

Modeling and Simulation of Aircraft Evacuations

by Jingxin Han and Stephen Otunba



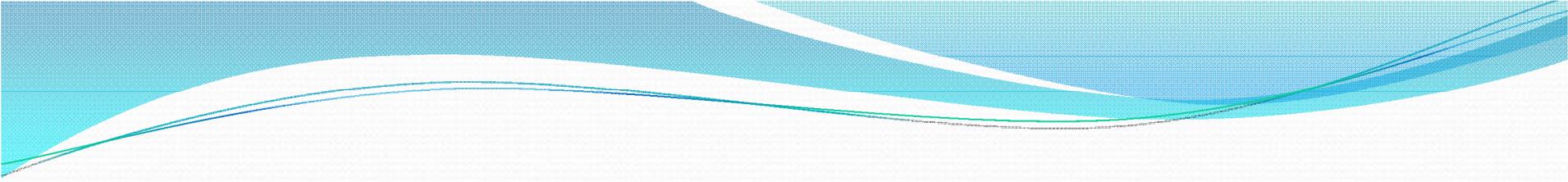
Topics

- Goals and Objectives
- Modeling
- 2D Versus 3D
- Exterior Modeling
- Interior Modeling
- VRML
- Software
- Problems Encountered and Future Goals



GOALS AND OBJECTIVES

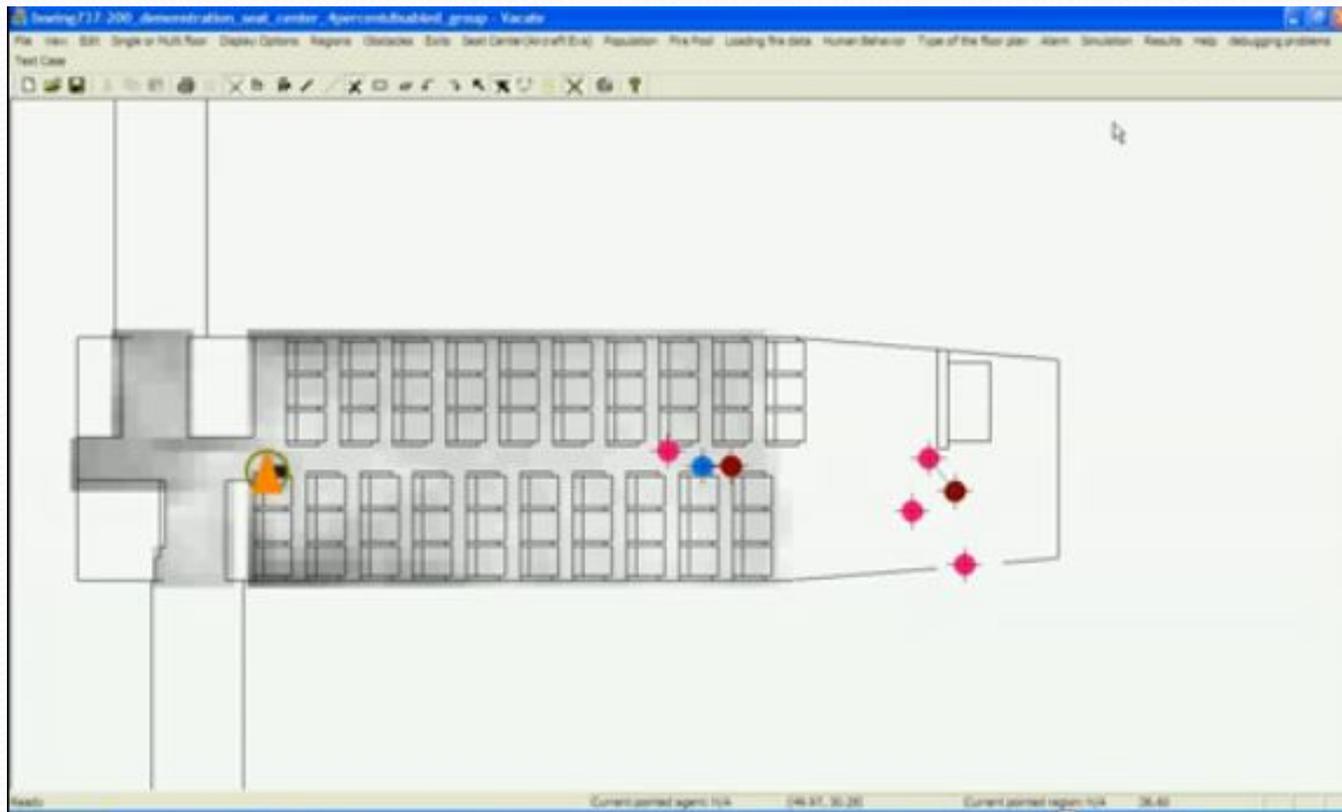
- In this project, we will simulate an evacuation behavior in an aircraft using a crowd component.
- In passed years, there has only 2D simulation and this application can be used by airlines to simulate emergency scenarios without the use of live actors.
- This will allow airlines to run multiple simulation under a variety of conditions which will save time and lower costs. The application can also be adapted and expanded to other industries.



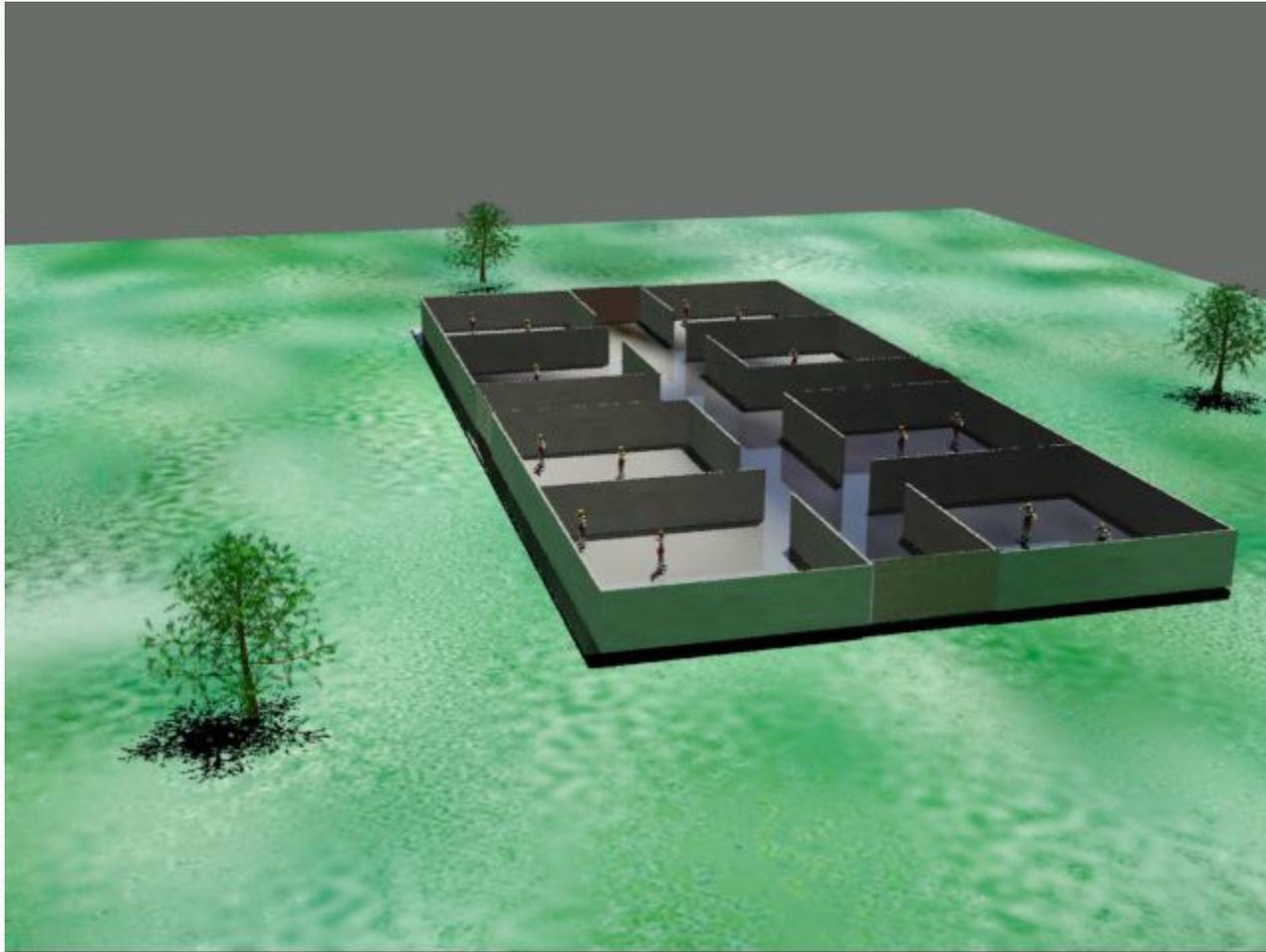
MODELING

- Modeling was done in 3D Studio Max
 - Outer aircraft environment and aircraft model
 - simple models downloaded from 3dviastudio.com were imported into 3ds Max
 - Inner aircraft environment
 - A model of the cross section of the interior of an aircraft as well as the passenger models were also downloaded from 3dviastudio.com
 - Biped models were inserted into the passenger models to create the evacuation animations.

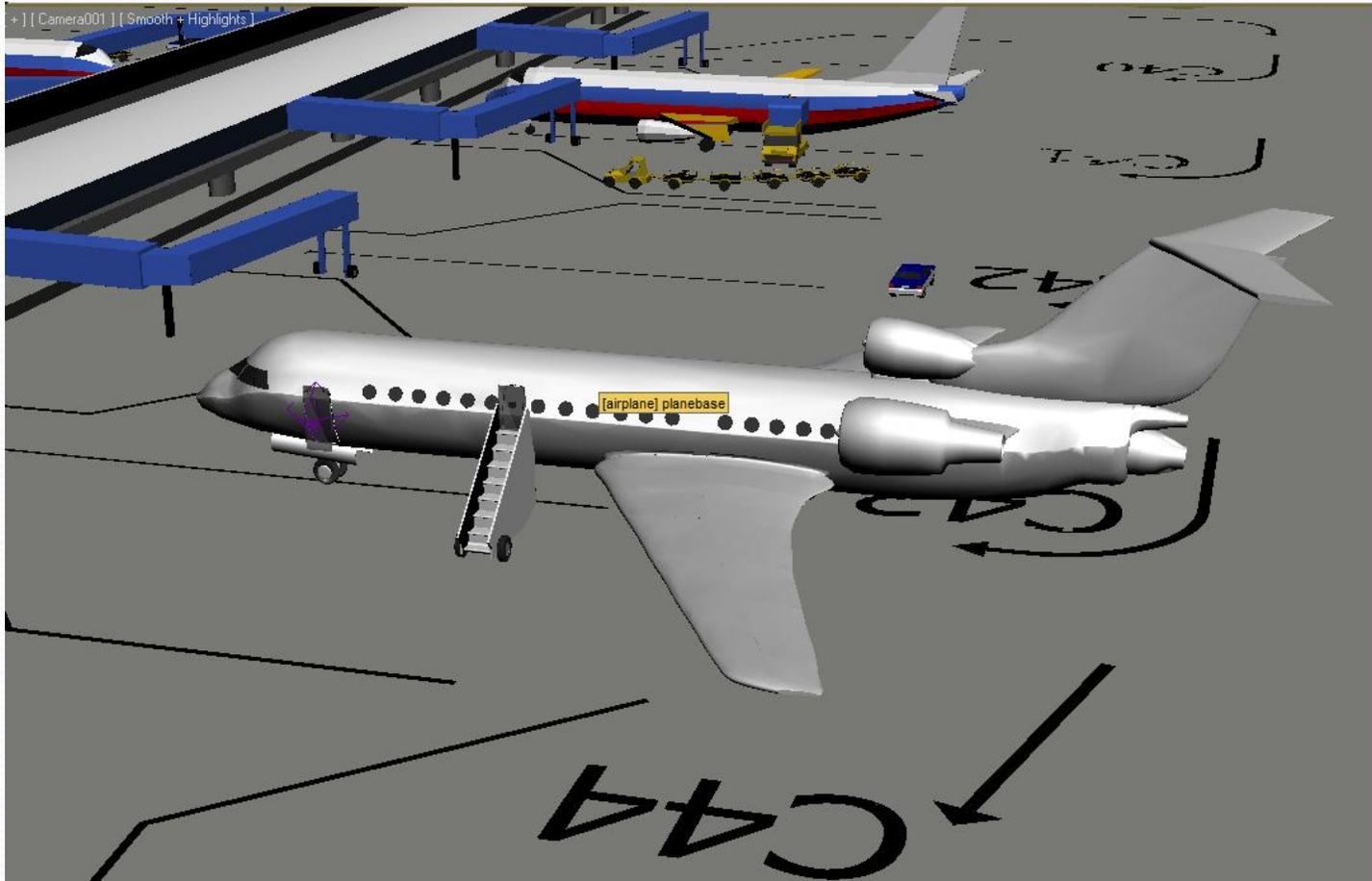
2D versus 3D



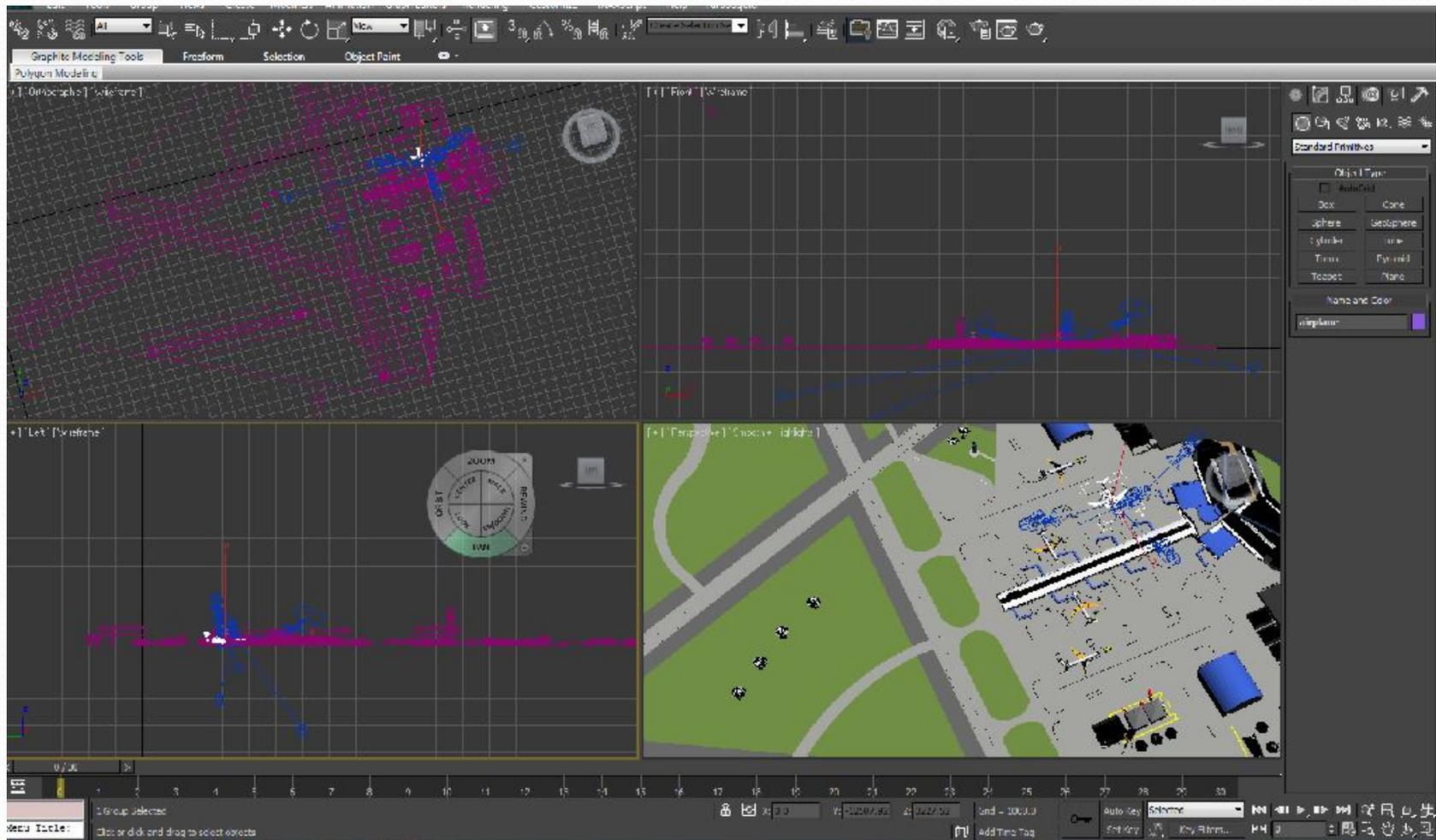
2D versus 3D



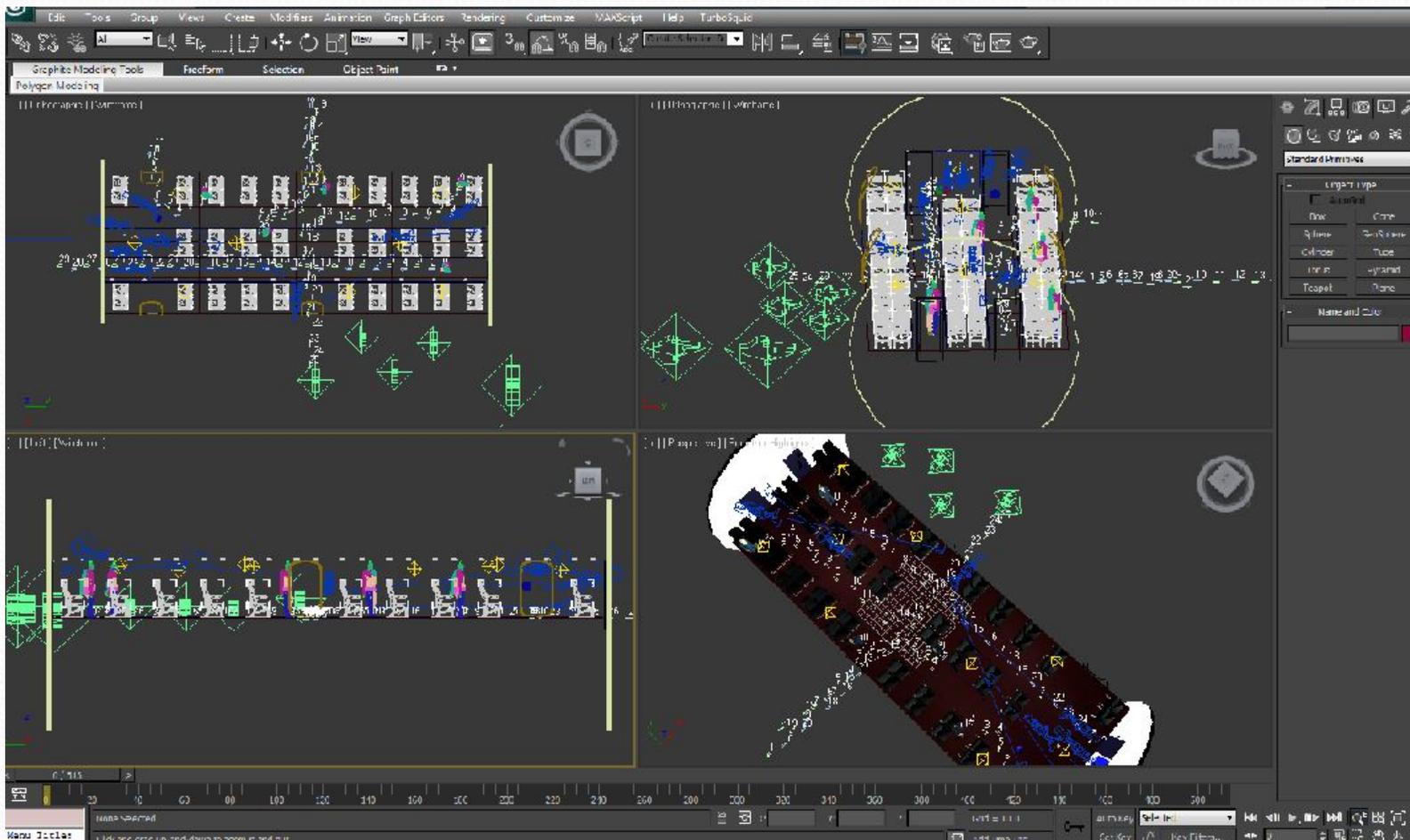
Exterior Modeling



Exterior Modeling in 3ds max



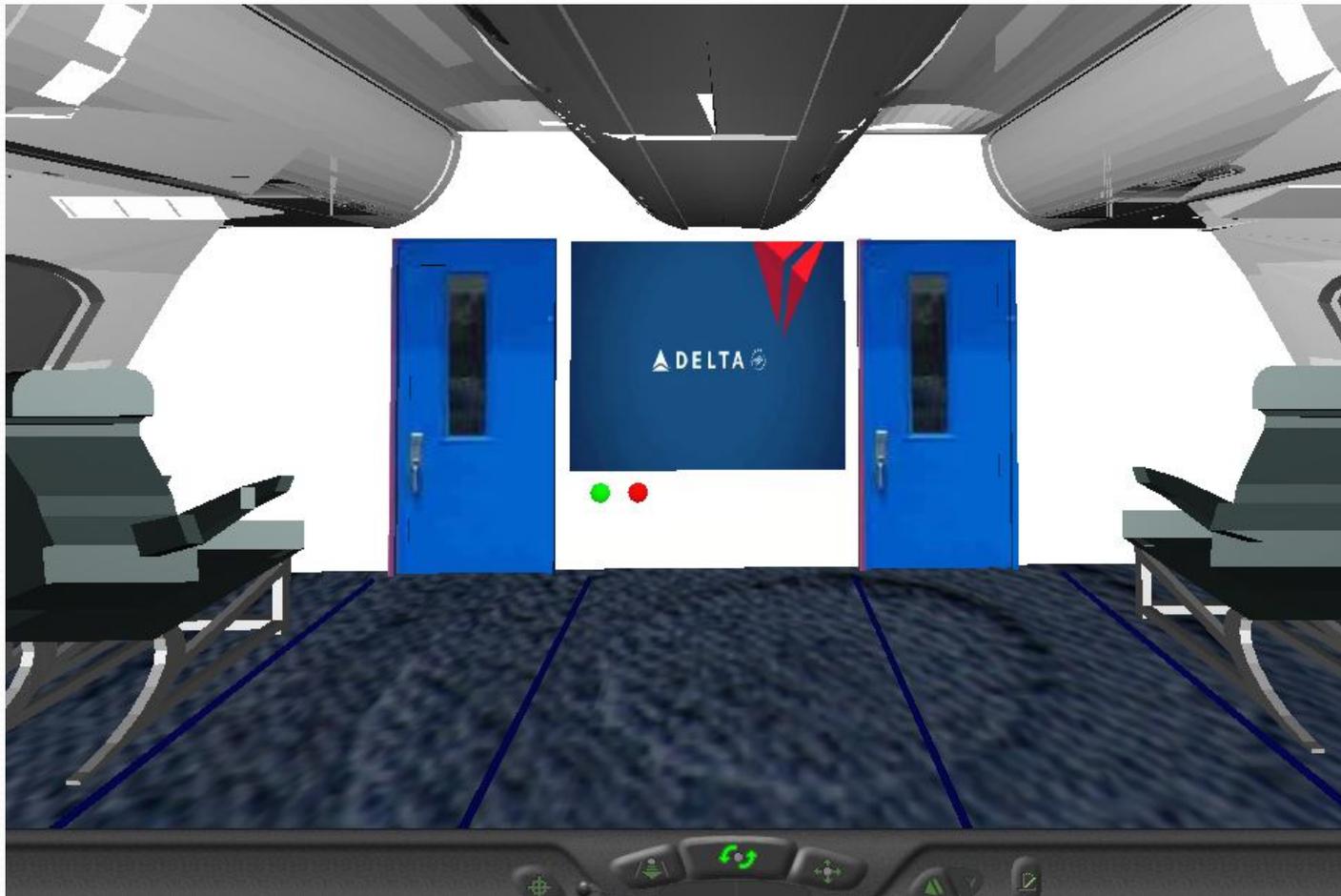
Interior Modeling in 3ds max



Cross Section of Plane Interior



Front of Plane Cabin



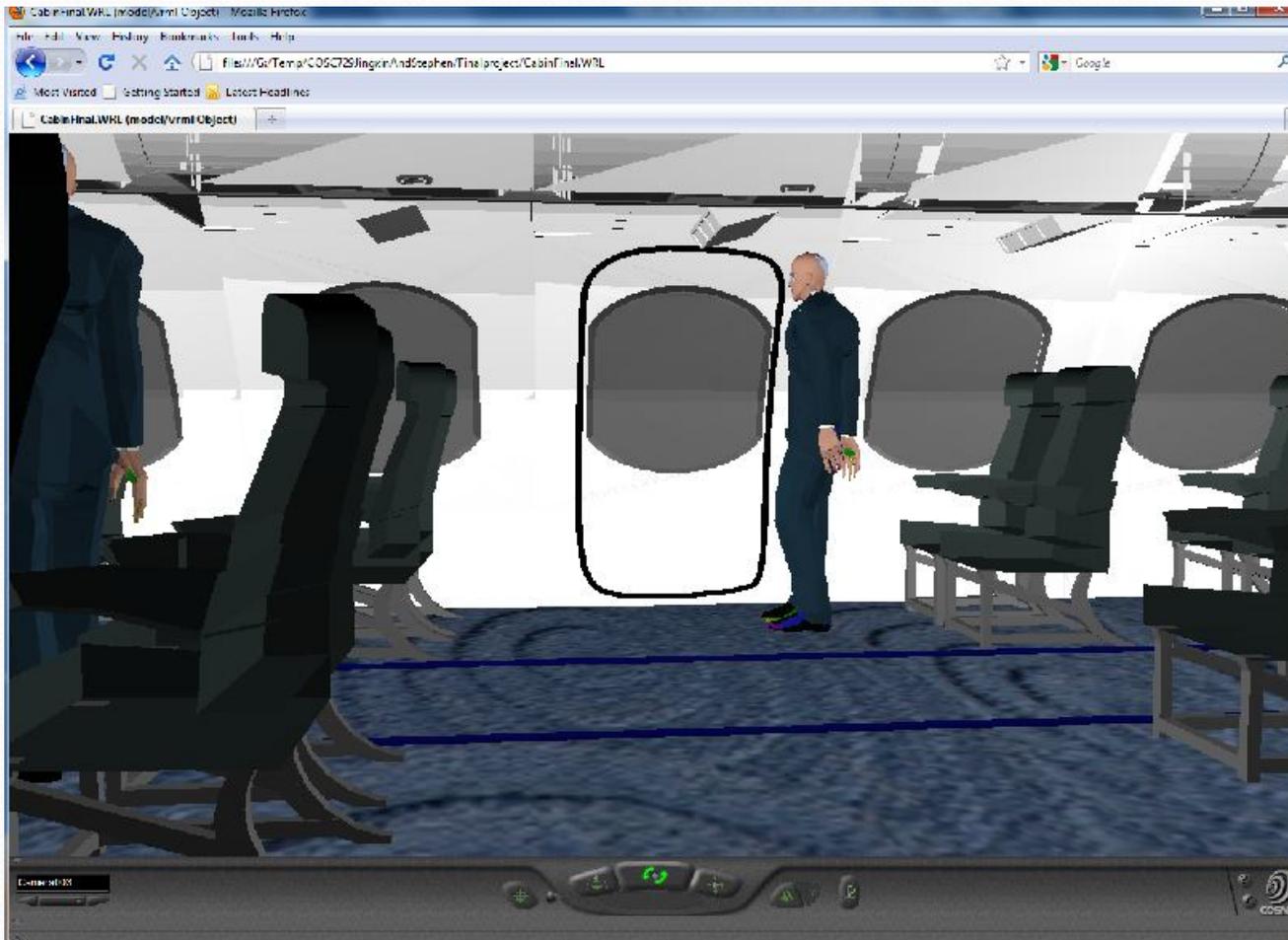
Plane Cabin



Cabin & Passengers

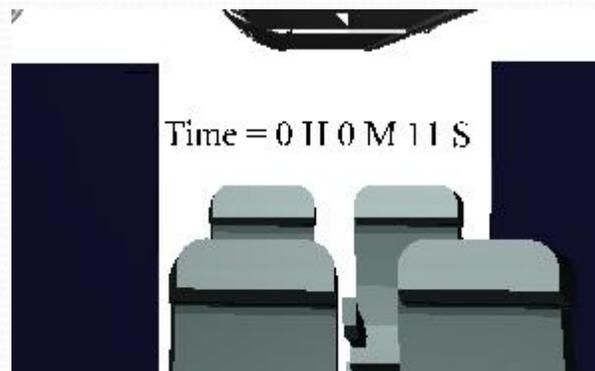


Passenger Exit



VRML

- VRML was used to add functionality to the virtual environment through the incorporation of:
 - Touch Sensors
 - Lights
 - Time Counter
 - Interpolators

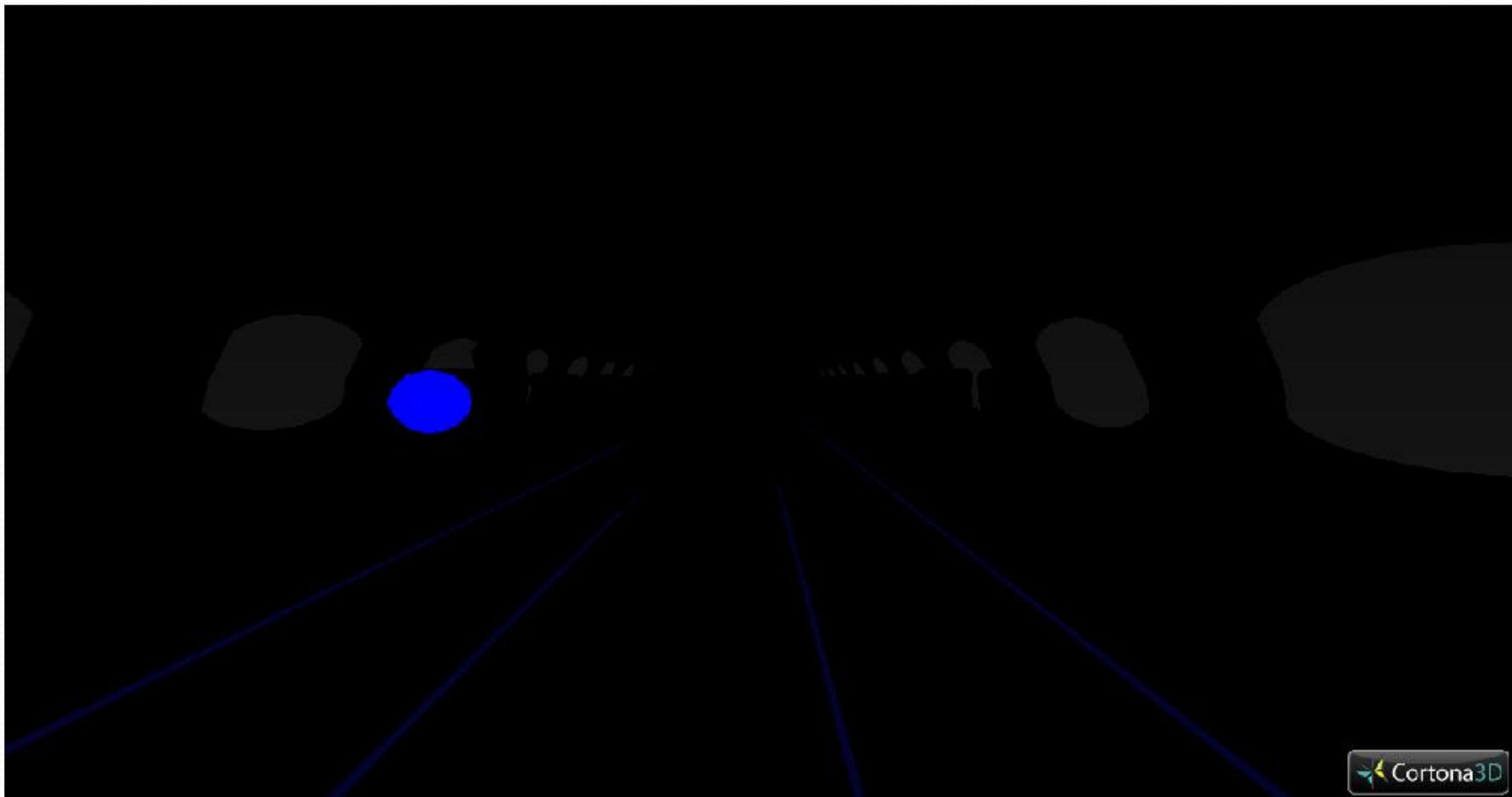




Lights

- Outer aircraft we used the standard daylight system that is available in 3ds Max.
- In the aircraft we used multiple point lights to illuminate the interior of the cabin.
- Emergency guide lines were added on either side of the aisles.

Light



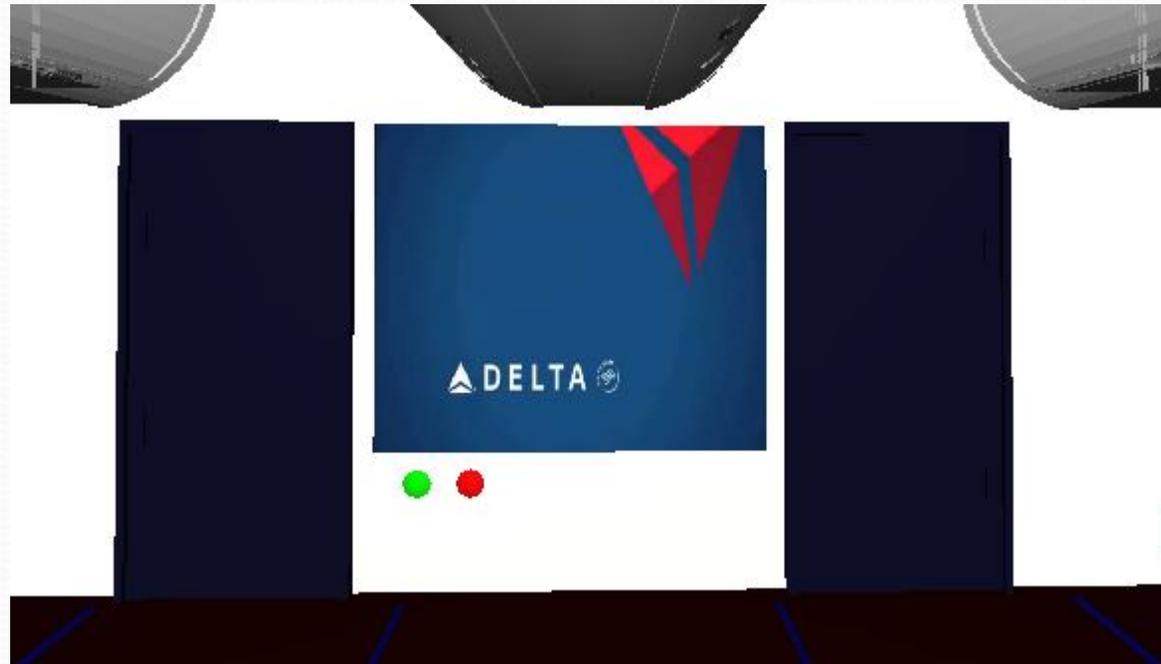


Sensors

- Touch sensors were placed on the emergency button, the outer aircraft doors, the buttons controlling the television screen, as well as on the heads of each of the passengers.
 - The touch sensors controlled video and audio playback as well as animation.
- A time counter was placed on the back wall of the aircraft cabin to keep track the total elapsed time for the evacuation.

Interpolator

- A scalar interpolator was applied to the television screen and triggered by touch sensors to turn the screen on and off.



VMRL pad

```
DEF LABEL Script {
  eventIn  STime    Clock
  eventOut MFString TimeText
  field    SFInt32  time -1
  field    SFInt32  hour  -1
  field    SFInt32  min   -1

  url "vrmlscript:

    function initialize() {
      time = -1;
      hour = 0;
      min = 0;
    }

    function Clock( value ) {
      if ( time == 59 ) {
        time = 0 ;
        if(min == 59)
        {
          min = 0;
          hour++;
        }
        else min++;
      }
      else time++;
      TimeText[0] = 'Time = '+hour+' H '+min+' M '+time+' S';
    }
  "
}

ROUTE CLOCK.cycleTime TO LABEL.Clock
ROUTE LABEL.TimeText TO TEXT.set_string
```

```
ROUTE TouchSensorforScreenOff.touchTime TO TIMEforScreenOff.startTime
ROUTE TIMEforScreenOff.fraction_changed TO SiforScreenOff.set_fraction
ROUTE SiforScreenOff.value_changed TO Screen.set_transparency
ROUTE TouchSensorforScreenOff.touchTime TO saac.set_stopTime

DEF SiforScreenOn ScalarInterpolator {
  key [ 0, .25, .5, .75, 1 ]
  keyValue [ 1 0.75 0.5 0.25 0 ]
}

DEF TIMEforScreenOn TimeSensor {
  loop FALSE
  cycleInterval 1
}

ROUTE TouchSensor001-SENSOR.touchTime TO TIMEforScreenOn.startTime
ROUTE TIMEforScreenOn.fraction_changed TO SiforScreenOn.set_fraction
ROUTE SiforScreenOn.value_changed TO Screen.set_transparency
ROUTE TouchSensor001-SENSOR.touchTime TO saac.set_startTime
ROUTE TouchSensor001-SENSOR.touchTime TO svmt.set_startTime
ROUTE TouchSensorforScreenOff.touchTime TO svmt.set_stopTime

DEF Timer Transform {
  translation -5.03134 40.47 -330.8
  children [
    Transform {
      #rotation
      children [
        Shape {
          geometry DEF TEXT Text {
```

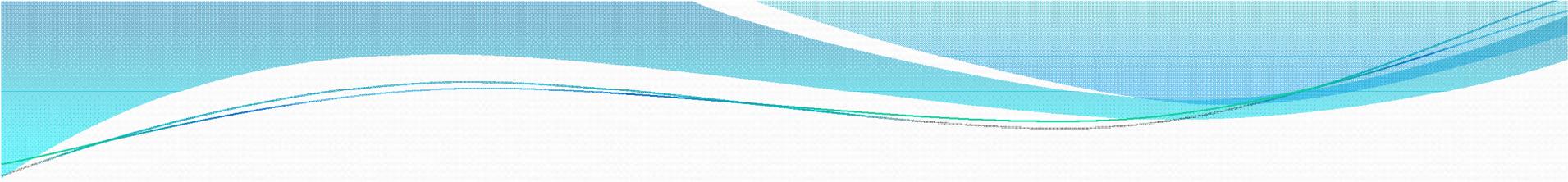


Software

- Autodesk 3ds Max 2011 64-bit
- Autodesk Maya 2011 64-bit
- Cosmo player
- VrmI Pad
- Windows 7 Enterprise 64-Version
- FBX Converter
- Mac OS
- Virtools (if we can find a way to import/export files)

Evacuation Video





Demo

- [PlaneOutside.WRL](#)