Are simulators the solution ?

Overview

- History of flight simulators

- Limitations of simulators

- “JOInT Simulator” program

- Discussion

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- **History of flight simulators**

- **Limitations of simulators**

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- **Discussion**

History – Limitations – JOInT Program

- First syntactic flight simulators were developed 1910
- Build on two half-sections of a barrel, pitch an roll movements could be simulated
- All movements were generated manually

1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

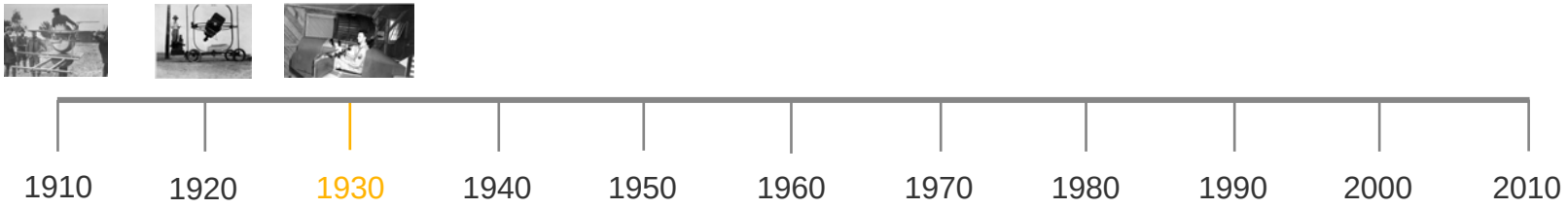
History – Limitations – JOInT Program

- Due to the large demand of pilots during World War I, the development of simulators was expedited
- The so called “Ruggles Orientator” was one of the first automatically animated trainers
- Primarily it was used to experience unusual attitudes and to practice recovering

1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

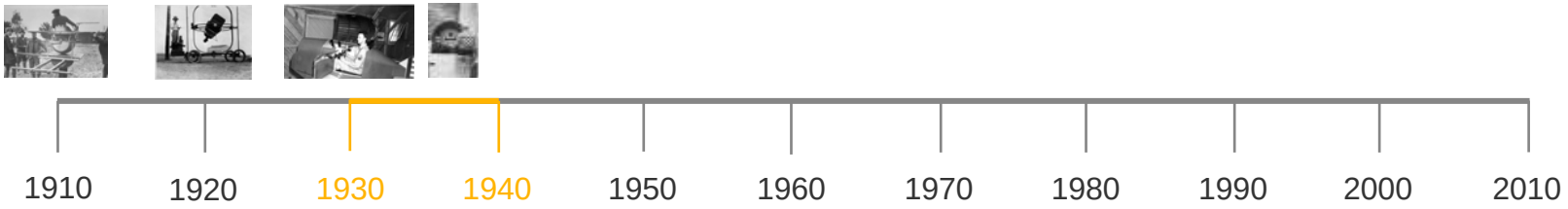
History – Limitations – JOInT Program

- The famous “Link Trainer” invented by Edwin Link was patented 1930
- Steering inputs were transferred with pneumatic actuators in corresponding movements
- Link Flying School offered a learn to fly flat charge of 85 $



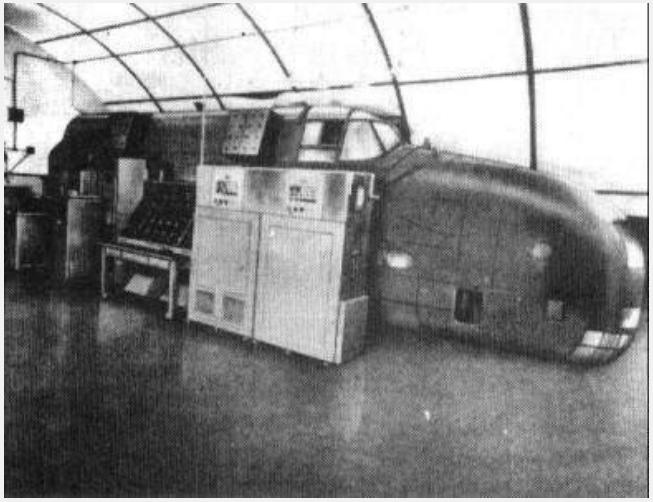
History – Limitations – JOInT Program

- In the 1930's the importance of "blind flying" training was recognized
- The "Link Trainers" were equipped with instruments and simple track plotters
- In 1929 Lufthansa started "instrument flying" training

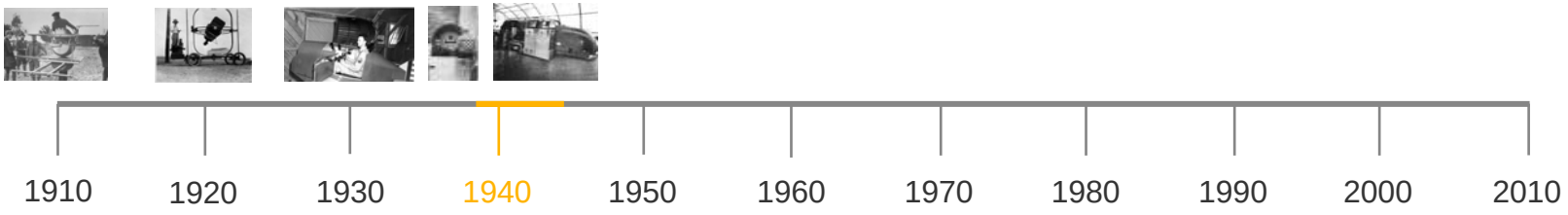


History – Limitations – JOInT Program

- During World War II new requirements boosted the development of simulation
- Simulation of entire normal procedures including system abnormal handling
- Need for multicrew and type specific training

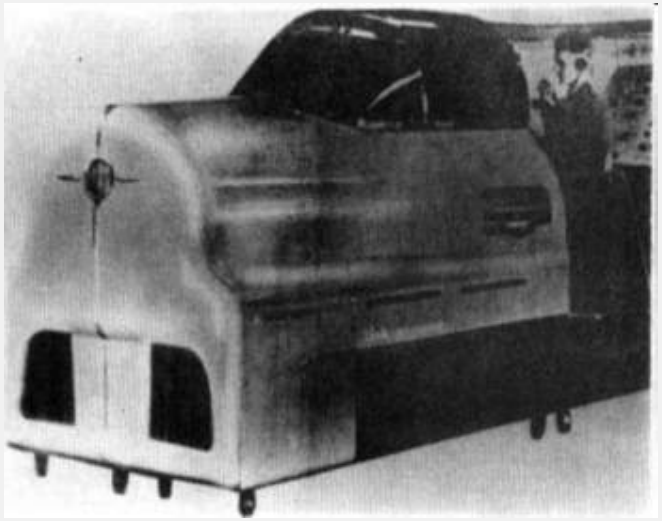


(Silloth Trainers)



History – Limitations – JOInT Program

- After the World War II, the focus was set on the simulation of instrument flying – rather than fuselage movements
- Advanced electronic technology as the first analogue computers improved the realism of simulation



(Advanced Link Trainer)

1910 1920 1930 1940 **1950** 1960 1970 1980 1990 2000 2010

History – Limitations – JOInT Program

- Lufthansa's first Lockheed "Super Constellation" simulator in 1957
- Arrival of sub-sonic jet transport required faster and more accurate simulations
- Transition from electronic to digital simulators began

1910 1920 1930 1940 1950 **1960** 1970 1980 1990 2000 2010

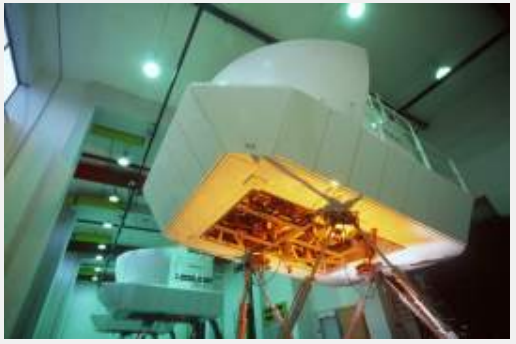
History – Limitations – JOInT Program

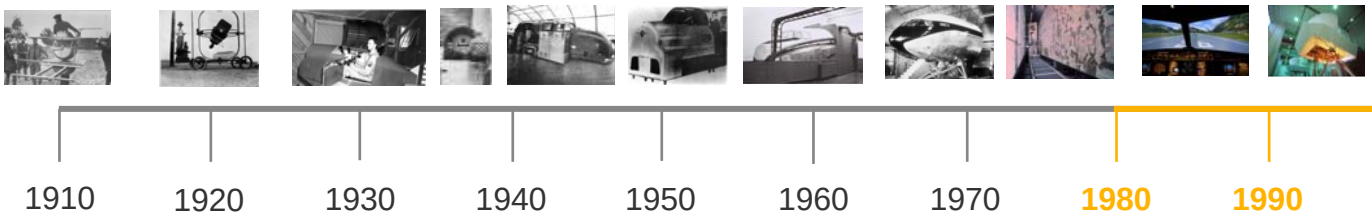
- In the 60's and 70's development concentrated on visual and motion systems
- The NASA moon mission enhanced the development of motion systems
- Early visual systems were based on cameras flying over artificial sceneries

1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

History – Limitations – JOInT Program

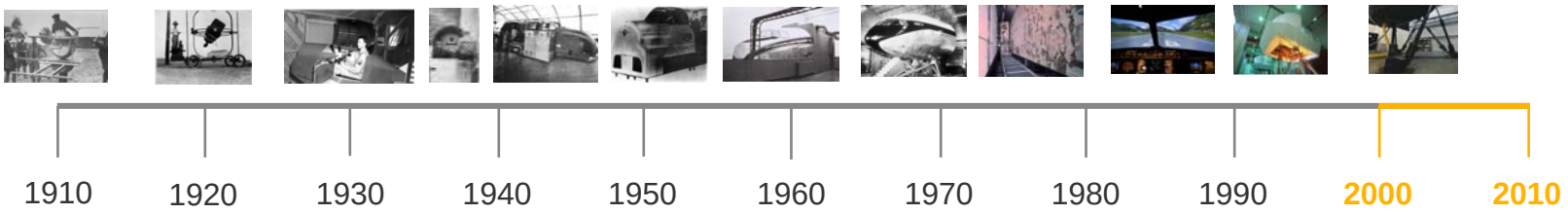
- In the 80's and 90's visual and motion systems were continuously enhanced
- Sophisticated 180 ° computer images became the standard and allowed route familiarizations
- In addition to the movement around the 3 axis, up and down motion was introduced





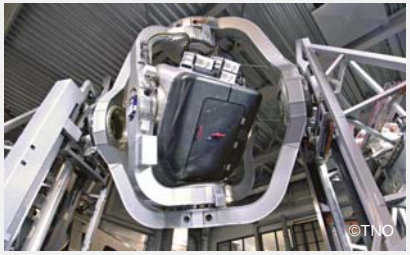
History – Limitations – JOInT Program

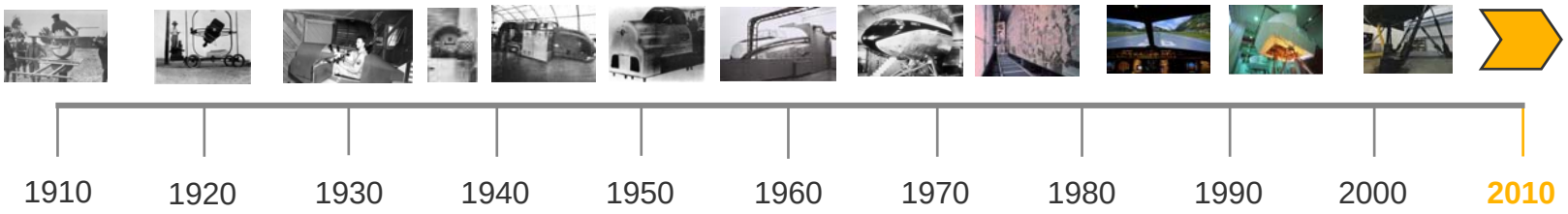
- Actual trends…
- New technologies allow reducing overall operating costs
- Development of capable electrical motions systems
- 100% software based simulators replace the need of real hardware components



History – Limitations – JOInT Program

- The future…
- Modular simulators with a common core element independent of the aircraft type
- Fully rotatable systems as the Desdemona simulator





Overview

- **History of flight simulators**

- **Limitations of simulators**

- **“JOInT Simulator” program**

- **Discussion**

History – Limitations – Joint Program

- Motion
- Visual & Sound
- Psychological
- Environment

History – Limitations – JOInT Program

- **Motion**
- **Visual & Sound**
- **Psychological**
- **Environment**

- Unusual attitude training
  - < 25° nose up
  - < 10° nose down
  - < 45° bank

- Perception of acceleration and deceleration
- G-force training
- Spatial disorientation
- Stall and spin simulation

History – Limitations – JOInT Program

- **Motion**
- **Visual & Sound**
- **Psychological**
- **Environment**

- Sun light blinding
- Complex 360 °visuals
- Visual synchronization with motion (time delay)
- Multi channel acoustic systems

History – Limitations – JOInT Program

- **Motion**
- **Visual & Sound**
- **Psychological**
- **Environment**

- Does not substitutes “real world” confidence
- Stress and fear perception

History – Limitations – JOInT Program

- **Motion**
- **Visual & Sound**
- **Psychological**
- **Environment**
  - Realistic ATC
  - Climatic (Heat etc.)
  - Cabin and passenger handling

History – Limitations – JOInT Program

- ~~Motion~~
- ~~Visual & Sound~~
- ~~Psychological~~
- ~~Environment~~

- **Benefits**

- High safety
- Low costs
- Less pollution
  (noise, nitrogene oxigen…)
- Flexible usage
- Independent of environment
  (weather, time of day, …)
- Simulation of abnormal
- Functionalities
  (Repos, Slew, Freeze)

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History – Limitations – JOInT Program

ATC

Environment Simulation

Individual limits

- „played“ by instructor
- No further traffic present
- No airspace restrictions

Individual limits

- „played“ by pseudo-pilots
- No cockpit stress present

History – Limitations – JOInT Program

JOInT

Joint Operational
Incidents Training

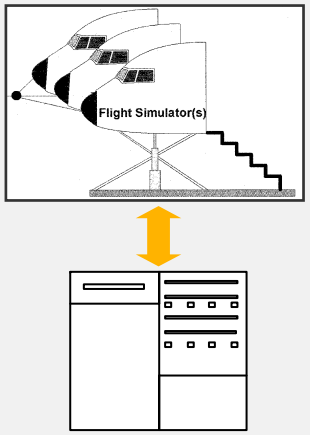
More realistic environment due to…

- Common simulator training
  for pilots and air traffic controllers
- developed in 1996 by
  - German Air Traffic Control (DFS)
  - Lufthansa German Airlines (DLH)
  - Lufthansa Flight Training Company (LFT)

History – Limitations – JOInT Program

JOInT system architecture

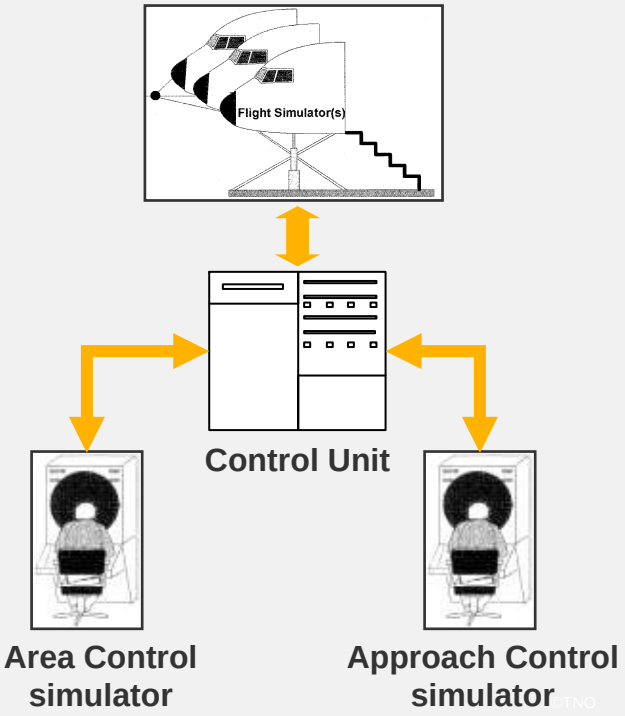
- Up to 8 flight simulators at a time are linked to a control unit



History – Limitations – JOInT Program

JOInT system architecture

- Up to 8 flight simulators at a time are linked to a control unit
- One area and one approach control simulator coordinate the traffic through the control unit



History – Limitations – JOInT Program

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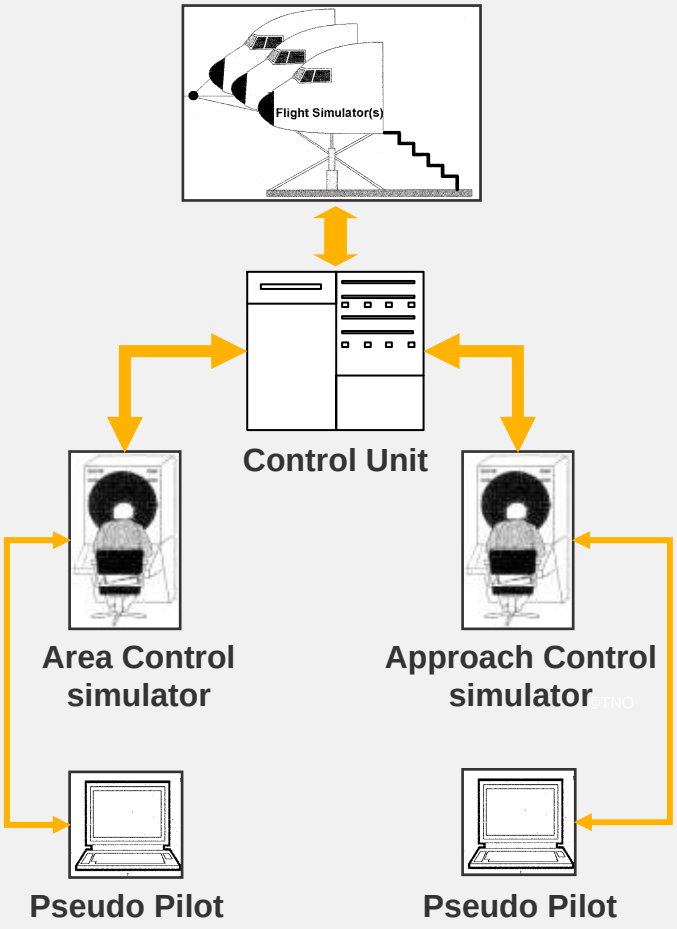
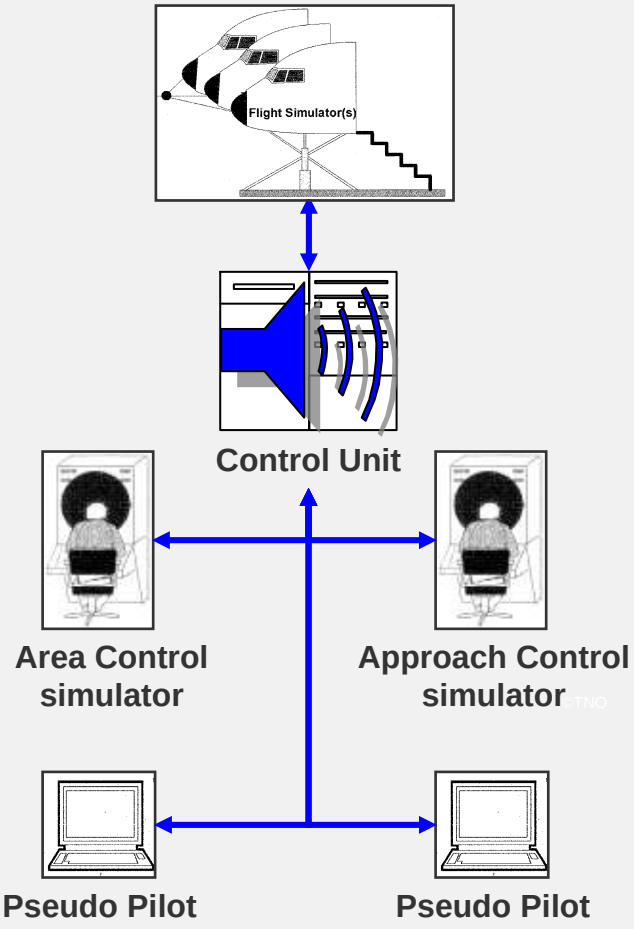


History – Limitations – JOInT Program

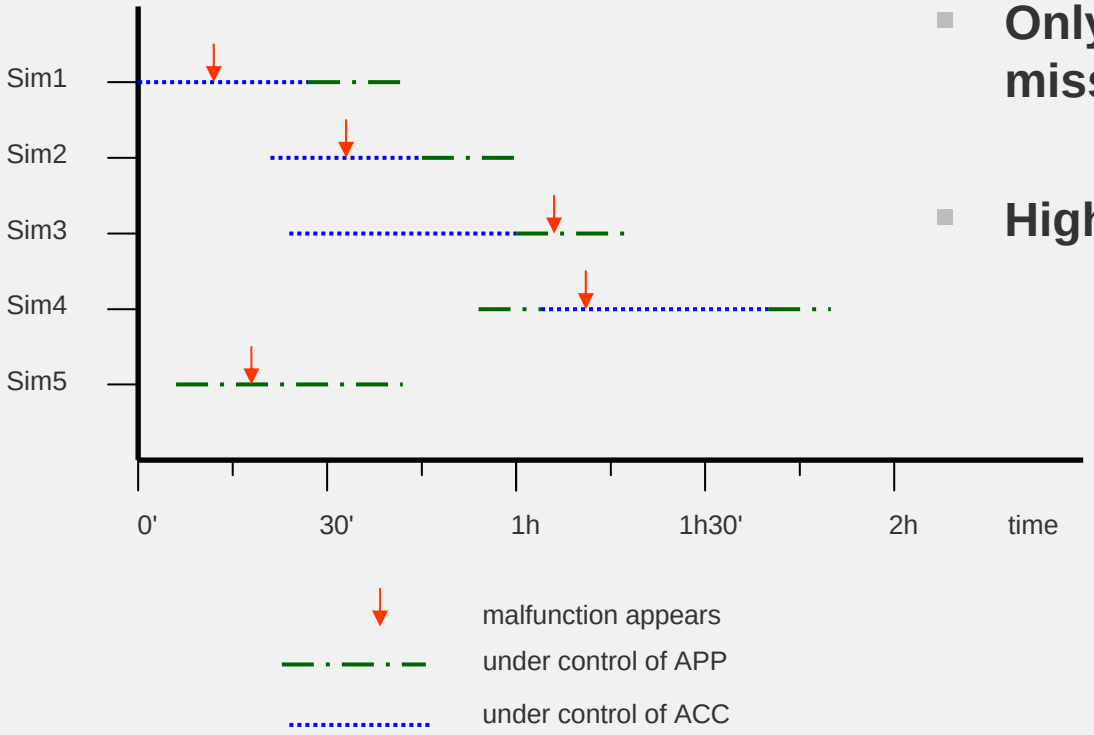
JOInT system architecture

- Up to 8 flight simulators at a time are linked to a control unit
- One area and one approach control simulator coordinate the traffic through the Control unit
- In order to increase traffic, additional “pseudo pilots” can be added
- All participants “hear” each other



History – Limitations – JOInT Program

JOInT Simulator planning



- Only certain simulator mission can be used
- High level of coordination

History – Limitations – JOInT Program

JOInT Pros and cons

Benefits:

- Much more realistic environment
- Personal interaction between pilots and AT controllers
- Improved CRM and human factor training
- Improved preparation for abnormal situations in real life
- High level of acceptance

Disadvantages:

- Expensive preparation
- Intensive need of man power
- Only usable within special coordinated missions

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Thank you !