



US005566073A

# United States Patent [19]

[11] Patent Number: **5,566,073**

Margolin

[45] Date of Patent: **Oct. 15, 1996**

2

- [54] **PILOT AID USING A SYNTHETIC ENVIRONMENT**
- [76] Inventor: **Jed Margolin**, 3570 Pleasant Echo Dr., San Jose, Calif. 95148-1916
- [21] Appl. No.: **513,298**
- [22] Filed: **Aug. 9, 1995**

### Related U.S. Application Data

- [63] Continuation of Ser. No. 274,394, Jul. 11, 1994, abandoned.
- [51] **Int. Cl.<sup>6</sup>** ..... **G06F 3/14; G09B 9/30**
- [52] **U.S. Cl.** ..... **364/449; 364/456; 364/457; 340/990; 340/995; 395/127; 395/129**
- [58] **Field of Search** ..... **364/449, 455, 364/456, 457, 460; 340/990, 995; 345/7, 11, 23, 27; 395/119, 124, 125, 127, 129**

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,028,725	6/1977	Lewis	340/980
4,213,252	7/1980	Sullivan et al.	395/125
4,445,118	4/1984	Taylor et al.	342/357
4,468,793	8/1984	Johnson et al.	375/97
4,485,383	11/1984	Maher	342/352
4,599,620	7/1986	Evans	342/357
4,660,157	4/1987	Beckwith et al.	395/101
4,715,005	12/1987	Heart	395/125
4,910,674	3/1990	Lerche	364/443
4,954,837	9/1990	Baird	364/449
5,005,148	4/1991	Behensky et al.	364/578
5,072,396	12/1991	Fitzpatrick et al.	364/450
5,101,356	3/1992	Timothy et al.	364/449
5,140,532	8/1992	Beckwith et al.	395/101
5,153,836	10/1992	Fraughton et al.	364/461
5,179,638	1/1993	Dawson et al.	395/125
5,185,610	2/1993	Ward et al.	342/357
5,192,208	3/1993	Ferguson et al.	342/169
5,208,590	5/1993	Pitts	340/973
5,296,854	3/1994	Hamilton et al.	340/980
5,302,964	4/1994	Lewins	345/7
5,317,689	5/1994	Nack et al.	395/163
5,334,991	8/1994	Wells et al.	340/705

### OTHER PUBLICATIONS

John Gallant, EDN magazine; Jan. 7, 1993; pp. 31-42 "System revolutionizes surveying and navigation".  
 Bill Clarke; Aviator's Guide to GPS; 1994; pp. 2 and 3 "GPS Program History".  
 Magellan Systems Corp, 960 Overland Ct, San Dimas, CA 91773 Sales brochure for GPS receiver with moving map display (MAP 7000), Jan. 1994.  
 Trimble Navigation; 2105 Donley Dr, Austin TX 78758 Sales brochure for Airborne GPS receiver (TNL-1000) (no date is available).  
 Jeppesen Sanderson, Inc; 55 Inverness Drive East, Englewood, CO 80112 Sales brochure for navigation data base in computer readable form.  
 U.S. Geological Service, Earth Science Information Center, Menlo Park, CA Sales brochure for Digital Elevation Model data, Jun. 1993.

(List continued on next page.)

*Primary Examiner*—Kevin J. Teska  
*Assistant Examiner*—Tan Nguyen  
*Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor & Zafman

### [57] ABSTRACT

A pilot aid using synthetic reality consists of a way to determine the aircraft's position and attitude such as by the global positioning system (GPS), a digital data base containing three-dimensional polygon data for terrain and man-made structures, a computer, and a display. The computer uses the aircraft's position and attitude to look up the terrain and manmade structure data in the data base and by using standard computer graphics methods creates a projected three-dimensional scene on a cockpit display. This presents the pilot with a synthesized view of the world regardless of the actual visibility. A second embodiment uses a head-mounted display with a head position sensor to provide the pilot with a synthesized view of the world that responds to where he or she is looking and which is not blocked by the cockpit or other aircraft structures. A third embodiment allows the pilot to preview the route ahead or to replay previous flights.

**37 Claims, 13 Drawing Sheets**

