GROUND CONTROLLED APPROACH

WORDS Jim Males

WITH NO ONBOARD INSTRUMENT LANDING SYSTEMS, EARLY MILITARY AVIATORS RELIED ON AN AIR TRAFFIC CONTROLLER GUIDING THEM DOWN TO A SAFE LANDING.

FLTLT Eric Trown (at the back), LEUT Grahame Higgs (RAN) and FLGOFF Ken Oprey at work in the CPN-4 operations cabin.

RECOVERING AIRCRAFT EFFICIENTLY and safely in inclement weather – low cloud and poor visibility – was a challenge around the world until the broad adoption of precise electronic glideslope and track guidance provided by instrument landing system (ILS) equipment and more recently GPS precision navigation.

Early military aircraft, particularly tactical aircraft, did not have the compartment or cockpit panel space to accommodate ILS components and displays. Military aviators consequently relied on an Air Traffic Controller providing glideslope and track guidance from a precision radar installation at each field. The equipment was called a precision-approach radar (PAR) and the pilot flew a ground-controlled approach (GCA).

GCA is now a part of RAAF history; phased out of service in 1990 following the arrival of aircraft equipped with ILS and the advent of GPS. But, when in service, GCA played an important role, especially for Sabre, Mirage and Macchi aircraft all-weather operations.

None of those aircraft had accurate navigation systems and the pilot relied mostly on dead reckoning – time, heading and speed, and a tactical air navigation system called TACAN that provided range and bearing from a fixed ground transmitter.

TACAN was notoriously unreliable, limited in range and subject to line-

of-sight reception and inherent errors. All aircraft had limited fuel capacity, particularly the Mirage, and efficient recovery in bad weather was essential.

RAAF GCA procedures were introduced in 1956, when an AN/CPN-4 PAR system was purchased and deployed to Essendon Airport for the Olympic Games. CPN-4s were subsequently installed at RAAF Bases Pearce, Williamtown and Amberley

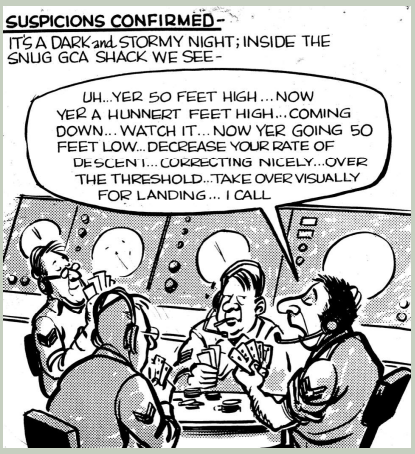
On other bases, the RAAF installed the smaller and less cumbersome AN/FPN-36 Quadradar, affectionately named to reflect its four radar functions: 360-degree azimuth search; precision approach; height finder; and taxi modes, plus the Indicator Group used by the controller. The Quadradar had 47 individual parameters that could be manually adjusted to refine radar performance. Throughout an approach, the controller continually adjusted radar reception gain – left side of console, while simultaneously working the elevation antenna azimuth servo left and right to keep it pointed at the aircraft – right side of console. One of the best controllers was Vic 'Wingy' Meyn, so called because he had only one arm, but still managed to operate the Quad effectively despite the console ergonomics.

The CPN-4 system, including the control station, was housed in two mobile cabins which were positioned in close proximity to the runway network and had to be moved and reorientated whenever there was a runway change. The working environment was very noisy, particularly with fighter type aircraft (Mirage) taking off nearby with full afterburner thrust.

There were three console positions in the operations cabin; the centre console usually manned by the Traffic Director with a Final Approach Controller in the other two bays. The radar equipment bays were behind the controllers. In wet weather, one of the controllers had to reach into the equipment bay to select circular polarisation to enable the x-band precision radar to "see" through the rain. Snakes were attracted to the warmth of the electronics and took up residence in the compartment. It was a brave controller who blindly put his arm into the equipment bay to wind in the polariser, although no-one was ever bitten.

The standard GCA traffic pattern normally comprised a 10-mile downwind leg during which the pilot was instructed to carry out landing checks. Downwind was followed by a 90-degree base leg, then a 30-degree intercept with the centreline. When close to centreline, the controller would adjust the angle of closure, finally making very small, two-degree adjustments to aircraft heading until established on the centreline. Further small adjustments would be made depending on the crosswind. At 6½ miles the pilot would be advised one mile to glidepath and to prepare for descent. At 6 miles to touchdown the GCA controller advised the tower controller of the GCA traffic on final approach. Near to 5½ miles the pilot would be instructed to commence descent to settle onto the glidepath. Small adjustments to centreline and glidepath were advised continuously to maintain the precision approach. At 3 miles to touchdown, the controller would again contact the tower to obtain a landing clearance or other instructions which would then be relayed to the pilot with a final wheels check.

At decision height (DH – 220ft) the pilot would be instructed to "look ahead and land visually". If the runway was not visible, in fog or heavy rain, the pilot would go around. Often with the Mirage a missed approach would be followed by a minimum fuel GCA,



TOP CPN-4 operations and systems cabins.

MIDDLE Quadradar display.

BOTTOM Cards were regularly played in the ops cabin during quiet times in the flying program.

a tight pattern at 1,000ft, a short and five-mile base leg and glidepath intercept at 3½ miles to touchdown. If the runway was still not visible at DH, the controller would continue centreline and glidepath guidance to touchdown if requested, alternatively the pilot would again go around or divert to a secondary airfield, fuel permitting.

Two other types of approach to cater for degraded radar or aircraft systems were practiced and occasionally employed. One, a surveillance radar approach, was used if the precision features of the PAR were degraded. In that situation, centreline tracking was derived from coarse surveillance radar returns and glidepath was the pilot's responsibility with the controller giving advisory heights each ½ mile based on 300ft/mile, for example "you're 3 miles to touchdown, you should be passing 900ft now". The other was a speechless approach practiced in case of facial injury or pilot microphone failure. In that case, the controller would give normal instructions and the pilot would answer by keying a carrier wave on the controlling radio frequency. One blip for "yes", two for "no" and three for "say again".

HMAS *Melbourne* had a ship-based version, SPN-35, and many old RAN controllers will fondly remember conducting a 'carrier-controlled approach' (CCA in lieu of GCA). The SPN-35 was similar to the FPN-36 but had a gyro stabilised antenna group because of ship motion. Talk down commenced as the ship was turning into wind, the final heading for aircraft recovery. It was not uncommon for naval aviators to be given large heading corrections with the ship turning up to 90 degrees to port or starboard; "commence descent and turn left 40 deg" etc. The philosophy was that we were training for war and aircraft were more expendable than the carrier so the ship spent minimal time vulnerable while tracking into wind.

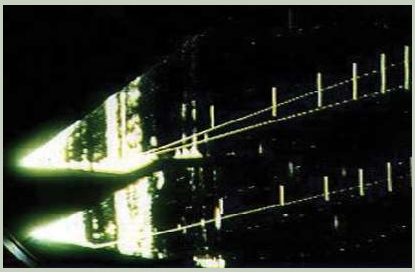
In training for electronic warfare procedures, communication, radar and navigation aids would be turned off deliberately by the ship to avoid detection. In those scenarios, aircraft returning in instrument meteorological conditions (IMC) would initially descend on a signal from a sonobuoy submarine detection beacon located in one of the gun sponsons, until acquired by the SPN-35 final approach radar.

In Butterworth, the STC (Standard Telephones and Cables Limited) SLA3-C PAR had separate screens for centreline and glideslope display and the console was only a couple of metres from the controller's crew room and dart board. Many a game was played by GCA controllers waiting for their next "customer".

Qualification as a GCA controller at Williamtown and Butterworth was a rewarding and challenging responsibility, as Mirages often recovered in bad weather with minimum fuel. To illustrate the precision possible, the controller would position one-third of the Mirage radar return (blip) above the glideslope to account for the high angle of incidence of the delta wing Mirage on final approach. Such was the accuracy, the controller could continue guidance beyond DH right to touchdown. It was an intrepid pilot who said "keep talking to touchdown", as the alternative of wasting the aircraft and banging out (ejecting) was not a cherished option. Many a Mirage pilot bought the GCA controller a few beers after using the service to get the wheels back on the runway.

At East Sale, the GCA procedure was also demanding of both controller and pilot, especially for the HS748 "draggies" that would often return from six-hour navexes (navigation

ABOVE SLA3-C console.



ABOVE Mirage high angle of incidence on approach and landing.

MIDDLE CPN-4 PAR display.

BOTTOM FPN-36 Quadradar antenna group.

exercises) when thick fog had set in. Often the fog bank top was only 300ft above ground level, so the aircraft would only enter very low visibility conditions just prior to DH and all would hope like hell that the pilot could see the high-intensity approach lights to orientate for landing on the prepared surface. It was therefore critical for the controller to have the aircraft "in the slot" positioned perfectly on glideslope and centreline at ½ mile to touchdown.

The School of Air Traffic Control and C Flight at Central Flying School (CFS), RAAF Base East Sale trained hundreds of controllers on the FPN-36. On graduation, controllers would undertake conversion training on the equipment installed at their home base.

Operating the FPN-36 required the controller to manually refine the radar beam orientation and sensitivity and most controllers carried a small screwdriver in their pocket as many of the 47 controls were 'tweeked' that way. The centreline cursor was orientated between two reflectors, one each side of the runway threshold, while the glideslope cursor was electronically set to 3 degrees, to give a descent rate of 300ft/mile.

The FPN-36 had search and elevation antennas. In search mode, the horizontal surveillance antenna scanned at 15rpm and was initially used to position the aircraft close to centreline. The controller would than select precision mode and the search antenna would scan 15 degrees left and right of centreline and the elevation antenna would scan vertically from -1 to +6 degrees.

The elevation antenna had a very narrow beam width and the controller had to constantly adjust the antenna left and right to keep the aircraft within the vertical beam.

In 1980, the CPN-4s were phased out and replaced with a much improved Raytheon FPN-802 and the tactical version, TPN-803. Those systems featured a computer-controlled tracking capability to maintained a radar lock on the approaching aircraft for centreline and glidepath guidance. The Raytheon equipment and the Quad radars remained in RAAF service until 1990 when PAR was progressively phased out.

• SQNLDR (Ret'd) Jim Males AM carried out more than 2,000 GCAs at Williamtown. Butterworth, East Sale and Richmond during his 22-year career in the RAAF. Jim was proficient on all PAR systems and instructed GCA Controllers at C Flight, CFS. A highlight of his career, Jim qualified on the FPN-802 in 1980 after training at Tinker Air Force Base, Oklahoma, USA.

TOP Macchi flyover on the occasion of the final CPN-4 talkdown.

MIDDLE FPN-802 antenna group.

BOTTOM FPN-802 display.