

# openWARP® combiner

Application Example  
**Overlay in flight simulators**

# Latency

Important in simulation, the openWARP combiner offers very low latency.

- With genlocked signal sources, a latency below 50 lines are possible.
- Without genlock the latency of the background image can be below 50 lines, but the overlaid signals have to have up to one Frame latency.

# Genlock

- The output signal can be genlocked to one of the eight inputs or to an external Sync-Signal.
- With openWARP softsync, standard graphic cards can be genlocked without additional hardware.

# Overlay

The openWARP® combiner can overlay images from up to eight high resolution computer sources or image generators into up to four composite images.

For details about possible resolutions see:

**openWARP combiner technical description.**

([http://www.openwarp.com/download/openWARP\\_combiner\\_english.pdf](http://www.openwarp.com/download/openWARP_combiner_english.pdf))

# Overlay - Methods

## • MASK OVERLAY

Four input signals generate an overlaid output image, where:

- **Channel 1** is the background image
- **Channel 2 and 3** are blended on top of the image of channel 1
- **Channel 4** has the mask information for the blending

# Mask-Overlay

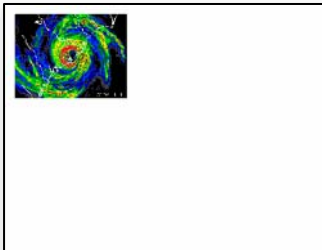
Ground-Simulation  
(Channel 1)



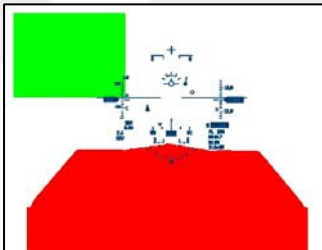
Cockpit-Simulation  
(Channel 2)



Video-Source  
(Channel 3)



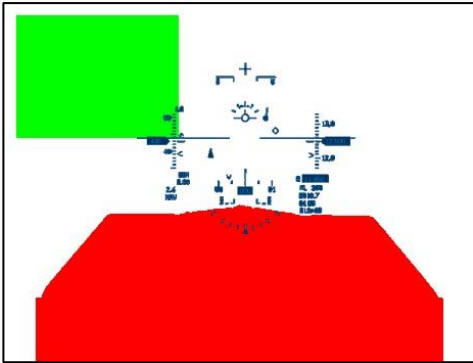
Mask information  
(Channel 4)



Resulting image



# Mask definition



**red:** On this position Channel 2 is blended over Channel 1.

**green:** On this position Channel 3 is put on top of the result of the prior overlay.

**blue:** Here the Image will be blended to a specific color on top of the result of the prior overlay.

The overlay does not work in binary mode, but relative to the intensity of the color value in the mask. “Continuous Overlays” are as well possible (alpha-Overlay).

# Transparent Mask-Overlay

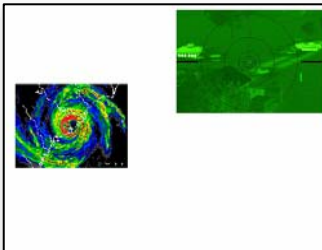
Ground-Simulation  
(Channel 1)



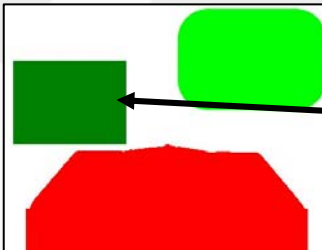
Cockpit-Simulation  
(Channel 2)



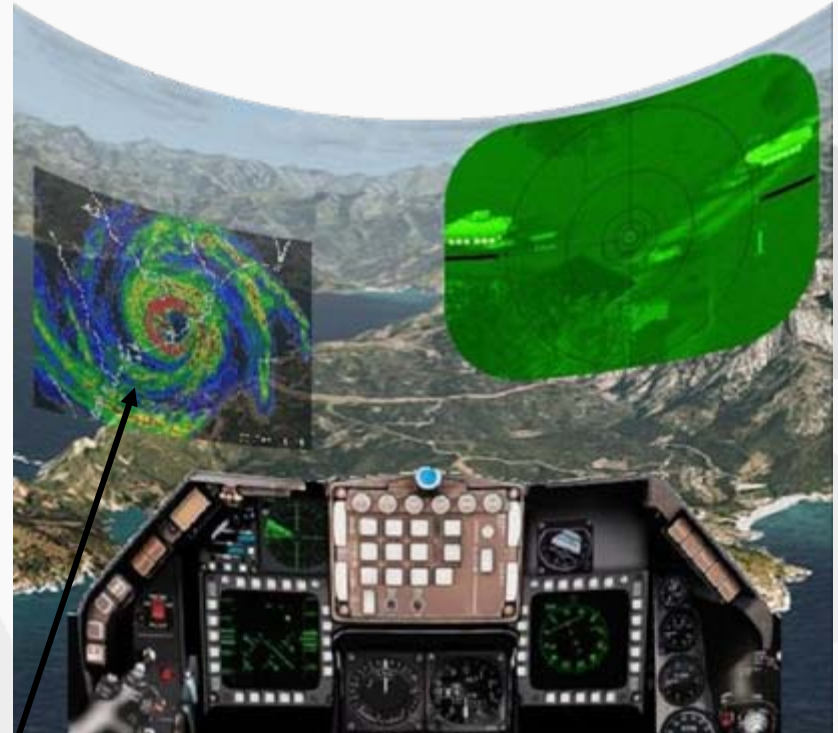
Video-Source and  
nightview-Simulation  
(Channel 3)



Mask information  
(Channel 4)



Resulting image geometrically corrected for  
projection on curved screen



The transparency is relative to the intensity  
of the color value in the mask. With this,  
'freeshape' soft edge overlays are possible.



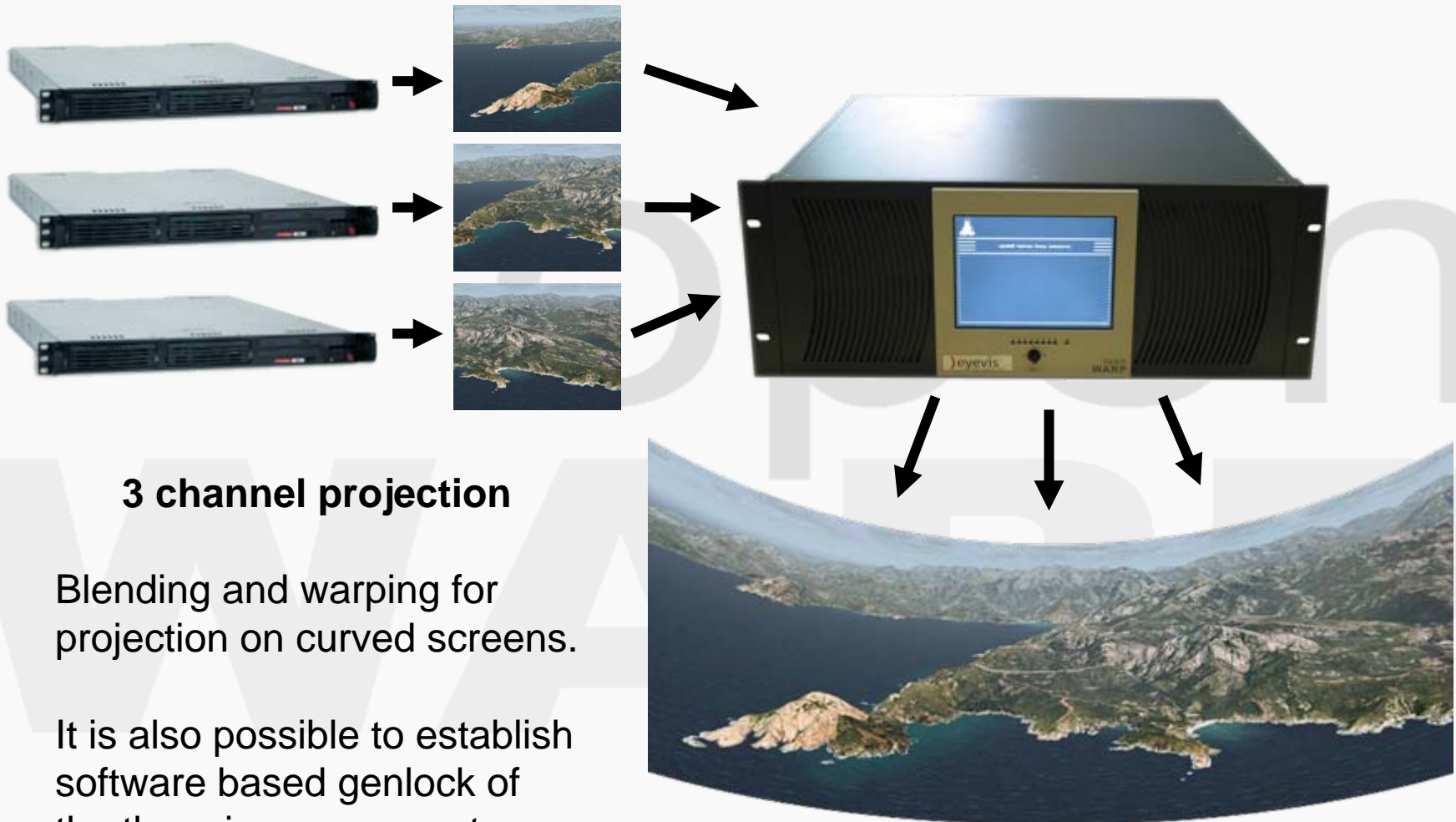
# Overlay - Methods

## •Z-ORDER OVERLAY

The input signals will be blended following a pre-defined sequence (zorder). For this type of overlay a transparent color can be set in form of a „color range“ (Chroma-Key).

The indication of a color range allows a precise adjustment of the transparent areas.

# Projection on curved screens

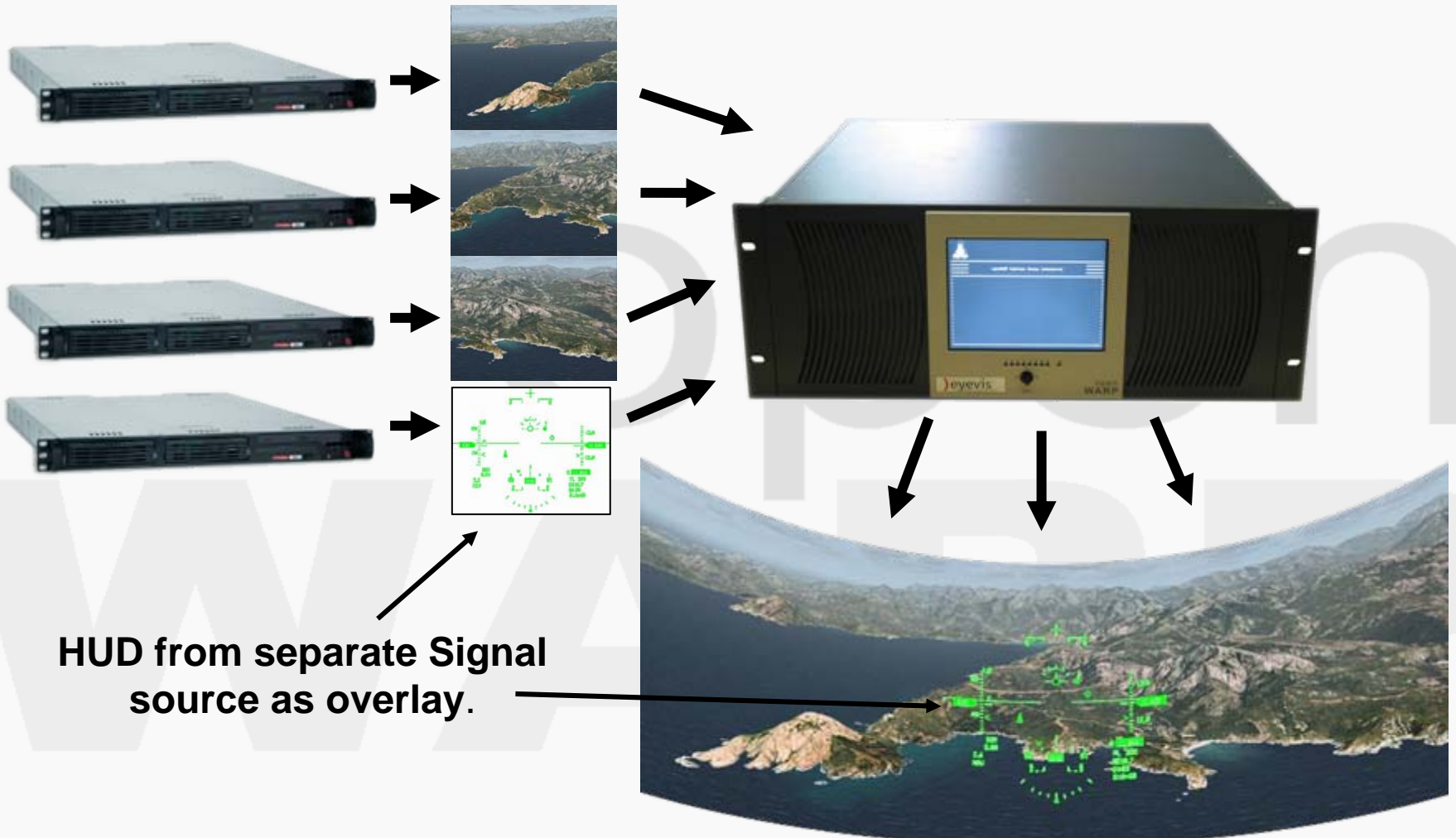


## 3 channel projection

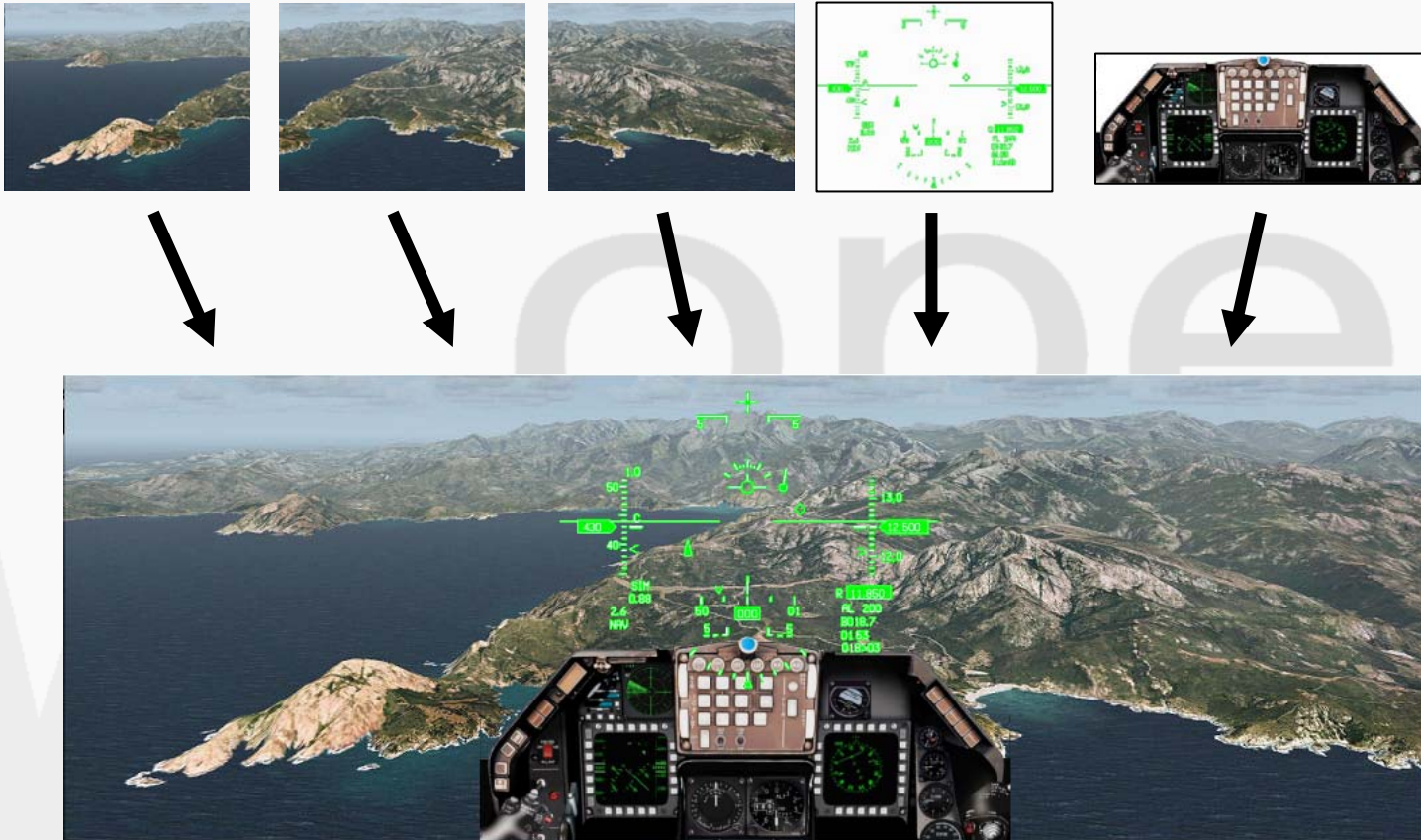
Blending and warping for projection on curved screens.

It is also possible to establish software based genlock of the three image generators.

# HUD overlay

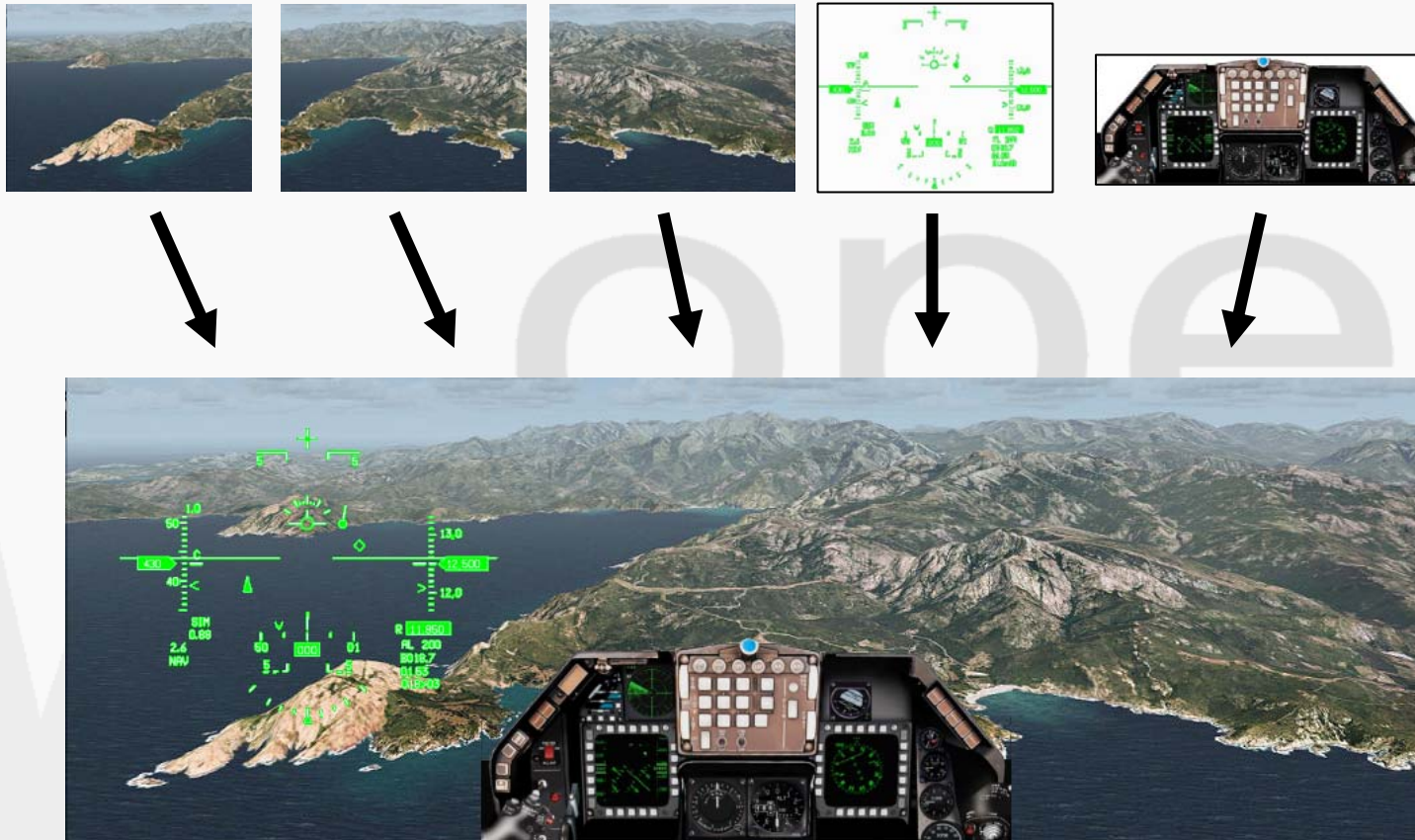


# HUD and Cockpit overlay



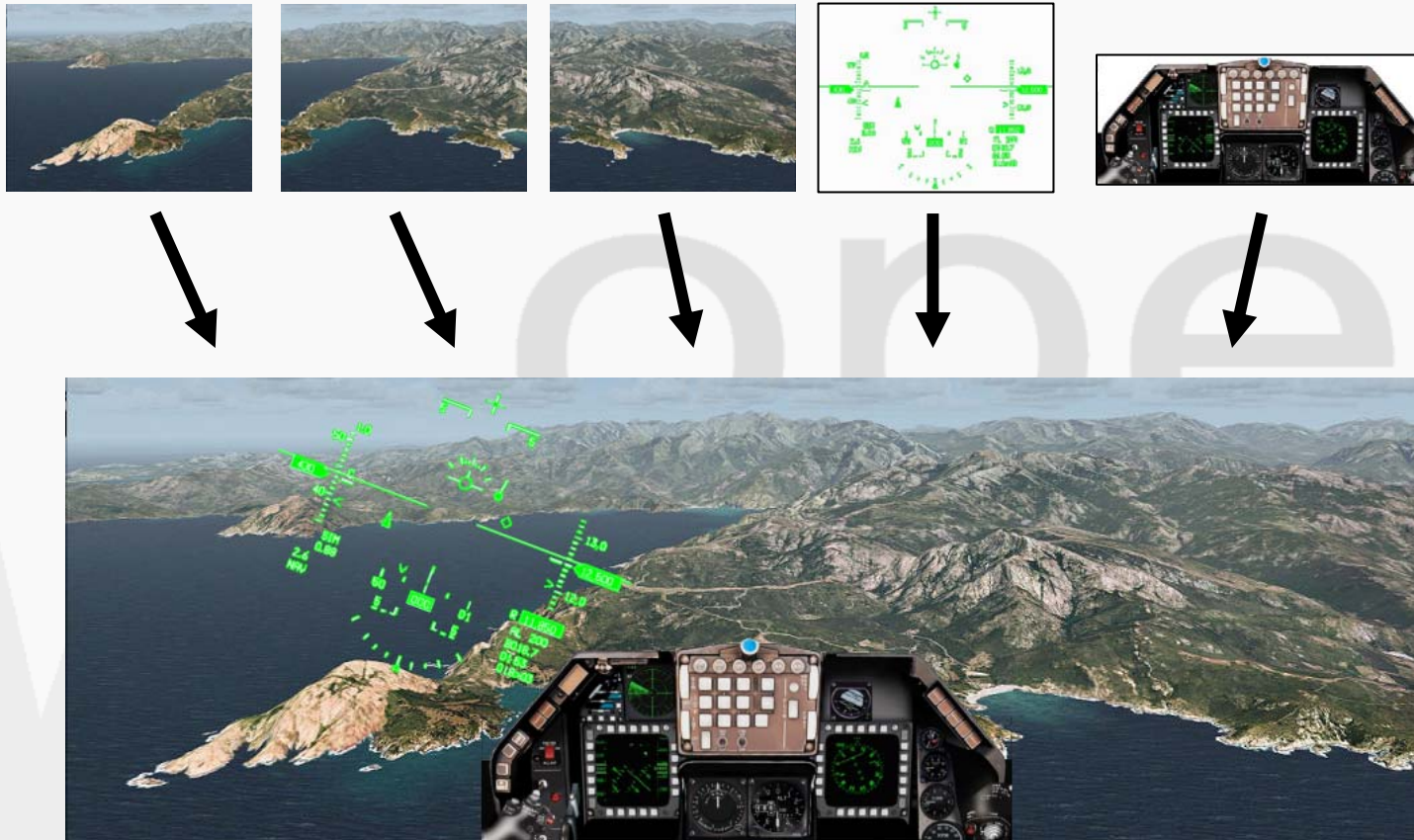
(Here without warping)

# HUD and Cockpit overlay



It is possible to freely place the overlays over the whole screen. In this demonstration, the HUD-overlay follows the pilot gaze.

# HUD and Cockpit overlay



It is also possible to use a specific geometry transformation for each overlay.  
In this demonstration, the rotation of the pilots head was corrected.

Realtime warping (apply a new transformation within one frame) is possible.

# Multiple overlays

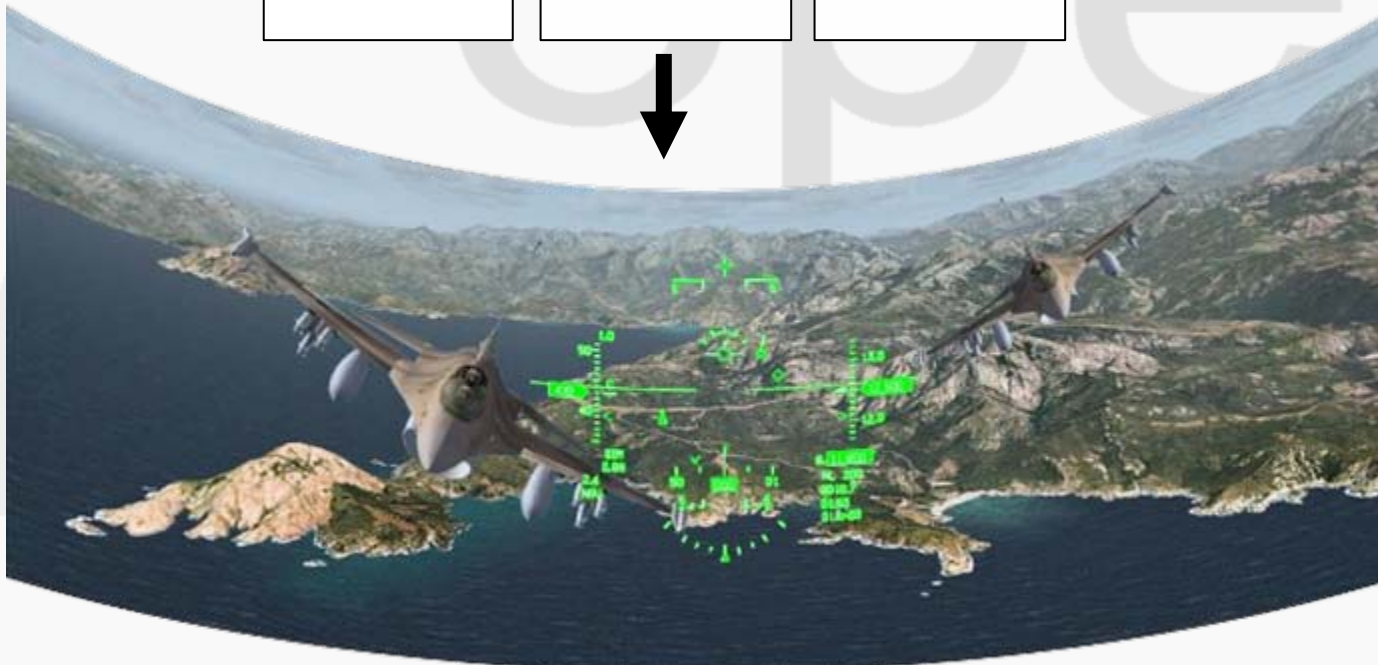
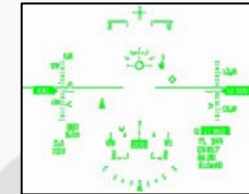
Ground-Simulation



Mission-Simulation



HUD-Simulation



# Specifications

## Inputs:

- 8 user-defined DVI-D inputs up to SXGA+ (1400x1050 @ 60Hz)

or

- 4 user-defined DVI-D inputs up to UXGA (1600x1200 @ 60Hz)

(Fully scalable to desired output resolution)

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## Outputs:

- 4 DVI-D / RGB Outputs  
(Digital Output up to 2k Resolution)

## Image Operations:

- Realtime highly flexible Image Warping (fifth-order polynomial based Geometry Distortion)
- Color correction for each input
- Edge-blending
- Pixel accurate synchronization of all inputs
- Image scaling and deinterlacing
- Image Combining / Compositing
- User defined transparent or nontransparent overlays
- Pixel accurate defining of position and size of windowed inputs