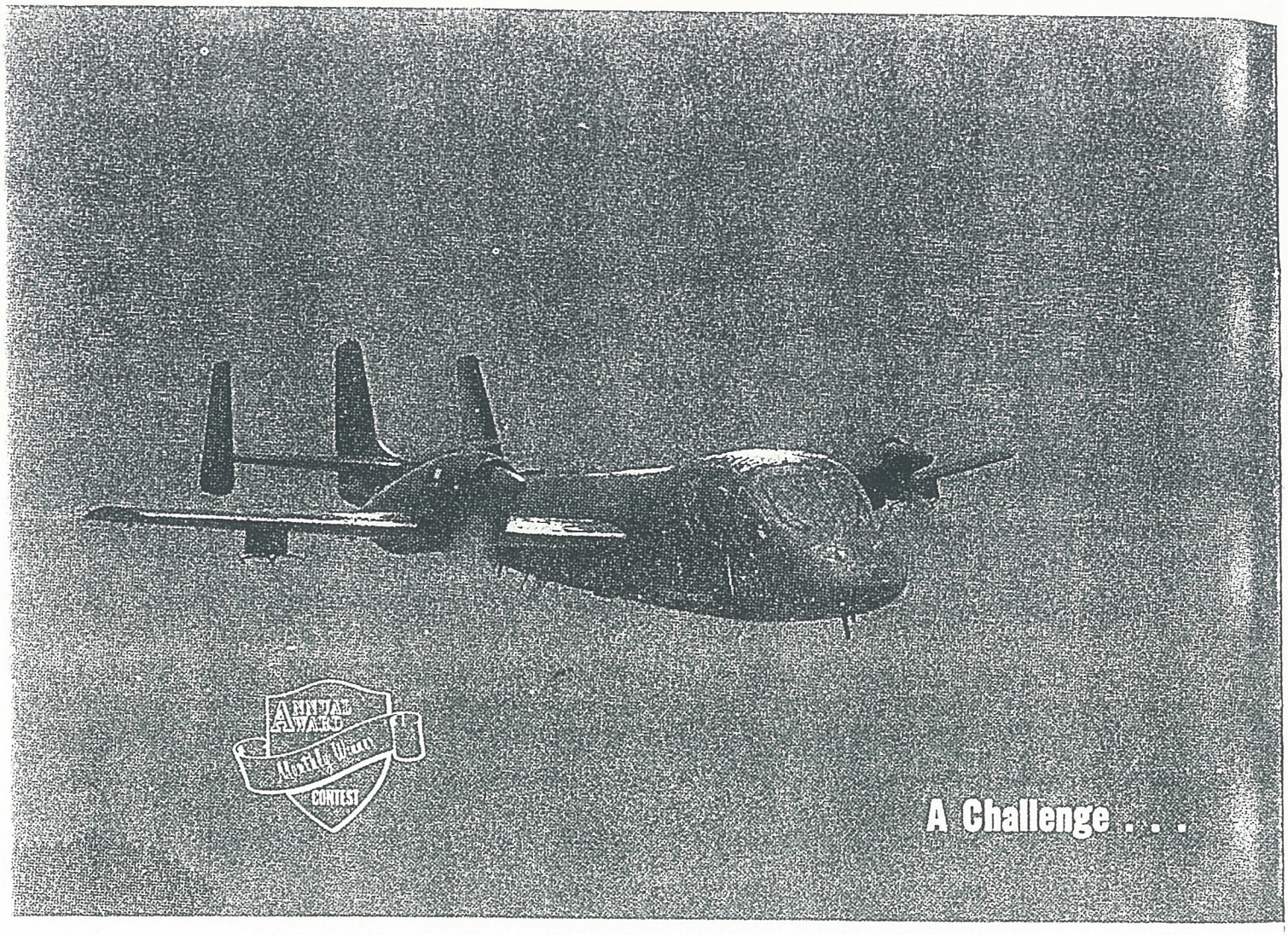
UNITED STATES ARMY OCTOBER 1968

AVIATION DIGEST



Mohawk Infrared Mission

Major Donald I. Bernstein

THE CQ RUNNER shook my shoulder indicating 0010 hours local time RVN. Time to get up. Darn my operations people. Did they have to be so efficient and remember to wake everyone up — well almost everyone. Well, I trained them so I can't complain. Seems my life is in reverse of the rest of humanity. When I work they sleep and vice versa. Well that's my lot. Everybody's got it tough I guess. Only 20 minutes to get washed and dressed for my briefing. Better step on it.

That shower sure felt refreshing. A nice cool morning. Seems every star in the universe is out there shining down on you, the Milky Way included. Beautiful. Wind as usual from the southwest. Means a blacked-out takeoff to prevent silhouetting the aircraft to Viet Cong ground fire. Darn those rascals. No moon either. Can't even see the mountaintops 4 miles away. It will be immediately IFR upon rotation.

Another night of instrument flying. Thank goodness for those Hawk instructors back at flight school. The division of attention, intense concentration, and pressure during takeoff and for about 1 minute after liftoff is tremendous. I can think of lots easier ways to work up a sweat.

First there is the blacked-out takeoff. No rotating beacon, navigation, landing or taxi lights are permitted — only the tactical runway lights. Ever try to keep a 16,000 pound hurtling object, which is gathering momentum from 0-110 knots in a relatively

short space of time and distance, on a barely visible white center line while plagued by torque from two monstrous powerplants operating at military power and crosswinds at 10-20 knots and using runway lights which only illuminate themselves and not one bit of ground? Try it on for size sometime.

You lift off. Below, somehow you see the numbers as you pass through 115 knots. You are already on those gauges. Keeping the wings level. Holding a steady climb. As soon as the vertical velocity needle starts showing a steady climb and the altimeter needle starts off the field elevation, you hit the gear handle and clean up the cockpit, turn on all lights after gaining a few hundred feet to avoid a mid-air, and initiate the standard instrument departure. Everything accomplished you make the last few radio checks with the tower and unit operations, and you are en route for your mission.

Man, I've practiced that procedure over and over. It's good and it works and we need it. In the Hawk you must have and follow procedures. Things happen too quickly, and without procedures a dangerous flight condition may result. Without a doubt the Hawk is a procedure airplane from learning how to don all that equipment to entering and exiting the cockpit and performing single engine instrument approaches.

Yipes! Only 10 minutes left. Need to get dressed quickly and hit the briefing area. Hope there's no problem with the aircraft or sensors. You know, I've often wondered how many Army people, even aviators and those concerned with aerial surveillance, know what an IR aerial surveillance mission sequence consists of. Haven't got too much time to brief them on IR operational procedures now, but I can cover them in flight planning and during flight. I could probably summarize a background of the Mohawk though. Let's see . . .

The OV-1 Mohawk airplane is a Grumman product engineered to withstand high landing stresses. It is ominously configured at the nose, looking somewhat like a mosquito, but this gives it an impressive 180° side to side view and an excellent overhead view. One can even see directly under the fuselage due to the rounded, bubbled enclosure. The triple tail is for aerodynamic design and to present a low silhouette for field parking.

Speed brakes, three quarters of the way back along the fuselage, are included on A and C models. They serve as slowdown devices for use during rapid descents (e. g., 2,000-6,000 fpm) and can also be used for various maneuvers. The engines are Lycoming turboprops; they mount three bladed, full feathering, full reversible, with autofeather and synchronizing / synchrophasing features, Hamilton standard, hydromatic, constant speed propellers.

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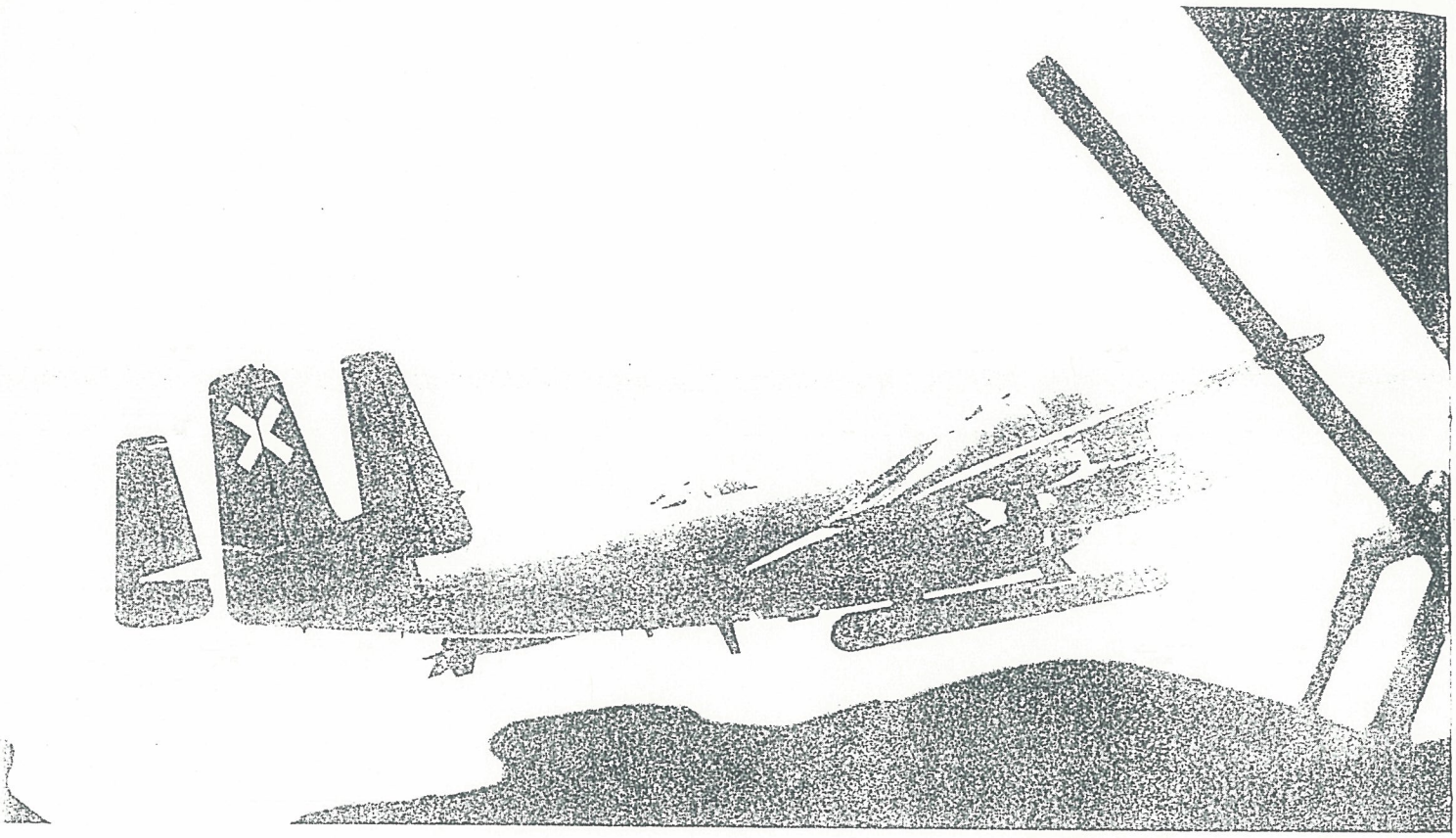
The basic OV-1 airplane has a 2 hour and 20 minute fuel endurance, but with the addition of two 150-gallon wing tanks, the air time can be extended to about 4 hours and 30 minutes, depending of course on altitude, power settings, etc. Many of the items of equipment work off the hydraulic system, such as power brakes, steering, and the landing gear. The electrical system, as can be imagined, is complex, and that's without adding the airborne electronic sensor electrical system.

The new AN/ASN-76 compass system is very accurate and feeds appropriate data to the FD-105 Collins integrated flight system. Not yet equipped with TACAN we can rely to a degree on Air Force GCI (ground controlled intercept) radar sites for bearings and distances to designated grid coordinates. Using the RMI (radio magnetic indicator) needles on an ADF station and the Doppler en route navigator combined serves as a rough TACAN. The Canadian-Marconi Doppler radar navigator is the primary navigational equipment and is used for en route tracking and for target area search pattern and maneuvers. This complex computer displays an immediate visual destination, bearing and distance indication, and uses military grid coordinates to display present position and proposed destinations. Also available are groundspeed, effective wind, track made good, drift angle, and lateral drift error.

An automatic flight control system (autopilot) the AN/ASW-12, is necessary to conduct an operational mission and relieve the pilot of flying the aircraft so he can concentrate on navigation and perform other functions. The autopilot will track in conjunction with omni, ILS glide slope and localizer, and even Doppler navigator. It is a sound, workable system.

The OV-1 series aircraft of today are equipped with a wide array of radio communications equipment to include SSB, HF, VHF, FM, and UHF gear, all with digital tuning. Both pilot and observer have signal distribution panels and both can talk/receive on different radios simultaneously.

Navigation radios include one omni, one TACAN (to be installed), an RMI and an ILS with localizer, glide slope, and marker beacon. Preplanned approaches



An OV-1 Mohawk on a SLAR mission five miles southeast of Vung Tau

can be devised using the Doppler radar. A combination of stations can be selected using the integrated flight control system and the RMI needles on the TACAN-VOR-ADF selector panel.

Additionally, the aircraft has a separate oxygen capability for each crewmember and is fully equipped for weather flying with engine, prop, wing and tail surfaces deicing equipment as well as anti-ice fluid for front windows and high power, varying speed window wipers. A radar altimeter indicates altitude above the terrain and is quite invaluable on IR runs.

One of the refinements of this aircraft is the British developed Martin-Baker ejection seat, which has never failed to function properly when properly rigged and used in its design envelope. Each occupant is securely fastened by shoulder, lap and leg straps to the seat. Once in and secured, no more bold body movements can be made. Each seat has primary and secondary firing handles to actuate the ejection which is not unlike a swift kick in the pants.

The OV-1 contains the KA-30 aerial camera system in the belly, which can take 240 pictures in the vertical and/or 15°-30° oblique mode. Additional film can be carried and after landing, with one engine then shut down, only a few minutes are required to set up the camera again. It is preferable that the landing field be near a developing facility, so the first roll will be developed and available for the imagery debriefing when the flight crew returns from the second sortie.

Various lenses are available and Mohawk unit photographic scale capability will vary with the size lenses on hand (3″, 6″, 12″ or 18″). Lenses must be changed on the ground. The aircraft is capable of taking pictures at varying speeds and altitudes depending on lens, weather and terrain. Varying scales can be obtained depending on lens and altitude. Prints can be enlarged by photo labs organic to the unit. Pictures can be taken automatically or clicked off singly. The control panel is set up for the desired results and maintained throughout the run. The exposure remaining counter will indicate number of pictures left to take.

The system is capable of night photography using photo flash cartridges or the recently introduced LS-59 strobe light system. To take night photographs requires ground changing of certain switches in the electronics bay. Therefore, a day and night photo run cannot be scheduled without landing to make the proper adjustments. The photo flash cartridges demand special handling since ordnance is involved. Care in loading and arming procedures and judicious use of controls is vital, and personnel must be well versed in procedures.

Another innovation introduced in the field is the KA-60 panoramic camera. Mounted in the nose it takes a 180° wide angle side-to-side panorama of the terrain for-

ward of the aircraft. It produces superior photographs for plotting helicopter landing zones, as it presents to the chopper pilot the same picture he will see on the combat assault approach.

The OV-1B model contains that elongated black cigar under the right side of the fuselage which projects a few feet forward of the nose. Commonly called the SLAR (side looking airborne radar), its mission is to detect moving targets on land or water. The autopilot must be employed to hold the airplane on a steady track, as any deviation causes wavy lines to appear on the imagery. A true picture of the terrain, reproduced from radar echoes reflected back to the receiver, appears on the target indicators.

SLAR only indicates that *something* is moving. It does not tell *what* is moving. The system contains the RO-166 inflight processor/viewer which develops and processes the imagery in approximately 3 minutes after it is taken. Unlike the Mohawk camera which takes separate pictures, the SLAR, as does the IR, prints continually. The scale is almost 1:500,000 and the film can be directly correlated to that scale map and six digit grid coordinates obtained for inflight spot reporting to ground, Naval or Air Force fire control agencies.

The system is a near all-weather product. The SLAR can penetrate through light clouds and rain, and future refinements will improve its "seeing" capability. Many a successful SLAR mission has been accomplished flying 2 to 3 hours "in the soup" and returning with perfect imagery. The SLAR system, as with the IR system, contains a terminal ground sensor terminal (GST) which, when in line of sight of the aircraft, will receive signals and produce imagery as recorded in the aircraft. FM communications between aircraft and ground sensor terminal is always desirable.

The mission of the OV-1C (IR) is to detect targets through emission of heat radiation relative to the temperature difference of the surrounding terrain. It does this through the use of infrared detectors mounted in the belly of the aircraft. Like the OV-1B, a KA-30 camera system is installed in the OV-1C. It can be combined with IR to take a complementary image during daylight hours. Infrared is best used for short strips and small areas, as the ground covered on the imagery is directly under the aircraft.

Well let me make sure I've got all my survival, evasion and escape gear. Weapon, ammo, knife, blood chit, survival map, Geneva Convention card, shot record, ID card, dog tags and flashlight. All A-OK.

The aerial surveillance intelligence briefing was standard for this mission and lasted about 15 minutes. This briefing is not concerned with air traffic control procedures. Routing is a pilot's responsibility and flight operations provides assistance in this area. Pilots have 1:250,000 scale maps for en route VFR navigation.

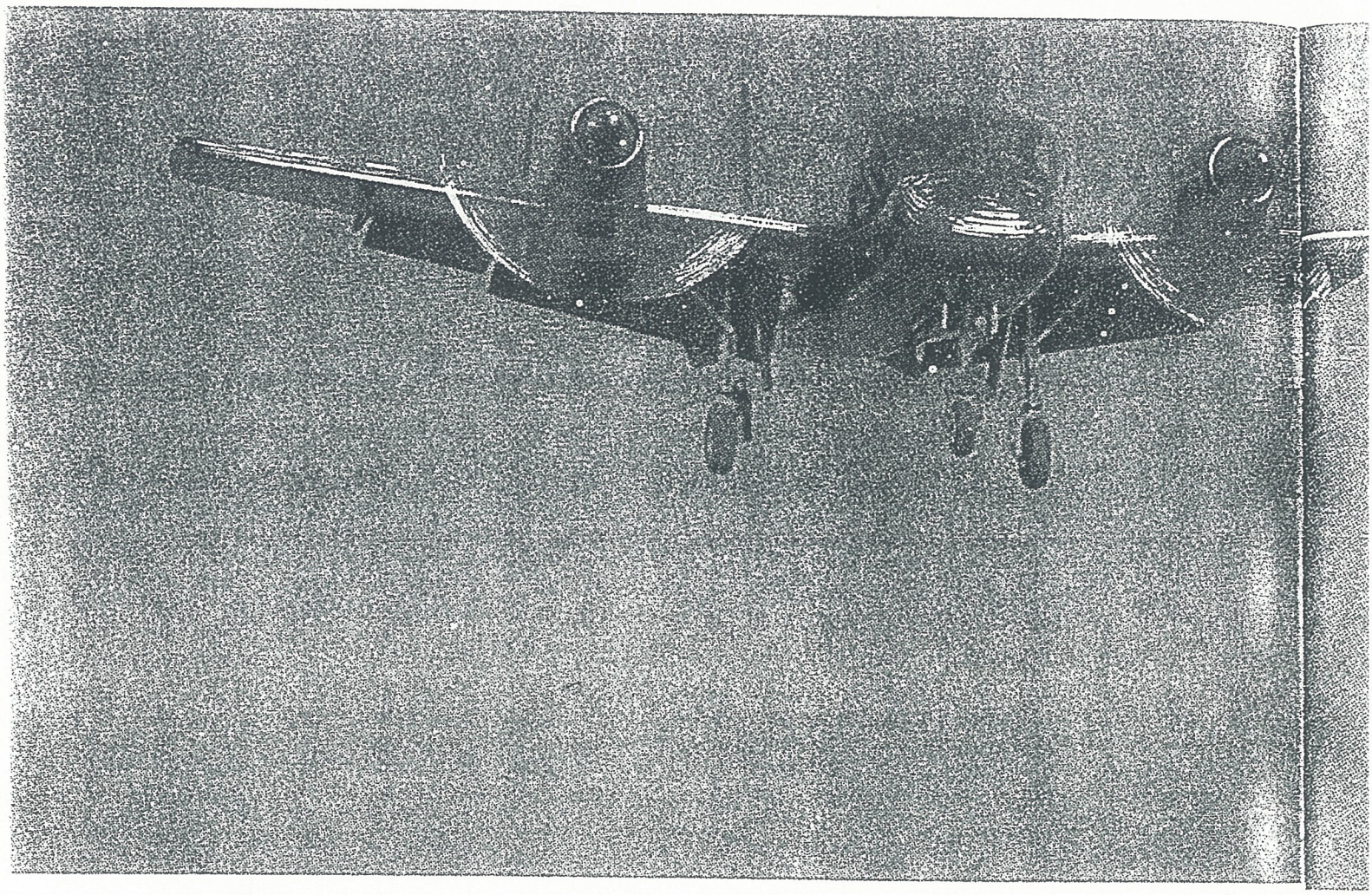
Flight crew planning follows the briefing and takes 30 minutes to 2 hours, depending on the aviator's experience with the area of operations, and complexity of the mission, i. e., number and location of suspected targets, routing and control agencies involved, and number of navigation update points required. During preflight planning all air traffic control procedures are covered to include general headings, altitudes, timing , control agencies involved, navigation update points, and method of area search to include direction of pattern legs and the all-critical altitude.

Upon completing their work, and satisfied that he and the observer know the plan, the flight crew will move to the flight line three quarters of an hour before takeoff time. Meeting takeoff time and time over target (TOT) is critical as it involves artillery coordination in and around the target area(s) and target entry and departure clearance.

A still, dark ramp, broken only by the mosquito like silhouettes of the poised Mohawks in their revetments and the eerie glow of flashlights, awaits the arrival of the crewmembers. The crewchief already has the aircraft prepared for the pilot's inspection and accompanies him on his preflight. Meanwhile the sensor ground crew has checked out the sensor and reviews its status with the observer who prepares the data slide and checks the clock, both of which will appear on the film. With all flight and survival gear secured and crew fastened to ejection seats, a thorough cockpit check ensures all is ready to start the engines.

A quick throw of switches, the flow of fuel mixed with air and combined with the spark of ignition, the searing flash of flames, and the turboprops start their endless rotation and peculiar whining as they whistle through the quiet morning. After a brief wait and monitoring of engine instruments, number two is started to join number one. After a careful primary and secondary flight control check, and engine and radio checks, the light wands of the crewchief guide the Hawk out of the revetment, slowed slightly by the testing of power brakes, and begins taxiing to the runup position.

Taxiing a Hawk during daylight has its problems. It seems to want to go faster than a quickly walking man. So we feather a prop, use reverse and a little brake pressure here and there. At night it looks and feels different, so you think you're going 20 mph. While taxiing, the pilot performs many instrument system checks, and the



The Mohawk returns just before dawn after a successful IR mission

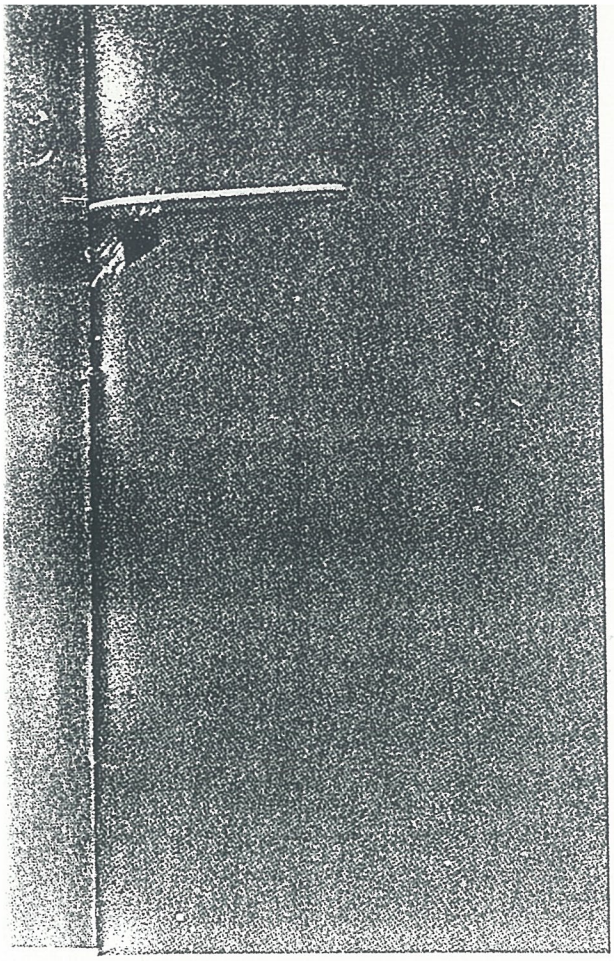
observer programs the Doppler computer with the grid coordinates of the airfield, initial update point and first en route update point. On performing a reverse power check, the aircraft slows down suddenly while the pilot slides the power levers into ground idle as the aircraft rolls into the runup area.

A normal night IR mission runup takes 8 to 10 minutes. A complete fuel system check, prop and pitch check, separate engine full power tests, and a complete autofeather system check completes the aircraft runup. All navigational equipment is checked with nearby beacons, the autopilot is tested in all modes and Doppler coordinates are verified. The pretakeoff checklist almost completed, the hatches close and the claw locking hooks move forward, smacking solidly into the waiting retaining rings. The ejection seats are armed and takeoff clearance is obtained.

Upon alignment with the runway, a last minute engine and aircraft systems check is made, all outside lights are extinguished and the brakes are released. Power levers are smoothly and uniformly advanced, and the two hefty T-53/L-7 turboprop 1,150 e.s.h.p. Lycoming engines deliver their thrust to launch this 16,000 pound bird weighted with 600 gallons of JP-4 into the medium of aerial flight. The airplane leaps forward and quickly gains speed. Maintaining centerline contact is a delicate balance of aileron and rudder.

A visual check is made of all engine instruments, especially power indicating gauges. Speed rapidly approaches 60, 70, and then 80 knots. Sitting almost 10 feet high and right up front, the lights rush by at an amazing speed and soon the clarity of each light is blended into the blurry sight of a continuous succession of lights. Soon 90, 100, and finally 110 knots. The plane is very light and with some back pressure is lifted into the softness of the cool night air.

Complying with the SID a climbing left turn is made to a heading of 060°, leveling at 1,000 feet MSL heading out over the South China Sea. The pilot squares the aircraft away, attains cruise airspeed, trims up the control surfaces, and engages the autopilot. Meanwhile the observer has turned on his IR sensor and makes minor adjustments. The pilot contacts approach control and makes his request: "A 1,000-foot low pass over the runway to update the Doppler, east to



west with radar monitoring for flight following and separation, squawking 04, flashing now, right climbing turn to 4,000 feet proceeding north." "Roger" was the reply to include current altimeter setting. While under positive radar control the pilot maneuvers the craft around the pattern, updates the Doppler over the numbers, and commences his climb.

Leaving the radar controller when out of range the pilot transfers to another approach control facility and makes another Doppler update as the observer gives a last minute sensor check. Checking into the supported unit tactical net the pilot is cleared into the target area. He climbs to the target altitude — 1,000 to 2,000 feet above the highest terrain and maneuvers the plane to a line on the previously determined search pattern. Up and down, back and forth, 12 passes, 7 minutes a pass, over approximately a 30 km by 10 km area. Purpose of mission: to locate elements of a VC division. Targets were reported to the supported unit G-2 air on FM, using the Doppler coordinate readout. Artillery strikes would hit the six digit locations after the Hawk cleared the area.

Completing the run the pilot signs off and flies to target number two, using GCI radar to approach the general location and Doppler to find the exact target area. However, he finds that artillery could not be lifted due to intense enemy action. As he has only 2,000 pounds of fuel remaining, his wing tanks having just gone dry, he decides to head home and run a local area target, working with approach radar for continuous coverage on a local frequency for spot reports.

There wasn't much jet traffic so approach control issued position reports every 10 minutes and everything worked beautifully. After finishing the last leg and down to almost 600 pounds the pilot ended the mission by allowing the observer to make an autopilot GCA to the air base, took over on 2 mile final and landed.

Landing roll completed, the pilot cleaned up the cockpit and called his down time to unit operations. The IR ground crew monitored the radio call, and their alert vehicle was already on the way to the ramp to remove, tag, and get the imagery processed at the photo lab. The flight operations dispatcher meanwhile had alerted the G-2 section of the landing. They would prepare the debriefing.

Soon the flight crew arrived at operations and received a standard intelligence debriefing. A form designed for the unit operations and requirements was filled out to be a part of the mission folder and filed for future use. A pilot's trace was prepared and after a snack break the crew returned to the tactical imagery interpretation facility (TIIF) to view their imagery. Resolution was good and plotting no problem as they had extended the pattern to include a stream on one end and a road on the other end. Coverage was 100 percent with overlap on several legs. The Doppler was working well this night.

The flight crew departed and left the imagery specialists to do their detailed plotting. The pilot's and observer's job was done. Maybe in a day or so the unit liaison officer at Field Force HQ would get word from the supported unit of the results of the artillery strike. That's in the nature of the intelligence job.

The time was now 0700 hours. The sun had just come up; it was the start of a new day. Another routine but successful IR aerial surveillance mission sequence has been written. It had taken 6½ hours of planning and flying for the flight crew to accomplish their portion: it would take the imagery interpreters several additional hours to close the story on this mission.

As the new day begins and our IR lads go to sleep, visual photo ships will begin operations. Testing of sensors and Dopplers will begin and aircraft maintenance officers will want to examine aircraft and engines. As the sun sets and the daylight draws to a close IR operations will begin again. So too with SLAR. And so it goes — day after day after day.

That's the challenge to the OV-1C Mohawk IR crew. They fly at night, under VFR and IFR weather conditions, covering all suspected targets in the Corps area, operating over hostile territory under numerous artillery and flight control agencies, and at remote distances from home base and friendly units.

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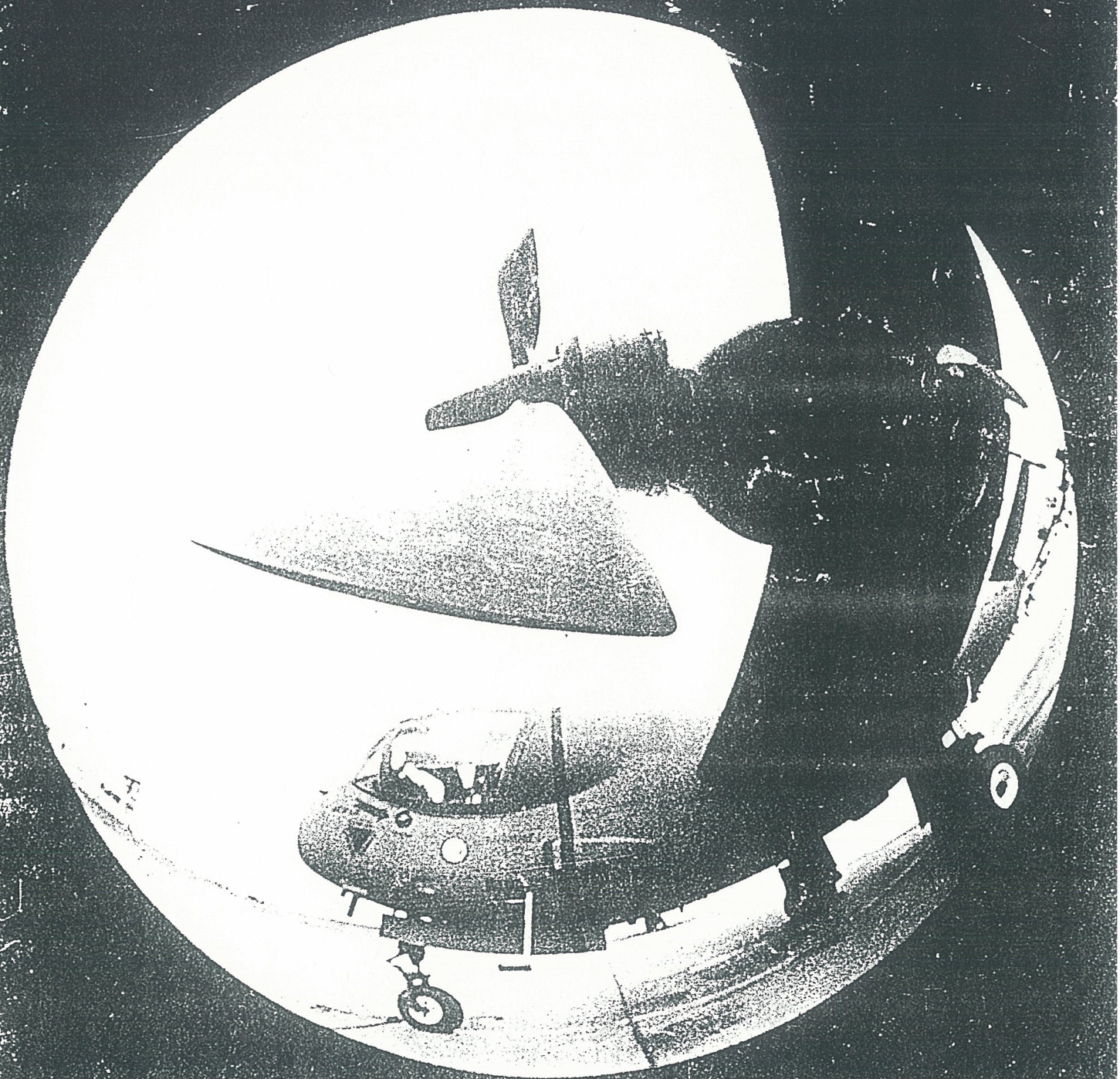

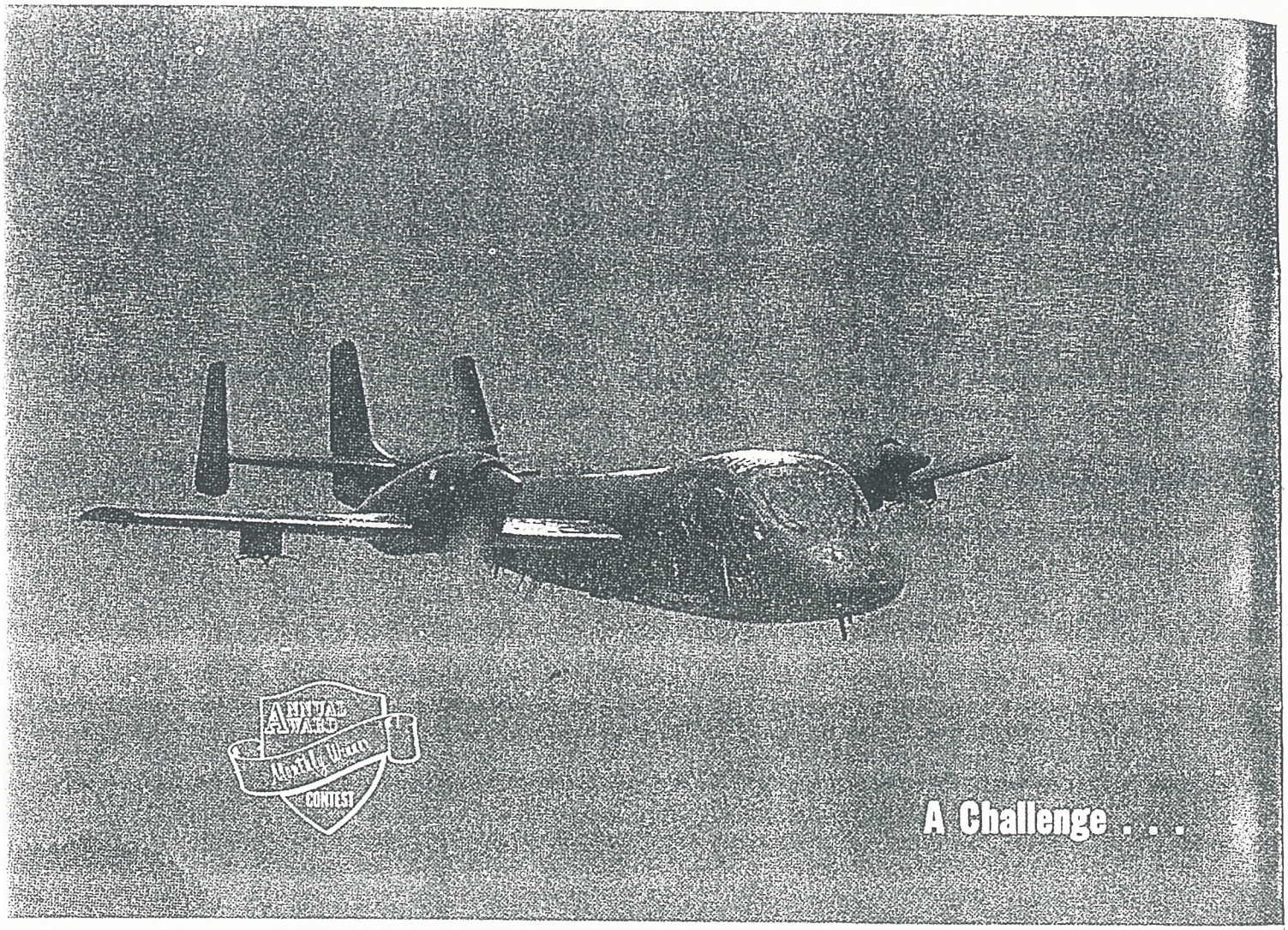

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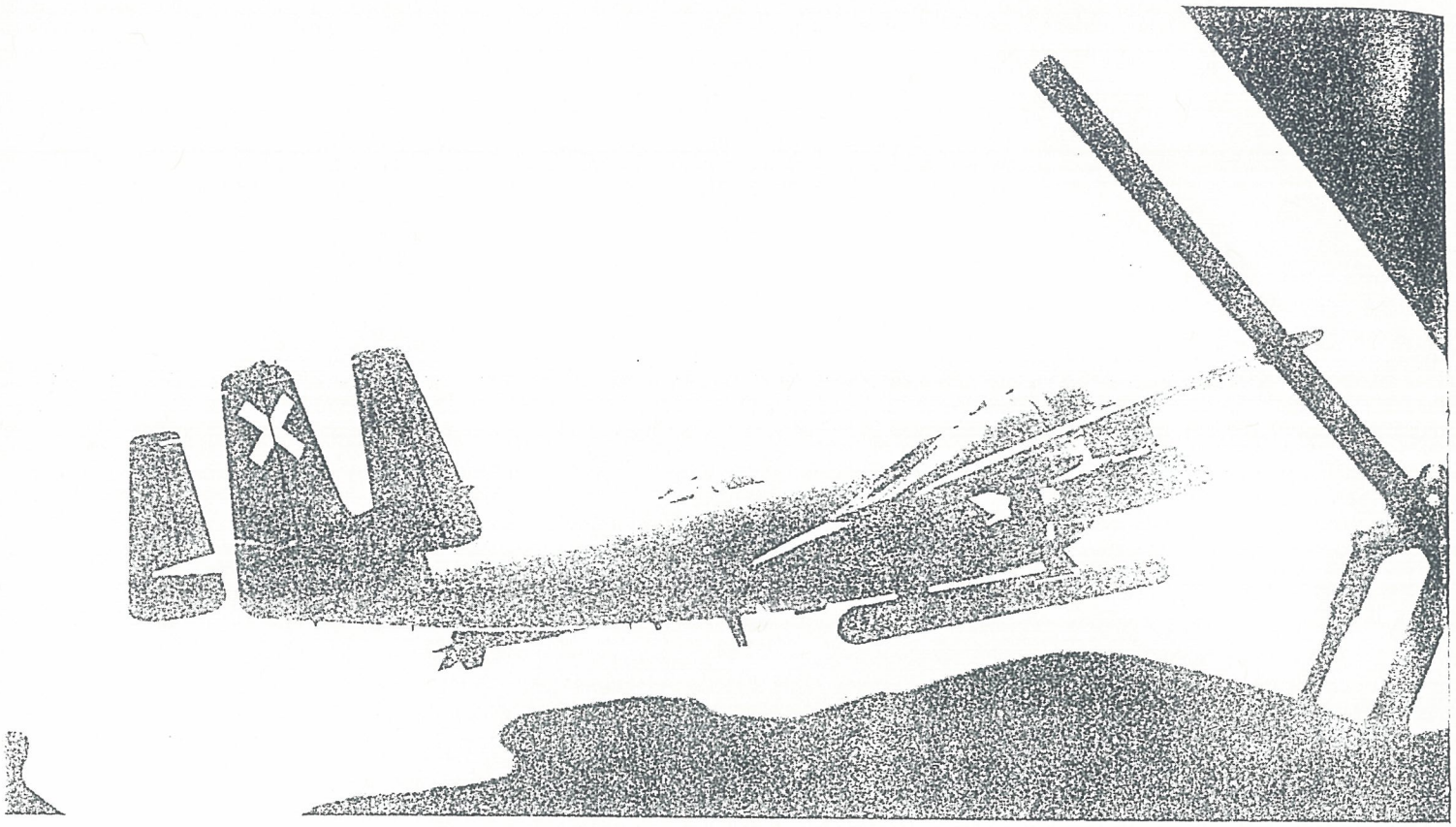

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The aerial surveillance intelligence briefing was standard for this mission and lasted about 15 minutes. This briefing is not concerned with air traffic control procedures. Routing is a pilot's responsibility and flight operations provides assistance in this area. Pilots have 1:250,000 scale maps for en route VFR navigation.

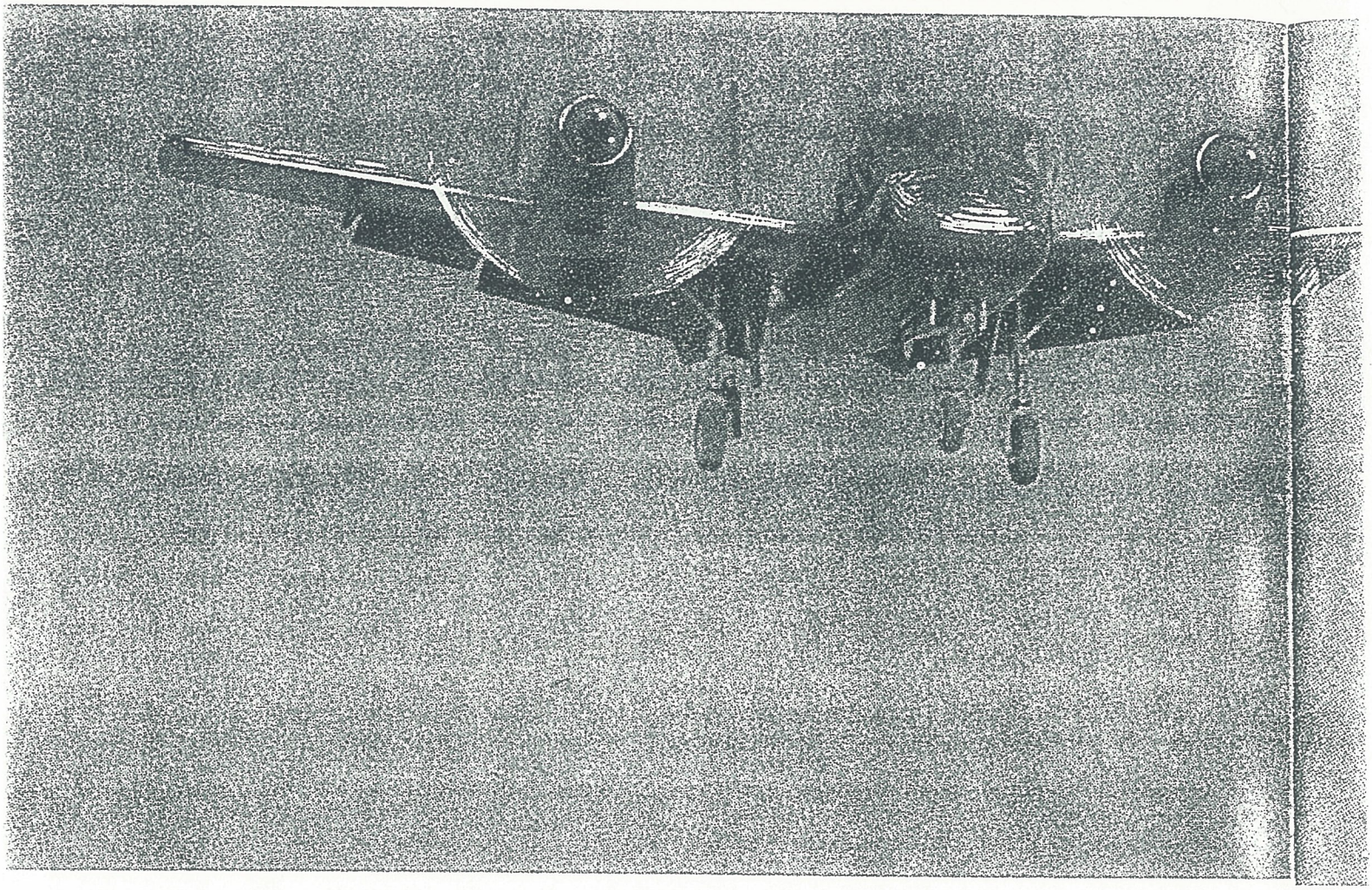
Flight crew planning follows the briefing and takes 30 minutes to 2 hours, depending on the aviator's experience with the area of operations, and complexity of the mission, i. e., number and location of suspected targets, routing and control agencies involved, and number of navigation update points required. During preflight planning all air traffic control procedures are covered to include general headings, altitudes, timing , control agencies involved, navigation update points, and method of area search to include direction of pattern legs and the all-critical altitude.

Upon completing their work, and satisfied that he and the observer know the plan, the flight crew will move to the flight line three quarters of an hour before takeoff time. Meeting takeoff time and time over target (TOT) is critical as it involves artillery coordination in and around the target area(s) and target entry and departure clearance.

A still, dark ramp, broken only by the mosquito like silhouettes of the poised Mohawks in their revetments and the eerie glow of flashlights, awaits the arrival of the crewmembers. The crewchief already has the aircraft prepared for the pilot's inspection and accompanies him on his preflight. Meanwhile the sensor ground crew has checked out the sensor and reviews its status with the observer who prepares the data slide and checks the clock, both of which will appear on the film. With all flight and survival gear secured and crew fastened to ejection seats, a thorough cockpit check ensures all is ready to start the engines.

A quick throw of switches, the flow of fuel mixed with air and combined with the spark of ignition, the searing flash of flames, and the turboprops start their endless rotation and peculiar whining as they whistle through the quiet morning. After a brief wait and monitoring of engine instruments, number two is started to join number one. After a careful primary and secondary flight control check, and engine and radio checks, the light wands of the crewchief guide the Hawk out of the revetment, slowed slightly by the testing of power brakes, and begins taxiing to the runup position.

Taxiing a Hawk during daylight has its problems. It seems to want to go faster than a quickly walking man. So we feather a prop, use reverse and a little brake pressure here and there. At night it looks and feels different, so you think you're going 20 mph. While taxiing, the pilot performs many instrument system checks, and the



The Mohawk returns just before dawn after a successful IR mission

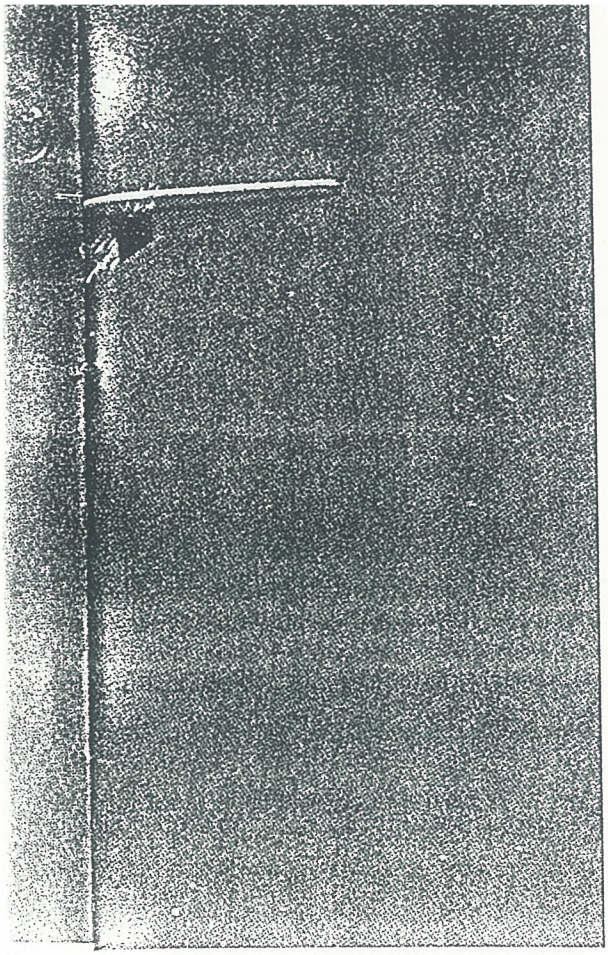
observer programs the Doppler computer with the grid coordinates of the airfield, initial update point and first en route update point. On performing a reverse power check, the aircraft slows down suddenly while the pilot slides the power levers into ground idle as the aircraft rolls into the runup area.

A normal night IR mission runup takes 8 to 10 minutes. A complete fuel system check, prop and pitch check, separate engine full power tests, and a complete autofeather system check completes the aircraft runup. All navigational equipment is checked with nearby beacons, the autopilot is tested in all modes and Doppler coordinates are verified. The pretakeoff checklist almost completed, the hatches close and the claw locking hooks move forward, smacking solidly into the waiting retaining rings. The ejection seats are armed and takeoff clearance is obtained.

Upon alignment with the runway, a last minute engine and aircraft systems check is made, all outside lights are extinguished and the brakes are released. Power levers are smoothly and uniformly advanced, and the two hefty T-53/L-7 turboprop 1,150 e.s.h.p. Lycoming engines deliver their thrust to launch this 16,000 pound bird weighted with 600 gallons of JP-4 into the medium of aerial flight. The airplane leaps forward and quickly gains speed. Maintaining centerline contact is a delicate balance of aileron and rudder.

A visual check is made of all engine instruments, especially power indicating gauges. Speed rapidly approaches 60, 70, and then 80 knots. Sitting almost 10 feet high and right up front, the lights rush by at an amazing speed and soon the clarity of each light is blended into the blurry sight of a continuous succession of lights. Soon 90, 100, and finally 110 knots. The plane is very light and with some back pressure is lifted into the softness of the cool night air.

Complying with the SID a climbing left turn is made to a heading of 060°, leveling at 1,000 feet MSL heading out over the South China Sea. The pilot squares the aircraft away, attains cruise airspeed, trims up the control surfaces, and engages the autopilot. Meanwhile the observer has turned on his IR sensor and makes minor adjustments. The pilot contacts approach control and makes his request: "A 1,000-foot low pass over the runway to update the Doppler, east to



west with radar monitoring for flight following and separation, squawking 04, flashing now, right climbing turn to 4,000 feet proceeding north." "Roger" was the reply to include current altimeter setting. While under positive radar control the pilot maneuvers the craft around the pattern, updates the Doppler over the numbers, and commences his climb.

Leaving the radar controller when out of range the pilot transfers to another approach control facility and makes another Doppler update as the observer gives a last minute sensor check. Checking into the supported unit tactical net the pilot is cleared into the target area. He climbs to the target altitude — 1,000 to 2,000 feet above the highest terrain and maneuvers the plane to a line on the previously determined search pattern. Up and down, back and forth, 12 passes, 7 minutes a pass, over approximately a 30 km by 10 km area. Purpose of mission: to locate elements of a VC division. Targets were reported to the supported unit G-2 air on FM, using the Doppler coordinate readout. Artillery strikes would hit the six digit locations after the Hawk cleared the area.

Completing the run the pilot signs off and flies to target number two, using GCI radar to approach the general location and Doppler to find the exact target area. However, he finds that artillery could not be lifted due to intense enemy action. As he has only 2,000 pounds of fuel remaining, his wing tanks having just gone dry, he decides to head home and run a local area target, working with approach radar for continuous coverage on a local frequency for spot reports.

There wasn't much jet traffic so approach control issued position reports every 10 minutes and everything worked beautifully. After finishing the last leg and down to almost 600 pounds the pilot ended the mission by allowing the observer to make an autopilot GCA to the air base, took over on 2 mile final and landed.

Landing roll completed, the pilot cleaned up the cockpit and called his down time to unit operations. The IR ground crew monitored the radio call, and their alert vehicle was already on the way to the ramp to remove, tag, and get the imagery processed at the photo lab. The flight operations dispatcher meanwhile had alerted the G-2 section of the landing. They would prepare the debriefing.

Soon the flight crew arrived at operations and received a standard intelligence debriefing. A form designed for the unit operations and requirements was filled out to be a part of the mission folder and filed for future use. A pilot's trace was prepared and after a snack break the crew returned to the tactical imagery interpretation facility (TIIF) to view their imagery. Resolution was good and plotting no problem as they had extended the pattern to include a stream on one end and a road on the other end. Coverage was 100 percent with overlap on several legs. The Doppler was working well this night.

The flight crew departed and left the imagery specialists to do their detailed plotting. The pilot's and observer's job was done. Maybe in a day or so the unit liaison officer at Field Force HQ would get word from the supported unit of the results of the artillery strike. That's in the nature of the intelligence job.

The time was now 0700 hours. The sun had just come up; it was the start of a new day. Another routine but successful IR aerial surveillance mission sequence has been written. It had taken 6½ hours of planning and flying for the flight crew to accomplish their portion: it would take the imagery interpreters several additional hours to close the story on this mission.

As the new day begins and our IR lads go to sleep, visual photo ships will begin operations. Testing of sensors and Dopplers will begin and aircraft maintenance officers will want to examine aircraft and engines. As the sun sets and the daylight draws to a close IR operations will begin again. So too with SLAR. And so it goes — day after day after day.

That's the challenge to the OV-1C Mohawk IR crew. They fly at night, under VFR and IFR weather conditions, covering all suspected targets in the Corps area, operating over hostile territory under numerous artillery and flight control agencies, and at remote distances from home base and friendly units.