



FullView[®]
Why Settle for Less?[®]

FullView Panoramic Cameras for Telepresence and Surveillance

Vic Nalwa, PhD, *Fellow IEEE*
President, FullView, Inc.
vic@fullview.com

FullView® Cameras



© 1999 FullView



FullView's patented cameras provide unrivaled panoramic video:

- Panoramic video that is live and seamless with unequaled resolution
- Allowing any number of users to pan, tilt and zoom independently

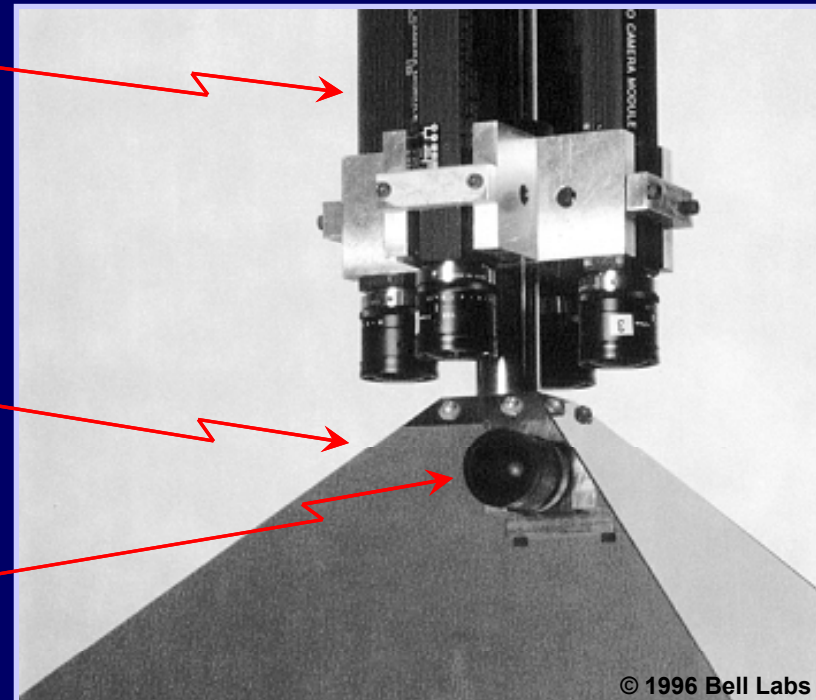
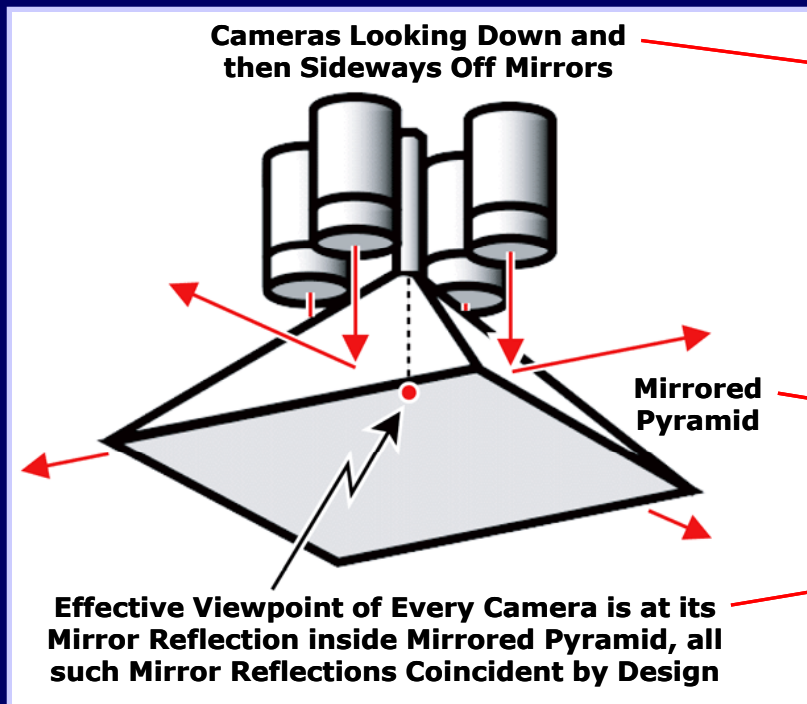
FullView® cameras were invented at Bell Labs in 1995

FullView® Camera Design

FullView's patented cameras produce live, seamless panoramic video by

- Mosaicing video from multiple cameras that are looking off mirrors such that
- Every camera is effectively looking out from the same single viewpoint

FullView has numerous patents that it has enforced successfully



FullView's Panoramas

FullView's patented panoramas — unfailingly seamless, artifact-free & blur-free — are always created in the same scene-independent way:
By placing parallax-free images from multiple cameras side-by-side after warping each image in a predetermined fashion



Images from Adjacent Cameras Abut Seamlessly Within Each Red Box

FullView® Cameras Provide Unrivaled Virtual Presence Over the Internet with each user free to pan, tilt & zoom independently



What is Virtual Presence?



Video
Conferencing



Virtual
Attendance



Interactive
Viewing



Distance
Learning



Remote
Monitoring

Virtual Presence describes

- The ability of one or more remote users to each look around the same scene
- Simultaneously, seamlessly and independently
- With each user free to pan, tilt & zoom without affecting any other user

Virtual Presence is key to Telepresence

FullView® Cameras Provide Unrivaled Situational Awareness on U.S. Aircraft Carriers by Day & Night



USS George Washington, 2006, by Day



USS George Washington, 2006, by Night



Two FullView
Cameras on
Carrier Island



FullView FC-110

What is Situational Awareness?



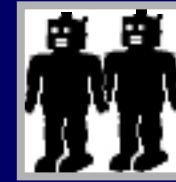
Military



Police



Facilities



Robots

Situational awareness describes

- A real-time awareness of one's surroundings without distraction or clutter
- To recognize the significance of what's seen, predict what might happen next, and react as quickly as possible

Situational Awareness is key to Surveillance

Alternatives to FullView: Disparate Images from Outwardly Pointing Cameras

Three Cameras
Centered Above
Three Life-Size
Screens Displaying
Disparate Views of
Remote Participants



Telepresence currently typically employs custom-built rooms in which

- Participants face life-size video screens that display remote participants
 - Each participant is restricted to sit wholly within the field of view of a single one of many cameras atop screens, rather than free to sit anywhere

This paradigm assumes life-size video is key to Telepresence

FullView Offers an Alternative Paradigm for Telepresence

FullView offers an alternative paradigm for Telepresence in which

- Local participants face each other around a single FullView camera, with
 - Each participant free to see, on a personal display, any remote participant

This paradigm assumes self determination is key to Telepresence



Single FullView-Licensed Camera Surrounded by Individual Displays, One Per Participant



Each Personal Display Might Show a Full 360° Panorama that can be Zoomed Into at Will in One or More Directions

Alternatives to FullView: Disparate Images from Outwardly Pointing Cameras



Situational Awareness typically requires users to mentally integrate disparate overlapping images — a process that is slow, crude, taxing and error-prone



FullView, in contrast, offers users seamless panoramas that provide immediate, accurate and comprehensive Situational Awareness

FullView Offers Unrivaled Situational Awareness for Surveillance



Westchester County Airport, NY, Dec 2007

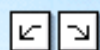
Each FullView panorama above is repeated beyond 360° to highlight that it wraps around a full circle, missing nothing

Alternatives to FullView: Composite Images from Outwardly Pointing Cameras

Golden Gate Bridge

[Street View Help](#)

[Full-screen](#)



**Bridge is Split in Two at Seam
Between Two Cameras Despite
Unconstrained Image Processing**



Google's Street View Camera



Golden Gate Bridge

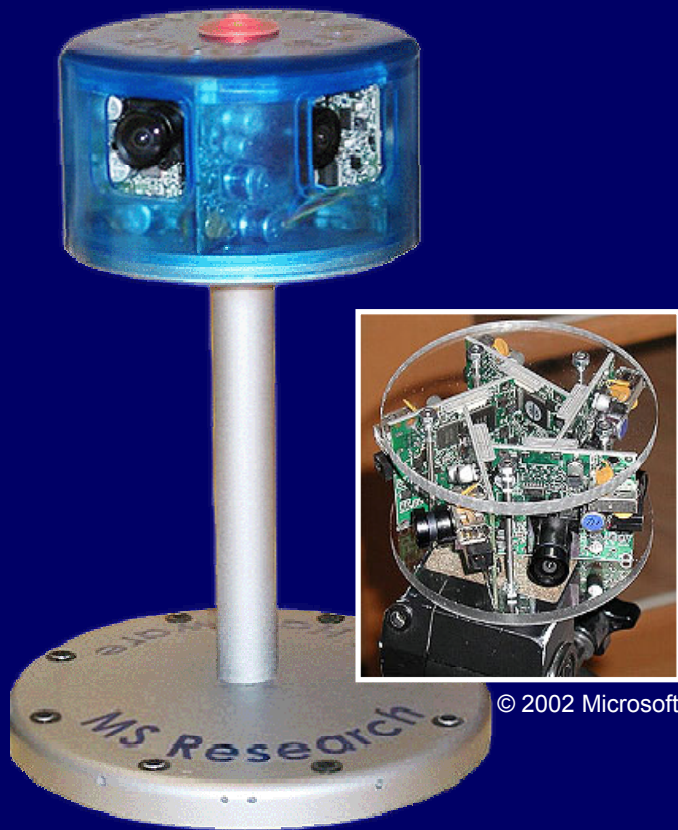


**Google's Street View
Using Outwardly Pointing Cameras**

© 2008 Google

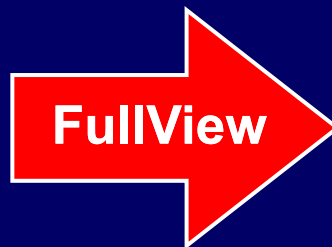
Unlike FullView's images, composite images from outwardly pointing cameras unfailingly exhibit artifacts and blurring, as in Google's Street View above

Microsoft RoundTable Too Was Previously Using Outwardly Pointing Cameras



© 2002 Microsoft

Cameras Looking Out Directly,
Before FullView License



© 2008 FullView

Cameras Looking Out Off Mirrors,
After FullView License

Until Microsoft licensed FullView's design, its RoundTable camera was using outwardly pointing cameras to produce composite panoramas, like Google's Street View, and exhibiting artifacts and blurring, also like Google's Street View

Alternatives to FullView: Fisheye Lenses



As a fisheye image is circular, it can occupy only about half a single camera's rectangular image and so its resolution is many times lower than that of a FullView image, which is a mosaic of images from several cameras

What FullView Offers You

What FullView offers you, then, is

- Unrivaled, live, seamless, high-resolution panoramic video that is free of artifacts and blurring
- Unlimited number of remote simultaneous users each free to pan, tilt & zoom independently
- License to patented and mature technology invented at Bell Labs Research in 1995

Alternatives to FullView exhibit one or more of

- Much lower resolution
- Disparate images that must be integrated mentally
- Composite images that are artifact-ridden and blurred