CAD-055

COMMODORE® 64/128,™

COSMI

SUPER® HUEY

by

Paul Norman

Authentic HELICOPTER FLIGHT SIMULATOR, that not only teaches you how to fly rotary wing aircraft, but also sends you on four separate and exciting missions.

GAMES WORTH PLAYING

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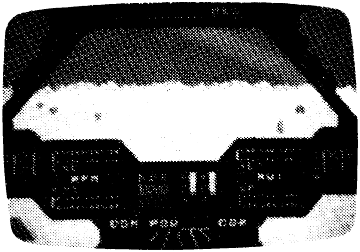
INSTRUCTIONS



COMMODORE® 64/128™

SUPER HUEY UH-IX

by Paul Norman

OVERVIEW

The UH-IX is a new, experimental high performance helicopter utilizing the latest in electronic control systems and stabilization.

Features include a state-of-the-art electronic instrument console; an on-board computer that regulates and monitors ships' systems as well as providing pilot commands for special functions; automatic pitch control/engine power linkage for RPM equilibrium including synchronization of anti-torque pitch unless directly controlled by the pilot.

Also employed is a new VLW (very light weight) piston engine molded with a super-strength, super-light material, still classified by the military, which rivals the weight/thrust ratio of most turboshaft engines. Mounted vertically, the engine is coupled to the main rotor shaft through a custom/direct drive transmission system with a 10 to 1 reduction ratio.

The rotor assembly consists of semi-rigid blades and a hub articulation system that is electronically adjustable through varying flight conditions. The effect of this system is to reduce drag by 40 to 60 per cent and increase forward speed potential substantially.

Structurally based on Bell Helicopters' UH-1 series, the UH-1X fuselage is made of a carbon-fiber material and molded for optimum aero-dynamic characteristics and low weight.

The streamlined interior seats one pilot in front with room for one passenger or co-operator directly behind. The main controls are incorporated into one stick, a revolutionary and controversial innovation that replaces the collective, cyclic, and anti-torque controls of conventional helicopters.

While this arrangement offers some new problems for novices and experienced pilots, it also provides a few advantages necessary for the UH-1X configuration. It allows for solo flight, enabling the single pilot to control the craft while at the same time operate the on-board computer, radio or weapons controls. The fuselage is vulnerable to weapons fire although the material has an elasticity component which can resist or deflect hits better than metal exteriors.

The Weapon System includes rockets that can be armed in sets of four and fired at one-second intervals. Two machine guns are mounted on either side of the fuselage and fire in tandem. Maximum rocket supply is sixteen and the guns have 2000 rounds each. The UH-1X was not specifically designed as a military aircraft. Its high speed and long range is useful for reconnaissance or rescue and its armaments provide adequate defense capability.

The UH-1X represents a step in a new direction in helicopter flight design and control. See your Huey dealer and test fly one soon. In the meantime, prepare yourself with the Super Huey Flight Simulator from Cosmi, Inc.

SYSTEM REQUIREMENTS

1.) The Super Huey Diskette.
2.) Commodore® 64™ or 128™ Computer.
3.) Commodore® 64™ or 128™ single drive floppy disk.
4.) One joystick controller.

LOADING THE PROGRAM

SUPER HUEY is a machine language game program which will load into any standard Commodore® 64™ or 128™ Computer by following the instructions below exactly.

IMPORTANT NOTE: The joystick controller must be plugged into CONTROL PORT NO. 2. (It will not function in CONTROL PORT NO. 1.) SUPER HUEY is a two part program. Do not remove the disk until the entire program has loaded.

DISKETTE VERSION

1.) Attach the Commodore® 64™ or 128™ Disk Drive to the computer according to the Disk Drive Instruction Manual.

2.) Turn on the computer and wait for the flashing cursor and the READY message. Now turn on the Disk Drive. Wait for the red light on the drive to go out.

3.) Insert the program Diskette and close the drive latch. Type on the computer: LOAD "SH", 8 and press the RETURN key. The computer will respond with the message, SEARCHING FOR SH.

4.) After a moment, it will read, FOUND SH-LOADING. When the READY message returns, type: RUN and press RETURN. The program title card will appear and the program will start loading automatically. When the program is loaded, the game will begin immediately.

5.) Do not turn off disk drive with diskette in disk drive.

6.) When the instrument cluster appears on the screen, turn on the on-board computer using the F1 function key. Enter the ASN command to select an assignment and stand by for the automatic loading of further program material.

    When the disk drive stops, leave the disk in place and proceed with normal helicopter operations (See Instructions).

A BRIEF SUMMARY OF CONVENTIONAL HELICOPTER CONTROLS

This is not intended as a tutorial on helicopters but rather a general description of the traditional and well understood characteristics of rotary-wing aircraft.

The physics of flight are the same for fixed wing and rotary wing aircraft but the helicopter introduces some complex problems over airplanes. In the first place, airplanes are inherently stable whereas helicopters are inherently unstable. As a result, planes require less constant controlling than do helicopters. Both the wing of an airplane and the rotor blade of a helicopter are "airfoils" and interact with the air in the same way through the "Bernoulli effect." Briefly, this describes the effect of the curvature of a wing causing a higher air pressure area below the wing and a low pressure area above, producing lift, as the wing moves through the air. A fixed-wing craft requires forward thrust to produce lift. A helicopter blade achieves forward thrust by spinning on a stationary axis thus producing lift only in a direction parallel to the axis, or vertical thrust. The amount of lift depends on the "angle of attack" of the airfoil, the angle of the blade to the relative wind. The angle of attack is proportional to the pitch of the rotor blade which is controlled by the pilot, greater pitch producing more lift. At the same time, as pitch increases, so does drag since more blade surface is presented to the airflow, and consequently, more power is required to maintain the rotor RPM.

The relationship between pitch and RPM is perhaps the most important consideration in operating a helicopter. Another factor in a rotary-wing system is the torque reaction of the spinning rotor on the fuselage. The torque of the turning rotor exerts an equal and opposite force on the body of the craft causing it to turn opposite to the blades unless counteracted by another force, in this case the tail, or anti-torque, rotor blades. The tail rotor provides thrust in a direction opposite the torque reaction, thus equalizing the force and stabilizing the heading of the craft. Further, the thrust of the tail rotor is controllable by the pilot providing directional control. This is possible because over-compensation of the torque effect will turn the fuselage in the direction of the spinning blades, and a thrust less than the force of torque will allow the fuselage to turn against the rotor direction.

Four main control systems are found in conventional helicopters. These are the cyclic stick, the collective pitch control, the throttle and the anti-torque (or rudder) pedals. The collective pitch control, or simply, collective, increases or decreases the pitch of all blades equally. The collective is the primary vertical thrust control. Normally, pulling up on the collective stick will produce lift and lowering it will decrease lift. As mentioned above, as pitch increases, so does rotor drag, requiring an increase in engine power to maintain RPM. In many helicopters, this synchronization is provided automatically by a link between the collective and the throttle.

The throttle controls engine power and RPM directly. It is usually located on the collective stick to aid in the coordination of pitch and RPM.

The anti-torque pedals control the pitch of the tail rotor blades, providing torque compensation and directional control. Normally, these are conventional rudder pedals. Finally, the cyclic stick is the main direction control which determines the attitude of the rotor system. Basically, when the plane of the spinning rotor disc is horizontal, all the thrust produced is directed upward, perpendicular to the plane and parallel to the rotor shaft. By moving the cyclic stick in any direction away from center (or neutral) the plane of the rotor, in essence, tilts in the same direction, thereby dividing the thrust between the vertical and the direction of tilt. For example, moving the cyclic forward will cause forward thrust to a degree which is equal to the amount of rotor deviation from the horizontal. At the same time the attitude of the fuselage will change to the same degree (in forward flight, a nose-down condition). Also, a cyclic change will change the "angle of attack" set by the collective pitch control, which will affect RPM and thereby, torque reaction.

This illustrates an essential characteristic of helicopter controls. Any change in one of the controls will, in most cases, require some adjustment in the other controls. This is why helicopters must be "flown" at all times.

In summation, the four main control systems can be thought of in general as follows:

The cyclic controls the direction and attitude of the helicopter. The collective controls the amount of thrust produced by the rotor blades in the direction set by the cyclic stick. The throttle directly controls engine power output and RPM. The anti-torque pedals control torque compensation and directional control to maintain heading.

THE UH-IX CONTROL SYSTEM

The Super Huey Control System can be divided into two main components. The control stick and the computer keyboard.

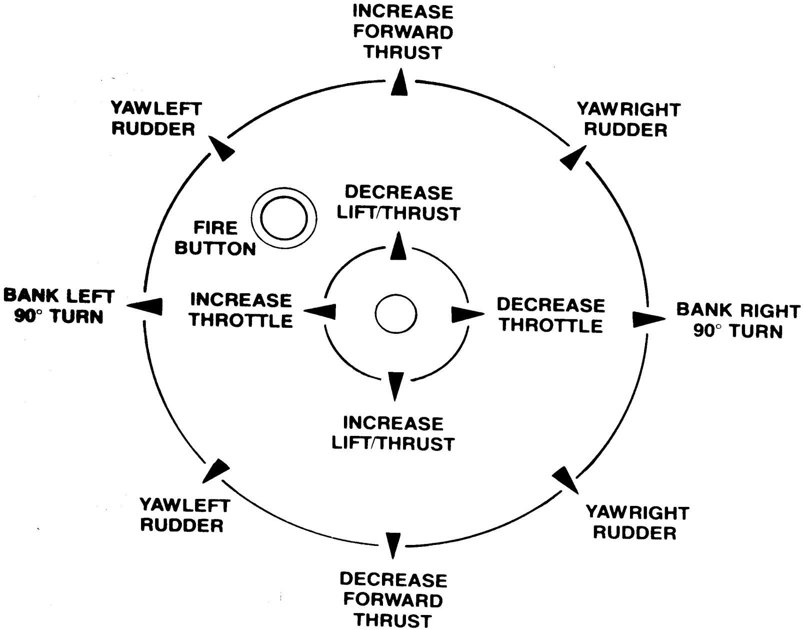
The keyboard design is based on the Commodore® 64/128™ Computer with the full key compliment and four function keys. The function keys in the UH-1X act as primary switches for computer on/off (F1), engine starter button (F3), rotor clutch engage (F5), and engine off/cut power (F7). The remainder of the keyboard is used to enter commands and data to the on-board computer.

The control stick is a new approach to helicopter control, housing all four of the normal control devices into a single unit. The stick itself is not dissimilar to a video game controller (called a "Joystick") incorporating an 8-position pivoting hand-grip and a single activation switch (or fire button). The UH-1X Control operates in two modes: the cyclic mode, wherein the stick acts almost precisely like a normal helicopter cyclic control stick, and the collective mode, wherein the stick affects blade pitch angle and the throttle.

The cyclic mode is in effect when the fire button is **not** depressed and the collective mode engages when the fire button is depressed.

The schematic illustrates the function of the UH-1X control stick. A geographical convention will be used to indicate the direction of stick movement. For example, pushing the stick forward, or away from the pilot, will be designated as North, and pulling back on the stick or toward the pilot, will be designated as South.

The inner circle describes the four operations of the collective mode which is engaged by pressing the fire button. Pushing the stick North will decrease the pitch angle of the


INCREASE FORWARD THRUST
YAWLEFT RUDDER
YAWRIGHT RUDDER
DECREASE LIFT/THRUST
FIRE BUTTON
BANK LEFT 90° TURN
INCREASE THROTTLE
DECREASE THROTTLE
BANK RIGHT 90° TURN
INCREASE LIFT/THRUST
YAWLEFT RUDDER
YAWRIGHT RUDDER
DECREASE FORWARD THRUST

rotor blades, thus reducing lift/thrust to a point of 0 angle of attack or no lift. Pulling back South will result in a blade pitch angle increase producing more lift/thrust. Pushing the stick West will increase the throttle opening producing more engine power and a higher RPM. A push to the East will close the throttle gradually, reducing power.

The Fire Button is used to switch from cyclic to collective mode unless weapons are activated.

The outer circle describes the function of the stick when in cyclic mode (the fire button is **not** depressed). A North movement of the stick will tilt the rotor forward resulting in forward thrust. Moving the stick South tilts the rotor back to counter the forward thrust, thus slowing the craft. If held long enough, the helicopter will come to a stop supplying only vertical thrust for hovering.

East or West stick movements will result in a hard banking turn in the same direction. Stabilizers will level the ship as soon as the stick is returned to center. Northeast/Southeast stick will change the heading to the right through use of the anti-torque, or tail, rotor. Northwest/Southwest will produce a change to the left. Small course corrections should be made with the rudders and significant turns should be handled by banking the ship left or right. With the exception of hard bank left/right turns, all other control changes are designed to "set and hold" in both cyclic and collective mode. This means that any change in flight attitude by the control stick will be continuous until an opposite control maneuver is executed by the pilot to the same degree.

For example, pushing the stick to the northwest will lessen tail rotor thrust thus allowing the fuselage to begin turning to the left. The longer the stick is held in that direction, the greater the reduction in tail-rotor thrust. Returning the stick to center will not eliminate this change. The pilot must move the stick to the northeast to begin counteracting the thrust change which will bring the level of anti-torque effect back to neutral to reestablish a straight-ahead attitude. Similarly, an increase in lift produced by moving the stick south, in the collective mode, will build vertical thrust which will remain the same until the collective is lowered (stick north) reducing lift. If the lift is not enough to overcome the weight of the helicopter, then it will begin to descend (this is how landings are accomplished). Only experience will allow the pilot to discover the precise points of equilibrium required to achieve the desired maneuver.

INSTRUMENTS

1.) **FRE** – VHF Omnidirectional range transmission from a local station or base used by the navigation computer to set a heading to the transmitting station.

2.) **NAV** – Compass heading computed from the VOR Transmission (1) The COR Command may be used to copy this heading to the automatic course setting; (2) or the NAV heading may be followed manually.

3.) **RAD** – Radar is activated by entering combat mode (LAR Command). This readout then gives the line-of-sight range of the radar trace from the helicopter (multiple traces are resolved to the closest target).

4.) **ARM** – Numbers 1 2 3 4 are lighted indicating which rockets are in the launch tubes (1 to all 4 are selectable). The indicator lights below the numbers show which rockets are armed and ready to fire.

5.) **HOM** – A homing device may be dropped using the HOM Command. The heading to return to the drop spot is then transmitted and displayed here. The homing device has a range of 20 miles.

6.) **RES** – This displays the transmitted heading of a homing device used by ground personnel to be located. This readout will activate (and take precedence) when in range.

7.) **INDICATOR LIGHTS** – Routine automatic systems check will light the appropriate indicator if a malfunction is found in any electronic system. The pilot has no control over such malfunctions and should return to base for repairs.

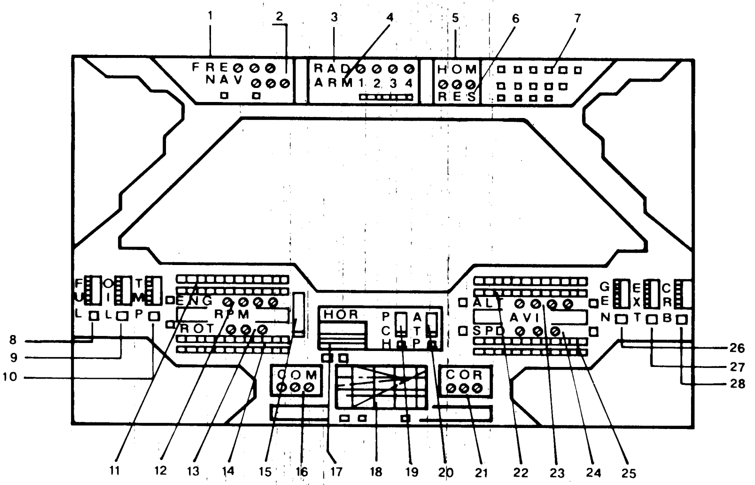
8.) **FUL** – Fuel gauge.

9.) **OIL** – Oil pressure gauge. Optimum reading is center mark.

10.) **TMP** – Engine temperature gauge. Normal cruise reading is center mark.

YAW RIGHT
RUDDER

Turn on Radar tracking without engaging weapons.



1.) Radio Frequency (Incoming)
2.) Direction Finder
3.) Range (Radar Track)
4.) Rockets Status Indicators and Arming Lights
5.) Homing Frequency/Heading
6.) Rescue Frequency/Heading
7.) Systems Status Indicator Lights
8.) Fuel Gauge
9.) Oil Pressure Gauge
10.) Engine Temperature Gauge
11.) Engine RPM Slide Gauge
12.) Engine RPM Digital Indicator
13.) Rotor RPM Digital Indicator
14.) Rotor RPM Slide Gauge
15.) Manifold Pressue Gauge
16.) Magnetic Compass
17.) Artificial Horizon
18.) On-Board Computer Screen
19.) Collective Pitch Gauge
20.) Anti-Torque Gauge
21.) Automatic Course Setting
22.) Altimeter Slide Gauge
23.) Altimeter Digital Indicator
24.) Speedometer Digital Indicator
25.) Speedometer Slide Gauge
26.) Generator (ammeter) Indicator
27.) Exhaust (Cylinder Head) Temperature
28.) Carburetor Mixture/Temperature
29.) Malfunction Indicator Lights

11 - 12.) Engine Tachometer Set includes sliding needle gauge and digital readout. Red areas are low or excessive levels. Yellow areas are cautionary levels. Green area is normal operating range.

13 - 14.) Rotor Tachometer Set includes sliding needle gauge and digital readout. Red, yellow, and green areas are explained above.

15.) Manifold pressure gauge. Indicates engine power output. Red area is dangerously high pressure.

Note: Computer will cut engine to prevent rupture at very high level.

16.) Magnetic Compass is digitized and corrected to show true north at 000°.

17.) Artificial Horizon indicates fuselage attitude to relative horizon line.

18.) On-Board Computer Screen.

19.) Collective pitch gauge shows degree of blade pitch change from "full low" (0 angle of attack) to highest pitch angle.

20.) Anti-torque gauge indicates level of rotor torque compensation by the tail rotor.

Note: Anti-torque level is automatically linked to pitch control to maintain equilibrium and straight heading. Manual control of tail rotor pitch overrides automatic control.

21.) Automatic course setting indicates preset heading (using COR Command) that will be followed if there is no manual control input.

Note: Although many stabilization features are incorporated in the UH-1X, the helicopter is still inherently unstable enough to make the ACS only 70-80 per cent reliable.

22 - 23.) Altimeter set includes sliding needle gauge and digital readout. Red, yellow and green areas are explained above.

24 - 25.) Speedometer set includes sliding needle gauge and digital readout. Red, yellow and green areas are explained above.

26.) Generator/Ammeter gauge indicates electrical power output. Normal output is center mark.

27.) Exhaust/cylinder head temperature gauge indicates engine operating conditions. Optimum reading is center mark.

28.) Carburetor Gauge. During warm-up, this gauge shows fuel mixture starting at "full rich" for primary ignition and falling to medium. At normal operating temperature, the gauge indicates carburetor air temperature.

29.) Most instruments include indicator lights that illuminate in the event of malfunction or excessive readings.

COMPUTER CONTROL

Function switches –

F1 – Turn on the on-board computer. No instruments will operate until the computer is on.

F3 – Start the engine. The engine will not start until power is turned on by the POW command.

F5 – Engage rotor clutch. It is not advisable to engage the rotor until engine RPM is 1600-1700.

F7 – Cut power and cut the engine. This will stop the engine, cut all electrical power and turn off the computer. The rotor clutch will automatically disengage and "free-wheel" for winding down or in an autorotative landing.

Computer commands –

ABT – Abort current mission. End assignment and stop all activity.

ACS – Set automatic course correction. When prompted by SET, enter compass heading. ACS works only when there is no manual control input.

ASN – Select a new assignment. Ater the command, enter one of the following:

- INS – flight instruction.
- EXP – exploratory mission.
- COM – combat.
- RSC – rescue mission.

CLM – Displays current climatic conditions including temperature, humidity, air density and pressure, and barometric reading.

DST – Calculate line-of-sight distance from take-off point.

GTK – Displays map grid for ground tracking based on Homing signal.

HOM – Drop a homing device that transmits directional signal to the navigation computer.

LAR – Load and arm rockets. At the LOAD prompt, enter numbers 1-4 to select the number of rockets loaded into the tubes. At the ARM prompt, enter numbers 1-4 to arm the corresponding rockets. The Fire Button is then engaged for firing.

MAC – Activate machine guns. The Fire Button is engaged.

POW – Turn on power.

SAF – Send coordinates when landing or during emergency.

RAD – Turn on Radar tracking without engaging weapons.

TRK – Displays grid for Radar tracking and targeting.

VOR – Activate VHF Omnidirectional Range reception for navigation.

VSI – Display digital vertical speed reading.

XXX – Cancel previous command input. (Not available on immediate action commands.)

STANDARD TAKE-OFF, FLIGHT AND LANDING PROCEDURES

1.) Turn on the computer (F1). Enter ASN to select an assignment. Enter three-letter designation for mission. Standby for computer collating.

2.) Enter POW command to turn on power.

3.) Start the engine (F3). Increase Throttle to bring engine RPM to 1600-1700.

4.) Engage Rotor clutch (F5). Wait for rotor RPM to reach engine RPM. Monitor Oil pressure gauge and Carburetor gauge for normal operating levels. Also watch for high or low temperature levels.

5.) Increase throttle to build RPM to take-off speed (3000-3100 engine, 300-310 rotor).

Note: If helicopter has been previously operated, make sure collective pitch is at FULL LOW before increasing throttle.

6.) With engine at proper RPM begin to increase pitch with the control stick (collective South). As lift is attained, watch for wind drift and stability. Control position and heading with Rudder control (cyclic NW, NE, SW, SE). Continue to control pitch angle as necessary to obtain smooth vertical movement. Equalize lift to attain a stationary hover at 20-30 feet.

7.) Select heading with the rudder control and begin moving the control stick, in cyclic mode, forward (cyclic North). As some airspeed is achieved, add more collective pitch to go into a climbing forward attitude. Forward cyclic will increase RPM and back collective will maintain RPM due to a throttle link. It is most important to hold RPM at a constant rate during cyclic/collective adjustments. Also, forward cyclic will tilt the fuselage forward bringing the nose down. Hold the ship at the proper attitude with some back cyclic modification. Increase forward thrust and airspeed with the collective control rather than further cyclic control to maintain attitude but monitor the degree of pitch and manifold pressure to stay at safe levels. Keep in mind that holding the control stick too long in any position will result in over-controlling. Make adjustments small and gradual to achieve a steady and controlled rate of change.

8.) Bring airspeed to between 70 and 90 knots and continue climbing to at least 500 feet, a minimum altitude from which to make an autorotative landing in the event of engine failure.

9.) Once desired altitude is reached, decrease collective to a point of equilibrium to enter straight-and-level flight. Watch the Airspeed indicator and altimeter for steady and consistent readings.

10.) Once in straight-and-level flight, maintain altitude and airspeed with cyclic and collective control and hold your course with the rudders. Watch the magnetic compass for heading.

11.) To return to base, enter a full 180 turn with cyclic West or East. Watch the compass to follow your heading through the turn. Slightly BEFORE reaching your desired return heading bring the control stick back to center and begin leveling off.

12.) Begin the descent by gradually decreasing pitch. As altitude begins to fall, maintain airspeed with the cyclic control. Keep the rate of descent constant by collective adjustments. As the altitude reaches 100 feet, slowly begin to increase collective pitch to reduce vertical speed. Also begin applying back cyclic to "flare" the helicopter, bringing the nose up and further reducing the speed of descent. At 10-20 feet, go into a hovering attitude and bring the ship to 0 airspeed with the cyclic control. Adjust pitch to hover and then very gradually decrease pitch with the collective to lower the helicopter to the ground. Just before touchdown, add some degree of pitch increase to cushion the landing and once on the ground immediately decrease the pitch angle to the FULL LOW position.

13.) Cut the engine and power (F7). The rotor clutch will disengage and gradually slow to a stop. **Note:** The engine cannot be started again until the rotor has come to a complete stop.

AUTOROTATIVE LANDING

Autorotation is a maneuver wherein, the failure or intent, the engine has stopped and the rotor is spinning freely. Control during autorotation is similar to a powered landing with exception that rotor RPM is maintained by either forward or vertical movement through the air. Therefore, speed or altitude is required to make a successful landing. In this regard, the main considerations are holding a high forward glide airspeed, which is aided by reducing collective pitch which reduces drag, and yet keeping enough lift to check the vertical descent speed. Near the ground, a full flare maneuver with back cyclic combined with a fairly quick and substantial collective pitch increase should cut vertical speed enough to allow for a fairly soft touch-down.

Note: Further reading materials are available on the flight characteristics of helicopters and, with the specific exception of the control configurtion, will be helpful in learning to operate the UH-1X with confidence.

GENERAL DESCRIPTION OF AVAILABLE ASSIGNMENTS

1.) **FLIGHT INSTRUCTION** *(enter INS)* – Computer controlled flight training. The computer will lead you through a series of maneuvers from take-off to landing with simple control prompts. However, the trainee is in full charge of aircraft performance and should have a satisfactory understanding of the instruments and controls before attempting this test flight.

2.) **EXPLORATION** *(enter EXP)* – Fly a survey mission over previously uncharted territory. Map out the general terrain, major geological features, water supply, timberland or signs of habitation.

3.) **RESCUE** *(enter RSC)* – Military personnel are either lost or incapacitated in a mountainous region. Their route cannot be determined because of the irregularities of the terrain. The mission is to locate, transmit heading and distance and, if possible, land and attempt pickup of injured. The helicopter's maximum passenger capacity is two.

4.) **COMBAT** *(enter COM)* – A secret desert installation to which you are assigned is under possible threat of attack by unknown hostile forces. Your job is reconnaissance and, if necessary, defense. Determine enemy's ground and air strength and decide if engagement is feasible.

All mission assignments are unrestricted in form and within the general outline are non-repetetive. All command decisions are the responsibility of the pilot.

Refueling and repairs are available at the original take-off point only. In the event of crash landings, damage or emergency set-downs, the current mission will be terminated.

IF YOU CANNOT LOAD THE PROGRAM

1.) Check your equipment carefully to be sure that all cables and connections are correct.

2.) Re-read the section in the manual about loading machine code programs from cassette tape and diskette. Try to load again.

3.) If you can adjust the volume and tone settings on your recorder, try different settings.

4.) If possible, load another program from a tape or diskette you know works on your computer. This will prove that your equipment works. Try once more to load your game.

5.) The normal reason cassette tapes will not load is tape recorder head misalignment. Your computer may be able to save and load programs on its own recorder, but be unable to load tapes made on a different recorder for this reason. Be sure that your tape recorder heads are properly aligned. Your local computer store or dealer can help with this.

6.) If the program still cannot be loaded, send the cassette or diskette, with a description of the problem (what the computer displays on the screen, if anything, when you try to load the cassette or diskette or play the game) and what you did to try to correct the problem.

Defective cassettes or diskettes will be replaced at no charge.

SUPER HUEY
SUPPLEMENTAL INSTRUCTIONS

INSTRUMENTS

1.) FRE – A digital monitor of the guidance radio frequency transmitted from Base. This signal is used by the navigation computer to calculate the NAV heading.

2.) NAV – This is the compass heading to return to Base. It is activated by the VOR command. If this function is cancelled by XXX or another computer command the digits will remain at their present values and will not be updated.

3.) RAD – Radar activated readout of the distance, in meters, to moving objects such as hostile aircraft. It can be engaged by the RAD command. It also activates automatically when the LAR command is used. This readout is of most use to the computer in targeting and tracking but the pilot can make some determinations from its actions. When the readout begins rapidly changing it always indicates that some other craft is within range even if it is not in view. Also, the direction of change of the numbers, up or down, shows the direction of movement of the object relative to the helicopter. This function has no application in land based navigation.

4.) ARM – The LAR command activates this readout. It shows the status of rockets. At the LOAD prompt, the numbers 1, 2, 3, 4 light when they are entered at the keyboard. This indicates the rockets loaded into the launch tubes. At the ARM prompt, the small lights below the numbers will light when those numbers are again entered. This arms the rockets that are now ready to fire. Each light and number goes out as the rockets are fired.

5.) HOM – This shows a heading computer from a homing signal transmitted by a device dropped by the pilot. It is intended for use only in the event of VOR signal failure or NAV malfunction. Therefore, it is not available when either of these conditions is not present. The possibility of malfunction in all systems is a matter of random chance.

6.) RES – This indicator shows a compass heading calculated from a signal transmitted by a source other than VOR. This readout is used exclusively in the Rescue mission and behaves the same as the NAV monitor. It activates automatically on take-off.

COMPUTER COMMANDS

ACS – Automatic course setting. This will turn the helicopter, by use of the ATP, to a specific compass heading without using the controls. If the controls are used by the pilot during the turn, the action will be suspended until the controls are free and then continue until the set course is reached. The heading will be displayed at the COR monitor at the right of the computer screen.

ASN – Select a new assignment. ASN must be typed in before the mission code is entered. The codes are INS, for flight instruction, EXP, for explore, COM, for combat, and RSC for the rescue mission. (**Note:** on some earlier versions, the rescue mission is coded as RES.)

CLM – Current climatic conditions that relate to helicopter performance. For instance, air temperature affects density which affects lift characteristics. Humidity and pressure influences resistance to speed and lift. Therefore, on a hot, humid day, lift will be less efficient but on a cold, dry day, lift will be easier but speed forward will meet more resistance. The most important readout, as far as navigation is concerned, is wind velocity because, unless you are flying due east or west, the wind will blow you off course by a degree proportionate to its velocity. The wind direction is always from the west.

GTK – Displays a grid on the computer screen and pinpoints the source of an incoming navigation signal, either RES in the rescue mission, or VOR otherwise. The range of this map is 15 square miles. The helicopter is always assumed to be at the center of the grid. Therefore, as the 'blip' is moving closer toward the center the helicopter is getting closer to the source of transmission.

HOM – Drop a Homing device to send a navigation signal from a selected point. This function will not activate if normal VOR or other signals are active.

TRK – Display a 'crosshairs' on the computer screen. When enemy targets are on line and in range, the image will flash red. This is the time to fire your weapon.

NAVIGATION

To understand the NAV and RES readouts of compass headings for navigation it is necessary to adopt the proper perspective of the relationship of the earth and helicopter. While the headings indicated are earth coordinates, the computer always sees itself at the exact center of the compass and the earth moving beneath it. If you observe the compass diagram provided with the documentation, assume that the compass circle is affixed to the aircraft. Wherever you fly, the vertical line that connects North and South and the horizontal line that connects East and West always converge at the helicopter. All points on the ground move apart from this heli-centered grid.

Let us take off from Base, the source of the VOR transmission, with our NAV active and fly due north. The COM reading will be 000. If we observe the NAV readout we see that it soon changes to 180, which is a heading of due south. This is because the Base is now to the south of us. If we stop, hover and turn completely around until the COM reads 180 and fly straight ahead, we will then fly back over the Base, at which point the NAV will change to 000, or due north, since we have gone south of it now. In the same manner, had we flown East or West from BASE the NAV readout would indicate the exact opposite direction since it is showing the way to get back to the source of transmission.

Before flying in some other directions, a further understanding of the way headings are computed is necessary. Since there is only one signal coming from one direction on which to home in on, the position of the source cannot be triangulated. To compute the position from a single source, the computer first utilizes a north/south bias that selects either north or south numbers depending on the incoming signal. A more discrete measurement is made of the angle of reception to find the distance to the east or west of the source.

To see how this works out, let us take off from BASE and this time fly Northeast at a COM reading of 040. What happens to the NAV readout? As we are moving north, we know the Base is moving to the south so the number at the NAV will be some southern degree. Similarly, since we are also flying east, the Base must be going to the west of us and so the number is further limited to the south-west arc of the compass, or something between 180 and 270. Since the Base is not exactly to the west or exactly south the reading will not be 270 or 180. Therefore, since we are moving east, in the northern half of the map, the reading should progress steadily from 180 toward 270 (in 10 degree increments, as that is the resolution of the equipment).

What would happen if we turned due North (COM 000)? The NAV readout would not change since we are still in the northern arc and are maintaining our eastern distance.

If, on the other hand, we turned southeast the NAV would continue to move toward 270 as before. But, when we cross the line and enter the southern arc of the compass, the NAV readout would 'flip' to the Northwest degrees.

For instance, if, at the point of crossing, the NAV read 210 then it would 'flip' to 330 which, if you look at the chart, is the northern counterpart of 210.

In practice, the pilot can interpret the NAV heading in light of the limitations of the system. If one followed the heading exactly as the numbers changed the course travelled back to Base would be an arc rather than a straight line. A thorough understanding of this will allow the pilot to 'cut in' to the arc and find a more direct course by leading the NAV heading in the direction of change. For example, you are somewhere northwest of Base. The NAV reads 150. If you travel east, the number changes to 160, 170, etc. As you can see, the heading is moving to due south (180). If you originally did not follow the heading 150 but, instead, turned more south, say 160, you would actually be moving more directly toward the Base. Calculating the amount of lead is a matter of geometry and practice but, as you can see, the selection in this instance must be somewhere between 150 and 180, exclusive. If you chose a lesser number you would stay too far north and a greater number would keep you too far west. A general rule of thumb could be to always choose a heading half way between the NAV readout and due North or South, depending on your position.

Another use of the NAV readout is to find your exact position on the map at any time. As we have seen, your direction from Base is always the exact diagonal opposite of the NAV. If you use the DST command to find the distance to the Base you then know how far and in what direction the helicopter lies.

THE MISSIONS

COMBAT

At a desert Base of undetermined location you will do battle with an unidentified enemy. The enemy consists of helicopters and tanks. The tanks are out of range above 500 feet. Their position is ten miles from your Base and they are moving so locating them may take a few minutes. Since your radar capability is limited to weapons range there is no way to locate the enemy before encountering them. Therefore, fly out from Base at least 10 miles and then begin your search in a more circular route. Watch your heading so you do not fly back into the safe area while searching.

The weapons available to you are rockets and machine guns. They are fixed mounted and thus aiming is accomplished with the helicopter. The rockets have proximity detonators and so can destroy an enemy craft without a direct hit. However, the effectiveness of this also depends on the maneuvering of the enemy.

The useful equipment for combat includes the TRK function that puts a window on the computer screen and will flash red when a target is on line and in range, RAD readout that plots the distance to an enemy craft in meters and can be read to determine the direction of movement, and the weapons activated by MAC for machine guns or LAR for rockets. There are 16 rockets in all and they are loaded, and armed 4 at a time.

The enemy will fire upon you only when coming directly at you. Maneuvering out of the way is the only defense. Flying straight and level is the best way to get shot down so keep an evasive course as much as possible. Make your computer entries while the RAD is still or while the enemy can be seen crossing in front of you. Firing weapons is restricted only when banking so make turns while shooting by setting the ATP off balance.

Although the tank force will be added to the enemy's number if you fly below 500 feet, remember that you also cut in half the enemy helicopter's ability to evade fire by flying at low altitudes since they of course cannot fly into the ground.

You can return to the safe area (within 10 miles of the Base) or you can shoot down 32 enemy craft to end the battle.

RESCUE

This mission takes you to an entirely new location. Personnel are lost or stranded in snowy mountain terrain. They have a homing device that transmits their heading to the helicopter at the RES monitor. This signal overrides the normal VOR transmission which means that the DST and GTK commands now key into their position rather than the Base until their transmitter is turned off upon their rescue. However the NAV still reads the Base transmission.

The mountains are of varying elevation and so flying this mission requires constant attention as well as monitoring navigation. If any cliff face comes completely across the windshield, it's all over. As a mountainside moves in on you, you can turn away from it, in which case you may run into something on the other side, or you can climb above it. Either maneuver often must be accomplished very quickly.

Follow the RES readout exactly like you do the NAV heading to find the party. When you fly over them they will see you and send up a flare. Any time after the flare has been spotted you can begin landing. Sounds simple? The maneuver of landing in the mountains is one of the most difficult and nerve-wracking tasks in all the missions. The first factor is luck. If the lost party should be in an area of low elevation, your task will be much simpler. This is because it will take less time to land while surrounded by mountains. If the elevation is high you could have white knuckles for quite awhile.

The first thing to do is slow speed to zero and come to a level hovering position. Use the VSI command to monitor your rate of descent. Now begin descending with the collective – slowly!

At some point the mountainsides will begin moving in across the windshield. If they come together you will crash. So start climbing again to separate them and be very careful that you do not inadvertently move forward. The general principle here is to lose altitude by descending and keep the mountains apart by ascending.

At first this sounds like a losing proposition. But the trick is to descend faster than you climb. This way, you will gain more downward footage than you lose when climbing back up. The time this maneuver takes depends upon the elevation of the terrain, how quickly you can operate the controls and so your rate of descent can be high compared to the climb, and just how close you are willing to let those mountainsides get to each other before you pull out. Remember that you are always safe while in a level hover so this is a good way to take a breather. Also, the VSI indicator is as important here as in any landing because your rate of descent must be less than 20 feet per second when you touch down.

Once you are on the ground, and are attempting to breathe normally again, you will notice in the lower left-hand window the grateful group walking out of snow to the helicopter. Once on-board, it is time to go home. All navigation systems will now revert to the VOR signal.

EXPLORE

The essential task of this assignment is to map the terrain that surrounds the Base. This can be a very long and involved process and so is probably best done in stages. The area involved is actually larger in terms of square miles than the other missions and as a result navigation equipment seems to respond more slowly. A recommended procedure might be to select an area to explore, the size of which will be determined by the amount of time available.

Fly to an edge point of the area and do a sweep back and forth until the area has been examined and charted. Due to the size of the terrain the width of the sweeps can be fairly large.

For example, let's take the entire Northwest quadrant. (This would of course take a very long time and so be further subdivided.)

We will start at Base, take off, and fly west. Our COM should be 280 to begin with to take us to the center of the first sweep. Check distance (DST) and when we are about 5 miles from Base then turn to heading 270 (due west). Turn on the NAV with the VOR command. The reading should be 170. As we continue west it will change toward 090. When it reaches 100 we should start turning North (COM 000) for about ten miles. This can be calculated by reading our distance (DST) when beginning the turn and then reading it again after a short while and subtracting the original distance and then dividing by two. A simpler method is to read the distance exactly one minute after leaving the Base. This will then tell us our miles per minute if we keep a steady speed. Once we are far enough north, we will turn back east and travel until the NAV reads 180. We can then repeat the procedure and return to the west. Another, more 'round about' method would be to fly a constantly widening spiral out from Base.

Actually, the method is entirely at the discretion of the pilot and needs to follow no particular routine. The terrain will always be the same however and when ever you fly over it. The key consideration should be to find a way not to cover the same ground twice.

Now, what is it we are looking for? There are three major land types in the area: grass, desert and snow. Each type covers very large areas. Particular features to watch for are towns, collections of houses and small buildings, Pine forests, all the trees will be green Pine, lakes, lots of clear blue water, and hilly areas where all ground features are small hills. There are several of each to map and their position can be plotted by simply plotting your position while flying over, using VOR and DST.

It should also be noted that lower flying altitudes will be helpful in spotting terrain features.

When you complete your map, send Cosmi a copy and we will send you the actual map so you can see how they compare.

CAD-055

ATARI® XL/XE™

COSMI

SUPER HUEY

by
Paul Norman

Authentic HELICOPTER FLIGHT SIMULATOR, that not only teaches you how to fly rotary wing aircraft, but also sends you on four separate and exciting missions.

GAMES WORTH PLAYING

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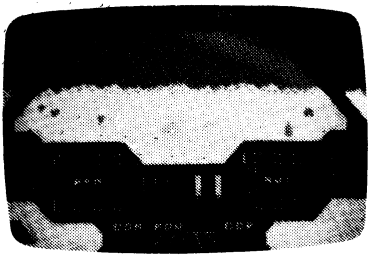
INSTRUCTIONS



ATARI® XL/XE™

SUPER HUEY UH-IX

by Paul Norman

OVERVIEW

The UH-IX is a new, experimental high performance helicopter utilizing the latest in electronic control systems and stabilization.

Features include a state-of-the-art electronic instrument console; an on-board computer that regulates and monitors ships' systems as well as providing pilot commands for special functions; automatic pitch control/engine power linkage for RPM equilibrium including synchronization of anti-torque pitch unless directly controlled by the pilot.

Also employed is a new VLW (very light weight) piston engine molded with a super-strength, super-light material, still classified by the military, which rivals the weight/thrust ratio of most turboshaft engines. Mounted vertically, the engine is coupled to the main rotor shaft through a custom/direct drive transmission system with a 10 to 1 reduction ratio.

The rotor assembly consists of semi-rigid blades and a hub articulation system that is electronically adjustable through varying flight conditions. The effect of this system is to reduce drag by 40 to 60 per cent and increase forward speed potential substantially.

Structurally based on Bell Helicopters' UH-1 series, the UH-1X fuselage is made of a carbon-fiber material and molded for optimum aero-dynamic characteristics and·low weight.

The streamlined interior seats one pilot in front with room for one passenger or co-operator directly behind. The main controls are incorporated into one stick, a revolutionary and controversial innovation that replaces the collective, cyclic, and anti-torque controls of conventional helicopters.

While this arrangement offers some new problems for novices and experienced pilots, it also provides a few advantages necessary for the UH-1X configuration. It allows for solo flight, enabling the single pilot to control the craft while at the same time operate the on-board computer, radio or weapons controls. The fuselage is vulnerable to weapons fire although the material has an elasticity component which can resist or deflect hits better than metal exteriors.

The Weapon System includes rockets that can be armed in sets of four and fired at one-second intervals. Two machine guns are mounted on either side of the fuselage and fire in tandem. Maximum rocket supply is sixteen and the guns have 2000 rounds each. The UH-1X was not specifically designed as a military aircraft. Its high speed and long range is useful for reconnaissance or rescue and its armaments provide adequate defense capability.

The UH-1X represents a step in a new direction in helicopter flight design and control. See your Huey dealer and test fly one soon. In the meantime, prepare yourself with the Super Huey Flight Simulator from Cosmi, Inc.

SYSTEM REQUIREMENTS

1.) The Super Huey Diskette.
2.) Atari® computer with at least 48k RAM memory.
3.) Atari® disk drive.
4.) One joystick controller.

LOADING THE PROGRAM

SUPER HUEY is a machine language game program which will load into any standard Atari® Computer with at least 48k RAM memory by following the instructions below exactly.

IMPORTANT NOTE: The joystick controller must be plugged into PORT NUMBER 1. (It will not function in any other port number). SUPER HUEY is a multipart program, the game disk must NOT be removed from the disk drive during the entire game play. For the computer may require the use of the disk DURING various stages of game play.

DISKETTE VERSION

1.) Attach the Atari® Disk drive to the Atari® computer as stated in the instruction manual.
2.) Turn on the Disk drive.
3.) Place the Game disk (Atari® side up) in the disk drive.
4.) Turn on the Atari® computer, the game will automatically load and run. Remember not to remove the game disk from the drive during the ENTIRE game playing session. Also, DO NOT turn off the disk drive or disconnect it from the computer.
5.) When the instrument cluster appears on the screen, turn on the on-board computer using the OPTION key on the computer. Enter the ASN command to select an assignment and stand by for the automatic loading of further program material.

    When the disk drive stops, leave the disk in place and proceed with normal helicopter operations. (See Instructions).

A BRIEF SUMMARY OF CONVENTIONAL HELICOPTER CONTROLS

This is not intended as a tutorial on helicopters but rather a general description of the traditional and well understood characteristics of rotary-wing aircraft.

The physics of flight are the same for fixed wing and rotary wing aircraft but the helicopter introduces some complex problems over airplanes. In the first place, airplanes are inherently stable whereas helicopters are inherently unstable. As a result, planes require less constant controlling than do helicopters. Both the wing of an airplane and the rotor blade of a helicopter are "airfoils" and interact with the air in the same way through the "Bernoulli effect." Briefly, this describes the effect of the curvature of a wing causing a higher air pressure area below the wing and a low pressure area above, producing lift, as the wing moves through the air. A fixed-wing craft requires forward thrust to produce lift. A helicopter blade achieves forward thrust by spinning on a stationary axis thus producing lift only in a direction parallel to the axis, or vertical thrust. The amount of lift depends on the "angle of attack" of the airfoil, the angle of the blade to the relative wind. The angle of attack is proportional to the pitch of the rotor blade which is controlled by the pilot, greater pitch producing more lift. At the same time, as pitch increases, so does drag since more blade surface is presented to the airflow, and consequently, more power is required to maintain the rotor RPM.

The relationship between pitch and RPM is perhaps the most important consideration in operating a helicopter. Another factor in a rotary-wing system is the torque reaction of the spinning rotor on the fuselage. The torque of the turning rotor exerts an equal and opposite force on the body of the craft causing it to turn opposite to the blades unless counteracted by another force, in this case the tail, or anti-torque, rotor blades. The tail rotor provides thrust in a direction opposite the torque reaction, thus equalizing the force and stabilizing the heading of the craft. Further, the thrust of the tail rotor is controllable by the pilot providing directional control. This is possible because over-compensation of the torque effect will turn the fuselage in the direction of the spinning blades, and a thrust less than the force of torque will allow the fuselage to turn against the rotor direction.

Four main control systems are found in conventional helicopters. These are the cyclic stick, the collective pitch control, the throttle and the anti-torque (or rudder) pedals. The collective pitch control, or simply, collective, increases or decreases the pitch of all blades equally. The collective is the primary vertical thrust control. Normally, pulling up on the collective stick will produce lift and lowering it will decrease lift. As mentioned above, as pitch increases, so does rotor drag, requiring an increase in engine power to maintain RPM. In many helicopters, this synchronization is provided automatically by a link between the collective and the throttle.

The throttle controls engine power and RPM directly. It is usually located on the collective stick to aid in the coordination of pitch and RPM.

The anti-torque pedals control the pitch of the tail rotor blades, providing torque compensation and directional control. Normally, these are conventional rudder pedals. Finally, the cyclic stick is the main direction control which determines the attitude of the rotor system. Basically, when the plane of the spinning rotor disc is horizontal, all the thrust produced is directed upward, perpendicular to the plane and parallel to the rotor shaft. By moving the cyclic stick in any direction away from center (or neutral) the plane of the rotor, in essence, tilts in the same direction, thereby dividing the thrust between the vertical and the direction of tilt. For example, moving the cyclic forward will cause forward thrust to a degree which is equal to the amount of rotor deviation from the horizontal. At the same time the attitude of the fuselage will change to the same degree (in forward flight, a nose-down condition). Also, a cyclic change will change the "angle of attack" set by the collective pitch control, which will affect RPM and thereby, torque reaction.

This illustrates an essential characteristic of helicopter controls. Any change in one of the controls will, in most cases, require some adjustment in the other controls. This is why helicopters must be "flown" at all times.

In summation, the four main control systems can be thought of in general as follows:

The cyclic controls the direction and attitude of the helicopter. The collective controls the amount of thrust produced by the rotor blades in the direction set by the cyclic stick. The throttle directly controls engine power output and RPM. The anti-torque pedals control torque compensation and directional control to maintain heading.

THE UH-IX CONTROL SYSTEM

The Super Huey Control System can be divided into two main components. The control stick and the computer keyboard.

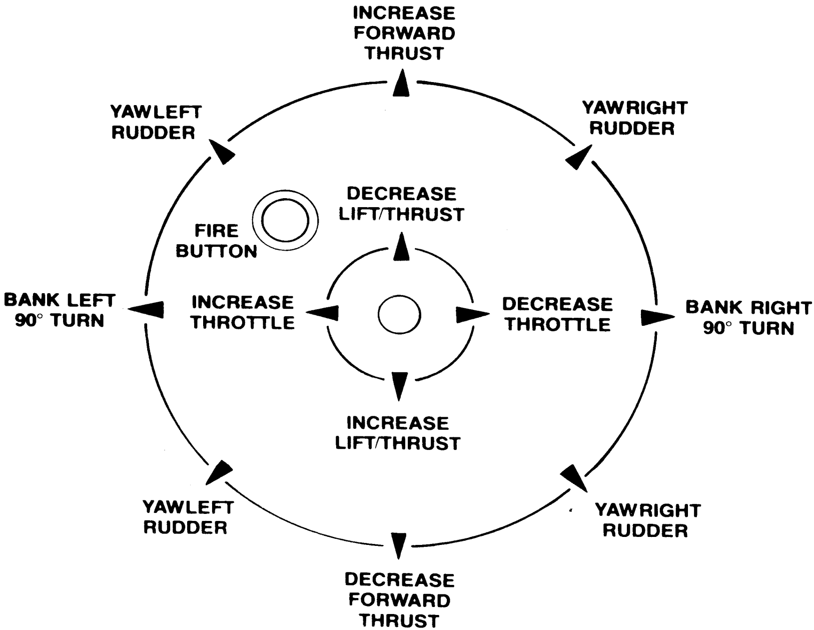
The keyboard design is based on the ATARI® Computer with the full key compliment and three function keys and the ESCAPE (ESC) key. The 3 function keys (OPTION, SELECT, & START) in the UH-1x act as primary switches for computer on/off (OPTION), ENGINE STARTER BUTTON (START), ROTOR CLUTCH ENGAGE (SELECT). And the ESCAPE (ESC) key is used as ENGINE OFF/CUT POWER. The remainder of the keyboard is used to enter commands and data to the on-board computer. The SYSTEM RESET button should not be pressed at any time.

The control stick is a new approach to helicopter control, housing all four of the normal control devices into a single unit. The stick itself is not dissimilar to a video game controller (called a "Joystick") incorporating an 8-position pivoting hand-grip and a single activation switch (or fire button). The UH-1X Control operates in two modes: the cyclic mode, wherein the stick acts almost precisely like a normal helicopter cyclic control stick, and the collective mode, wherein the stick affects blade pitch angle and the throttle.

The cyclic mode is in effect when the fire button is **not** depressed and the collective mode engages when the fire button is depressed.

The schematic illustrates the function of the UH-1X control stick. A geographical convention will be used to indicate the direction of stick movement. For example, pushing the stick forward, or away from the pilot, will be designated as North, and pulling back on the stick or toward the pilot, will be designated as South.

The inner circle describes the four operations of the collective mode which is engaged by pressing the fire button. Pushing the stick North will decrease the pitch angle of the


INCREASE FORWARD THRUST
YAWLEFT RUDDER
YAWRIGHT RUDDER
DECREASE LIFT/THRUST
FIRE BUTTON
BANK LEFT 90° TURN
INCREASE THROTTLE
DECREASE THROTTLE
BANK RIGHT 90° TURN
INCREASE LIFT/THRUST
YAWLEFT RUDDER
YAWRIGHT RUDDER
DECREASE FORWARD THRUST

rotor blades, thus reducing lift/thrust to a point of 0 angle of attack or no lift. Pulling back South will result in a blade pitch angle increase producing more lift/thrust. Pushing the stick West will increase the throttle opening producing more engine power and a higher RPM. A push to the East will close the throttle gradually, reducing power.

The Fire Button is used to switch from cyclic to collective mode unless weapons are activated.

The outer circle describes the function of the stick when in cyclic mode (the fire button is **not** depressed). A North movement of the stick will tilt the rotor forward resulting in forward thrust. Moving the stick South tilts the rotor back to counter the forward thrust, thus slowing the craft. If held long enough, the helicopter will come to a stop supplying only vertical thrust for hovering.

East or West stick movements will result in a hard banking turn in the same direction. Stabilizers will level the ship as soon as the stick is returned to center. Northeast/Southeast stick will change the heading to the right through use of the anti-torque, or tail, rotor. Northwest/Southwest will produce a change to the left. Small course corrections should be made with the rudders and significant turns should be handled by banking the ship left or right. With the exception of hard bank left/right turns, all other control changes are designed to "set and hold" in both cyclic and collective mode. This means that any change in flight attitude by the control stick will be continuous until an opposite control maneuver is executed by the pilot to the same degree.

For example, pushing the stick to the northwest will lessen tail rotor thrust thus allowing the fuselage to begin turning to the left. The longer the stick is held in that direction, the greater the reduction in tail-rotor thrust. Returning the stick to center will not eliminate this change. The pilot must move the stick to the northeast to begin counteracting the thrust change which will bring the level of anti-torque effect back to neutral to reestablish a straight-ahead attitude. Similarly, an increase in lift produced by moving the stick south, in the collective mode, will build vertical thrust which will remain the same until the collective is lowered (stick north) reducing lift. If the lift is not enough to overcome the weight of the helicopter, then it will begin to descend (this is how landings are accomplished). Only experience will allow the pilot to discover the precise points of equilibrium required to achieve the desired maneuver.

INSTRUMENTS

1.) **FRE** – VHF Omnidirectional range transmission from a local station or base used by the navigation computer to set a heading to the transmitting station.

2.) **NAV** – Compass heading computed from the VOR Transmission (1) The COR Command may be used to copy this heading to the automatic course setting; (2) or the NAV heading may be followed manually.

3.) **RAD** – Radar is activated by entering combat mode (LAR Command). This readout then gives the line-of-sight range of the radar trace from the helicopter (multiple traces are resolved to the closest target).

4.) **ARM** – Numbers 1 2 3 4 are lighted indicating which rockets are in the launch tubes (1 to all 4 are selectable). The indicator lights below the numbers show which rockets are armed and ready to fire.

5.) **HOM** – A homing device may be dropped using the HOM Command. The heading to return to the drop spot is then transmitted and displayed here. The homing device has a range of 20 miles.

6.) **RES** – This displays the transmitted heading of a homing device used by ground personnel to be located. This readout will activate (and take precedence) when in range.

7.) **INDICATOR LIGHTS** – Routine automatic systems check will light the appropriate indicator if a malfunction is found in any electronic system. The pilot has no control over such malfunctions and should return to base for repairs.

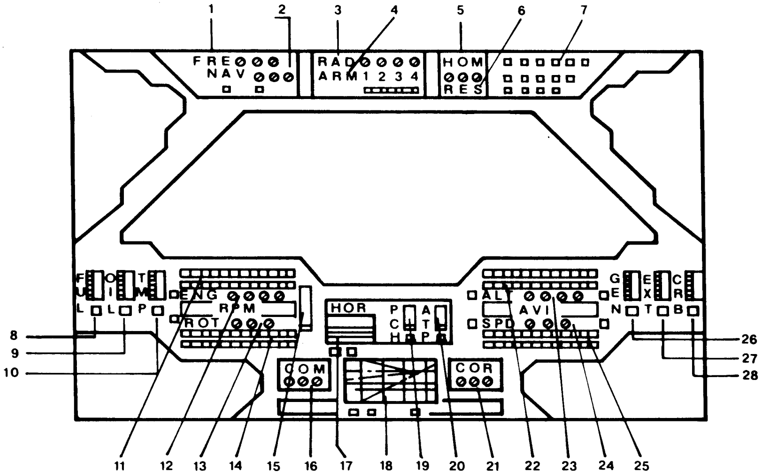
8.) **FUL** – Fuel gauge.

9.) **OIL** – Oil pressure gauge. Optimum reading is center mark.

10.) **TMP** – Engine temperature gauge. Normal cruise reading is center mark.

YAW RIGHT
RUDDER

Turn on Radar tracking without engaging weapons.



1.) Radio Frequency (Incoming)
2.) Direction Finder
3.) Range (Radar Track)
4.) Rockets Status Indicators and Arming Lights
5.) Homing Frequency/Heading
6.) Rescue Frequency/Heading
7.) Systems Status Indicator Lights
8.) Fuel Gauge
9.) Oil Pressure Gauge
10.) Engine Temperature Gauge
11.) Engine RPM Slide Gauge
12.) Engine RPM Digital Indicator
13.) Rotor RPM Digital Indicator
14.) Rotor RPM Slide Gauge
15.) Manifold Pressue Gauge
16.) Magnetic Compass
17.) Artificial Horizon
18.) On-Board Computer Screen
19.) Collective Pitch Gauge
20.) Anti-Torque Gauge
21.) Automatic Course Setting
22.) Altimeter Slide Gauge
23.) Altimeter Digital Indicator
24.) Speedometer Digital Indicator
25.) Speedometer Slide Gauge
26.) Generator (ammeter) Indicator
27.) Exhaust (Cylinder Head) Temperature
28.) Carburetor Mixture/Temperature
29.) Malfunction Indicator Lights

11 - 12.) Engine Tachometer Set includes sliding needle gauge and digital readout. If the sliding needle gauge flashes, this means excessive levels. A non-flashing gauge means levels are normal.

13 - 14.) Rotor Tachometer Set includes sliding needle gauge and digital readout. Again, a flashing gauge means excessive levels.

15.) Manifold pressure gauge. Indicates engine power output. A flashing gauge means dangerously high pressure.

Note: Computer will cut engine to prevent rupture at very high level.

16.) Magnetic Compass is digitized and corrected to show true north at 000°.

17.) Artificial Horizon indicates fuselage attitude to relative horizon line.

18.) On-Board Computer Screen.

19.) Collective pitch gauge shows degree of blade pitch change from "full low" (0 angle of attack) to highest pitch angle.

20.) Anti-torque gauge indicates level of rotor torque compensation by the tail rotor.

Note: Anti-torque level is automatically linked to pitch control to maintain equilibrium and straight heading. Manual control of tail rotor pitch overrides automatic control.

21.) Automatic course setting indicates preset heading (using COR Command) that will be followed if there is no manual control input.

Note: Although many stabilization features are incorporated in the UH-1X, the helicopter is still inherently unstable enough to make the ACS only 70-80 per cent reliable.

22 - 23). Altimeter set includes sliding needle gauge and digital readout. A flashing gauge is explained above.

24 - 25.) Speedometer set includes sliding needle gauge and digital readout. Flashing gauges are explained above.

26.) Generator/Ammeter gauge indicates electrical power output. Normal output is center mark.

27.) Exhaust/cylinder head temperature gauge indicates engine operating conditions. Optimum reading is center mark.

28.) Carburetor Gauge. During warm-up, this gauge shows fuel mixture starting at "full rich" for primary ignition and falling to medium. At normal operating temperature, the gauge indicates carburetor air temperature.

29.) Most instruments include indicator lights that illuminate in the event of malfunction or excessive readings.

CCMPUTER CONTROL

Function switches –

OPTION – Turn on the on-board computer. No instruments will operate until the computer is on.

SELECT – Engage rotor clutch. It is not advisable to engage the rotor until engine RPM is 1600-1700.

START – Start the engine. The engine will not start until power is turned on by the POW command.

ESCAPE KEY – (ESC) – Cut power and cut the engine. This will stop the engine, cut all electrical power and turn off the computer. The rotor clutch will automatically disengage and "free-wheel" for winding down or in an autorotative landing.

IMPORTANT NOTE
FOR ATARI® XL COMPUTER OWNERS

Some ATARI® XL series computers which include built-in ATARI® BASIC programming language require that the BASIC language be disengaged before they will load cassette and diskette programs. This is accomplished on the diskette version by holding the OPTION key down while turning the computer on **and** until the TV monitor screen turns blue. When loading the cassette version, you must hold down **both** the START **and** OPTION keys while turning on the computer. After the computer goes "beep," release **only** the START key and push the RETURN key. When the TV screen turns blue, you may then release the OPTION key and the program will load normally.

Computer commands –

ABT – Abort current mission. End assignment and stop all activity.

ACS – Set automatic course correction. When prompted by SET, enter compass heading. ACS works only when there is no manual control input.

ASN – Select a new assignment. Ater the command, enter one of the following:

- INS – flight instruction.
- EXP – exploratory mission.
- COM – combat.
- RSC – rescue mission.

CLM – Displays current climatic conditions including temperature, humidity, air density and pressure, and barometric reading.

DST – Calculate line-of-sight distance from take-off point.

GTK – Displays map grid for ground tracking based on Homing signal.

HOM – Drop a homing device that transmits directional signal to the navigation computer.

LAR – Load and arm rockets. At the LOAD prompt, enter numbers 1-4 to select the number of rockets loaded into the tubes. At the ARM prompt, enter numbers 1-4 to arm the corresponding rockets. The Fire Button is then engaged for firing.

MAC – Activate machine guns. The Fire Button is engaged.

POW – Turn on power.

SAF – Send coordinates when landing or during emergency.

RAD – Turn on Radar tracking without engaging weapons.

TRK – Displays grid for Radar tracking and targeting.

VOR – Activate VHF Omnidirectional Range reception for navigation.

VSI – Display digital vertical speed reading.

XXX – Cancel previous command input. (Not available on immediate action commands.)

STANDARD TAKE-OFF, FLIGHT AND LANDING PROCEDURES

1.) Turn on the computer (OPTION). Enter ASN to select an assignment. Enter 3 letter designation for mission. Standby for computer collating.

2.) Enter POW command to turn on power.

3.) Start the engine (START). Increase Throttle to bring engine RPM to 1600-1700.

4.) Engage Rotor clutch (SELECT). Wait for rotor RPM to reach engine RPM. Monitor Oil pressure gauge and Carburetor gauge for normal operating levels. Also watch for high or low temp levels.

5.) Increase throttle to build RPM to take-off speed (3000-3100 engine, 300-310 rotor).

Note: If helicopter has been previously operated, make sure collective pitch is at FULL LOW before increasing throttle.

6.) With engine at proper RPM begin to increase pitch with the control stick (collective South). As lift is attained, watch for wind drift and stability. Control position and heading with Rudder control (cyclic NW, NE, SW, SE). Continue to control pitch angle as necessary to obtain smooth vertical movement. Equalize lift to attain a stationary hover at 20-30 feet.

7.) Select heading with the rudder control and begin moving the control stick, in cyclic mode, forward (cyclic North). As some airspeed is achieved, add more collective pitch to go into a climbing forward attitude. Forward cyclic will increase RPM and back collective will maintain RPM due to a throttle link. It is most important to hold RPM at a constant rate during cyclic/collective adjustments. Also, forward cyclic will tilt the fuselage forward bringing the nose down. Hold the ship at the proper attitude with some back cyclic modification. Increase forward thrust and airspeed with the collective control rather than further cyclic control to maintain attitude but monitor the degree of pitch and manifold pressure to stay at safe levels. Keep in mind that holding the control stick too long in any position will result in over-controlling. Make adjustments small and gradual to achieve a steady and controlled rate of change.

8.) Bring airspeed to between 70 and 90 knots and continue climbing to at least 500 feet, a minimum altitude from which to make an autorotative landing in the event of engine failure.

9.) Once desired altitude is reached, decrease collective to a point of equilibrium to enter straight-and-level flight. Watch the Airspeed indicator and altimeter for steady and consistent readings.

10.) Once in straight-and-level flight, maintain altitude and airspeed with cyclic and collective control and hold your course with the rudders. Watch the magnetic compass for heading.

11.) To return to base, enter a full 180 turn with cyclic West or East. Watch the compass to follow your heading through the turn. Slightly BEFORE reaching your desired return heading bring the control stick back to center and begin leveling off.

12.) Begin the descent by gradually decreasing pitch. As altitude begins to fall, maintain airspeed with the cyclic control. Keep the rate of descent constant by collective adjustments. As the altitude reaches 100 feet, slowly begin to increase collective pitch to reduce vertical speed. Also begin applying back cyclic to "flare" the helicopter, bringing the nose up and further reducing the speed of descent. At 10-20 feet, go into a hovering attitude and bring the ship to 0 airspeed with the cyclic control. Adjust pitch to hover and then very gradually decrease pitch with the collective to lower the helicopter to the ground. Just before touchdown, add some degree of pitch increase to cushion the landing and once on the ground immediately decrease the pitch angle to the FULL LOW position.

13.) Cut the engine and power (ESCAPE KEY). The rotor cutch will disengage and gradually slow to a stop. **Note:** The engine cannot be started again until the rotor has come to a complete stop.

AUTOROTATIVE LANDING

Autorotation is a maneuver wherein, the failure or intent, the engine has stopped and the rotor is spinning freely. Control during autorotation is similar to a powered landing with exception that rotor RPM is maintained by either forward or vertical movement through the air. Therefore, speed or altitude is required to make a successful landing. In this regard, the main considerations are holding a high forward glide airspeed, which is aided by reducing collective pitch which reduces drag, and yet keeping enough lift to check the vertical descent speed. Near the ground, a full flare maneuver with back cyclic combined with a fairly quick and substantial collective pitch increase should cut vertical speed enough to allow for a fairly soft touch-down.

Note: Further reading materials are available on the flight characteristics of helicopters and, with the specific exception of the control configurtion, will be helpful in learning to operate the UH-1X with confidence.

GENERAL DESCRIPTION OF AVAILABLE ASSIGNMENTS

1.) **FLIGHT INSTRUCTION** *(enter INS)* – Computer controlled flight training. The computer will lead you through a series of maneuvers from take-off to landing with simple control prompts. However, the trainee is in full charge of aircraft performance and should have a satisfactory understanding of the instruments and controls before attempting this test flight.

2.) **EXPLORATION** *(enter EXP)* – Fly a survey mission over previously uncharted territory. Map out the general terrain, major geological features, water supply, timberland or signs of habitation.

3.) **RESCUE** *(enter RSC)* – Military personnel are either lost or incapacitated in a mountainous region. Their route cannot be determined because of the irregularities of the terrain. The mission is to locate, transmit heading and distance and, if possible, land and attempt pickup of injured. The helicopter's maximum passenger capacity is two.

4.) **COMBAT** *(enter COM)* – A secret desert installation to which you are assigned is under possible threat of attack by unknown hostile forces. Your job is reconnaissance and, if necessary, defense. Determine enemy's ground and air strength and decide if engagement is feasible.

All mission assignments are unrestricted in form and within the general outline are non-repetetive. All command decisions are the responsibility of the pilot.

Refueling and repairs are available at the original take-off point only. In the event of crash landings, damage or emergency set-downs, the current mission will be terminated.

IF YOU CANNOT LOAD THE PROGRAM

1.) Check your equipment carefully to be sure that all cables and connections are correct.

2.) Re-read the section in the manual about loading machine code programs from cassette tape and diskette. Try to load again.

3.) If you can adjust the volume and tone settings on your recorder, try different settings.

4.) If possible, load another program from a tape or diskette you know works on your computer. This will prove that your equipment works. Try once more to load your game.

5.) The normal reason cassette tapes will not load is tape recorder head misalignment. Your computer may be able to save and load programs on its own recorder, but be unable to load tapes made on a different recorder for this reason. Be sure that your tape recorder heads are properly aligned. Your local computer store or dealer can help with this.

6.) If the program still cannot be loaded, send the cassette or diskette, with a description of the problem (what the computer displays on the screen, if anything, when you try to load the cassette or diskette or play the game) and what you did to try to correct the problem.

Defective cassettes or diskettes will be replaced at no charge.

SUPER HUEY
SUPPLEMENTAL INSTRUCTIONS

INSTRUMENTS

1.) FRE – A digital monitor of the guidance radio frequency transmitted from Base. This signal is used by the navigation computer to calculate the NAV heading.

2.) NAV – This is the compass heading to return to Base. It is activated by the VOR command. If this function is cancelled by XXX or another computer command the digits will remain at their present values and will not be updated.

3.) RAD – Radar activated readout of the distance, in meters, to moving objects such as hostile aircraft. It can be engaged by the RAD command. It also activates automatically when the LAR command is used. This readout is of most use to the computer in targeting and tracking but the pilot can make some determinations from its actions. When the readout begins rapidly changing it always indicates that some other craft is within range even if it is not in view. Also, the direction of change of the numbers, up or down, shows the direction of movement of the object relative to the helicopter. This function has no application in land based navigation.

4.) ARM – The LAR command activates this readout. It shows the status of rockets. At the LOAD prompt, the numbers 1, 2, 3, 4 light when they are entered at the keyboard. This indicates the rockets loaded into the launch tubes. At the ARM prompt, the small lights below the numbers will light when those numbers are again entered. This arms the rockets that are now ready to fire. Each light and number goes out as the rockets are fired.

5.) HOM – This shows a heading computer from a homing signal transmitted by a device dropped by the pilot. It is intended for use only in the event of VOR signal failure or NAV malfunction. Therefore, it is not available when either of these conditions is not present. The possibility of malfunction in all systems is a matter of random chance.

6.) RES – This indicator shows a compass heading calculated from a signal transmitted by a source other than VOR. This readout is used exclusively in the Rescue mission and behaves the same as the NAV monitor. It activates automatically on take-off.

COMPUTER COMMANDS

ACS – Automatic course setting. This will turn the helicopter, by use of the ATP, to a specific compass heading without using the controls. If the controls are used by the pilot during the turn, the action will be suspended until the controls are free and then continue until the set course is reached. The heading will be displayed at the COR monitor at the right of the computer screen.

ASN – Select a new assignment. ASN must be typed in before the mission code is entered. The codes are INS, for flight instruction, EXP, for explore, COM, for combat, and RSC for the rescue mission. (**Note:** on some earlier versions, the rescue mission is coded as RES.)

CLM – Current climatic conditions that relate to helicopter performance. For instance, air temperature affects density which affects lift characteristics. Humidity and pressure influences resistance to speed and lift. Therefore, on a hot, humid day, lift will be less efficient but on a cold, dry day, lift will be easier but speed forward will meet more resistance. The most important readout, as far as navigation is concerned, is wind velocity because, unless you are flying due east or west, the wind will blow you off course by a degree proportionate to its velocity. The wind direction is always from the west.

GTK – Displays a grid on the computer screen and pinpoints the source of an incoming navigation signal, either RES in the rescue mission, or VOR otherwise. The range of this map is 15 square miles. The helicopter is always assumed to be at the center of the grid. Therefore, as the 'blip' is moving closer toward the center the helicopter is getting closer to the source of transmission.

HOM – Drop a Homing device to send a navigation signal from a selected point. This function will not activate if normal VOR or other signals are active.

TRK – Display a 'crosshairs' on the computer screen. When enemy targets are on line and in range, the image will flash red. This is the time to fire your weapon.

NAVIGATION

To understand the NAV and RES readouts of compass headings for navigation it is necessary to adopt the proper perspective of the relationship of the earth and helicopter. While the headings indicated are earth coordinates, the computer always sees itself at the exact center of the compass and the earth moving beneath it. If you observe the compass diagram provided with the documentation, assume that the compass circle is affixed to the aircraft. Wherever you fly, the vertical line that connects North and South and the horizontal line that connects East and West always converge at the helicopter. All points on the ground move apart from this heli-centered grid.

Let us take off from Base, the source of the VOR transmission, with our NAV active and fly due north. The COM reading will be 000. If we observe the NAV readout we see that it soon changes to 180, which is a heading of due south. This is because the Base is now to the south of us. If we stop, hover and turn completely around until the COM reads 180 and fly straight ahead, we will then fly back over the Base, at which point the NAV will change to 000, or due north, since we have gone south of it now. In the same manner, had we flown East or West from BASE the NAV readout would indicate the exact opposite direction since it is showing the way to get back to the source of transmission.

Before flying in some other directions, a further understanding of the way headings are computed is necessary. Since there is only one signal coming from one direction on which to home in on, the position of the source cannot be triangulated. To compute the position from a single source, the computer first utilizes a north/south bias that selects either north or south numbers depending on the incoming signal. A more discrete measurement is made of the angle of reception to find the distance to the east or west of the source.

To see how this works out, let us take off from BASE and this time fly Northeast at a COM reading of 040. What happens to the NAV readout? As we are moving north, we know the Base is moving to the south so the number at the NAV will be some southern degree. Similarly, since we are also flying east, the Base must be going to the west of us and so the number is further limited to the south-west arc of the compass, or something between 180 and 270. Since the Base is not exactly to the west or exactly south the reading will not be 270 or 180. Therefore, since we are moving east, in the northern half of the map, the reading should progress steadily from 180 toward 270 (in 10 degree increments, as that is the resolution of the equipment).

What would happen if we turned due North (COM 000)? The NAV readout would not change since we are still in the northern arc and are maintaining our eastern distance.

If, on the other hand, we turned southeast the NAV would continue to move toward 270 as before. But, when we cross the line and enter the southern arc of the compass, the NAV readout would 'flip' to the Northwest degrees.

For instance, if, at the point of crossing, the NAV read 210 then it would 'flip' to 330 which, if you look at the chart, is the northern counterpart of 210.

In practice, the pilot can interpret the NAV heading in light of the limitations of the system. If one followed the heading exactly as the numbers changed the course travelled back to Base would be an arc rather than a straight line. A thorough understanding of this will allow the pilot to 'cut in' to the arc and find a more direct course by leading the NAV heading in the direction of change. For example, you are somewhere northwest of Base. The NAV reads 150. If you travel east, the number changes to 160, 170, etc. As you can see, the heading is moving to due south (180). If you originally did not follow the heading 150 but, instead, turned more south, say 160, you would actually be moving more directly toward the Base. Calculating the amount of lead is a matter of geometry and practice but, as you can see, the selection in this instance must be somewhere between 150 and 180, exclusive. If you chose a lesser number you would stay too far north and a greater number would keep you too far west. A general rule of thumb could be to always choose a heading half way between the NAV readout and due North or South, depending on your position.

Another use of the NAV readout is to find your exact position on the map at any time. As we have seen, your direction from Base is always the exact diagonal opposite of the NAV. If you use the DST command to find the distance to the Base you then know how far and in what direction the helicopter lies.

THE MISSIONS

COMBAT

At a desert Base of undetermined location you will do battle with an unidentified enemy. The enemy consists of helicopters and tanks. The tanks are out of range above 500 feet. Their position is ten miles from your Base and they are moving so locating them may take a few minutes. Since your radar capability is limited to weapons range there is no way to locate the enemy before encountering them. Therefore, fly out from Base at least 10 miles and then begin your search in a more circular route. Watch your heading so you do not fly back into the safe area while searching.

The weapons available to you are rockets and machine guns. They are fixed mounted and thus aiming is accomplished with the helicopter. The rockets have proximity detonators and so can destroy an enemy craft without a direct hit. However, the effectiveness of this also depends on the maneuvering of the enemy.

The useful equipment for combat includes the TRK function that puts a window on the computer screen and will flash red when a target is on line and in range, RAD readout that plots the distance to an enemy craft in meters and can be read to determine the direction of movement, and the weapons activated by MAC for machine guns or LAR for rockets. There are 16 rockets in all and they are loaded, and armed 4 at a time.

The enemy will fire upon you only when coming directly at you. Maneuvering out of the way is the only defense. Flying straight and level is the best way to get shot down so keep an evasive course as much as possible. Make your computer entries while the RAD is still or while the enemy can be seen crossing in front of you. Firing weapons is restricted only when banking so make turns while shooting by setting the ATP off balance.

Although the tank force will be added to the enemy's number if you fly below 500 feet, remember that you also cut in half the enemy helicopter's ability to evade fire by flying at low altitudes since they of course cannot fly into the ground.

You can return to the safe area (within 10 miles of the Base) or you can shoot down 32 enemy craft to end the battle.

RESCUE

This mission takes you to an entirely new location. Personnel are lost or stranded in snowy mountain terrain. They have a homing device that transmits their heading to the helicopter at the RES monitor. This signal overrides the normal VOR transmission which means that the DST and GTK commands now key into their position rather than the Base until their transmitter is turned off upon their rescue. However the NAV still reads the Base transmission.

The mountains are of varying elevation and so flying this mission requires constant attention as well as monitoring navigation. If any cliff face comes completely across the windshield, it's all over. As a mountainside moves in on you, you can turn away from it, in which case you may run into something on the other side, or you can climb above it. Either maneuver often must be accomplished very quickly.

Follow the RES readout exactly like you do the NAV heading to find the party. When you fly over them they will see you and send up a flare. Any time after the flare has been spotted you can begin landing. Sounds simple? The maneuver of landing in the mountains is one of the most difficult and nerve-wracking tasks in all the missions. The first factor is luck. If the lost party should be in an area of low elevation, your task will be much simpler. This is because it will take less time to land while surrounded by mountains. If the elevation is high you could have white knuckles for quite awhile.

The first thing to do is slow speed to zero and come to a level hovering position. Use the VSI command to monitor your rate of descent. Now begin descending with the collective – slowly!

At some point the mountainsides will begin moving in across the windshield. If they come together you will crash. So start climbing again to separate them and be very careful that you do not inadvertently move forward. The general principle here is to lose altitude by descending and keep the mountains apart by ascending.

At first this sounds like a losing proposition. But the trick is to descend faster than you climb. This way, you will gain more downward footage than you lose when climbing back up. The time this maneuver takes depends upon the elevation of the terrain, how quickly you can operate the controls and so your rate of descent can be high compared to the climb, and just how close you are willing to let those mountainsides get to each other before you pull out. Remember that you are always safe while in a level hover so this is a good way to take a breather. Also, the VSI indicator is as important here as in any landing because your rate of descent must be less than 20 feet per second when you touch down.

Once you are on the ground, and are attempting to breathe normally again, you will notice in the lower left-hand window the grateful group walking out of snow to the helicopter. Once on-board, it is time to go home. All navigation systems will now revert to the VOR signal.

EXPLORE

The essential task of this assignment is to map the terrain that surrounds the Base. This can be a very long and involved process and so is probably best done in stages. The area involved is actually larger in terms of square miles than the other missions and as a result navigation equipment seems to respond more slowly. A recommended procedure might be to select an area to explore, the size of which will be determined by the amount of time available.

Fly to an edge point of the area and do a sweep back and forth until the area has been examined and charted. Due to the size of the terrain the width of the sweeps can be fairly large.

For example, let's take the entire Northwest quadrant. (This would of course take a very long time and so be further subdivided.)

We will start at Base, take off, and fly west. Our COM should be 280 to begin with to take us to the center of the first sweep. Check distance (DST) and when we are about 5 miles from Base then turn to heading 270 (due west). Turn on the NAV with the VOR command. The reading should be 170. As we continue west it will change toward 090. When it reaches 100 we should start turning North (COM 000) for about ten miles. This can be calculated by reading our distance (DST) when beginning the turn and then reading it again after a short while and subtracting the original distance and then dividing by two. A simpler method is to read the distance exactly one minute after leaving the Base. This will then tell us our miles per minute if we keep a steady speed. Once we are far enough north, we will turn back east and travel until the NAV reads 180. We can then repeat the procedure and return to the west. Another, more 'round about' method would be to fly a constantly widening spiral out from Base.

Actually, the method is entirely at the discretion of the pilot and needs to follow no particular routine. The terrain will always be the same however and when ever you fly over it. The key consideration should be to find a way not to cover the same ground twice.

Now, what is it we are looking for? There are three major land types in the area: grass, desert and snow. Each type covers very large areas. Particular features to watch for are towns, collections of houses and small buildings, Pine forests, all the trees will be green Pine, lakes, lots of clear blue water, and hilly areas where all ground features are small hills. There are several of each to map and their position can be plotted by simply plotting your position while flying over, using VOR and DST.

It should also be noted that lower flying altitudes will be helpful in spotting terrain features.

When you complete your map, send Cosmi a copy and we will send you the actual map so you can see how they compare.

WARRANTY

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