



# Introduction to **Virtual Reality**

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# Introduction

## What is **Virtual Reality**?

- A technology which is capable of shifting a subject into a different environment without physically moving him/her.

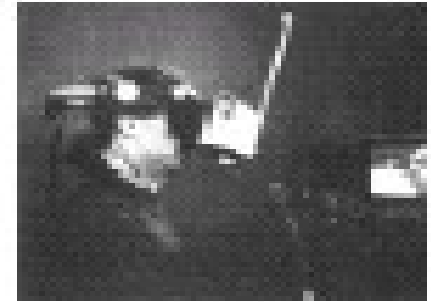
Indeed making a **Virtual Environment**, and manipulate his sensory organs such a way he perceives this Virtual environment instead of the real physical one.



- Researchers at NASA's Ames Research Center charged with creating affordable **pilot training system** for manned space missions.



- 1984: Mike McGreevy and Jim Humphries originators of **VIVED** (**V**irtual **V**isual **E**nvironment **D**isplay) .
  - Later, **VIEW** (**V**irtual **I**nteractive **E**nvironment **W**orkstation) project developed general\_purpose, multi\_sensory, personal simulator and telepresence device.



VIVED



VIEW

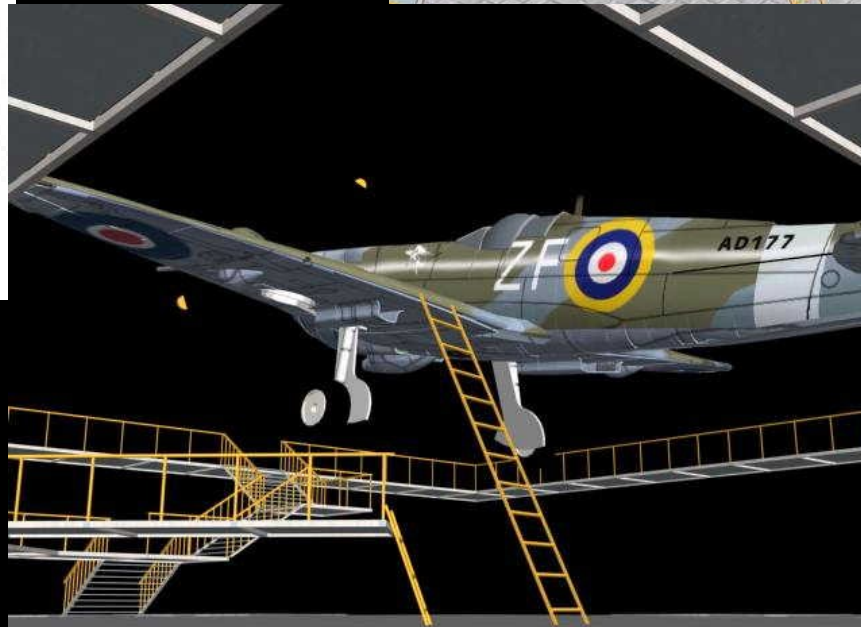
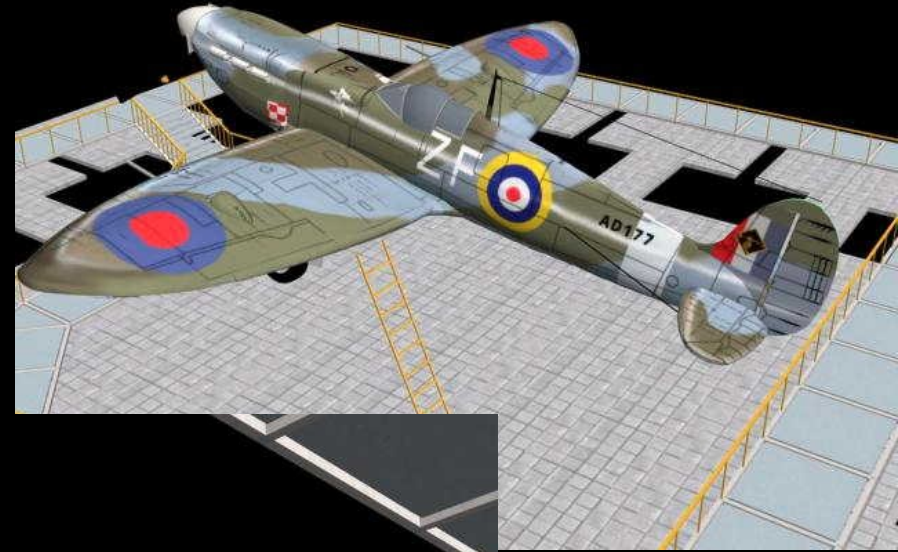
Movie (web)



# Today !

- In recent years, **VR devices have improved dramatically** as result of various technological advances.
- **Computers** more powerful, higher memory capacity, smaller, and cost less than in the past.
- *These developments + advent of small LCD displays that can be used in HMDs, have made it possible for scientists to develop VR simulations.*

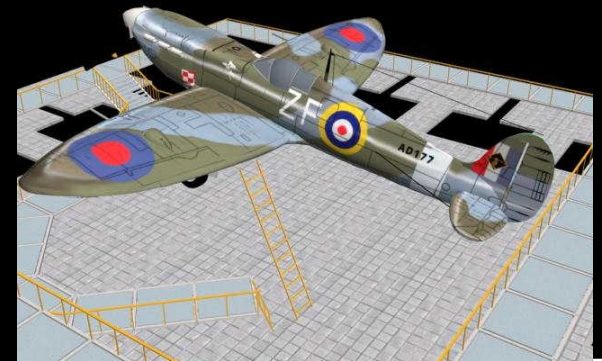
# *Flight simulators*



# *Flight simulators*



- Much of technology needed for VR developed for **military flight simulators** (Furness at US Air Force) .





- **different environment without physically moving him/her.**
- To this end inputs into **subject's sensory organs are manipulated** in such a way, that perceived environment associated with desired VE and not with physical one.
- manipulation process controlled by computer model based on physical description of VE.
- Consequently, technology able to create almost **arbitrarily perceived environments.**





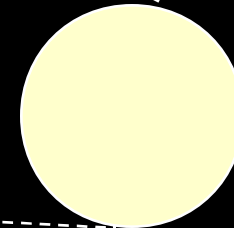
real environment

real but  
distant reality

virtual environment



virtual (artificial)  
environment





?

- Today's interfaces (keyboard, mouse, monitor, etc.) force us to working within tight, unnatural, two-dimensional constraints.
- **In Virtual Reality (VR), human-computer interface technology leverages the natural human capabilities.**
- VR provides engineers with real-time 3D audio, visual & sensory perception in a more intuitive & natural manner.
- **VR system lets us experience data directly.**
- In VR, we can look and move around/inside a virtual model or environment, drive through it, lift items, hear things & feel things.
  - **VR serves as a cost-effective problem-solving tool.**

# *Triangle of Virtual Reality*



## **Immersion :**

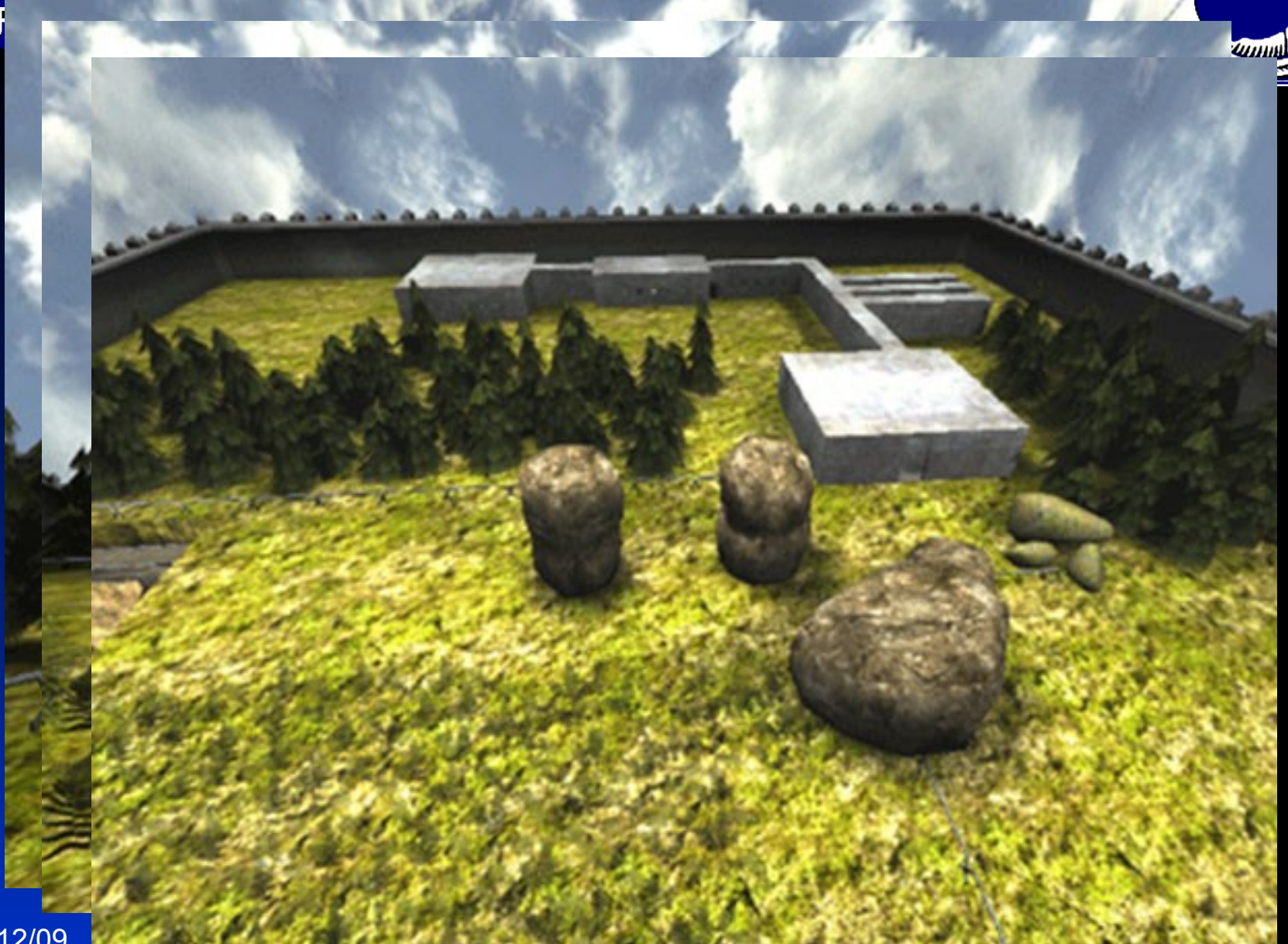
*Feeling to be in the 3D Virtual Space.*

## **Interaction :**

*Possibility of moving in the 3D space and  
manipulate objects*

## **Real Time :**

*Actions from VR should translate to the real space with  
almost no delay*



# *Immersion*



- key issue in VR systems as central to paradigm where **user becomes part of simulated world**, rather than simulated world being feature of user's own world
- First “**immersive VR systems**” : flight simulators where immersion achieved by subtle mixture of real hardware and virtual imagery.



**Cockpits real with their instruments, joysticks, levers, switches, buttons, sliders.**

- **Each instrument possess individual mechanical characteristics.**
- **Pilots constrained to floor-mounted chairs, and during take-off and landing scenarios, restrained by seat belts.**
- **It would be ridiculous to build all instruments and chairs in virtual world**



SGI simulator



Virtual Take Off simulator



- **Several conditions must be met to achieve immersion**  
: the most important seems to be
  - 1 - small feedback lag;**
  - 2 - wide field-of-view.**
  - 3 - Stereoscopic Display, usually with HMDs.**



- **Presence: psychological sense of "being there"**





# Augmented Reality views of real objects + augmentation

- Sometimes it is not necessary to completely replace the real environment with virtual environment
- In some applications it is enough to augment the real environment with some elements of virtual environment
- This is called augmented reality
- Augmented reality = true + virtual reality