

# KDC-10 ADVANCED TANKER CONCEPT

## THE KDC-10, AN ADVANCED TANKER CONCEPT

The KDC-10 is the largest aircraft of the Koninklijke Luchtmacht (Klu) or Dutch Air Force. (RNLAf). In June 1992 two former Martin Air DC-10 aircraft were converted into tanker aircraft for air refuelling operations but received a dual function and were also utilized to transport passengers and cargo. A third DC-10 was purchased later and specialised for transport role only. A fourth example stays in the Arizona desert for spares. The KDC-10 is a success story for the Klu from both operational and technical point of view. In this article we zoom in on this unique aircraft.

## KDC-10 AND DC-10

The two KDC-10; 'John Scheffer'/ T-235 and 'Prins Bernhard'/T-264 are based at Eindhoven AFB with 334 Squadron together with a Gulfstream IV-SP and two Fokker 50 aircraft which last two are almost at the point to be disposed of. The third DC-10 was purchased from United Airlines in 2006 and received the serial T-255.

This DC-10 was chosen to be the first to be fitted with a new cockpit configuration which project is called Cockpit Upgrade Program (CUP). Currently the DC-10 is in the certification phase which is authorized by the 'Militaire Luchtvaart Autoriteit' (MLA). When certified, the DC-10 will enter an Operation, Test en Evaluation program (OT&E) and new Standard Operating Procedures (SOP) will be written. After this process is completed the two KDC-10 tankers will receive the same CUP.

## MULTI TASKING

The KDC-10 aircraft are of great importance for the Klu and its NATO allies. Not only acting as tanker aircraft but also in strategic transport role to deployment zones far from home they demonstrate their great value. Other tasks involve human relief operations (Tsunami disaster in 2004 and recently Haiti) and bringing home Dutch civilians out of danger zones (Lebanon, Ivory Coast and Kosovo). Acting as a tanker the KDC-10 is very much appreciated by partner air forces in the alliance. Every aircraft with an Universal Aerial Refuelling Slipway System Installation (UARSSI) can obtain fuel from the KDC-10. This includes both fighter aircraft and large 'boom capable' aircraft such as C-17 Globemasters or E-3 AWACS. KDC-10 aircraft from the Klu saw action in war zones in the past. They proved to be excellent platforms for fuel supply to fighters during the enforcing of no fly zones over former Yugoslavia and they assisted in allied raids on Bosnia and Kosovo.

When tension is low, the aircraft are often requested to take part in exercises. The receiving aircraft pays for the fuel by contact or by minute. For this purpose fuel deliveries are precisely noted in a log-book. The KDC-10 can reach remote areas in Europe easily, only the fuel has to be calculated in a transit and deliverance quantity. For example Klu KDC-10's are quite popular with the F-16's of the Greek Air Force in training their in-flight refuelling operations. Requests for fuel supply flights during exercises from European air forces can be sent to Eindhoven Air base and will be

scheduled, although the bulk of flights are under request of the Klu itself. When the RNLAf is joining an exercise far from home like 'flag exercises' in the USA or Canada the KDC-10 will 'ferry' the F-16's to the far destination and back home afterwards. A ferry flight can be up to six F-16's or comparable aircraft. In the same way Dutch F-16's are replaced for others in Afghanistan. The decision to purpose the third DC-10 for the transport role only saves the KDC-10 for more efficient use in the tanker job.

## **HI-TECH**

The precise designation of the tankers is KDC-10-30CF. Dash-30 means an extended range and CF stands for 'Convertible Freighter'. The fuel capacity and total weight has increased in comparison to the DC-10-10 (Dash-10) and therefore an extra centre landing gear is fitted. Convertible freighter indicates the possibility to transport cargo and this is combined with passenger seats. The fourth example in Arizona desert was very useful in supplying extra chairs. The KC-10 Extender of the USAF has a quite different configuration of the cabin with extra fuel tanks inside. Also different from the KC-10 is the position of the boom operator or Boomer. Instead of looking through a window just above the boom in the KC-10, the Dutch KDC-10 has the provision of a complete operating system with computers and screens which puts the Boomer operating position just behind the cockpit area. With five screens the approaching aircraft can be watched and directed from here. This system is called Remote Air Refuelling Operating (RARO) and is unique in the world.

No less than five cameras are used to spot the area around the telescopic boom which can be extended from about 26 ft. (8 metres) to a maximum of 49 ft. (15 meters). A new three dimensional system was developed by TNO and called Tanker Remote Vision System (TRVS). This sensitive system applies high resolution images with a good contrast to the operator. The system beats the naked eye with a three times sharper image. The cameras are near infrared for operations in night hours and equipped with digital filters. This is of much help when sunlight is facing you during late afternoon in-flight refuelling missions.

Outside on the rear end of the fuselage is a housing for the five cameras. Three cameras are protruding outside this housing to register the area behind the tail and two cameras are situated behind small windows looking side wards. Altogether the area which can be watched is over a 180 degrees envelope. No other country in the world is operating such a system. About this feature much interest or even envy exists with other nations, among them the United States. The TRVS is a brand new system which was approved with an acceptance flight on 12-03-2010.

## **REFUELLING PROCESS**

The process of in-flight refuelling is a standard procedure in case of exercises and also when acting in war zones. The tanker reaches a track after a transit flight and will stay in there to await fighter aircraft asking for fuel. Always a tanker will be accompanied and defended by fighter aircraft. Considered as a High Valuable Air Asset (HVAA) fighters will perform Combat Air Patrols (CAP) in direct neighbourhood

of the tanker and take control when danger occurs and will eliminate enemy aircraft when necessary. A tanker cannot be exposed to highly dangerous areas and first there will be attempts to achieve air superiority in the surrounding airspace or at least a track will be chosen far from reach of SAM rockets as was the case with positions above the Adriatic Sea far from the Serb mainland. When the KDC-10 receives a call for fuel delivery by radio, the fighter will approach the tanker from beneath at the rear. A bright yellow longitudinal line painted on the ventral fuselage helps the fighter pilot to find the aircraft and to position himself.

Also a system of bright lighting at the rear side will help to increase the visibility. Two rays of lights, called Pilot Director Lights are fitted ventrally and direct the fighter precisely in good position. The left row of lights indicates if the fighter pilot must change in vertical position and the lights at the right side directs if the fighter must come forwards or go aft. Green lights will show up when the position is good, yellow lights appear when it looks like you loose position and red means you must move the fighter back in position.

The Boomer looks at fighter by his screens and has 180 degrees turned sight which means that left and right are turned. Indicators on the screens show the position of the fighter to the Boomer. The display looks very much like a very big Head Up Display (HUD) and data will be enlighten on the screen together wit acoustic signals in the head-set when the fighter is 'locked' in good position. The Boomer communicates by radio with the receiver and manually gives light signals to coach the pilot and direct the aircraft in position. Both Boomer and fighter pilot have the possibility to disconnect after the fuel is delivered. About 385 gallons (1750 litres) of fuel can be supplied in one minute and normally around 240.000 pounds is available. Because the KDC-10 delivers from the own fuel tanks, precise calculations must be made to save an amount of fuel for a save transit flight back home. The KDC-10 can handle a few fighters for long distance missions or several fighters for smaller fuel proportions depending on the kind of requests.

## **COCKPIT**

The cockpit was partly modernised, however there are still a lot of analogue instruments. According the crew the DC-10 is a very good design and very convenient in aircraft handling. The crew consists of a pilot, a co-pilot, and a flight engineer. The latter having an important job. You never know from where the KDC-10 will have to operate and if technical knowledge is available at that specific airfield. The flight engineer can up rate a higher percentage of operation ability when solving little mechanical or electrical problems at forward locations.

A fourth seat is the observer seat and sometimes used by the boomer. During small updates three digital multifunctional displays (MFD's) were installed for pilot and co-pilot and in middle-position and displays information from TCAS, INS/GPS, weather radar, Lightning Detector System and some mapping of the ground beneath the track. It is of great importance to give the crew much awareness while they are not only responsible for the own aircraft but also for others very near to the airplane. There are four beds to rest when having a second crew on long missions such as

ferries, however the average of flights, being part of exercises, last 6-7 hours. Of course there is a catering available which has the capacity of a big airliner and sometimes the cabin with its 174 passenger seats is fully occupied. The catering takes good care for passengers and crew with special treats. A popular Dutch candy called 'stroopwafeltjes' is much appreciated by the crew. After working for hours, far from home in foreign air space sitting with a cup of coffee such little things can give you a good feeling of relief. This aspect also shows the good atmosphere within the group of people who makes it all work. The commander mentioned the remarkable teamwork of his people in the airplane but also on the ground. When visiting other countries he often receives the compliment; 'your aircraft looks splendid'.

## **CUP MODIFICATION**

The CUP modification will introduce the 'glass cockpit' in the KDC-10 and the three small MFD's will be replaced by two big screens called Electronic Flight Information System (EFIS) displays and a Flight Management System (FMS). On this screens next to data of radar and navigation also control data of the engines will be projected. The system will be completed with a Link-16 capable data-link system. One is looking forward how this will increase the operational abilities. Worldwide it will be possible to log in the system for those who are authorised, such as the home base, friendly airplanes or ships but also the man in the field can exchange real time data. The KDC-10 can see who is where, and in what situation?

On the other hand for example an F-16 can see how much fuel is in the KDC-10 by his data-link connection. When using the radars of all fighter aircraft in the neighbourhood as a system the situational awareness (SA) will be very much extended and so creating enhanced air warfare techniques. Of course the language is cryptic and not in reach of enemies. The introduction of SATCOM will boost the operation ability. Worldwide communication with 'secure voice' VHF radio will replace the 'line of sight' situation. The FMS can communicate by data-link with the tower by the Controller Pilot Data Link Communication (CPDLC). Requests for change of altitude but also exchange of position reports can be handled by CPDLC. Pilots looking forward with delight to meet the new capabilities of the upgraded KDC-10 in near-future. The DC-10 is scheduled to enter OT&E phase in early 2011 after completion of the certifying in late 2010, most probably in a configuration for 250 passengers with two medevac units.

The two KDC-10 aircraft will follow later one by one. Involved companies in the upgrade are Boeing with Fokker Air Services and TNO. When operational the state-of-the-art cockpit will be of great interest for the USAF. A previous attempt to upgrade their KC-10 cockpit was not a success. A contract was signed with CAE in Hoofddorp to train the crews of the Klu with a full mission simulator which will be available in mid 2010. Provisions on this simulator to train pilots and flight engineers will be supplemented most probably by a program called 'Boom Operator Trainer'.

In that case Boomers don't have to go to the United States anymore to train on the KC-10 Simulator but will have a more appropriate trainer to the KDC-10 system. Several other countries would like to be in the position of the Klu with its advanced and highly capable in-flight refuelling system and professional operating system.

### **KDC-10 in short:**

Manufacturer	McDonnell Douglas
Length:	55.35m
Wingspan:	50.39m
Height:	17.55m
Diameter:	6.02m
Engines:	3 x General Electric CF6-50C2
Weight:	Empty 120.000 kg. Max. 256.300 kg.
Cruise speed:	890 km/u
Maximum speed:	962 km/u
Range:	circa 9760 km
Ceiling:	12.8 km/u
Fuel contents:	138.745 L.
Maximum cargo:	74.000 kg.

Kees Otten & Wim Das