

## Abstract

It is known that peripheral area of view is essential for sense of self-motion. Therefore, the user of visual displays with narrow field of view is often hard to feel such sensation fully. In this research, we propose the peripheral display for augmented reality of self-motion. The peripheral display consists of simple displays to stimulate the peripheral area of view of the user.

Then, by changing the stimulus on the peripheral display, **THE SYSTEM SHOULD BE ABLE TO AUGMENT THE USER'S SENSE OF SELF-MOTION.**

In this poster, we describe about

- ◆ A prototype display system using simple **LED-MATRIX-ARRAYs**
- ◆ The experimental result which shows that the prototype system has an ability to **AUGMENT THE USER'S SENSE OF SELF-MOTION.**

## Research Background & Goal

### Research Background

- ◆ Conventional PC Flight Simulators have poor ability to display the sense of motion (i.e. speed and acceleration)(Fig.1).
- ◆ High-end Flight Simulators have good ability to display such sensation. However, they are quite expensive(Fig.2).
- ◆ Lack of such sensation may influence the quality of flying real aircraft.
  - ◆ The landing during cross wind(Fig.3). The pilot often have difficulty finding lateral movement.
  - ◆ The hovering flight at very high altitude/over ocean/low visibility. (Fig.4) The pilot often have difficulty finding lateral/longitudinal/altitudinal movement.

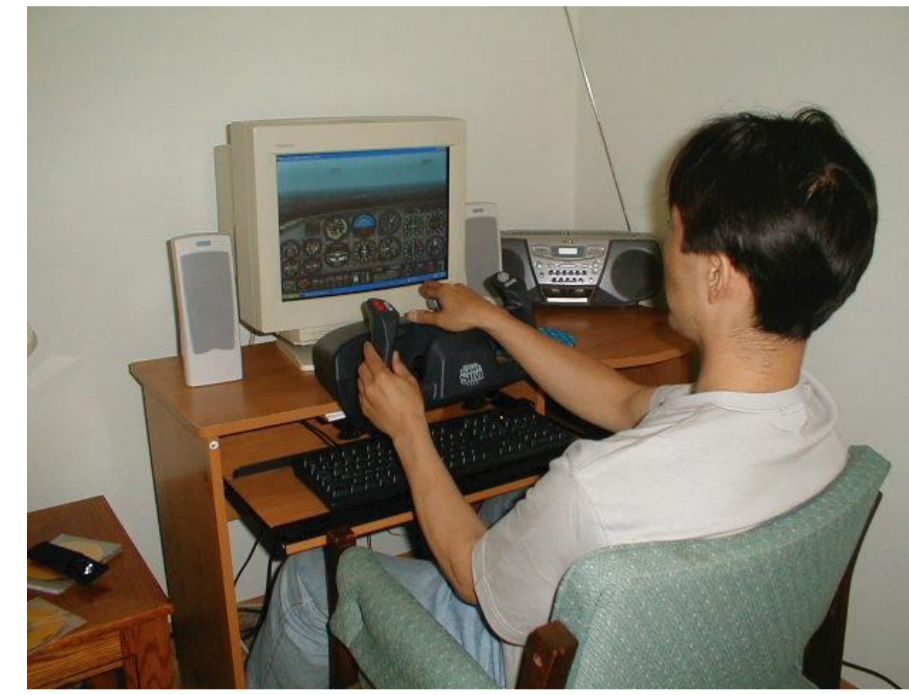


Fig.1 Conventional PC Flight Simulators Fig.2 High-end Flight Simulators



Fig.3 A Crosswind Landing (Heavy wind is blowing from left side of the airplane) Fig.4 A Hovering Flight

### Research Goal

In this poster, we especially focus on **the sense of speed**. Then, our research goal is **to develop the system that can augment the sense of speed**.

The additional requirements are listed below.

- ◆ The system should be inexpensive enough that a personal user can easily use it.
- ◆ The system should have a potential to be installed at cockpit.

## System Development: The Peripheral Display

- ◆ The system use LED-MATRIX-ARRAY to display optical flow on the user's peripheral area of sight.
  - ◆ Peripheral area of sight is essential to the sense of speed.
  - ◆ Optical flow is displayed on that area to augment the user's sense of speed.
  - ◆ LED-MATRIX-ARRAY is light weight and inexpensive enough comparing HMD with wide field of view.
- ◆ LED-MATRIX-ARRAY is placed around the user's eye(left/right/bottom)
- ◆ LED-MATRIX-ARRAY is driven by H8 Micro Computer

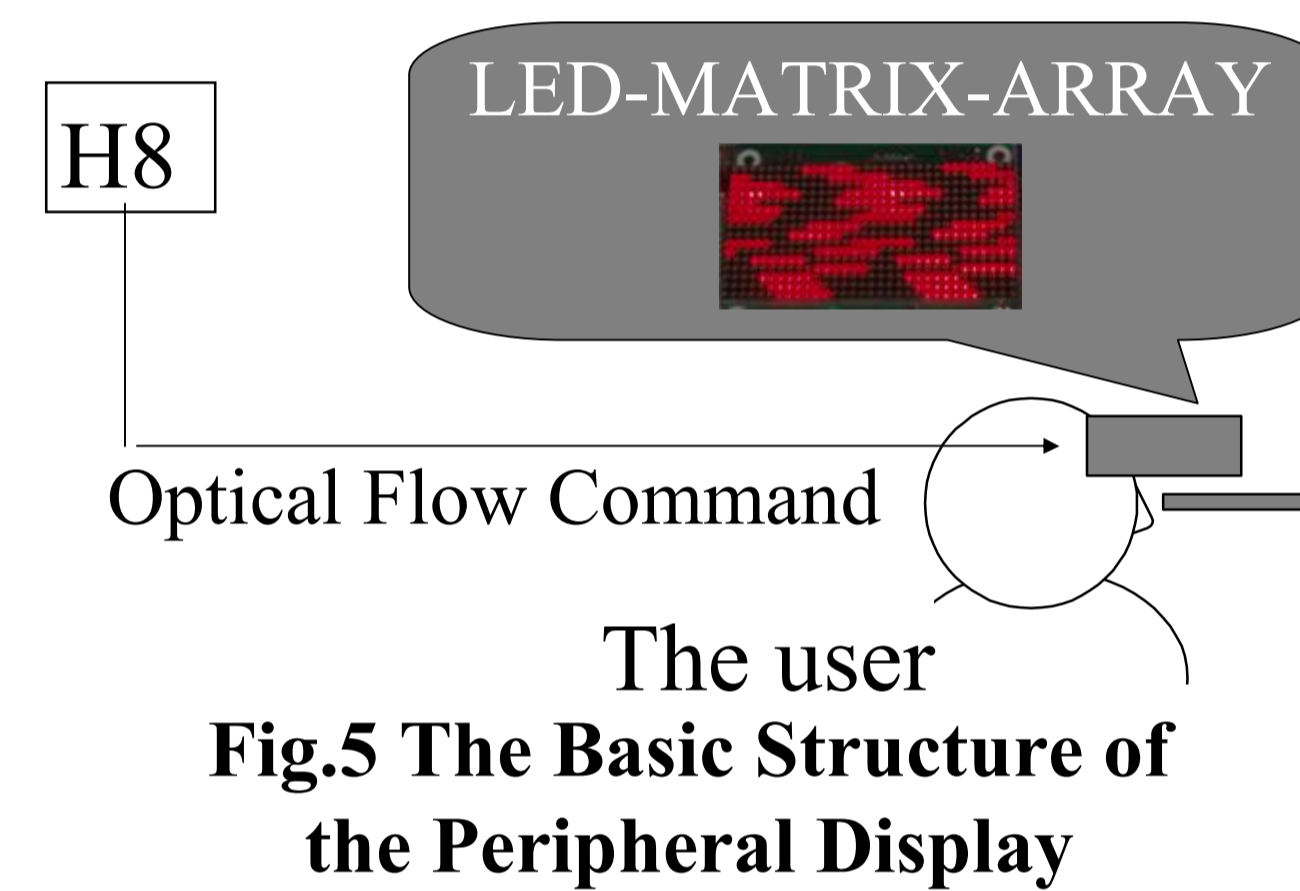


Fig.6 A User Put on the Peripheral Display (The Bottom Display is omitted)

## Experiment & Result

### Experimental Setup

- ◆ The subject puts on the peripheral display.
- ◆ The subject watches the fly-through image generated from the Microsoft Flight Simulator X.
- ◆ The light points on the peripheral display flows at constant velocity during each case.
- ◆ The speed of light points is defined independently from that of the aircraft
- ◆ Compare the PSE of speed with/without peripheral display

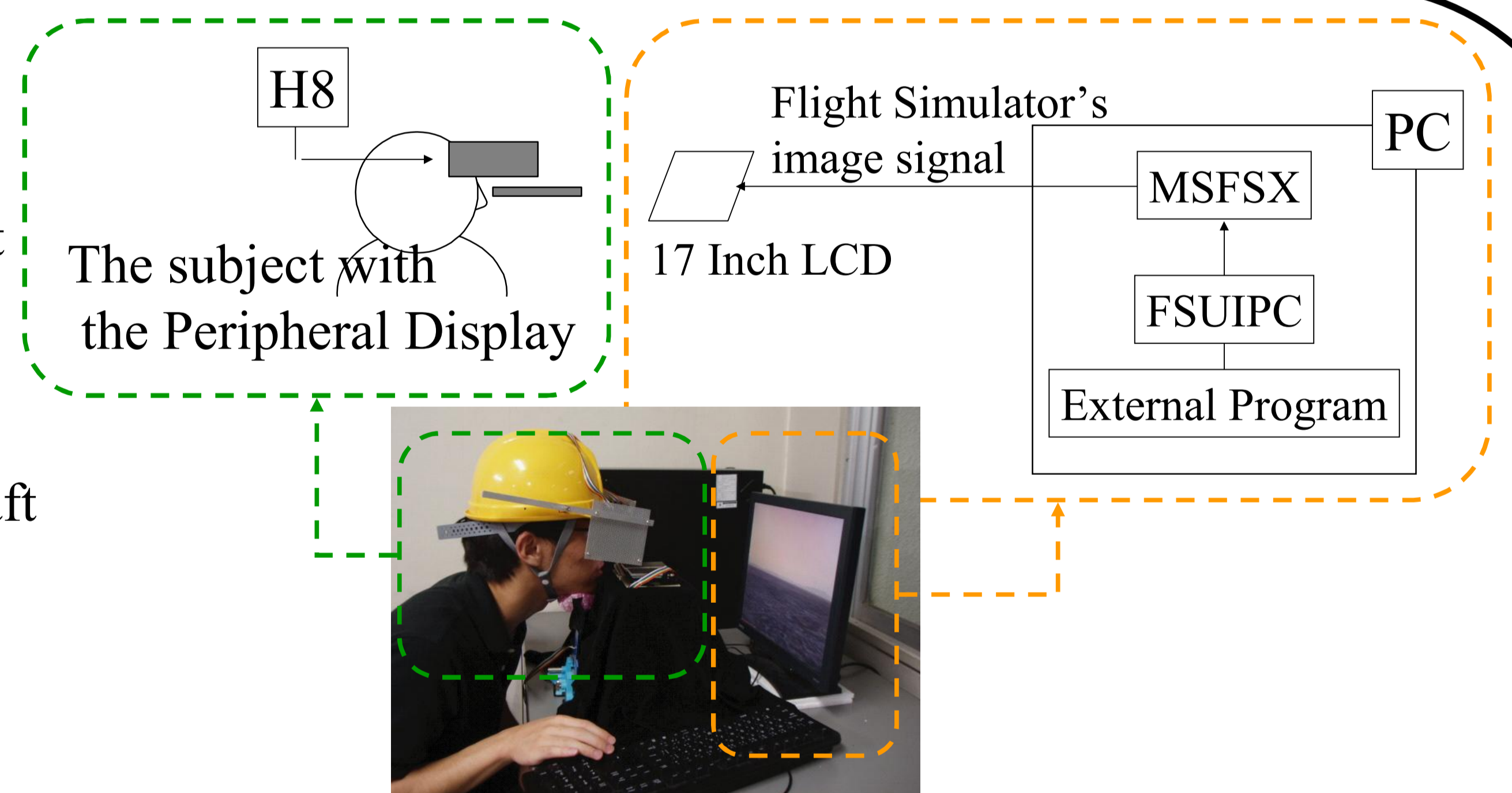
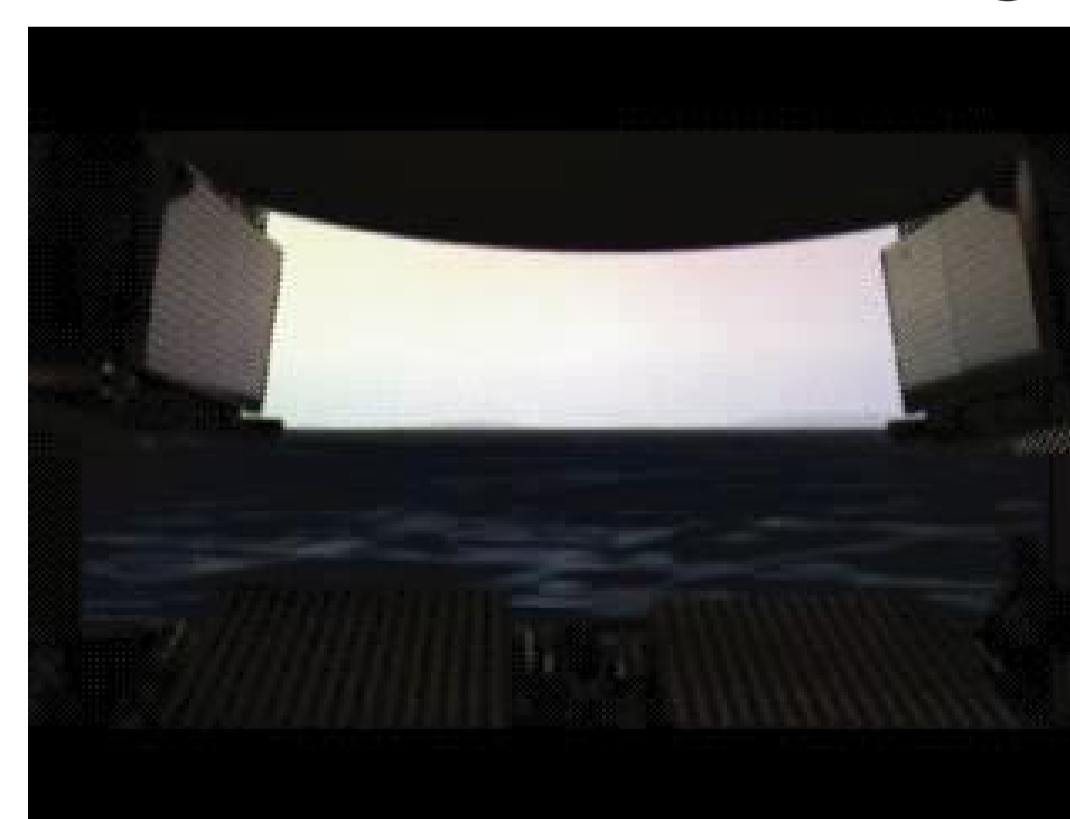
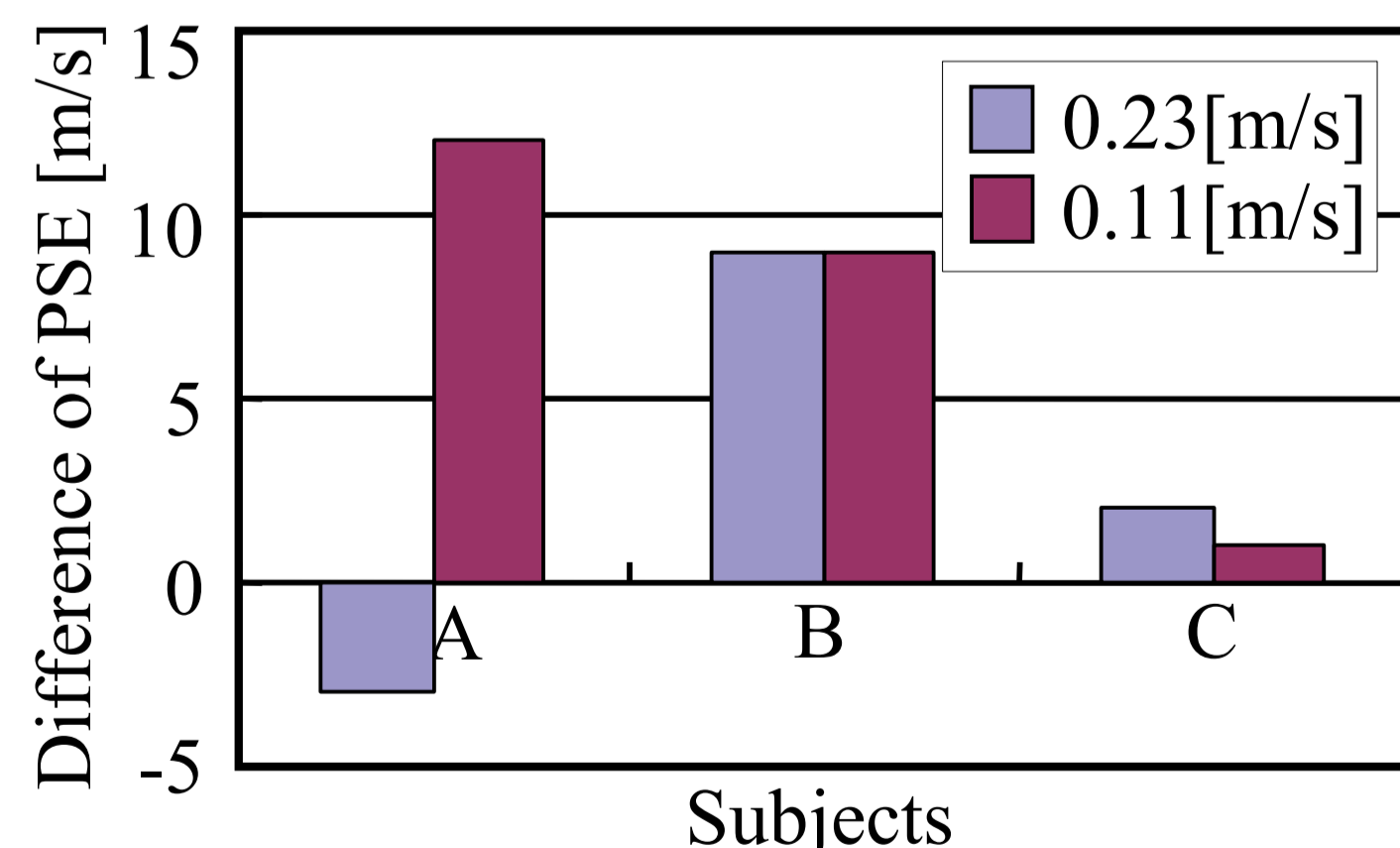


Fig.7 The Experimental Setup with Flight Simulator (Including Bottom Display)



## Conclusion & Futurework

Our research goal is to develop the system that can augment sense of self-motion.

The requirements to the system is listed below.

- \* Inexpensive enough that a personal user easily can buy the system.
- \* Have potential to be installed at cockpit

light weight

minimum necessity of hardware adaptation

less occlusion

### Related Work?

It is known that peripheral area of view is essential for sense of self-motion. Therefore, the user of visual displays with narrow field of view is often hard to feel such sensation fully. In this research, we propose the peripheral display for augmented reality of self-motion. The peripheral display consists of simple displays to stimulate the peripheral area of view of the user. **THE SYSTEM SHOULD BE ABLE TO AUGMENT THE USER'S SENSE OF SELF-MOTION.**

