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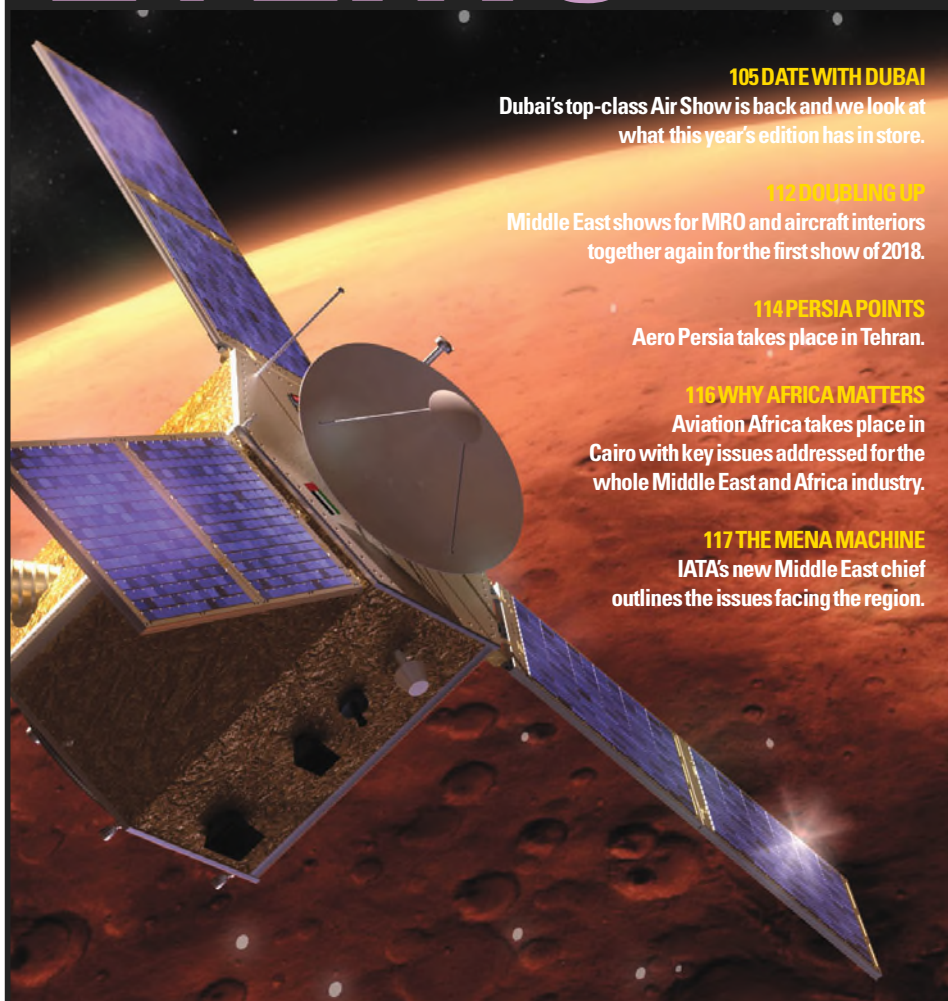
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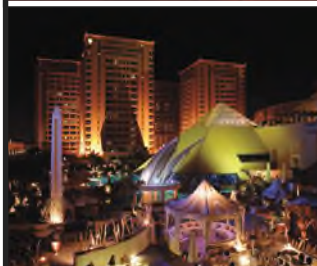
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The first PC-21 at Mafrq during the acceptance flight by RJAF.



AMMAN ON A MISSION

The Royal Jordanian Air Force (RJAF) is in transition. With the recent delivery of the first Pilatus PC-21 trainer aircraft, it has taken a huge step forward in its future fighter pilot training capabilities.

Frank Mink visited Amman to see the new arrival in action.

In 2015, the RJAF placed an order for nine PC-9M aircraft with Pilatus Aircraft in Stans, Switzerland.

The PC-9M was to replace the Casa 101CC that had been in service since 1987.

The order was amended when, in April 2016, it was decided to buy eight PC-21 aircraft instead of nine PC-9Ms.

An option for two additional aircraft was converted into an order in October 2016 and, in January 2017, Pilatus announced that another two PC-21s had also been ordered.

The role of the PC-21 will be basic and advanced training, used before the students join the fighter squadrons.

The RJAF has 43 F-16MLU fighter aircraft in its inventory, divided over three squadrons at Al Azraq Air Base. It will soon receive another 15 former Royal Netherlands Air Force F-16MLUs that are upgraded to the M6.5 standard.

At the time of writing, four instructor pilots had been converted to the PC-21 and, by October 3, it was expected that all 11 Squadron instructors would have changed over.

The initial instructor conversions took place in Stans, where two weeks of ground school were followed by 20 hours of actual PC-21 flying. Training also included five simulator flight

sessions.

All PC-21s will be delivered to 11 Squadron as part of the King Hussein College based at Mafrq Air Base.

The first delivery flight took six stretches divided over three days. Pilatus ferry pilots flew the two aircraft to Mafrq on August 23. The company's production test pilot, Reto Amstutz, said: "The ferry flight was smooth. That third day we flew from Aqaba to Mafrq in 40 minutes."

Amstutz is a former Swiss Air Force fighter pilot and has flown the F-18 Hornet. He was also a member of the famous Swiss Air Force aerobatic team, Patrouille Suisse. As well as his job at Pilatus, he is still a Swiss Air Force reserve pilot flying the F-5E Tiger II.

At Mafrq, 40-minute acceptance flights for both aircraft were completed on the day of delivery. The flights consisted of an extract from the production flight-test programme.

During the whole process of production and delivery, the aircraft had a Swiss civil aircraft registration. Only after customer acceptance were they deregistered. At that point, emergency locator transmitter (ELT) and transponder 24bit codes were changed to customer settings.

The ferry flight included stretches over water. Therefore, the ejection

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seat personal survival package (PSP) had a dinghy installed, including associated survival equipment. After the ferry flight, the packages were replaced by desert PSPs to accord with RJAF requirements.

The RJAF PC-21 aircraft have the new Saab mission computer installed, along with a new pilot memory module (PMM).

"In the old days we did the flight data recording through a separate recorder. Now the recording goes through the mission computer," explained Amstutz.

"You can store several missions on this PPM. You can upload approach plates, for example, or load different maps in different scales and bring them up in the multi-function displays (MFDs). You can define different mission loadouts and alternate parameters, like tactical parameters. Mission loadout can be air-to-air or air-to-ground weapons, or what you like for your specific missions or intelligence line."

Amstutz continued: "We have the hardware installed for TERPORM, which is basically a tactical terrain avoidance system. It will work in visual flight rules (VFR) conditions in any situation, also in inverted flight. It will not only warn you for terrain but also for obstacles. Right now we have started the engineering phase, so it's not certified yet. Actual testing will start in a few weeks time in Switzerland. When certification is complete, the RJAF will get the new software installed."

Ground-breaking move

Pilatus made a ground-breaking move in the turboprop trainer aircraft class with the installation of a dual flight management system (FMS) in the PC-21.

The RJAF has Esterline CMC CMA-9000 FMS, which can be coupled to the autopilot. Esterline CMC has been awarded the contract to supply the cockpit avionics for the RJAF aircraft.

The early PC-21 models had one global navigation system sensor unit (GNSSU) installed. The current aircraft being delivered to the RJAF contains two CMA-5024 GNS landing system sensor units (GLSSUs).

With the GLSSU, regional navigation (RNAV) approaches with lateral guidance can be flown. Now the PC-21 can achieve GPS-based precision approaches on a spaced-based augmentation system with vertical guidance.

Both cockpits are equipped with new state-of-the-art 6in x 8in active matrix LCD displays. Both front and rear cockpits have a centre smart MFD-2068 that functions as a primary flight display. Two CHDD-268 side displays can show additional information, such as radar images or system pages.

The front cockpit has a CMC-4000 Sparrowhawk head-up display (HUD) installed, including an up-front control panel. The rear cockpit is equipped with a 'repeater' screen, which shows the camera picture of the outside world and the HUD symbology, as seen by the pilot in the front.

The HUD has various modes, such as flight



RJAF PC-21 awaiting delivery at Pilatus factory in Stans.

Centre: PC-21 view on centre fuselage.

Right: Offset engine and propeller.

PHOTOS:TRISTAR AVIATION

Ferry flight

Under call signs PCH83C and PCH84T, the first two RJAF PC-21s departed Stans airfield for the delivery flight to Jordan on Monday August 21 2017.

The first stop was Abruzzo International Airport at Pescara, Italy followed by another fuel stop at Kithira, Greece. Iraklion Airport of Heraklion was used for a night stop.

The following day a fuel stop was made at Borg El Arab, Alexandria, Egypt.

The next leg brought both aircraft to King Hussein Airport Aqaba, Jordan for another night stop.

On the third day both aircraft flew a 40-minute flight to Mafraq. During the ferry flight both aircraft flew under their own instrument flight rules (IFR) flight plan with a 10-minute separation, while continuously staying in touch.

mode, target mode or approach mode, where it gives instrument landing system (ILS) symbology and glide path guidance.

A benefit for the students is that the system is adapted to the RJAF F-16MLU symbology.

To further assist the student with preparing to fly an F-16MLU, the hands-on-throttle-and-stick (HOTAS) system has several buttons reassigned through software to operate the mission systems on the PC-21 in the same way as an F-16.

The PC-21 is fully night-vision goggles (NVG) compatible for the latest generation systems.

Students do not use NVG yet but, in the future, operational F-16 pilots will be able to use the PC-21 for recurrent NVG training as an alternative to using the (more expensive) F-16.

A huge step forward in training is the mission briefing and debriefing suit that comes with the PC-21. A student can plan the mission to be flown and load it on to the PMM via the mission planning and debriefing system. Once connected to the aircraft, PMM data can be loaded into the mission computer.

Every system page is continuously recorded and cockpit images, filmed through the HUD camera, are also stored on the PMM. During debriefing, all this stored data can be retrieved and the student can replay the flight in 3D, even showing screens that weren't looked at while flying.

Simulated air-to-air radar training can be accomplished by linking automatic dependent surveillance – broadcast (ADS-B) signals from joining PC-21 aircraft. These signals are computed



and presented in realistic radar contacts for students on the mission system displays.

Air-to-ground training can be performed retrieving ground data from a database and presenting it to the student in the cockpit. A training area as large as 100 by 100 miles can be stored in the database.

The PC-21 is powered by a Pratt & Whitney PT6A-68B turboprop engine with electronic engine control (EEC). The engine delivers a maximum of 1,600shp. The power output is speed-rated and controlled by the EEC to give the aircraft a jet-like handling.

Aircraft bulkhead

The engine is mounted on the aircraft bulkhead with a four degree offset to the right to minimize torque effect and prop wash. It drives a Hartzell E8991KX graphite/titanium composite scimitar five-blade propeller.

Two Martin-Baker CH-16C ejection seats with zero-zero capabilities are installed, which can be used at up to 400kts for ejection. Both seats are slightly tilted for crew comfort.

The engine drives an air-conditioning pump for the updated environmental and pressurisation system. Also, crew oxygen is supplied when the engine is in operation.

A two-piece canopy gives the crew ample view outside the aircraft. The front piece is reinforced with an insert against bird-strikes and has a detonation cord for when the ejection seat is used.

The swept low wing structure has wet-wing fuel tanks. The leading edges are filled with foam to minimize the impact of foreign objects like bird-strikes. Hydraulic-operated spoilers are added to reduce the stick force and to increase roll rate. Also, an auto rudder trim is installed. Both features add to the fighter-like flying characteristics of the PC-21.

The RJAF aircraft are equipped with the latest generation LED exterior lighting. Furthermore, four fluorescent stripes are installed on each side of the aircraft for night formation flying training.

All in all, the RJAF now has a sophisticated aircraft that has the capabilities to train its students up to the level where they can transfer directly to the F-16 squadrons. There they only have to get accustomed to fast-jet flying and higher G-load handling.

As proven by other PC-21 customers, the graduation rate also significantly improves by using this next generation trainer aircraft.

Major General Yousef Al-Hunaiti is the current RJAF commander and is head of the committee that sets the configuration and the scope of operation for the future training of RJAF pilots.

The RJAF sees a benefit in having the PC-21 over the Casa 101CC by transition from analogue to glass cockpit and by mimicking advanced aircraft systems. The plan is to have the first students start training on the PC-21 between January and February 2018.

PC-21 vital statistics

The first flight ever of a PC-21 took place on July 1 2002.

Since then more than 210 aircraft have been delivered to seven air forces worldwide.

The Republic of Singapore Air Force was the launch customer. Since then, aircraft have been delivered to the air forces of Switzerland, the UAE, Saudi Arabia, Qatar, Australia and Jordan.

France and the United Kingdom also ordered PC-21s and will receive their first aircraft in the near future.

Maximum take-off weight:	4,250kg
Maximum operating altitude	25,000ft
Take-off ground roll, sea level	490 metres
Landing ground roll, sea level	600 metres
Maximum operating speed (Vmo)	370 KEATS
Maximum operating Mach number (Mmo)	0.72 Mach
Cruise speed 10,000ft	335KTAS
Stalling speed at idle power (Vso)	81kCAS
Roll rate aerobatic configuration	220 degrees/sec at 10,000ft
Maximum positive G aerobatic mode	+8.0 G
Maximum negative G aerobatic mode	-4.0 G
Wingspan	9.11 metres
Fuselage length	11.22 metres
Fuselage width	1.00 metres
Wheel base	2.69 metres
Propeller diameter	15.22 metres
Minimum operating temperature	55 Celsius (-40 degrees oil temperature for engine starting)
Maximum operating temperature	+55 Celsius