopter to leave the missed approach protected airspace. This may result in controlled flight into terrain (CFIT) or obstacles.

If a helicopter has a V_{MINI} greater than 70 knots, then it is not capable of conducting this type of approach. Similarly, if the autopilot in "go-around" mode climbs at a V_{YI} greater than 70 knots, then that mode cannot be used. It is the responsibility of the pilot to determine compliance with missed approach climb gradient requirements when operating at speeds other than V_Y or V_{YI} . Missed approaches that specify an "IMMEDIATE CLIMBING TURN" have no provision for a straight ahead climbing segment

before turning. A straight segment results in exceeding the protected airspace limits.

Protected obstacle clearance areas and surfaces for the missed approach are established on the assumption that the missed approach is initiated at the DA point and for non-precision approaches no lower than the MDA at the MAP (normally at the threshold of the approach end of the runway). The pilot must begin the missed approach at those points. Flying beyond either point before beginning the missed approach results in flying below the protected obstacle clearance surface (OCS) and can result in a collision with an obstacle.

The missed approach segment U.S. Standard for Terminal Instrument Procedures (TERPS) criteria for all Copter approaches take advantage of the helicopter's climb capabilities at slow airspeeds, resulting in high climb gradients. [Figure 7-12] The OCS used to evaluate the missed approach is a 20:1 inclined plane. This surface is twice as steep for the helicopter as the OCS used to evaluate the airplane missed approach segment. The helicopter climb gradient is, therefore, required to be double that of the airplane's required missed approach climb gradient.

A minimum climb gradient of at least 400 ft/NM is required unless a higher gradient is published on the approach chart (e.g., a helicopter with a ground speed of 70 knots is required to climb at a rate of 467 fpm (467 fpm = 70 KIAS × 400 feet per NM/60 seconds)). The advantage of using the 20:1 OCS for the helicopter missed approach

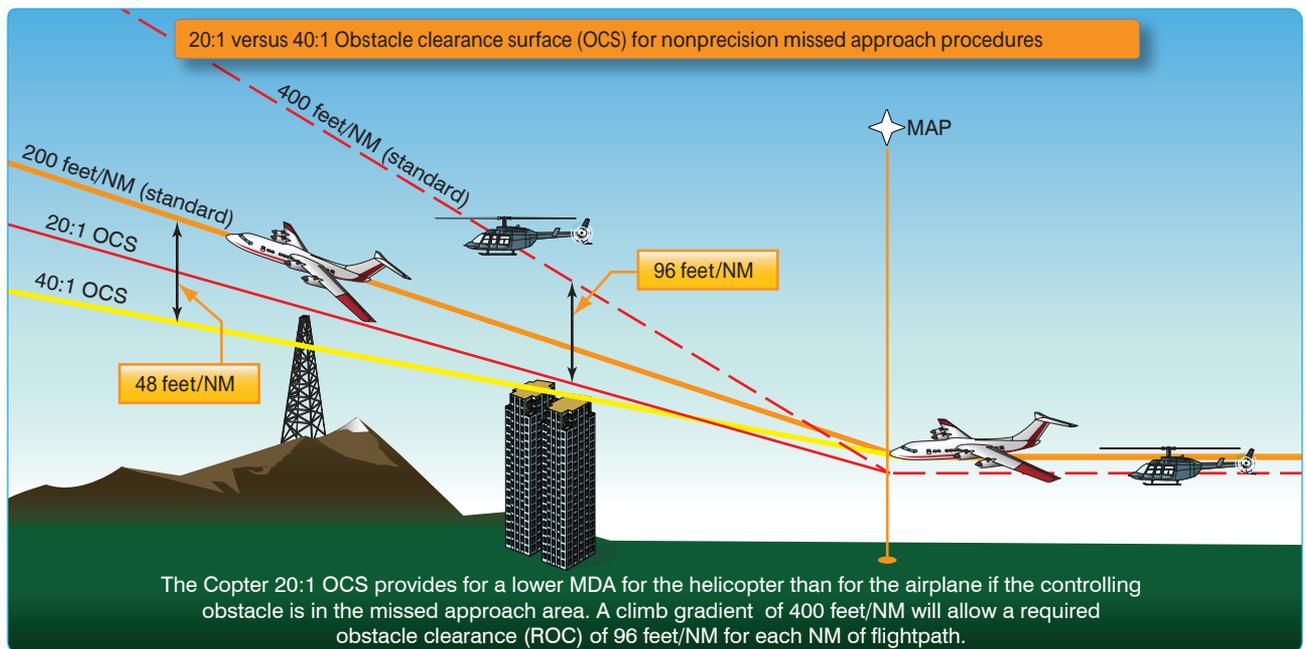


Figure 7-12. Obstacle clearance surface (OCS).

segment instead of the 40:1 OCS used for the airplane is that obstacles that penetrate the 40:1 missed approach segment may not have to be considered. The result is the DA/MDA may be lower for helicopters than for other aircraft. The minimum required climb gradient of 400 ft/NM for the helicopter in a missed approach provides 96 feet of required obstacle clearance (ROC) for each NM of flightpath.

Helicopter Approaches to VFR Heliports

Helicopter approaches to VFR heliports are normally developed either as public procedures to a PinS that may serve more than one heliport or as a special procedure to a specific VFR heliport that requires pilot training due to its unique characteristics. These approaches can be developed using very high frequency omni-directional range (VOR) or automatic direction finder (ADF), but area navigation (RNAV) using GPS is the most common system used today. RNAV using the WAAS offers the most advantages because it can provide lower approach minimums, narrower route widths to support a network of approaches, and may allow the heliport to be used as an alternate. A majority of the special procedures to a specific VFR heliport are developed in support of HAA operators and have a "Proceed Visually" segment between the MAP and the heliport. Public procedures are developed as a PinS approach with a "Proceed VFR" segment between the MAP and the landing area. These PinS "Proceed VFR" procedures specify a course and distance from the MAP to the available heliports in the area.

Approach to a PinS

The note associated with these procedures is: "PROCEED VFR FROM (NAMED MAP) OR CONDUCT THE SPECIFIED MISSED APPROACH." They may be developed as a special or public procedure where the MAP is located more than 2 SM from the landing site, the turn from the final approach to the visual segment is greater than 30 degrees, or the VFR segment from the MAP to the landing site has obstructions that require pilot actions to avoid them. Figure 7-13 is an example of a public PinS approach that allows the pilot to fly to one of four heliports after reaching the MAP.

For Part 135 operations, pilots may not begin the instrument approach unless the latest weather report indicates that the weather conditions are at or above the authorized IFR or VFR minimums as required by the class of airspace, operating rule and/or OpSpecs, whichever is higher. Visual contact with the landing site is not required; however, prior to the MAP, for either Part 91 or 135 operators, the pilot must determine if the flight visibility meets the basic VFR minimums required by the class of airspace, operating rule and/or OpSpecs

(whichever is higher). The visibility is limited to no lower than that published in the procedure until canceling IFR. If VFR minimums do not exist, then the published MAP must be executed. The pilot must contact air traffic control (ATC) upon reaching the MAP, or as soon as practical after that, and advise whether executing the missed approach or canceling IFR and proceeding VFR.

To proceed VFR in uncontrolled airspace, Part 135 operators must observe minimum regulatory VFR conditions, but under some conditions, such as provided for in 14 CFR 135.613 for HAA operators, specific weather minimums are required when near the MAP and the heliport of intended landing. These minimums apply regardless of whether the approach is located on the plains of Oklahoma or in the Colorado mountains. However, for heliports located farther than 3 NM from the heliport, Part 135 HAA operators are held to an even higher standard and the minimums and lighting conditions contained in Figure 7-15 apply to the entire route. Mountainous terrain at night with low light conditions requires a ceiling of 1,000 feet and either 3 SM or 5 SM visibility depending on whether it has been determined as part of the operator's local flying area.

In Class B, C, D, and E surface area airspace, a SVFR clearance may be obtained if SVFR minimums exist. On your flight plan, give ATC a heads up about your intentions by entering the following in the remarks section: "Request SVFR clearance after the MAP."

Approach to a Specific VFR Heliport

The note associated with these procedures is: "PROCEED VISUALLY FROM (NAMED MAP) OR CONDUCT THE SPECIFIED MISSED APPROACH." Due to their unique characteristics, these approaches require training. They are developed for hospitals, oil rigs, private heliports, etc. As Specials, they require Flight Standards approval by a Letter of Authorization (LOA) for Part 91 operators or by OpSpecs for Part 135 operators. For public procedures, the heliport associated with these procedures must be located within 2 SM of the MAP, the visual segment between the MAP and the heliport evaluated for obstacle hazards, and the heliport must meet the appropriate VFR heliport recommendations of AC 150/5390-2, Heliport Design.

The PinS optimum location is 0.65 NM from the heliport. This provides an adequate distance to decelerate and land from an approach speed of 70 KIAS. Certain airframes may be certified to fly at reduced V_{MINI} or below V_{MINI} speeds as a result of flight control design or adherence to AC 29-2, Certification of Transport Category Rotorcraft. In these cases, an approach procedure stating the minimum

NEW YORK, NEW YORK

AL-289 (FAA)

COPTER RNAV (GPS) 250°

NEW YORK/ LA GUARDIA (LGA)

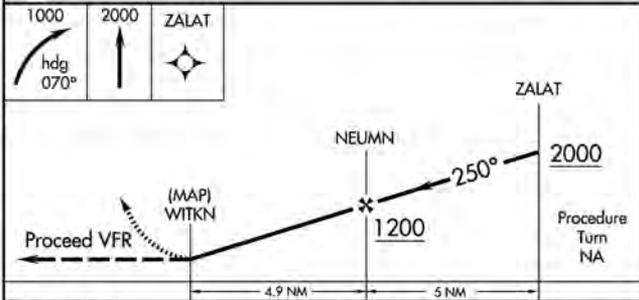
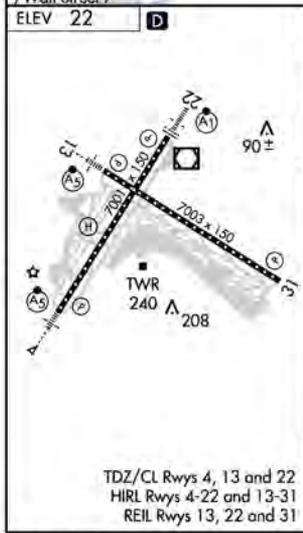
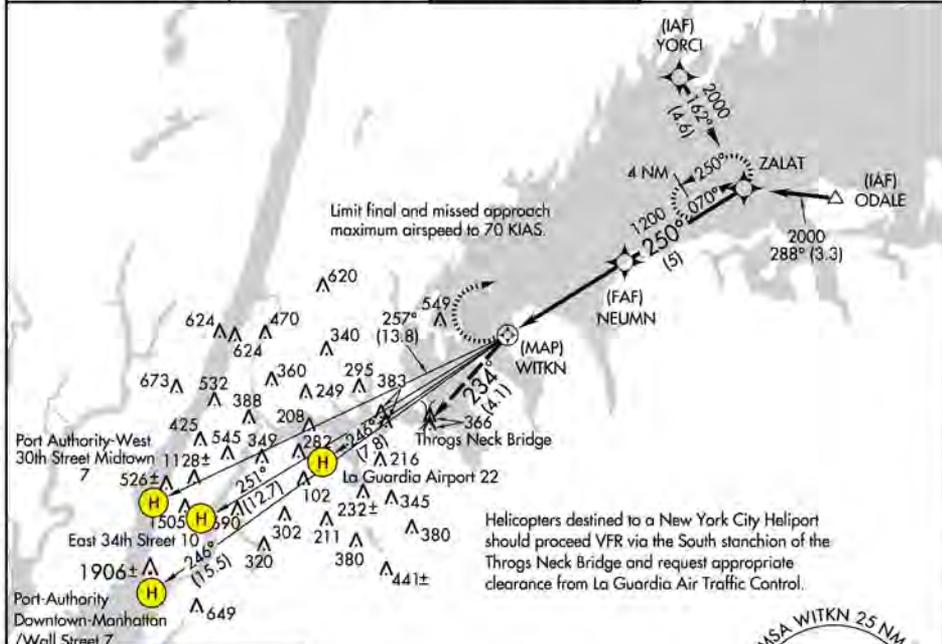
APP CRS	Rwy Idg	N/A
250°	TDZE	N/A
	Apl Elev	22

NA Use La Guardia altimeter setting. **MISSED APPROACH:** Climbing right turn to 1000 until heading through 070°, climb to 2000 direct ZALAT WP and hold.

ATIS ARR	125.95	NEW YORK APP CON	120.8 263.0	LA GUARDIA TOWER	118.7 263.0	GND CON	121.7 263.0	CLNC DEL	135.2
ATIS DEP	127.05								

NE-2, 23 AUG 2012 to 20 SEP 2012

NE-2, 23 AUG 2012 to 20 SEP 2012



CATEGORY	COPTER
H-250°	480-¾ 351 (400-¾)
CIRCLING	NA

NEW YORK, NEW YORK
Orig-A 12040

NEW YORK/LA GUARDIA (LGA)
40°47'N - 73°52'W **COPTER RNAV (GPS) 250°**

Figure 7-13. COPTER RNAV (GPS) 250° at New York/La Guardia Airport.

Point-in-Space Approach Examples

EXAMPLE 1

Under Part 91, the operator flies the published IFR PinS approach procedure that has a charted MDA of 340 mean sea level (MSL) and visibility of $\frac{3}{4}$ SM. When approaching the MAP at an altitude of 340 feet MSL, the pilot transitions from Instrument Meteorological Conditions (IMC) to Visual Meteorological Conditions (VMC) and determines that the flight visibility is $\frac{1}{2}$ SM. The pilot must determine prior to the MAP whether the applicable basic VFR weather minimums can be maintained from the MAP to the heliport or execute a missed approach. If the pilot determines that the applicable basic VFR weather minimums can be maintained to the heliport, the pilot may proceed VFR. If the visual segment is in Class B, C, D, or the surface area of Class E airspace, it may require the pilot to obtain a Special VFR clearance.

EXAMPLE 2

For an operator to proceed VFR under Part 135, a minimum visibility of $\frac{1}{2}$ SM during the day and 1 SM at night with a minimum ceiling of 300 feet. If prior to commencing the approach, the pilot determines the reported visibility is $\frac{3}{4}$ SM during the day, the pilot descends IMC to an altitude no lower than the MDA and transitions to VMC. If the pilot determines prior to the MAP that the flight visibility is less than $\frac{1}{2}$ SM in the visual segment, a missed approach must be executed at the MAP.

Figure 7-15. Point-in-space (PinS) approach examples for Part 91 and Part 135 operations.

certified airspeed or flight below V_{MINI} should be annotated on the approach procedure. The distance also permits optimal blending of obstacle clearance criteria with non-instrument heliport approach areas.

The visibility minimum is based on the distance from the MAP to the heliport, among other factors (e.g., height above the heliport elevation when at the MAP MDA). The pilot is required to acquire and maintain visual contact with the heliport final approach and takeoff (FATO) area at or prior to the MAP. Obstacle or terrain avoidance from the MAP to the heliport is the responsibility of the pilot. Pilots need to level off when reaching the MDA, which may occur before arriving at the MAP, until reaching the visual approach angle on the approach path to clear the obstacles. If the required weather minimums do not exist, then the published MAP must be executed at the MAP because IFR obstruction clearance areas are not applied to the visual segment of the approach and a missed approach segment protection is not provided between the MAP and the heliport. As soon as practicable after reaching the MAP, the pilot advises ATC whether cancelling IFR and proceeding visually or executing the missed approach.

Inadvertent IMC

Whether it is a corporate or HAA operation, helicopter pilots sometimes operate in challenging weather conditions. An encounter with weather that does not permit continued flight under VFR might occur when conditions do not allow for the visual determination of a usable horizon (e.g., fog,

snow showers, or night operations over unlit surfaces such as water). Flight in conditions of limited visual contrast should be avoided since this can result in a loss of horizontal or surface reference, and obstacles such as wires become perceptually invisible. To prevent spatial disorientation, loss of control (LOC) or CFIT, pilots should slow the helicopter to a speed that provides a controlled deceleration in the distance equal to the forward visibility. The pilot should look for terrain that provides sufficient contrast to either continue the flight or to make a precautionary landing. If spatial disorientation occurs and a climb into IMC is not feasible due to fuel state, icing conditions, equipment, etc., make every effort to land the helicopter with a slight forward descent to prevent any sideward or rearward motion.

All helicopter pilots should receive training on avoidance and recovery from inadvertent IMC with emphasis on avoidance. An unplanned transition from VMC to IMC flight is an emergency that involves a different set of pilot actions. It requires the use of different navigation and operational procedures, interaction with ATC, and crewmember resource management (CRM). Consideration should be given to the local flying area's terrain, airspace, air traffic facilities, weather (including seasonal affects such as icing and thunderstorms), and available airfield/heliport approaches.

Training should emphasize the identification of circumstances conducive to inadvertent IMC and a strategy to abandon continued VFR flight in deteriorating conditions. This strategy should include a minimum altitude/airspeed combination that provides for an off-

airport/heliport landing, diverting to better conditions, or initiating an emergency transition to IFR. Pilots should be able to readily identify the minimum initial altitude and course in order to avoid CFIT. Current IFR en route and approach charts for the route of flight are essential. A GPS navigation receiver with a moving map provides exceptional situational awareness for terrain and obstacle avoidance.

Training for an emergency transition to IFR should include full and partial panel instrument flight, unusual attitude recovery, ATC communications, and instrument approaches. If an ILS is available and the helicopter is equipped, an ILS approach should be made. Otherwise, if the helicopter is equipped with an IFR approach-capable GPS receiver with a current database, a GPS approach should be made. If neither, an ILS or GPS procedure is available use another instrument approach.

Upon entering inadvertent IMC, priority must be given to control of the helicopter. Keep it simple and take one action at a time.

- Control. First use the wings on the attitude indicator to level the helicopter. Maintain heading and increase to climb power. Establish climb airspeed at the best angle of climb but no slower than V_{MINI} .
- Climb. Climb straight ahead until your crosscheck is established. Then make a turn only to avoid terrain or objects. If an altitude has not been previously established with ATC to climb to for inadvertent IMC, then you should climb to an altitude that is at least 1,000 feet above the highest known object and that allows for contacting ATC.
- Communicate. Attempt to contact ATC as soon as the helicopter is stabilized in the climb and headed away from danger. If the appropriate frequency is not known, you should attempt to contact ATC on either very high frequency (VHF) 121.5 or ultra high frequency (UHF) 243.0. Initial information provided to ATC should be your approximate location, that inadvertent IMC has been encountered and an emergency climb has been made, your altitude, amount of flight time remaining (fuel state), and number of persons on board. You should then request a vector to either VFR weather conditions or to the nearest suitable airport/heliport that conditions will support a successful approach. If unable to contact ATC and a transponder code has not been previously established with ATC for inadvertent IMC, change the transponder code to 7700.

A radio altimeter is a necessity for alerting the pilot when inadvertently going below the minimum altitude. Barometric altimeters are subject to inaccuracies that become important in helicopter IFR operations, especially in cold temperatures.

IFR Heliports

AC 150/5390-2, Heliport Design, provides recommendations for heliport design to support non-precision, approach with vertical guidance (APV), and precision approaches to a heliport. When a heliport does not meet the criteria of AC 150/5390-2, FAA Order 8260.42, United States Standard for Helicopter Area Navigation (RNAV), requires that an instrument approach be published as a Special procedure with annotations that special aircrew qualifications are required to fly the procedure. Currently, there are no operational civil IFR heliports in the U.S., although the U.S. military has some non-precision and precision approach procedures to IFR heliports.

