3D MODEL OF AIRCRAFT AIRBUS A380

Zuzana Šusterová – Róbert Rozenberg

Article briefly describes the creation of a 3D model of the Airbus A380, which was subsequently used in the animation. The aim of animation was to simulate the functional elements of the aircraft during takeoff and landing as realistic as possible. Used software was 3ds Max by Autodesk.

K e y w o r d s: airplane, Airbus, animation, simulation, model

1 INTRODUCTION

Airbus A380 is a double-deck, four-engine, wide body aircraft whose manufacturer is Airbus. Founded in 1970 and just two years later took off first Airbus A300 aircraft. Despite the fact that today as headquarters of Airbus is the French city of Toulouse, it operates internationally and currently in all of their production aircraft produced worldwide.

In June 1994 has launched A3XX project, the final draft was accepted in 1996 and the first prototype successfully flew on Jan. 18, 2005 from Toulouse airport. By the time the plane already has built its position on market a new aircraft from Boeing labelled 474-8I has come. Although it uses the latest technologies and offering new solutions for environment, Airbus A380 remains as colossus of the sky.

The fact that the aircraft is so far the largest Airbus A380 airliner in the world was one of the main reasons for creating this 3D visualization and animation.

2 TECHNICAL PARAMETERS

Airbus A380 has a wingspan of 79.75 m, length of 72.72 m and height of 24.09 m. According to official information range is up to 15 700 km and maximum fuel capacity is 320 000 l. The maximum weight of the aircraft without fuel is 361 t, the maximum landing weight is 386 t, and the maximum take-off weight is 560 t. The upper deck measures 44.93 m and main deck 49.90 m. Fuselage width is 7.14 m. In the base configuration, the Airbus A380 offers three classes with 525 seats together, the maximum capacity for this aircraft is certified to 853 passengers. The cockpit of the aircraft has a similar arrangement as the other aircrafts from Airbus.

Airbus A380 has a new hydraulic system with a pressure of 35 MPa which is a change compared to previously used value of 21 MPa. For aircraft, more pressure means less hydraulic fluid as well as weight reduction. Consists of eight pressure hydraulic pumps, with pipes made out of titanium. Instead of a secondary hydraulic system, there is an electrically driven hydraulic which saved the aircraft mass and reduce demands on the maintenance.

Figure 1: Front view of an airplane model

Fuel GTL (Gas to Liquids) has a very low concentration of hazardous substances and its combustion produces significantly less harmful to health PAH (polycyclic aromatic hydrocarbons) compared to commonly recognized jet fuel, while none lose of engine power. Airbus A380 has four engines and separate fuel tanks, so one or two engines are free to burn GTL fuel. The first commercial flight lasting three hours using GTL fuel was performed on Friday, 01 February 2008 under the research program of alternative fuels. The aircraft took off from Airbus factory in Filtrone, UK, France to the city of Toulouse. One engine worked with 40% of GTL fuel and the remaining three engines were powered by a standard jet fuel.

In Airbus A380 aircraft can be found IMA (Integrated Modular Avionics) and 8 displays on the dashboard. Tail is made of plastic reinforced by a fibber, upper torso, together with the stabilizing edges are reinforced with new Glare material. Technology FBW (fly - by - wire) is one of the main competitive advantages of Airbus. Orders from pilots to aircraft are much more accurate, precise and increasing flight safety.

3 CURRENT OPERATORS

The first customers were Emirates, binding order was described by 24 July 2000. The first Airbus A380 was delivered to Singapore Airlines on 15 October 2007 and the first flight took place on 25 October 2007 from Singapore to Sydney. 28 July 2008 the aircraft was delivered to Emirates Airlines and the first flight from Dubai to New York was made in August 2008. Qantas Airlines received its first aircraft on 19 September 2008 and the first flight took place about a month later, on 21 October 2008 from Melbourne to Los Angeles. Lufthansa adopted a plane on 19 May 2010 and in 6 June 2010 has

already realized the first flight from Frankfurt to Johannesburg. In late May 2012 this aircraft was delivered to the Malaysia Airlines and put into service on 2 July 2012 from Kuala Lumpur to London.

Companies which are current operators are:
- Air France,
- Emirates,
- Korean Air,
- Qantas,
- Malaysia Airlines,
- British Airways,
- China Southern Airlines,
- Singapore Airlines,
- Lufthansa,
- THAI.

4 PROCESS OF MODELING

Modelling process of aircraft consisted of finding resources, making the aircraft itself and adding textures.

Figure 2: Faculty logo at the tail surface

Technical drawings of the aircraft were placed in the program 3ds Max, then model is created from the drawing in isometric view with transparent blueprint displayed in the background of modelled object. Thank to that, model captures the main shapes of the aircraft and for details, many of aircraft photos were used which are available online on the web. Model uses polygonal technology, so it was using the "editable poly" technique. The most commonly used features include:
Connect (cross cutting selected edges of polygons):
- Bridge (connecting two selected borders of separate polygons)
- Extrude (selected polygons can be pulled out into space including new links)
- Collapse (connecting selected verticals into one)
- Cut (cutting new connections in the grid),
- Cap (roofing open holes in the model).

On the whole model was also used so-called. modifiers, i.e. indirect editing tools that are applied to the entire object (aircraft). The most commonly used modifiers in this aircraft are:
- Turbo Smooth that mathematically smoothed model,
- Shell tool converting 2D to 3D surface structure

- Skin, tool for binding polygonal model to virtual joint skelet used for animating
- Symmetry, creating a new mirrored image of model to the selected object,
- Unwrap UVW, a set of tools for adjusting projection of the 3D model to 2D surface that will be textured.

5 ANIMATION

While creating of animation, the simplified skeleton model was created. It is actually a network of joints and animated is only this logically connected structure. Root bone is in place of the rear chassis where is the rotation pivot of the aircraft during start -up (axis of rotation), and the root bone is using skin modifier applied to all static parts of the aircraft such as fuselage, wing alone without functional systems and tail. Subsequently to root bone all other bones are linked for dynamic tree structure of the aircraft as the undercarriage, flaps , rudder and wing leading edge and etc., the model follow the moves of the skeleton.

Figure 3: View of the modelled gear

Animation is based on the labelling of the key points on the timeline. During move of object from point A to point B, it is necessary to specify the time of the initial key frame for the object in position A, then move the timeline for the final time, move the object to point B and enter the second key frame. Smooth animation is automatically created between key frames by the curve, which can be freely adjusted.

The modifier attribute holder were created for individual actions as tilting rudder, flaps, brakes, leading edge but also the entire animation retraction and withdrawal of gear. Rotating of aircraft is made by adjusting the rotation key frame of root bone while watching the flight curve.

Lightning and cameras are using V-ray that uses its own cameras to simulate real parameters of cameras and movie cameras. For this animation was selected camera film gate 36, focal length 40, f-number 14, D65 white balance, shutter speed 200 and ISO 300 cameras have been animated so that follow path along with an aircraft and always focuses on aircraft specific important events during take-off and landing.

The light in this animation is "Vray Sun", for the position of the sun in the sky has been used "Daylight System" from 3DS Max. Daylight position of the sun is set as the real sky in 07.11.2013 at 12:00 in Kosice (date of setting up of light system).

6 CONCLUSIONS

The result is a nearly two-minute of video showing the takeoff and landing of the aircraft. This is a simulation that correctly shows all functional elements of the aircraft exactly as the real during takeoff and landing.

BIBLIOGRAPHY

[1]   http://www.airbus.com
[2]   http://en.wikipedia.org/wiki/Airbus

AUTHORS' ADDRESSES

Šusterová Zuzana, Bc.
Stálicová 18, Košice
zuzana.susterova@icloud.com

Róbert Rozenberg, Ing., PhD.
Department of Air Traffic Management,
Faculty of Aeronautics, Technical University in Košice,
Rampová 7, 041 21 Košice, Slovakia
robert.rozenberg@tuke.sk