

X-Sender: [redacted]  
X-Mailer: QUALCOMM Windows Eudora Version 5.1  
Date: Mon, 19 May 2003 11:15:04 -0400  
To: [redacted]  
From: "Barry V. Gibbens, LaRC" <[redacted]>  
Subject: Fwd: Re: X-38, Synthetic Vision, Patents, Claim for Compensation  
Cc: "Linda B. Blackburn" <[redacted]>  
robin W Edwards <[redacted]>  
"Kurt G. Hammerle" <[redacted]>

b(6)

[redacted]

b(5)

Date: Tue, 13 May 2003 17:14:07 -0400  
To: "Jed Margolin" <[redacted]>  
From: "Kurt G. Hammerle @ Langley Research Center" <[redacted]>  
Subject: Re: X-38, Synthetic Vision, Patents, Claim for Compensation  
Cc: linda

b(6)

Dear Mr. Margolin:

This reply acknowledges my receipt of your correspondence below.

Sincerely,  
Kurt Hammerle

At 11:13 PM 5/12/2003 -0700, you wrote:  
Dear Mr. Hammerle,

This is in reference to our telephone conversation of May 12, 2003, where I expressed my belief that NASA may have used one or more of my patents in connection with the X-38 project and may be using one or more of my patents in other projects using Synthetic Vision.

Summary

[redacted]

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

[REDACTED]

0001

b(6)

phone: (757) 864-7141  
fax: (757) 864-9190  
email: [REDACTED]  
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

NEW E-MAIL ADDRESS: Please note that effective immediately, my e-mail address is now [REDACTED]. Please update your mail systems accordingly. Thanks.

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

[REDACTED]

phone: (757) 864-7141  
fax: (757) 864-9190  
email: [REDACTED]  
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

NEW E-MAIL ADDRESS: Please note that effective immediately, my e-mail address is now [REDACTED]. Please update your mail systems accordingly. Thanks.

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

[REDACTED]

phone: (757) 864-7141  
fax: (757) 864-9190  
email: [REDACTED]  
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

NEW E-MAIL ADDRESS: Please note that effective immediately, my e-mail address is now [REDACTED]. Please update your mail systems accordingly. Thanks.

**FW: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project**

From: FEIN, EDWARD K. (JSC-HA) (NASA) [REDACTED]  
To: Kennedy, Alan [REDACTED]

Date: Jul 09 2004 - 4:17pm  
Viewed On: -- ?date?

Alan ... Not sure I forwarded this one.

-Ed

-----Original Message-----

From: Mike Abernathy [mailto: [REDACTED] b(e)]  
Sent: Monday, June 28, 2004 9:10 AM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Subject: RE: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project

Hi Ed,

Frank is back in West Virginia presenting SmartCam3D for NASA Software of the Year.

What kinds of things would be used to demonstrate that a patent is invalid? Is it necessary to show that people had done this before the patent was issued or before the patent application?

This patent claims in the 1995 application that it developed the method of pilot aid using a 3D synthetic environment. But at this webpage, you can see that a Dutch university had already flown such an environment in 1994:

<http://www.synthetic-vision.tudelft.nl/>

(See First flight of the DELPHINS Tunnel-in-the-sky display at the bottom of the list of links).

The patent claims a pilot aid using a synthetic environment – if the method were used for another purpose than aiding the pilot like for example aiding a camera operator instead would that be infringement?

What bothers me about this patent is that it appears to be not a patent on peanut butter, nor on jelly, but rather a patent on the method of making a sandwich by combining the two. This to me appears to be a non-novel use of existing technologies to create a “method”. Everyone familiar with the field of synthetic vision is boggled that such a patent has been issued because it is obvious use of existing technologies.

Let me know how I can help.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.  
[REDACTED] b(e)

[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto: [REDACTED] b(e)]  
Sent: Thursday, June 24, 2004 9:01 AM  
To: DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)  
Cc: [REDACTED] WHITTINGTON, JAMES (JSC-HA) (USA); DICKERSON, MARY E. (JSC-HA) (NASA); MURATORE, JOHN F. (JSC-MS) (NASA)  
Subject: RE: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project

Frank ... Haven't heard from you in a while. Where are we on this project? I just spoke with Mike Abernathy, Rapid Imaging, one of our SBIR contractors. He said he'd be happy to help us. He has information which may

04603

be relevant to antedating the subject patent.

-Ed

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA)

Sent: Monday, February 23, 2004 10:10 AM

To: DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)

Cc: 'Kennedy, Alan'; MURATORE, JOHN F. (JSC-MS) (NASA)

Subject: RE: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project

Thanks, Frank!

-Ed

-----Original Message-----

From: DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)

Sent: Friday, February 20, 2004 8:16 PM

To: MURATORE, JOHN F. (JSC-MS) (NASA); FEIN, EDWARD K. (JSC-HA) (NASA)

Cc: 'Kennedy, Alan'

Subject: RE: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project

[REDACTED]

b(5) [REDACTED]

[REDACTED]

Thanks,

Frank Delgado

Frank Delgado

Building 1, Room 920C

Phone: [REDACTED]

Fax: [REDACTED]

Pager: [REDACTED]

b(6)

-----Original Message-----

From: MURATORE, JOHN F. (JSC-MS) (NASA)

Sent: Friday, February 20, 2004 6:37 PM

To: FEIN, EDWARD K. (JSC-HA) (NASA); DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)

Cc: 'Kennedy, Alan'

Subject: RE: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project

[REDACTED]

b(5)

jm

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA)  
Sent: Friday, February 13, 2004 10:52 AM  
To: MURATORE, JOHN F. (JSC-MS) (NASA)  
Cc: 'Kennedy, Alan'  
Subject: Administrative Claim of Jed Margolin for Infringement of U.S. Patent 5,904,724 by the X-38 Project

b(5)  
[Redacted]

-Ed

Edward K. Fein  
Intellectual Property Counsel  
NASA Johnson Space Center

[Redacted]

Fax: [Redacted]  
E-Mail: [Redacted]


b(6)

**FW: Margolin Infringement**

From: FEIN, EDWARD K. (JSC-HA) (NASA) <[Redacted]>  
To: DICKERSON, MARY E. (JSC-HA) (NASA) <[Redacted]>  
Date: Jul 09 2004 - 2:43pm  
Viewed On: -- ?date?

[Redacted]

b(6)

- 
- RE: - 267k
- RE: - 100k
- RE: - 9.7k
- FW: - 12k
- FW: - 12k

-----Original Message-----  
From: FEIN, EDWARD K. (JSC-HA) (NASA)  
Sent: Friday, July 09, 2004 2:41 PM  
To: 'Kennedy, Alan'

Cc: 'Bayer, Kathy';  
Subject: Margolin Infringement

b(5)

[Redacted]

☑ RE:

From: Mike Abernathy <[Redacted]>  
To: 'FEIN, EDWARD K. (JSC-HA) (NASA)' <[Redacted]> b(6)  
Date: Jun 28 2004 - 1:29pm  
Viewed On: -- ?date?

☑ FW: Patents 5566073 and 5904724

From: FEIN, EDWARD K. (JSC-HA) (NASA) <[Redacted]> b(6)  
To: 'CULBERT, CHRISTOPHER J. (CHRIS) (JSC-ER) (NASA)' <[Redacted]>  
Date: Jul 13 2004 - 1:26pm  
Viewed On: -- ?date?

[Redacted] b(5)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA)  
Sent: Tuesday, July 13, 2004 8:37 AM  
To: BENZ, FRANK J. (JSC-EA) (NASA); GUY, WALTER W. (JSC-ER) (NASA); FARMER, CLIFF L. (JSC-ER) (NASA)  
Cc: GILBERT, CHARLENE E. (JSC-HA) (NASA); JAMES, JOHN E. (JACK) (JSC-HA) (NASA)  
Subject: Patents 5566073 and 5904724

b(5)

[Redacted]

Edward K. Fein  
Intellectual Property Counsel  
NASA Johnson Space Center  
Mail Code HA

[Redacted] b(6)  
Fax: [Redacted]  
E-Mail: [Redacted]

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA)  
Sent: Monday, July 12, 2004 11:00 AM  
To: DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA); 'Kennedy, Alan'; [REDACTED] b(6)  
Cc: FARMER, CLIFF L. (JSC-ER) (NASA); MURATORE, JOHN F. (JSC-MS) (NASA)  
Subject: RE: Patents 5566073 and 5904724

Frank ... Thank you so much for your detailed analysis and research on this matter. I know that you invested considerable time into assisting in the defense of this infringement claim. Your effort, together with valuable input from Mike Abernathy, will be the basis for NASA's denying the administrative claim. There is always a chance that Margolin will file a law suit, but with all of the information you guys have turned up, I think the chance of that is small.

Thanks again!

-Ed

Edward K. Fein  
Intellectual Property Counsel  
NASA Johnson Space Center

[REDACTED] b(6)  
Fax: [REDACTED]  
E-Mail: [REDACTED]

Hi,

The material I sent you was actually with reference to the other Margolin patent 5,506,673.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.

[REDACTED] b(6)  
[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto:[REDACTED]] b(6)  
Sent: Monday, June 28, 2004 9:13 AM  
To: 'Mike Abernathy'  
Cc: 'Kennedy, Alan'  
Subject: RE:

Thanks, Mike!

-Ed

-----Original Message-----

From: Mike Abernathy [mailto:[REDACTED]] b(6)  
Sent: Monday, June 28, 2004 9:48 AM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Subject:  
Ok, one more:

04607

G. Sachs:

[Redacted]

b(4)

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.  
(505) 265 7020

[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

✉ RE: FW: Jed Margolin (I 222)

From: DICKERSON, MARY E. (JSC-HA) (NASA) <[Redacted]>  
To: Kathryn L. Bayer <[Redacted]>  
CC: FEIN, EDWARD K. (JSC-HA) (NASA) <[Redacted]>  
Date: Jun 09 2004 - 1:16pm  
Viewed On: -- ?date?

b(6)

[Redacted]

b(5)

-----Original Message-----

From: Kathryn L. Bayer [mailto:[Kathy.Bayer@nasa.gov](mailto:Kathy.Bayer@nasa.gov)]  
Sent: Wednesday, June 09, 2004 1:10 PM  
To: DICKERSON, MARY E. (JSC-HA) (NASA)  
Subject: Re: FW: Jed Margolin (I 222)

[Redacted]

b(5)

At 01:07 PM 6/9/2004 -0500, you wrote:

> [Redacted]  
> [Redacted]  
> [Redacted]  
> [Redacted]

b(5)

>-----Original Message-----

>From: FEIN, EDWARD K. (JSC-HA) (NASA)



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---

From: Robert Adams-OTG [mailto: [REDACTED] b(6)]  
Sent: Thursday, February 12, 2009 5:35 PM  
To: McNutt, Jan (HQ-MC000)  
Subject: RE: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

Jan,

We have now licensed Cobham the parent company of Chelton Flight System and expect to wrap up a license for Rockwell in the coming weeks.

Attached you will find the voicemail from Cobham's attorney that concluded a yearlong drawn out process; as I write this letter we await the signed hard copies in the mail.

We shall be filing in Federal Court against Garmin in the coming months as they are the last one who is being definite due to their bad advice from a money hungry attorney.

Can you please provide me a status as to the resolve regarding the issues between our two companies'?

With the recent new licensee's I remain optimistic that this business matter can be resolved peacefully between our two companies.

Thank you,

Robert

From: McNutt, Jan (HQ-MC000) [mailto: [REDACTED] b(6)]  
Sent: Thursday, January 22, 2009 1:16 PM  
To: Robert Adams-OTG  
Subject: RE: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

04613

Dr. Adams,

We are close to a decision on this matter. I will inform you of our progress (possibly decision) in the next couple of weeks.

Regards,

Jan S. McNutt  
Senior Attorney (Commercial)

[REDACTED]

b(6)

---

From: Robert Adams-OTG [mailto:[REDACTED]]  
Sent: Saturday, December 27, 2008 7:27 PM  
To: McNutt, Jan (HQ-MC000)  
Subject: FW: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

b(6)

Mr. McNutt,

Please advise us as to our progress of settlement on this matter and NASA taking a license of our patented technology.

I will advise you that a lack of response or no response could be a violation of Rule 11, thus your continued delay tactics could allow us to move forward and ask the court to impose an appropriate sanction.

Dr. Adams

From: Robert Adams-OTG [mailto:[REDACTED]]  
Sent: Friday, October 03, 2008 5:18 AM  
To: 'McNutt, Jan (HQ-MC000)'  
Subject: RE: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

b(6)

Mr. McNutt,

Our company provided you're everything that had been requested by your counsel as all of that is legal and current, for you to say otherwise is nothing more than an attempt to delay the process and shall be brought up latter to the judge should this matter go to court.

Dr. Adams

From: McNutt, Jan (HQ-MC000) [mailto: [REDACTED] b(6)]  
Sent: Wednesday, October 01, 2008 7:58 AM  
To: Robert Adams-OTG  
Subject: RE: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

Dear Mr. Adams,

b(4) [REDACTED]  
[REDACTED] We trust that you have forwarded our letter of August 20, 2008 to your attorney Mr. Larry Oliverio and anticipate that he will be responding to the more detailed and also more current information we requested in that letter.

Regards,

Jan S. McNutt  
Senior Attorney (Commercial)  
Office of the General Counsel  
NASA Headquarters

[REDACTED] b(6)  
[REDACTED]  
HYPERLINK "mailto: [REDACTED]"

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From: Robert Adams-OTG [mailto: [REDACTED] b(6)]  
Sent: Tuesday, September 30, 2008 1:04 PM  
To: McNutt, Jan (HQ-MC000)

04615

Subject: FW: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

Sir,

b(4)

Dr. Adams

From: Robert Adams-OTG [mailto: [REDACTED] b(6)  
Sent: Monday, August 25, 2008 3:48 PM  
To: 'McNutt, Jan (HQ-MC000)'; [REDACTED]  
Subject: Jan S. McNutt, Please see the attached letter; it is your response to your most recent letter.

Sent via U.S. Mail with tracking number

Jan S. McNutt,

Please see the attached letter; it is your response to your most recent letter.

Thank you,

Dr. Robert Adams – CEO

Optima Technology Group

[REDACTED] Phone

[REDACTED] Fax

b(6)

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04616

# Synthetic Vision Technology for Unmanned Aerial Vehicles: Historical Examples and Current Emphasis

Michael Abernathy<sup>a</sup>, Mark Draper<sup>b</sup>, Gloria Calhoun<sup>b</sup>

<sup>a</sup> Rapid Imaging Software, Inc.

<sup>b</sup> Air Force Research Laboratory, Wright-Patterson Air Force Base, OH

## Background – Flight Simulation Real-Time 3D Computer Graphics

In the aviation context, synthetic vision can be described, in simplest terms, as the use of a computer and a terrain database to generate a simulated 3D view of an environment in real time. The application of synthetic vision to remotely piloted vehicles (RPVs) and unmanned aerial vehicles (UAVs) goes back three decades and has recently evolved from a piloting aid for UAV pilots to a potentially powerful tool for sensor operators [1]. It is anticipated that integration of this technology can ameliorate many factors that currently compromise the utility of UAV video imagery: narrow camera field-of-view, degraded datalinks, poor environmental conditions, limited bandwidth, and highly cluttered visual scenes such as in urban areas. With this technology, spatially-relevant information, constructed from databases (e.g., terrain elevation, cultural features, maps, photo imagery) as well as networked information sources, can be represented as computer-generated imagery and symbology overlaid conformal, in real time, onto a dynamic video image display. This computer-generated imagery and symbology appears to co-exist with real objects in the visual scene, highlighting points of interest and helping the operator maintain situation awareness of the environment. The purpose of this paper is to briefly summarize the evolution of this technology towards RPV/UAV applications.

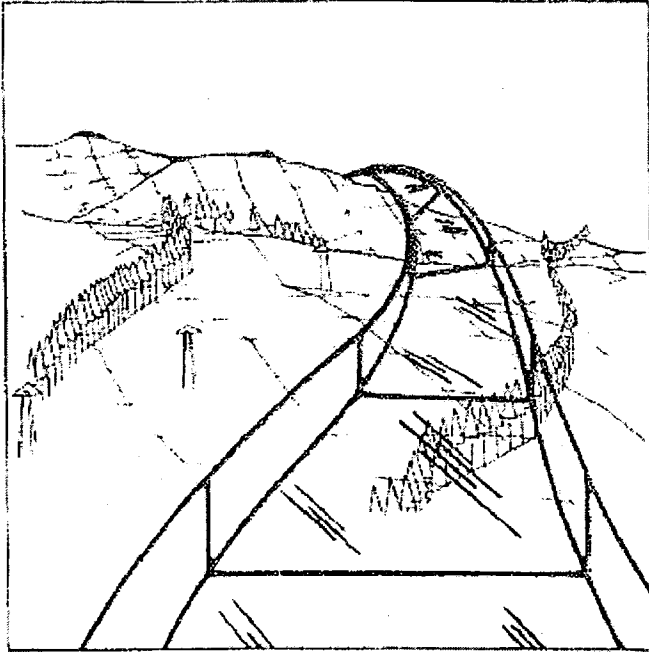
The story begins in the 1970's when the use of computers to create 3D real-time out-the-window synthetic environments was beginning to see wide acceptance for training pilots of manned aircraft. Evans and Sutherland (E & S) had seen the commercial potential for flight simulation and had introduced special purpose graphics computers, like their Picture System, which transformed and projected 3D terrain data as simple 3D polygons to a pilot's perspective view in real-time (30 Hz) [2]. In 1975 an engineering student named Bruce Artwick wrote "Flight Simulator" for the Apple II computer [3]. He formed a company and in 1980 marketed the product that ultimately became Microsoft Flight Simulator®.

In fact it was this phenomenon – the emergence of computer flight simulation in the 1970s – that appears to have sparked a monumental amount of research. The Air Force began its Visually Coupled Airborne Systems Simulator (VCASS) program, with a particular eye toward future generation fighters [4]. NASA was developing synthetic vision for the Super Sonic Transport and for its High Maneuverability Aircraft Testbed (HiMAT) RPV program. Educational institutions studied the limitless new possibilities for virtual reality human-machine interfaces. By the mid-1980s, synthetic vision for RPV simulation was even commercially available for radio control aircraft hobbyists.

Actually, there is a large body of research from the 1970s to the present that addresses the application of synthetic vision to manned and unmanned aircraft. In the interest of brevity, we will focus on select systems that were important enablers towards UAV synthetic vision systems.

## Pictorial Format Avionics Displays

In 1977, NASA researchers published "Pathway-in-the-Sky Contact Analog Piloting Display" [5], which included a complete design for a synthetic vision system. It featured a computer that projected a 3D view of the terrain, given the aircraft's position and orientation. This out-the-window perspective view was displayed on a CRT type display. Such displays were called "Pictorial Format" avionics systems, but we recognize them as containing all of the essential elements of a modern synthetic vision display.



**Figure 1 1984 USAF pictorial format avionics synthetic vision display.**

In 1979 the Air Force completed its "Airborne Electronic Terrain Map Applications Study (AETMS)", and in 1981 published "The Electronic Terrain Map: A New Avionics Integrator" describing how a computerized terrain database could be displayed as an out-the-window 3D view allowing the pilot to "see" even at night and in other limited visibility situations [6].

Also in 1979, the Air Force published research [7] identifying human factors problems that would have to be overcome in RPV cockpit design. NASA would use this in the design of the HiMAT RPV 3D visual system in 1984.

Pictorial format avionics (i.e., synthetic vision) formed a key ingredient of the Air Force Super Cockpit concept. This program included a bold future vision in which "*the pilot need not be present in the actual vehicle which he is piloting since with the appropriate data links a "remote" super cockpit would provide the visual and aural "telepresence" cues as if he were located in the vehicle*" according to Air Force researcher Tom Furness [8].



Figure 2. USAF Super cockpit helmet, simulator, and sample visual format (photo courtesy <http://www.hitl.washington.edu>)

### HiMAT: Remotely Piloted Aircraft with Synthetic Vision

In 1984, NASA published research that investigated synthetic vision for lateral control during RPV landings [9]. These tests featured the USAF/NASA HiMAT (High Maneuverability Aircraft Testbed), a remotely piloted research vehicle flown at Dryden Flight Research Center. These aircraft (Figure 3) were dropped from a B-52 and remotely piloted from a ground station to a landing on the lakebed. The vehicle had a nose camera which produced video that could be shown in the remote cockpit, allowing the comparison of nose camera imagery versus synthetic vision during pilot testing.

Vehicle position was computed using RADAR computations, along with a radio altimeter. Electro-mechanical gyroscope systems were installed onboard the RPV aircraft and measured the 3D attitude of the vehicle. The position and attitude were down-linked from the RPV to a remote cockpit, and pilot control inputs were up-linked from the remote cockpit via the radio communication system [10].

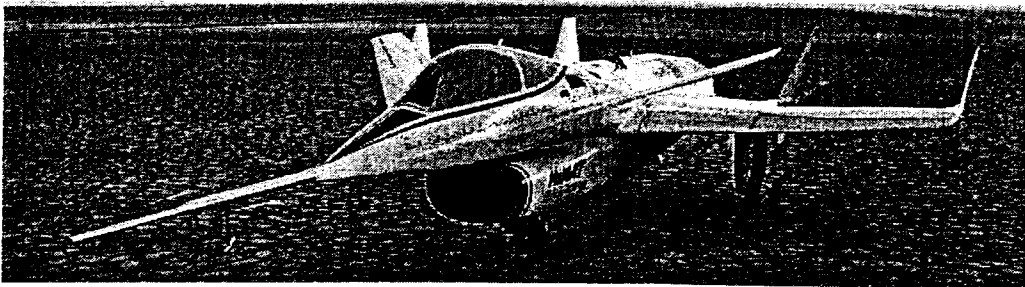


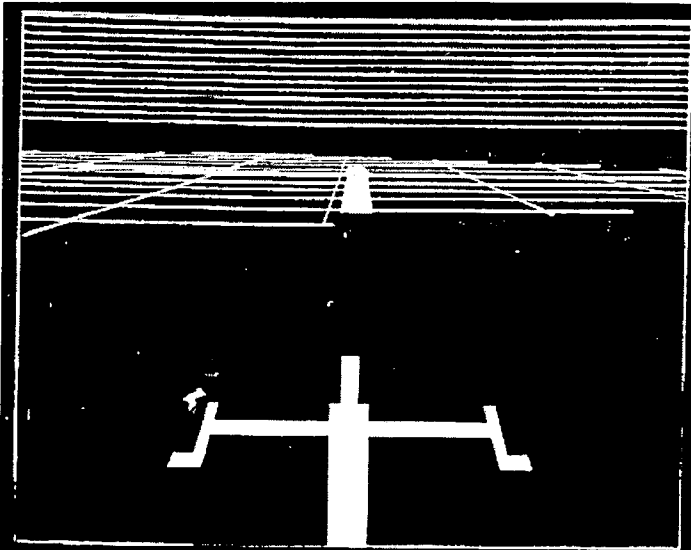
Figure 3. HiMAT Remotely Piloted Vehicle after flight at Dryden Flight Research Center. (Photo courtesy NASA)

The remote cockpit (Figure 4) included a joystick and rudder controls connected to the computer and control signals were up-linked to the RPV. The computer compensated for delays in the control/communications loop [10].



**Figure 4. HiMAT RPV remote cockpit showing synthetic vision display (photo courtesy of NASA)**

The Edwards Air Force Base dry lake bed and runway were represented in three dimensions in the terrain database as polygons (triangles and rectangles). An Evans and Sutherland (E&S) Picture System computer transformed the terrain in the database into a projected 3D out-the-window view at the pilot cockpit. Finally, the projected 3D out-the-window view was displayed on an E&S Calligraphic video display system capable of 4000 lines of resolution (Figure 5). According to the pilots participating in the study, the synthetic vision compared well to the nose camera view. By the mid 1990s, NASA had migrated the RPV synthetic vision concept used on HiMAT to PC computers for X-36 and on X-38 [11].



**Figure 5. HiMAT synthetic vision display showing terrain and runway. Note the synthetic vision representation of the HiMAT nose probe at center bottom.**



## Synthetic Vision for Recreational Remotely Piloting Vehicles

One of the early uses of synthetic vision for RPVs was recreational simulation. In 1986 Ambrosia Microcomputer Products introduced RC AeroChopper, a radio controlled aircraft simulator which enabled pilots to learn to fly a remotely controlled aircraft, without risk to their aircraft.,. According to the AeroChopper Owner's Manual [12], the product accepted aileron, elevator, rudder, and throttle pilot inputs via joysticks to control the simulated aircraft. The product also contained data files containing a 3D terrain database provided with AeroChopper representing the earth's surface as well as buildings and obstructions.

The software was run on a computer (an Amiga for example) and was connected to the flight controls and communicated the aircraft position and attitude in three-space to the user. The computer used the terrain data to create a projected view of the aircraft and its environment in three dimensions (Figure 6). Like most visual simulations of its time, the program used relatively few polygons to represent the terrain and man-made objects, and so looks relatively crude by today's standards.

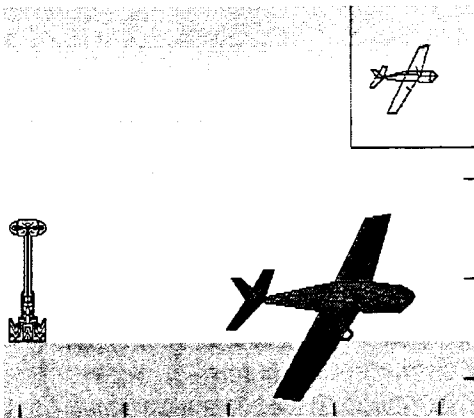


Figure 6. This 3D synthetic vision simulation display for radio controlled aircraft is from RC AeroChopper.

## Synthetic Vision for Sensor Operations

Although most of the historical focus with synthetic vision has been on aiding flight management, recent efforts have focused on how synthetic vision can aid UAV sensor operator functions. Ongoing research at the US Air Force Research Laboratory's Human Effectiveness Directorate is exploring how to improve UAV sensor operator utility of video imagery. The overall objective is to determine the value of combining synthetic vision imagery/symbology with live camera video presented on a UAV control station camera display. One research study [13] evaluated the utility of computer-generated video overlays for four different task types: controlling the camera to locate specific ground landmarks in the 360 degree area surrounding the loitering UAV, designating multiple ground targets marked with synthetic symbology, tracing a synthetically highlighted ground convoy route with the UAV camera boresight, and reading text from synthetic overlaid symbology. UAV telemetry update rate was manipulated from 0.5 Hz to 24 Hz. The results indicated the potential of synthetic symbology overlay for enhancing situation awareness, reducing workload, and improving the designation of points of interest, at nearly all the update rates evaluated and for all four task types. However, data across the task types indicated that update rates larger than 2-4 Hz generally resulted in improved objective performance and subjective impressions of utility.

A second research area focused on a picture-in-picture (PIP) concept where video imagery is surrounded by a synthetic-generated terrain imagery border on the physical camera display,

increasing the operator's instantaneous field-of-view (Figure 7). Experimental data showed that the PIP helps mitigate the "soda-straw effect", reducing landmark search time and enhancing operator situation awareness. In an evaluation [14] examining the impact of PIP display size and symbology overlay registration error, results indicated that performance on a landmark search task was particularly better with the more compressed video imagery (Figure 7c), reducing average designation time by 60%. Also, the registration error between the virtual flags and their respective physical correlates was less critical with the PIP capability enabled.

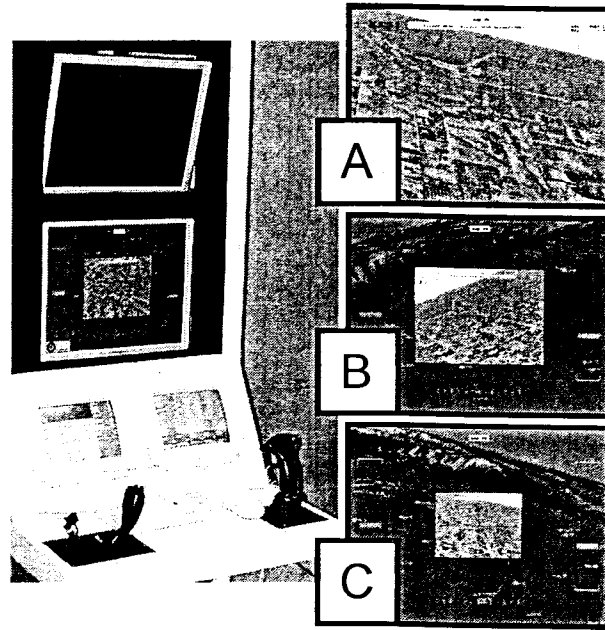


Figure 7 UAV Control Station Simulator. ( A: no picture-in-picture (PIP), B: video imagery compressed to 50% original size, C video imagery compressed to 33% original size. )

## Summary

More than three decades of research regarding synthetic vision for RPVs and UAVs began with the emergence of computers and display systems capable of creating real-time 3D projected moving displays. This research was conducted by the US Air Force, NASA, US Army, and numerous commercial and educational entities. Several systems, including the NASA HiMAT in 1984, demonstrated the utility for synthetic vision in remotely piloting aircraft and simulated aircraft. The recent availability of sophisticated UAV autopilots capable of autonomous flight control has fundamentally changed the paradigm of UAV operation, potentially reducing the utility of synthetic vision for supporting UAV piloting tasks. At the same time, research has demonstrated and quantified a substantial improvement in the efficiency of sensor operations through the use of synthetic vision sensor fusion technology. We expect this to continue to be an important technology for UAV operation.

## References

1. Calhoun, G.L., Draper, M.F., Abernathy, M., Patzek, M., and Delgado, F. (2005). Synthetic Vision System for Improving Unmanned Aerial Vehicle Operator Situation Awareness. Proceedings of the SPIE,.
2. Evans and Sutherland, Picture Systems Brochure, 1974. ([http://archive.computerhistory.org/resources/text/Evans\\_Sutherland/EvansSutherland.3D.1974.102646288.pdf](http://archive.computerhistory.org/resources/text/Evans_Sutherland/EvansSutherland.3D.1974.102646288.pdf))
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4. Kocian, D., "VCASS: An Approach to Visual Simulation," 1977, Proceedings, IMAGE Conference, Williams AFB, AZ.
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9. Sarrafian, S., "Simulator Evaluation of a Remotely Piloted Vehicle Lateral Landing Task Using a Visual Display", 1984, NASA TM 85903.
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**Graham, Courtney B. (HQ-MC000)**

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**From:** Fein, Edward K. (JSC-AL111)  
**Sent:** Monday, August 24, 2009 2:21 PM  
**To:** Graham, Courtney B. (HQ-MC000)  
**Subject:** REVISED AU VSI column v5 clean.doc  
**Attachments:** REVISED AU VSI column v5 clean.doc

04624

# Synthetic Vision Technology for Unmanned Aerial Vehicles: Historical Examples and Current Emphasis

Michael Abernathy<sup>a</sup>, Mark Draper<sup>b</sup>, Gloria Calhoun<sup>b</sup>

<sup>a</sup> Rapid Imaging Software, Inc.

<sup>b</sup> Air Force Research Laboratory, Wright-Patterson Air Force Base, OH

## Background – Flight Simulation Real-Time 3D Computer Graphics

In the aviation context, synthetic vision can be described, in simplest terms, as the use of a computer and a terrain database to generate a simulated 3D view of an environment in real time. The application of synthetic vision to remotely piloted vehicles (RPVs) and unmanned aerial vehicles (UAVs) goes back three decades and has recently evolved from a piloting aid for UAV pilots to a potentially powerful tool for sensor operators [1]. It is anticipated that integration of this technology can ameliorate many factors that currently compromise the utility of UAV video imagery: narrow camera field-of-view, degraded datalinks, poor environmental conditions, limited bandwidth, and highly cluttered visual scenes such as in urban areas. With this technology, spatially-relevant information, constructed from databases (e.g., terrain elevation, cultural features, maps, photo imagery) as well as networked information sources, can be represented as computer-generated imagery and symbology overlaid conformal, in real time, onto a dynamic video image display. This computer-generated imagery and symbology appears to co-exist with real objects in the visual scene, highlighting points of interest and helping the operator maintain situation awareness of the environment. The purpose of this paper is to briefly summarize the evolution of this technology towards RPV/UAV applications.

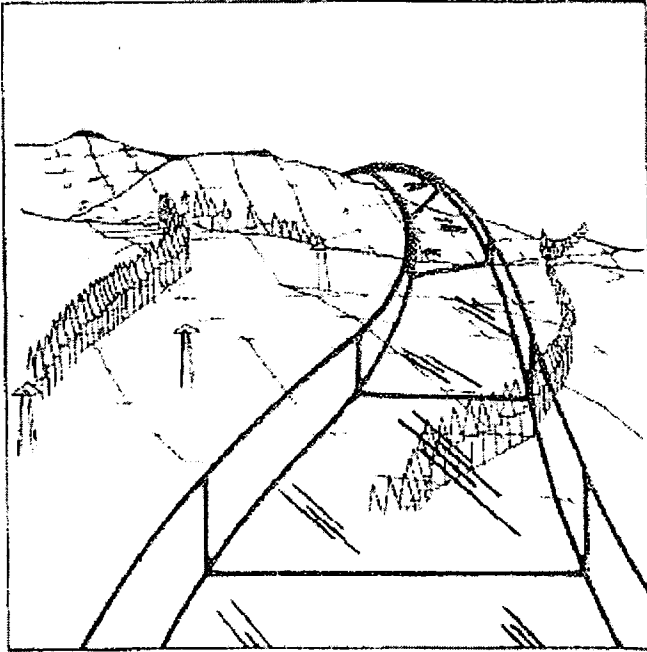
The story begins in the 1970's when the use of computers to create 3D real-time out-the-window synthetic environments was beginning to see wide acceptance for training pilots of manned aircraft. Evans and Sutherland (E & S) had seen the commercial potential for flight simulation and had introduced special purpose graphics computers, like their Picture System, which transformed and projected 3D terrain data as simple 3D polygons to a pilot's perspective view in real-time (30 Hz) [2]. In 1975 an engineering student named Bruce Artwick wrote "Flight Simulator" for the Apple II computer [3]. He formed a company and in 1980 marketed the product that ultimately became Microsoft Flight Simulator®.

In fact it was this phenomenon – the emergence of computer flight simulation in the 1970s – that appears to have sparked a monumental amount of research. The Air Force began its Visually Coupled Airborne Systems Simulator (VCASS) program, with a particular eye toward future generation fighters [4]. NASA was developing synthetic vision for the Super Sonic Transport and for its High Maneuverability Aircraft Testbed (HiMAT) RPV program. Educational institutions studied the limitless new possibilities for virtual reality human-machine interfaces. By the mid-1980s, synthetic vision for RPV simulation was even commercially available for radio control aircraft hobbyists.

Actually, there is a large body of research from the 1970s to the present that addresses the application of synthetic vision to manned and unmanned aircraft. In the interest of brevity, we will focus on select systems that were important enablers towards UAV synthetic vision systems.

## Pictorial Format Avionics Displays

In 1977, NASA researchers published "Pathway-in-the-Sky Contact Analog Piloting Display" [5], which included a complete design for a synthetic vision system. It featured a computer that projected a 3D view of the terrain, given the aircraft's position and orientation. This out-the-window perspective view was displayed on a CRT type display. Such displays were called "Pictorial Format" avionics systems, but we recognize them as containing all of the essential elements of a modern synthetic vision display.



**Figure 1 1984 USAF pictorial format avionics synthetic vision display.**

In 1979 the Air Force completed its "Airborne Electronic Terrain Map Applications Study (AETMS)", and in 1981 published "The Electronic Terrain Map: A New Avionics Integrator" describing how a computerized terrain database could be displayed as an out-the-window 3D view allowing the pilot to "see" even at night and in other limited visibility situations [6].

Also in 1979, the Air Force published research [7] identifying human factors problems that would have to be overcome in RPV cockpit design. NASA would use this in the design of the HiMAT RPV 3D visual system in 1984.

Pictorial format avionics (i.e., synthetic vision) formed a key ingredient of the Air Force Super Cockpit concept. This program included a bold future vision in which "*the pilot need not be present in the actual vehicle which he is piloting since with the appropriate data links a "remote" super cockpit would provide the visual and aural "telepresence" cues as if he were located in the vehicle*" according to Air Force researcher Tom Furness [8].



Figure 2. USAF Super cockpit helmet, simulator, and sample visual format (photo courtesy <http://www.hitl.washington.edu>)

### HiMAT: Remotely Piloted Aircraft with Synthetic Vision

In 1984, NASA published research that investigated synthetic vision for lateral control during RPV landings [9]. These tests featured the USAF/NASA HiMAT (High Maneuverability Aircraft Testbed), a remotely piloted research vehicle flown at Dryden Flight Research Center. These aircraft (Figure 3) were dropped from a B-52 and remotely piloted from a ground station to a landing on the lakebed. The vehicle had a nose camera which produced video that could be shown in the remote cockpit, allowing the comparison of nose camera imagery versus synthetic vision during pilot testing.

Vehicle position was computed using RADAR computations, along with a radio altimeter. Electro-mechanical gyroscope systems were installed onboard the RPV aircraft and measured the 3D attitude of the vehicle. The position and attitude were down-linked from the RPV to a remote cockpit, and pilot control inputs were up-linked from the remote cockpit via the radio communication system [10].

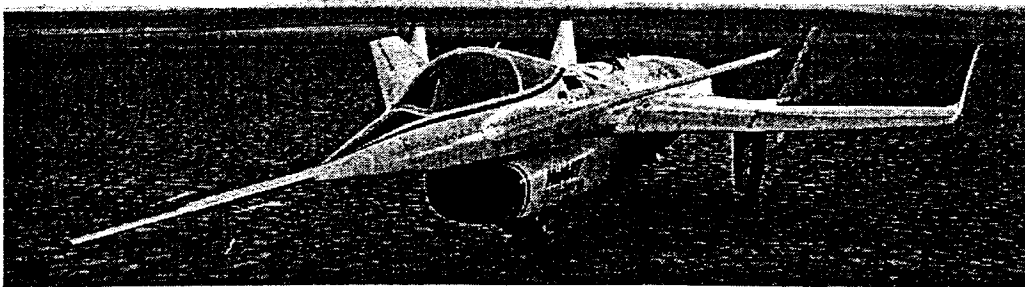


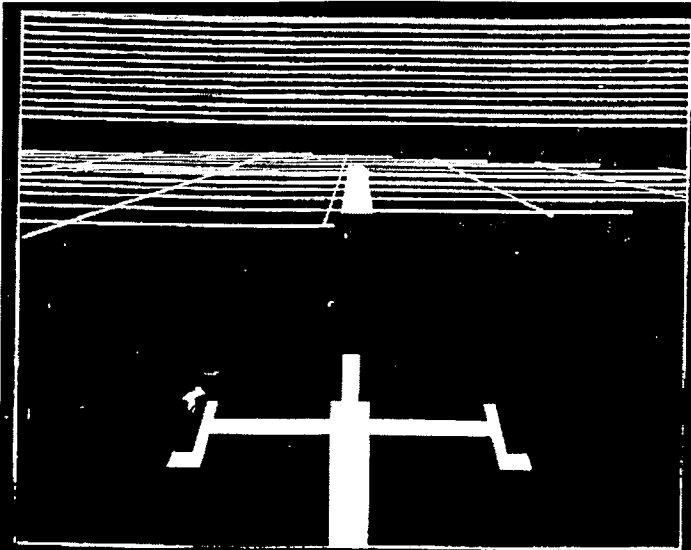
Figure 3. HiMAT Remotely Piloted Vehicle after flight at Dryden Flight Research Center. (Photo courtesy NASA)

The remote cockpit (Figure 4) included a joystick and rudder controls connected to the computer and control signals were up-linked to the RPV. The computer compensated for delays in the control/communications loop [10].



**Figure 4. HiMAT RPV remote cockpit showing synthetic vision display (photo courtesy of NASA)**

The Edwards Air Force Base dry lake bed and runway were represented in three dimensions in the terrain database as polygons (triangles and rectangles). An Evans and Sutherland (E&S) Picture System computer transformed the terrain in the database into a projected 3D out-the-window view at the pilot cockpit. Finally, the projected 3D out-the-window view was displayed on an E&S Calligraphic video display system capable of 4000 lines of resolution (Figure 5). According to the pilots participating in the study, the synthetic vision compared well to the nose camera view. By the mid 1990s, NASA had migrated the RPV synthetic vision concept used on HiMAT to PC computers for X-36 and on X-38 [11].



**Figure 5. HiMAT synthetic vision display showing terrain and runway. Note the synthetic vision representation of the HiMAT nose probe at center bottom.**



## Synthetic Vision for Recreational Remotely Piloted Vehicles

One of the early uses of synthetic vision for RPVs was recreational simulation. In 1986 Ambrosia Microcomputer Products introduced RC AeroChopper, a radio controlled aircraft simulator which enabled pilots to learn to fly a remotely controlled aircraft, without risk to their aircraft... According to the AeroChopper Owner's Manual [12], the product accepted aileron, elevator, rudder, and throttle pilot inputs via joysticks to control the simulated aircraft. The product also contained data files containing a 3D terrain database provided with AeroChopper representing the earth's surface as well as buildings and obstructions.

The software was run on a computer (an Amiga for example) and was connected to the flight controls and communicated the aircraft position and attitude in three-space to the user. The computer used the terrain data to create a projected view of the aircraft and its environment in three dimensions (Figure 6). Like most visual simulations of its time, the program used relatively few polygons to represent the terrain and man-made objects, and so looks relatively crude by today's standards.

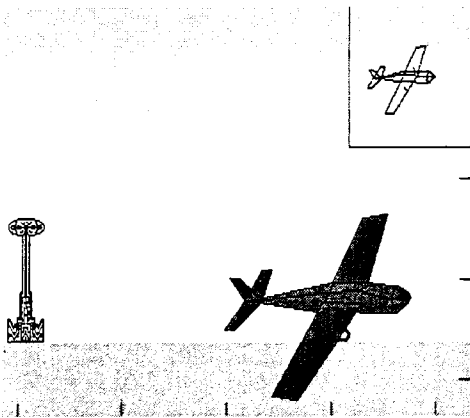


Figure 6. This 3D synthetic vision simulation display for radio controlled aircraft is from RC AeroChopper.

## Synthetic Vision for Sensor Operations

Although most of the historical focus with synthetic vision has been on aiding flight management, recent efforts have focused on how synthetic vision can aid UAV sensor operator functions. Ongoing research at the US Air Force Research Laboratory's Human Effectiveness Directorate is exploring how to improve UAV sensor operator utility of video imagery. The overall objective is to determine the value of combining synthetic vision imagery/symbology with live camera video presented on a UAV control station camera display. One research study [13] evaluated the utility of computer-generated video overlays for four different task types: controlling the camera to locate specific ground landmarks in the 360 degree area surrounding the loitering UAV, designating multiple ground targets marked with synthetic symbology, tracing a synthetically highlighted ground convoy route with the UAV camera boresight, and reading text from synthetic overlaid symbology. UAV telemetry update rate was manipulated from 0.5 Hz to 24 Hz. The results indicated the potential of synthetic symbology overlay for enhancing situation awareness, reducing workload, and improving the designation of points of interest, at nearly all the update rates evaluated and for all four task types. However, data across the task types indicated that update rates larger than 2-4 Hz generally resulted in improved objective performance and subjective impressions of utility.

A second research area focused on a picture-in-picture (PIP) concept where video imagery is surrounded by a synthetic-generated terrain imagery border on the physical camera display,

increasing the operator's instantaneous field-of-view (Figure 7). Experimental data showed that the PIP helps mitigate the "soda-straw effect", reducing landmark search time and enhancing operator situation awareness. In an evaluation [14] examining the impact of PIP display size and symbology overlay registration error, results indicated that performance on a landmark search task was particularly better with the more compressed video imagery (Figure 7c), reducing average designation time by 60%. Also, the registration error between the virtual flags and their respective physical correlates was less critical with the PIP capability enabled.

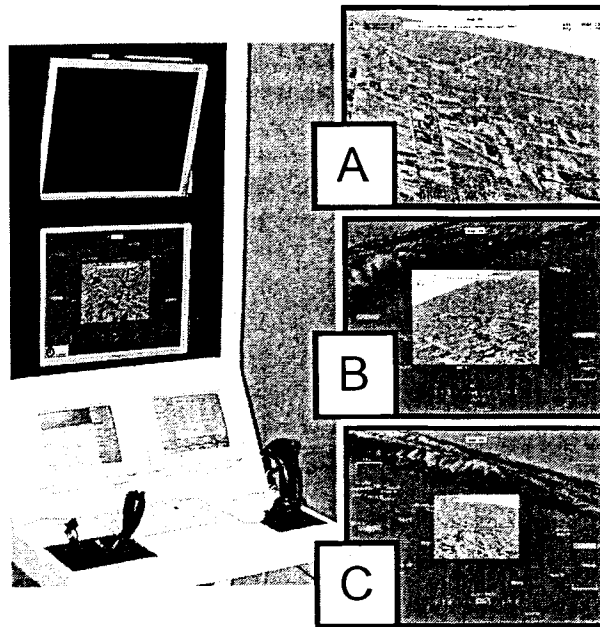


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More than three decades of research regarding synthetic vision for RPVs and UAVs began with the emergence of computers and display systems capable of creating real-time 3D projected moving displays. This research was conducted by the US Air Force, NASA, US Army, and numerous commercial and educational entities. Several systems, including the NASA HiMAT in 1984, demonstrated the utility for synthetic vision in remotely piloting aircraft and simulated aircraft. The recent availability of sophisticated UAV autopilots capable of autonomous flight control has fundamentally changed the paradigm of UAV operation, potentially reducing the utility of synthetic vision for supporting UAV piloting tasks. At the same time, research has demonstrated and quantified a substantial improvement in the efficiency of sensor operations through the use of synthetic vision sensor fusion technology. We expect this to continue to be an important technology for UAV operation.

## References

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04637

[REDACTED]

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**From:** Fein, Edward K. (JSC-AL)  
**Sent:** Wednesday, August 06, 2008 3:29 PM  
**To:** McNutt, Jan (HQ-MC000)  
**Cc:** Borda, Gary G. (HQ-MC000); Rotella, Robert F. (HQ-MA000)  
**Subject:** RE: Patent Infringement claim from Jed Margolin; NASA Case No. I-222

**Attachments:** [REDACTED] b(5)

b(5)

[REDACTED]

[REDACTED]

[REDACTED]

-Ed

**RE: Read: Let us chat on about SCOUT, SC3D, the X-38 program and RIS; noted below are our patents that cover said technology that RIS and your groups are using.**

**From:** Mike Abernathy <[REDACTED]>  
**To:** 'Delgado, Francisco J. (JSC-ER2)'; [REDACTED]; 'Fein, Edward K. (JSC-AL)'; [REDACTED]; Kennedy, Alan J. (HQ-MC000)'; [REDACTED]  
**CC:** 'Fredrickson, Steven E. (JSC-ER)'; [REDACTED]  
**Date:** Sep 26 2006 - 12:13pm

b(6)

Thank you very much. It means very much to Carolyn and I right now.

Mike Abernathy

Rapid Imaging Software, Inc.

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**From:** Delgado, Francisco J. (JSC-ER2) [mailto:[REDACTED]]  
**Sent:** Monday, September 25, 2006 9:42 PM  
**To:** Mike Abernathy; Fein, Edward K. (JSC-AL); Kennedy, Alan J. (HQ-MC000); [REDACTED]  
**Cc:** Delgado, Francisco J. (JSC-ER2); Fredrickson, Steven E. (JSC-ER)  
**Subject:** FW: Read: Let us chat on about SCOUT, SC3D, the X-38 program and RIS; noted below are our patents that cover said technology that RIS and your groups are using.

b(6)

See email from "Mr. Adams" below.

This is getting more ridiculous by the minute. I have resisted replying in any form as suggested by JSC council. However, this matter has been left open for quite some time and something needs to be done NOW. It has come to my attention that Mr. Adams and company have issued a letter that prohibits RIS from selling any of their software until this issue is resolved. We have had a very "intellectually" fruitful relationship with RIS for almost a decade and would like to continue this relationship for many years to come. Some of the technology concepts in question were co-developed by RIS and I during many "brainstorming sessions" on how to provide optimal situation awareness to various users.

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Please let me know what I need to do on my end to help move this along.

BTW: If we do not deal with issue immediately it will only get worse for NASA. I know of several Projects within JSC, JPL, and Langley that use independently developed technology (i.e. technology that does not use what RIS and I came up with) that I am sure Mr. Adams and company would claim infringes on their "Patents." We seem to be on his radar at the moment because we do what government organizations are encouraged to do ("Publish their work").

Thank You,

Frank Delgado

---

From: Robert Adams [mailto: b(6)]  
Sent: Mon 9/25/2006 5:58 PM  
To: Delgado, Francisco J. (JSC-ER2)  
Subject: RE: Read: Let us chat on about SCOUT, SC3D, the X-38 program and RIS; noted below are our patents that cover said technology that RIS and your groups are using.

Sir,

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We simple have one goal in mind and that is have a chat regarding the technology and that RIS and NASA take a license of said IP technology.

Thank you

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From: Delgado, Francisco J. (JSC-ER2) [mailto: b(6)]  
Sent: Tuesday, September 19, 2006 7:30 AM  
Subject: Read: Let us chat on about SCOUT, SC3D, the X-38 program and RIS; noted below are our patents that cover said technology that RIS and your groups are using.

Your message

To: Delgado, Francisco J. (JSC-ER2)

Cc:

Subject: Let us chat on about SCOUT, SC3D, the X-38 program and RIS;  
noted below are our patents that cover said technology that RIS and your  
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Sent: Tue, 19 Sep 2006 08:52:25 -0500

was read on Tue, 19 Sep 2006 09:30:05 -0500

**RE: Read: Let us chat on about SCOUT, SC3D, the X-38  
program and RIS; noted below are our patents that cover  
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From: Fein, Edward K. (JSC-AL) [REDACTED]

To: Delgado, Francisco J. (JSC-ER2) [REDACTED]

Kennedy, Alan J. (HQ-MC000) [REDACTED]

Date: Sep 26 2006 - 10:58am

b(6)

[REDACTED]  
b(5)

**RE: Read: Let us chat on about SCOUT, SC3D, the X-38  
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Edward K. (JSC-AL) [REDACTED], 'Fein,  
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04641

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Thank you

04642



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Sent: Tuesday, September 19, 2006 7:30 AM  
Subject: Read: Let us chat on about SCOUT, SC3D, the X-38 program and RIS; noted below are our patents that cover said technology that RIS and your groups are using.

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To: Delgado, Francisco J. (JSC-ER2)

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was read on Tue, 19 Sep 2006 09:30:05 -0500

**FW: and the very last communication of the day**

From: Fein, Edward K. (JSC-AL) [mailto: [REDACTED]

To: Kennedy, Alan J. (HQ-MC000) <[REDACTED] b(6)

CC: Borda, Gary G. (HQ-MC000) <[REDACTED]

Date: Sep 26 2006 - 8:11am

[REDACTED] b(5)

fyi ...

From: Mike Abernathy [mailto: [REDACTED] b(6)  
Sent: Monday, September 25, 2006 8:18 PM  
To: Delgado, Francisco J. (JSC-ER2); Fein, Edward K. (JSC-AL)  
Subject: FW: and the very last communication of the day

Mike Abernathy

Rapid Imaging Software, Inc.

From: Mike Abernathy [mailto: [REDACTED] b(6)  
Sent: Monday, September 25, 2006 6:25 PM  
To: FEIN, EDWARD K. (JSC-HA) (NASA); DELGADO FRANCISCO J. (FRANK) [REDACTED]  
Kennedy, Alan J. (HQ-MC000) [REDACTED]; 'Moore, Thomas, Mr, OSD-ATL';  
'Davey, Jon (Bingaman)'  
Subject: and the very last communication of the day

Hi All,

04643

Let me summarize what I think has just happened to our company.

In late 1995 we introduce our LandForm synthetic vision system to the market as COTS software product.

In 1997/8 we sell this to NASA and together we are the first people on earth to create a synthetic vision flight guidance system for a remotely piloted vehicle. Starting in 1998 the X38 is captive carried and test flown using this system. We documented our success in the attached document written in 1998 and published in early 1999. It was my privilege to be at Edwards when it happened, and is the highlight of my career until the program is cancelled in 2002.

We go on and demonstrate that our software can be used as pilot aid to other UAVs including Predator, Shadow, Tern, and many more. We receive no interest in this application, but instead they use it for sensor operator stations. It is a commercial success and people say good things about it. It is sold to mostly to a commercial UAV manufacturer named AAI Corporation. Many tests are done and the military guys all like it.

In 1999 the patent office issues a patent to a former Atari employee named Margolin for a Synthetic Environment for Remotely Piloted Vehicle. He had evidently applied for it in 1996. Shortly thereafter he begins to complain to NASA that they and RIS infringed upon his patent presumably by flying a system 2 years before he received his patent. Is this a joke?

In 7 years he never so much as asked RIS about using his technology. Margolin as best I can tell never built this system and never test flew it. Can't say as I blame him because his system looks to me like a crater looking for an address. It cannot be safely operated in the form patented (no autopilot). No one is even stupid enough to build it this way, not even him.

Sometime after that, I am alerted to the patent. I read it, but since there are major differences in the way X-38 worked with our software, I felt strongly that we had not infringed. I provide this information, plus evidence of prior art to NASA legal counsel. I am troubled because really I can't see how his system could fly because it would fail during link loss. Margolin also had a patent on synthetic vision for manned aircraft (if you can imagine) and we found copious prior art for that. I am also troubled because I never hear that the request for reexamination has been sent in by NASA.

Last week I received an email from Optima technology group threatening (thinly veiled) to destroy our relationships with our customers and sue us if we don't license their technologies. We explain that we do not sell software for use in piloting unmanned aerial vehicles any more owing to insurance which is true. We had demonstrated this in the past, but there really is not much market that we could see. We also explained that we had not infringed and why we thought we had been respectful of their patent, but they just tried to make it look like we infringed. But we did not.

They know we cannot withstand the onslaught of their lawsuits, even though we are clearly and obviously not guilty of infringement. They think that we will have to fold and accept their license, but we cannot do this because they are legal blackmailers, and because they are selling defective technology. If we give in, then they will just destroy some other little companies they way they did ours. And we cannot let anyone pay them off for us, because that just gives them funds to go destroy another company. For many years our company has tried to provide an innovative product with an excellent value and never compromise our integrity. I cannot let this nonsense bring that to an end by pretending that we are licensing technology when what they are selling is a fraud.

04644

When I asked politely if their system has ever been tested Mr. Adams simply tells us to go get a lawyer, he is referring the matter for filing. I felt that it was not unreasonable to ask to know this but it really made him furious. Anyway I told him to tell it to our lawyer Mr. Ben Allison of Sutinfirm with whom I shall meet tomorrow. Tonight they said that they will issue a cease and desist order, which I believe means that we will be unable to sell our software anymore which will destroy our income stream and that will be it. I can't waste anymore time on this now. It is time for me to get back to work on things that matter for our users.

I have a docs appointment tomorrow at 8-10 local time. I had throat surgery recently so I really can't talk and frankly I find I tend to break into tears very frequently when I try to do so. But I want you all to know that I will stand firm until it is over. What would the soldiers who have used our software in combat think of me if I gave ground? Then bring it on.


I know it sounds bad for us right now, but remember that whatever happens to us no one can take away the honor and the privilege of working with NASA, the OSD, and all the other completely excellent people with whom we have worked.

Mike Abernathy

Rapid Imaging Software, Inc.

Attached are the other communications from them.

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From: Robert Adams [mailto: b(6)]  
Sent: Monday, September 25, 2006 3:51 PM  
To: 'Mike Abernathy'  
Subject: RE: license

Mike,

Let me try and be clear, all such development at OTG on behalf and or/or by our licensee is covered by NDA's and thus our company can be sued should we violate such agreements. As to your company's infringement of our patents, since that was clearly not covered by a NDA with us; please provide said information in detail:


Other than those items listed at your website and NASA's, what other projects did you do that infringed on our invention? If so when, where, and how?

Who at NASA flight-tested your product that used our invention? Please provide us with the name of the Pilot in Command, the responsible Flight Test Engineer, the model and block number of the vehicle and GCS, and the range or location at which such testing might have taken place with NASA and others. Also, indicate the dates of such testing. If flight test reports are available, as well please provide them to us.

Mike, I have no time to play games with someone who clearly infringes and thinks nothing of respecting our IP.

I will forward said matter to our legal department for further research and filing in accordance with the Federal laws. Please have your legal IP counsel contact our attorneys.

Robert Adams

From: Mike Abernathy [mailto:] b(c)  
Sent: Monday, September 25, 2006 2:26 PM  
To: 'Robert Adams'  
Subject: RE: license

Robert,


You have offered to license your technology to our company. You have stated that this technology is useful for "see and avoid applications" for UAVs which is an interesting market arena. We are making a good faith effort to consider your offer. We must know whether this technology has been brought into existence and whether it was ever test flown as a matter of due diligence.

We are not asking these questions out of idle curiosity and we certainly not trying to be difficult – we need this information in order to know the market value of the technology to our users, and there are certain elements of the method that we have concerns about. A flight test report – even if the system was implemented on a model airplane – will almost certainly allay our concerns and we can get on with this. The fact of whether or not this technology has been tested does not require an NDA.

Robert, throughout our dealings I have been honest and responsive to all of your requests, perhaps at peril to our company. I now ask you to please reciprocate my efforts in a small way and provide the requested information so that we may consider your offer of license.

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto:] b(c)  
Sent: Monday, September 25, 2006 2:49 PM  
To: 'Mike Abernathy'  
Subject: RE: license

Mike,


Neither the company nor I are in any way anxious in signing any more licensees's as we have many already, but as you know we must protect our patents in order to preserve said Intellectual Property.

As to your questions, they do not relate to a license and/or a licensee. Our Intellectual Property has been tested in court and is proven solid by far such standards the Federal Court including the Federal Appeals Court. In addition, as to matters of disclosure, all such development at OTG and by our licensee is covered by NDA's.

Should you wish to challenge such, then I advise you to seek proper legal counseling as we are not an attorney nor will ours advice you on such a matters.

Your company has clearly infringed and OTG must protect itself against such matters just as your company would do if in the same position.

Robert Adams

From: Mike Abernathy [mailto:] b(6)  
Sent: Monday, September 25, 2006 1:29 PM  
To: 'Robert Adams'  
Subject: license

Dear Robert,

Please tell the legal team thanks for getting back to us right away – we appreciate it.





You have asked us to consider licensing and this we are now doing. In the interest of due diligence as a prospective licensor of your technology, we ask that you provide us with the following information about the subject invention:

Was this invention ever constructed? If so when, where, and how?  
Was this invention ever flight tested? Please provide us with the name of the Pilot in Command, the responsible Flight Test Engineer, the model and block number of the vehicle and GCS, and the range or location at which such testing might have taken place. Also, indicate the dates of such testing. If flight test reports are available please provide them to us, as well.

I know that you are anxious for us to consider your license offer, please provide us with this information.

Mike Abernathy

Rapid Imaging Software, Inc.

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**latest from Optima**  
From: Mike Abernathy < >  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  b(6)  
Kennedy, Alan J. (HQ-MC000)   
Date: Sep 25 2006 - 3:08pm  
 image002.gif - 6.9k - [View in Outlook](#)

Ed,


04647

This has not blown over. We would rather lose our company than see NASA hurt by this. Ed, it appears that RIS situation is hopeless. They know that we did not infringe, yet they continue because they know that we lack the funds to fight them. Our situation appears hopeless but we cannot accept a license for technology that we know is dangerous to the public, so I cannot accept this deal that they have offered.

Let us know what you think as soon as possible.

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto:] (b6)  
Sent: Monday, September 25, 2006 12:26 PM  
To: 'Mike Abernathy'  
Subject: Privileged and Confidential Settlement Communications Protected Under Rule 408 of the Federal Rules of Evidence

Privileged and Confidential Settlement Communications Protected

Under Rule 408 of the Federal Rules of Evidence

Mike,

My legal team has read your response and it is a personal shame since you would rather cut and run verse facing the facts and take a license for past and future business, as I am sure it would be substantially less then litigation.

As you have been made aware in our prior communications, among other inventions, the Patents protect a number of features that are implemented in products capable of flying any and all UAV's (1.3) remotely and/or using Synthetic Vision and/or using a synthetic environment.

1.1 "Patent Portfolio" shall mean the portfolio consisting of United States Patent Numbers 5,904,724 (Method and Apparatus for Remotely Piloting an Aircraft), 5,566,073 (Pilot Aid Using a Synthetic Environment), and those future United States patents that may be added in accordance with the covenants and warranties.

1.2 "RPV" shall mean "remotely piloted vehicle." A "remotely piloted aircraft" is an RPV. "UAV" shall mean "unmanned aerial vehicle." RPV is an older term for UAV. "UCAV" shall mean "Unmanned Combat Aerial Vehicle." UCAV is also sometimes defined as an "Uninhabited Combat Aerial Vehicle." UCAV is a UAV that is intended for use in combat. UCAS means "Unmanned Combat Air System."

1.3 "Synthetic Vision" is the current term for "Synthetic Environment" and is the three dimensional projected image data presented to the pilot or other observer.

Of the ten companies responsible for the establishment of UAV Specifications or standard, eight of those companies sell UAV-Devices under brands they control, and each of those companies, i.e., Boeing Aerospace; Lockheed; Nakamichi Corporation; General Atomics Corporation; L-3 and Jacor Corporation; Raytheon; and Geneva Aerospace, pay Optima running royalties for the above referenced patents. //k

The substantial terms and conditions of our licensing Agreement: i) resulted from negotiations with the market leading manufacturers of UAV's; ii) are subject to most favored nation clauses; and iii) are, therefore, not negotiable.

The Agreement i) is exceedingly fair; ii) does not obligate Infringer to anything more than an industry accepted reasonable royalty for the Patents; iii) does not obligate Infringer to anything more than an industry accepted reasonable terms; and iv) may be canceled by Infringer at any time.

Mike, there is no reason to permit Infringer (Your company) to further drag on the execution of said Agreement based on the facts present on the infringement matter.

Infringer must appreciate that the Patents cover a range of different inventions required to implement the UAV using Synthetic Vision Specifications; and there exists pending divisions of the Patents having claims that are read on by implementation of the UAV Specifications. Infringer principal competitors have appreciated the exceptional litigation strength and flexibility of my patent portfolio and have decided to accept a license rather than expose themselves to an injunction.

Infringer must appreciate that if litigation between the parties is initiated: i) the matter will immediately become personal for both parties; ii) I do not have to account to any other person; and iii) no license or settlement of any kind will ever be possible under any of my intellectual properties. Infringer's competitors require that Infringer be either licensed or enjoined.

I have resolved myself to this course of action in the event an agreement reached shortly, I firmly believe that enjoining Infringer from selling UAV-Devices will not result in lost royalties; and it is in Optima's long-term interests to make an example of a company that has refused to take a license.

Anyone who is fully knowledgeable of the strength and scope of my patent portfolio, and who appreciates the risk-taking and tenacity that I have demonstrated, would not, in light of the terms being offered, recommend jeopardizing the UAV business Infringer enjoys in the U.S.

1.

I have just returned from business travel, and have not had a chance to look over your communications in detail. Thank you very much for bringing your concerns to our attention. Let me assure you that we will do everything in our power, now and in the future, to avoid infringement of these or any patents. We have already begun another careful analysis of them and will act swiftly upon what we learn, should any problems be found. We have been aware of these patents for some years and have not ever infringed upon them, and will not do so. When we first learned of them, we carefully examined our activities and those of our customers to make sure there was no possible infringement of them. As soon as we learned of it, we also informed the legal departments of our major customers to alert them to the existence of USP 5,904,724, but so far no UAV manufacturers have been seriously interested in offering synthetic vision for their UAV pilot stations.

RIS own admission they knew about '724 will go to show that their infringement was willful, which means treble damages Robert. (They probably found out about it when NASA interviewed Jed about their X-38 project.) We will find out at trial and/or during the discover phase.

From their web site: <http://www.landform.com/>

SmartCam3D provides unparalleled situation awareness for UAS sensor operators. It fuses video with synthetic vision to create the most powerful situation awareness technology currently available. SmartCam3D is an augmented reality system that has been developed, flight tested, and deployed in the most demanding conditions including combat, and as a result it is highly evolved technology which is in use today around the world. The reason that SmartCam3D is so popular is simple: it makes sensor operators more effective, and reduces the target response time. SmartCam3D is deployed with US Army Shadow UAV, and is at present being integrated to the USAF Predator, as well as the Army Warrior UAS. SmartCam3D is the war fighter's choice for sensor operator situational awareness.

Improving a patented invention by adding something to it (in this case fusing video with synthetic vision) is still infringement. Indeed, you may be able to patent the improvement. However, you may not practice the improved invention without the permission of the original patent holder. (It also means that the holder of the original patent may not practice your improvement without your permission.)

Since they publicly admit SmartCam3D is being used with US Army Shadow, USAF Predator, and Army Warrior his statement "no UAV manufacturers have been seriously interested in offering synthetic vision for their UAV pilot stations" is obviously false.

Also from their web site:

#### Software License Changes

RIS, Inc. changed insurance carriers, and effective September 1st, 2006 we updated our Software User License agreement. It now states that "The user is prohibited from using this software to pilot manned or unmanned aircraft." Our licenses have always prohibited use of our software for piloting manned aircraft. As you know, we had hoped that we would find a market for our UAV Glass Cockpit Product line. However, there is simply not sufficient market interest for us to bring such a product to market at this time, so we have decided not to release it. As a small company, we need to focus on our energy on the Sensor Operator and Intelligence Analyst at this time.

He is saying that his product should not be used for the very purpose it being advertised, sold, and used for. Lame. And it doesn't get him off the hook as he is still legally liable.

Since it did not state this until September 1, 2006, he has started to take this seriously, and he is clearly worried thus, he changed the terms to try to reduce the liability. I will have our team use wayback site and pull up the old Software User License agreement prior to Sept 1, 2006 this is when I bet they made all their sales and that is what OTG would be entitled too as well.

Here is a short lesson on infringement for Mike.

From : [http://inventors.about.com/library/bl/toc/bl\\_patent-infringement.htm](http://inventors.about.com/library/bl/toc/bl_patent-infringement.htm)

Text Box: Infringement can be direct, indirect, or contributory. Anyone who makes, uses, or sells the patented invention is a direct infringer. If a person actively encourages another to make, use, or sell the invention, the person so inducing is liable for indirect infringement. Contributory infringement can be committed by knowingly selling or supplying an item for which the only use is in connection with a patented invention. Good faith or ignorance is no defense for direct infringement, but it can be for indirect or contributory infringement. The remedies for infringement consist of: 1. Injunctive relief, 2. damages (including treble damages for willful infringement), 3. attorneys' fees in some cases, and 4. court costs.

2.

We discovered that the system described the in patent pertaining to remotely piloted vehicles USP 5,904,724 contains an entire clause in claim 1 that did not exist in the X38 or other UAVs that we have seen - this is the final paragraph of clause 1 regarding the method for handling delay in the control loop by "adjusting control sensitivity". This simply is not present in any form in any vehicles with which we have experience. Since all claims of this patent include this clause by reference,



that patent is not relevant to these vehicles because none of them have this feature.

The clause he is referring to is:

a set of one or more remote flight controls coupled to said computer for inputting said flight control information, wherein said computer is also for determining a delay time for communicating said flight data between said computer and said remotely piloted aircraft, and wherein said computer adjusts the sensitivity of said set of one or more remote flight controls based on said delay time.

Time delays in a control system are unavoidable. Normally, a control system has fixed time delays and the system is designed to operate properly with these time delays. Because of the complexity of a UAV system these time delays may not be known at the time the system (including the control laws) are designed. These time delays may also change during a mission due to the communications path changing. If the system does not properly deal with these changing time delays it will lead to pilot-induced oscillation and there is a good chance the aircraft will crash.

Anyone designing a UAS that does not adjust for changing time delays is an idiot. I don't think the people making UAVs are idiots. That does not relieve him of contributory infringement. It is likely that these time delays are dealt with as part of the control law system which Abernathy might not be privy to and thus a court order will provide us his insider info.

3.

More important however, is that all UAV control systems with which we are familiar require a device called an autopilot which is not contemplated at all in the subject patent. This device is similar to ones in modern manned aircraft, but it is used to control the aircraft flight in the pitch, heading, and roll axes. On UAVs, the communications delay is not handled by determining the delay and adjusting the control sensitivity as Margolin prescribes. Instead, an autopilot is installed onboard the aircraft where it senses changes in pitch, heading, and roll locally on board the aircraft. The pilot still makes control inputs to fly the airplane, but only via the autopilot on board the aircraft. The autopilot corrects attitude drift instantaneously avoiding the problem of substantial communication delays, and allows the pilot to control the vehicle in a more stable manner.

Most important, the autopilot is absolutely required to deal with the frequent communications outages which occur between the UAV and the ground control segment (This can be anywhere from a second to an hour in length, generally). In the system of Margolin, a communications outage would often result in the loss of the aircraft, because the pilot would be unable to correct attitude drift during communication link loss and the air vehicle would go out of control and could crash. In the last decade of working with UAVs never have I witnessed a flight in which the communication link was not lost at least once during the flight. If the control communication link goes down, no control inputs can be made to the aircraft from the pilot on the ground, but the autopilot keeps the airplane from crashing by flying straight and level or gently banking until the link is restored. The system of Margolin does not recognize the problem of link loss, and fails to offer any solution. The autopilot functionality can be located in various components in the X38 it was in the on board GNC (Guidance Navigation and Control) computer, as I recollect.

The fact that '724 does not explicitly teach an autopilot is irrelevant. Adding an autopilot to '724 is still infringement, just as adding a video overlay is infringement.

There is also the matter of the Doctrine of Equivalence. See attached file patents1.pdf

Consider Column 2, lines 12-18:

The computers in the system allow for several modes of operation. For example, the remote aircraft can be instructed to fly to given coordinates without further input from the remote pilot. It also makes it possible to provide computer assistance to the remote pilot. In this mode, the remote flight control controls absolute pitch and roll angles instead pitch and roll rates which is the normal mode for aircraft.

That legal sounds like a defined autopilot to me and that as we need to show infringement at the Markman hearing..

4.

There is another on-board component called a SAS or Stability Augmentation System found on most large modern UAVs such as Predator, and which performs additional real-time stabilization to that done by the autopilot. Again, the SAS is not contemplated by the Margolin patent, yet is required to dampen control system oscillations in order to safely operate a UAV in systems that may suffer from communications delays to remote user control inputs. There are many more differences that we found when we first examined it, but as you can see we have never worked with a vehicle upon which your system could have been implemented and safely flown, and therefore we realized that it is impossible for us to have infringed this patent 5,904,724. You may easily independently verify the fact of these profound and fundamental

differences from your system by examining the printed published materials regarding UAV control system and NASAs many publications on X-38 control systems.

Again, adding something to '724 is still infringement.

As far as examining the control systems on NASA's X-38 project is concerned, in a telephone conversation with NASA's Alan Kennedy in the Office of the General Counsel on February 9, 2006, he repeated his claim that, "The X-38 does fly." NASA has a video of the X-38 (flying) on its web site. (See <http://www.dfrc.nasa.gov/Gallery/Movie/X-38/HTML/EM-0038-01.html>)

5.

We have never allowed our software to be used as an aid in piloting manned aircraft and thus cannot have infringed 5,566,073. If you aware of anyone doing this with our software, kindly inform us immediately, and we will ask them to desist.

We still have him on infringing on '724.

6.

Finally, let me set your mind at ease by informing you that our software product license currently explicitly contains the following clause: "The user is prohibited from using this software to pilot manned or unmanned aircraft." Alas, the requirements of our current company insurance policy, combined with the profound lack of a market for this possible application of our technology facilitated this business decision. Your letter said we recognize the "value" of this technology, but in view of the current situation "lack of value" is probably more appropriate.

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From: Mike Abernathy [mailto: [REDACTED] b6)  
Sent: Monday, September 25, 2006 9:08 AM  
To: 'Robert Adams'  
Subject: question

Robert,

Thanks for your offer to call but I am still getting over throat surgery from 2 weeks ago so my phone is forwarded, but I look forward to email from you and/or your attorneys.

In trying to understand the value of your IP I would like to ask 2 questions regarding USP 5,904,724. Was this system ever built? Was it ever flight tested? Of course you need not answer, but it really would be helpful in understanding what is required to get your technology to market.

Mike Abernathy

Rapid Imaging Software, Inc.

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From: Robert Adams [mailto: [REDACTED] b6)  
Sent: Monday, September 25, 2006 8:55 AM  
To: 'Mike Abernathy'  
Subject: RE: Rapid Imaging Software, Inc. patent infringement

Mike,

Thanks for your email, I will forward it today over to my patent and review legal team. Once they complete a review of your comments, I will give you a ring on the phone and a response via the post and/or attorneys.

Respectfully,

Robert Adams

\_\_\_\_\_  
From: Mike Abernathy [mailto: [REDACTED] b6)  
Sent: Sunday, September 24, 2006 4:29 PM  
To: 'Robert Adams'  
Subject: RE: Rapid Imaging Software, Inc. patent infringement

Dear Mr. Adams,

I have just returned from business travel, and have not had a chance to look over your communications in detail. Thank you very much for bringing your concerns to our attention. Let me assure you that we will do everything in our power, now and in the future, to avoid infringement of these or any patents. We have already begun another careful analysis of them and will act swiftly upon what we learn, should any problems be found. We have been aware of these patents for some years and have not ever infringed upon them, and will not do so. When we first learned of them we carefully examined our activities and those of our customers to make sure there was no possible infringement of them. As soon as we learned of it, we also informed the legal departs of our major customers to alert them to the existence of USP 5,904,724, but so far no UAV manufacturers have been seriously interested in offering synthetic vision for their UAV pilot stations.

We discovered that the system described the in patent pertaining to remotely piloted vehicles USP 5,904,724 contains an entire clause in claim 1 that did not exist in the X38 or other UAVs that we have seen – this is the final paragraph of clause 1 regarding the method for handling delay in the control loop by “adjusting control sensitivity”. This simply is not present in any form in any vehicles with which we have experience. Since all claims of this patent include this clause by reference, that patent is not relevant to these vehicles because none of them have this feature.

More important however, is that all UAV control systems with which we are familiar require a device called an autopilot which is not contemplated at all in the subject patent. This device is similar to ones in modern manned aircraft, but it is used to control the aircraft flight in the pitch, heading, and roll axes. On UAVs, the communications delay is not handled by determining the delay and adjusting the control sensitivity as Margolin prescribes. Instead, an autopilot is installed onboard the aircraft where it senses changes in pitch, heading, and roll locally on board the aircraft. The pilot still makes control inputs to fly the airplane, but only via the autopilot on board the aircraft. The autopilot corrects attitude drift instantaneously avoiding the problem of substantial communication delays, and allows the pilot to control the vehicle in a more stable manner.

Most important, the autopilot is absolutely required to deal with the frequent communications outages which occur between

the UAV and the ground control segment (This can be anywhere from a second to an hour in length, generally). In the system of Margolin, a communications outage would often result in the loss of the aircraft, because the pilot would be unable to correct attitude drift during communication link loss and the air vehicle would go out of control and could crash. In the last decade of working with UAVs never have I witnessed a flight in which the communication link was not lost at least once during the flight. If the control communication link goes down, no control inputs can be made to the aircraft from the pilot on the ground, but the autopilot keeps the airplane from crashing by flying straight and level or gently banking until the link is restored. The system of Margolin does not recognize the problem of link loss, and fails to offer any solution. The autopilot functionality can be located in various components in the X38 it was in the on board GNC (Guidance Navigation and Control) computer, as I recollect.

There is another on-board component called a SAS or Stability Augmentation System found on most large modern UAVs such as Predator, and which performs additional real-time stabilization to that done by the autopilot. Again, the SAS is not contemplated by the Margolin patent, yet is required to dampen control system oscillations in order to safely operate a UAV in systems that may suffer from communications delays to remote user control inputs. There are many more differences that we found when we first examined it, but as you can see we have never worked with a vehicle upon which your system could have been implemented and safely flown, and therefore we realized that it is impossible for us to have infringed this patent 5,904,724. You may easily independently verify the fact of these profound and fundamental differences from your system by examining the printed published materials regarding UAV control system and NASAs many publications on X-38 control systems.

We have never allowed our software to be used as an aid in piloting manned aircraft and thus cannot have infringed 5,566,073. If you aware of anyone doing this with our software, kindly inform us immediately, and we will ask them to desist.

Finally, let me set your mind at ease by informing you that our software product license currently explicitly contains the following clause: "The user is prohibited from using this software to pilot manned or unmanned aircraft." Alas, the requirements of our current company insurance policy, combined with the profound lack of a market for this possible application of our technology facilitated this business decision. Your letter said we recognize the "value" of this technology, but in view of the current situation "lack of value" is probably more appropriate.

We will get back to you just as soon as we have had a chance to study these patent claims further. For now, is there anything else that our company can reasonably do in regard to the concern that you expressed?

Sincerely,

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto: [REDACTED]]  
Sent: Tuesday, September 19, 2006 7:53 AM  
To: [REDACTED] (b/c)  
Cc: [REDACTED]  
Subject: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

September 19, 2006

Michael F. Abernathy

Rapid Imaging Software, Inc.

[Redacted address lines]

b(6)

Sent via US MAIL, FAX & EMAIL

Mr. Abernathy,

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

I am sure that Mr. Francisco Delgado of NASA and your other clients would agree with your company having a proper license of our intellectual property.

Hence as a legal formality, we are inviting your company to license our technology seeing that your company is already commercially using and selling said technology as covered by our IP listed below:

United States Patent 5,566,073 Margolin October 15, 1996 Pilot aid using a synthetic environment

United States Patent 5,904,724 Margolin May 18, 1999, Method and apparatus for remotely piloting an aircraft

We are pleased that you recognize the value of using Synthetic Vision to allow UAV's to See-and-Avoid other aircraft; this is covered by our patents as noted above.

Please contact us so that we can a proper legal license with our attorneys for your use of our technology and/or you may contact our attorneys (HYPERLINK "<http://by106fd.bay106.hotmail.msn.com/cgi-bin/compose?mailto=1&msg=0BE8FF07-CD08-47B5-A58D-A825698FD5EB&start=0&len=6480>  
&src=&type=x&to=[Redacted]&cc=&bcc=&subject=&body=&curmbox=00000000-0000-0000-0000-000000000001  
&a=ad17460c4976d4c8a2dcf004b74ca88163cef3516fe0531abada331a64870d4c" [Redacted] to

b(6)

arrange a proper license of said intellectual property. You have 15 days to do so.

Sincerely,

Robert Adams, CEO  
Optima Technology Group

RA/cp

-enclosure links-

-----  
**FW: question**

From: Mike Abernathy <[REDACTED]>  
To: DELGADO FRANCISCO J. (FRANK) <[REDACTED]> b(6)  
<[\[REDACTED\]@jsc.nasa.gov](mailto:[REDACTED]@jsc.nasa.gov)>, 'Fein, Edward K. (JSC-AL)' <[REDACTED]>  
'Kennedy, Alan J. (HQ-MC000)' <[REDACTED]>

Date: Sep 25 2006 - 11:44am  
One more FYI.

Mike Abernathy  
Rapid Imaging Software, Inc.

-----  
From: Mike Abernathy [mailto:[REDACTED]] b(6)  
Sent: Monday, September 25, 2006 10:08 AM  
To: 'Robert Adams'  
Subject: question

Robert,

Thanks for your offer to call but I am still getting over throat surgery from 2 weeks ago so my phone is forwarded, but I look forward to email from you and/or your attorneys.

In trying to understand the value of your IP I would like to ask 2 questions regarding USP 5,904,724. Was this system ever built? Was it ever flight tested? Of course you need not answer, but it really would be helpful in understanding what is required to get your technology to market.

Mike Abernathy  
Rapid Imaging Software, Inc.

From: Robert Adams [mailto: [REDACTED] b(6)  
Sent: Monday, September 25, 2006 8:55 AM  
To: 'Mike Abernathy'  
Subject: RE: Rapid Imaging Software, Inc. patent infringement

Mike,

Thanks for your email, I will forward it today over to my patent and review legal team. Once they complete a review of your comments, I will give you a ring on the phone and a response via the post and/or attorneys.

Respectfully,

Robert Adams

\_\_\_\_\_  
From: Mike Abernathy [mailto: [REDACTED] b(6)  
Sent: Sunday, September 24, 2006 4:29 PM  
To: 'Robert Adams'  
Subject: RE: Rapid Imaging Software, Inc. patent infringement

Dear Mr. Adams,

I have just returned from business travel, and have not had a chance to look over your communications in detail. Thank you very much for bringing your concerns to our attention. Let me assure you that we will do everything in our power, now and in the future, to avoid infringement of these or any patents. We have already begun another careful analysis of them and will act swiftly upon what we learn, should any problems be found. We have been aware of these patents for some years and have not ever infringed upon them, and will not do so. When we first learned of them we carefully examined our activities and those of our customers to make sure there was no possible infringement of them. As soon as we learned of it, we also informed the legal departments of our major customers to alert them to the existence of USP 5,904,724, but so far no UAV manufacturers have been seriously interested in offering synthetic vision for their UAV pilot stations.

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control inputs to fly the airplane, but only via the autopilot on board the aircraft. The autopilot corrects attitude drift instantaneously avoiding the problem of substantial communication delays, and allows the pilot to control the vehicle in a more stable manner.

Most important, the autopilot is absolutely required to deal with the frequent communications outages which occur between the UAV and the ground control segment (This can be anywhere from a second to an hour in length, generally). In the system of Margolin, a communications outage would often result in the loss of the aircraft, because the pilot would be unable to correct attitude drift during communication link loss and the air vehicle would go out of control and could crash. In the last decade of working with UAVs never have I witnessed a flight in which the communication link was not lost at least once during the flight. If the control communication link goes down, no control inputs can be made to the aircraft from the pilot on the ground, but the autopilot keeps the airplane from crashing by flying straight and level or gently banking until the link is restored. The system of Margolin does not recognize the problem of link loss, and fails to offer any solution. The autopilot functionality can be located in various components in the X38 it was in the on board GNC (Guidance Navigation and Control) computer, as I recollect.

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We have never allowed our software to be used as an aid in piloting manned aircraft and thus cannot have infringed 5,566,073. If you aware of anyone doing this with our software, kindly inform us immediately, and we will ask them to desist.




Finally, let me set your mind at ease by informing you that our software product license currently explicitly contains the following clause: "The user is prohibited from using this software to pilot manned or unmanned aircraft." Alas, the requirements of our current company insurance policy, combined with the profound lack of a market for this possible application of our technology facilitated this business decision. Your letter said we recognize the "value" of this technology, but in view of the current situation "lack of value" is probably more appropriate.

We will get back to you just as soon as we have had a chance to study these patent claims further. For now, is there anything else that our company can reasonably do in regard to the concern that you expressed?

Sincerely,

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto:  
Sent: Tuesday, September 19, 2006 7:53 AM  
To:   
Cc: 

b(6)

04658



Subject: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

September 19, 2006

Michael F. Abernathy

Rapid Imaging Software, Inc.

b(6)

Sent via US MAIL, FAX & EMAIL

Mr. Abernathy,

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I am sure that Mr. Francisco Delgado of NASA and your other clients would agree with your company having a proper license of our intellectual property.

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&src=&type=x&to=[REDACTED]&cc=&bcc=&subject=&body=&curmbox=00000000-0000-0000-0000-000000000001

b(6)

&a=ad17460c4976d4c8a2dcf004b74ca88163cef3516fe0531abada331a64870d4c" [REDACTED] to arrange a proper license of said intellectual property. You have 15 days to do so.

Sincerely,

Robert Adams, CEO

Optima Technology Group

RA/cp

-enclosure links-

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**RE: Rapid Imaging Software, Inc. patent infringement**

From: Fein, Edward K. (JSC-AL) [REDACTED]  
To: Mike Abernathy [REDACTED], DELGADO FRANCISCO J. (FRANK) [REDACTED]  
CC: Kennedy, Alan J. (HQ-MC000) [REDACTED]  
Date: Sep 25 2006 - 10:38am

b(6)

Thanks, Mike.

-Ed

From: Mike Abernathy [mailto:[REDACTED]]  
Sent: Monday, September 25, 2006 10:32 AM  
To: Fein, Edward K. (JSC-AL); DELGADO FRANCISCO J. (FRANK)  
Cc: Kennedy, Alan J. (HQ-MC000)  
Subject: FW: Rapid Imaging Software, Inc. patent infringement

b(6)

FYI

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto:[REDACTED]]  
Sent: Monday, September 25, 2006 8:55 AM  
To: 'Mike Abernathy'

b(6)

Subject: RE: Rapid Imaging Software, Inc. patent infringement

Mike,

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Respectfully,

Robert Adams

From: Mike Abernathy [mailto: [REDACTED] b(6)]  
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To: 'Robert Adams'  
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We have never allowed our software to be used as an aid in piloting manned aircraft and thus cannot have infringed 5,566,073. If you aware of anyone doing this with our software, kindly inform us immediately, and we will ask them to desist.




Finally, let me set your mind at ease by informing you that our software product license currently explicitly contains the following clause: "The user is prohibited from using this software to pilot manned or unmanned aircraft." Alas, the requirements of our current company insurance policy, combined with the profound lack of a market for this possible application of our technology facilitated this business decision. Your letter said we recognize the "value" of this technology, but in view of the current situation "lack of value" is probably more appropriate.

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Sincerely,

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto:  b(6)]  
Sent: Tuesday, September 19, 2006 7:53 AM  
To:   
Cc:   
Subject: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

September 19, 2006

Michael F. Abernathy

Rapid Imaging Software, Inc.

[REDACTED]  
[REDACTED]

b(6)

Sent via US MAIL, FAX & EMAIL

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&src=&type=x&to=[REDACTED]&cc=&bcc=&subject=&body=&curmbox=  
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&a=ad17460c4976d4c8a2dcf004b74ca88163cef3516fe0531abada331a64870d4c  
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b(6)

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Robert Adams, CEO  
Optima Technology Group

RA/cp

-enclosure links-

**RE: Rapid Imaging Software, Inc. patent infringement**

From: Fein, Edward K. (JSC-AL) [REDACTED]  
To: Mike Abernathy [REDACTED], DELGADO FRANCISCO J. (FRANK) [REDACTED]  
CC: Kennedy, Alan J. (HQ-MC000) [REDACTED]  
Date: Sep 25 2006 - 10:38am  
Thanks, Mike.

b(6)

-Ed

From: Mike Abernathy [mailto:[REDACTED]]  
Sent: Monday, September 25, 2006 10:32 AM  
To: Fein, Edward K. (JSC-AL); DELGADO FRANCISCO J. (FRANK)  
Cc: Kennedy, Alan J. (HQ-MC000)  
Subject: FW: Rapid Imaging Software, Inc. patent infringement

b(6)

FYI

Mike Abernathy  
Rapid Imaging Software, Inc.

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Sent: Monday, September 25, 2006 8:55 AM  
To: 'Mike Abernathy'  
Subject: RE: Rapid Imaging Software, Inc. patent infringement

b(6)

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Sincerely,

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto: [REDACTED] b(6)]  
Sent: Tuesday, September 19, 2006 7:53 AM  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.



September 19, 2006

Michael F. Abernathy

Rapid Imaging Software, Inc.

[Redacted]  
[Redacted]

b(6)

Sent via US MAIL, FAX & EMAIL

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b(6)

[00000000-0000-0000-0000-000000000001](mailto:00000000-0000-0000-0000-000000000001) c=&bcc=&subject=&body=&curmbox= [00000000-0000-0000-0000-000000000001](mailto:00000000-0000-0000-0000-000000000001) to arrange a proper license of said intellectual property. You have 15 days to do so.

Sincerely,

Robert Adams, CEO

Optima Technology Group

RA/cp

-enclosure links-

**RE: Rapid Imaging Software, Inc. patent infringement**

From: Fein, Edward K. (JSC-AL) <[redacted]>  
To: Mike Abernathy <[redacted]>, Delgado, Francisco J. (JSC-ER2) <[redacted]>, Kennedy, Alan J. (HQ-MC000) <[redacted]>

b(6)

Date: Sep 25 2006 - 9:59am

Thanks, Mike!

**RE: Rapid Imaging Software, Inc. patent infringement**

From: Fein, Edward K. (JSC-AL) <[redacted]>  
To: Delgado, Francisco J. (JSC-ER2) <[redacted]>, Mike Abernathy <[redacted]>, Kennedy, Alan <[redacted]>

b(6)

Date: Sep 25 2006 - 8:55am

I'm including Alan Kennedy, the attorney at NASA Headquarters who handles patent infringement for the agency, on this response. I believe your (Mike's) response to Optima is quite thorough and could very well diffuse this issue. I'm not sure a telecon at this time is warranted. I suggest we wait to see Optima's response.

Alan, do you have any additional thoughts?

-Ed

Edward K. Fein  
Deputy Chief Counsel/  
Intellectual Property Counsel

[redacted]  
[redacted]  
[redacted]

b(6)

Telephone: [redacted]  
Fax: [redacted]  
E-Mail: [redacted]

04668

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From: Delgado, Francisco J. (JSC-ER2)  
Sent: Monday, September 25, 2006 1:12 AM  
To: Mike Abernathy; Fein, Edward K. (JSC-AL)  
Subject: RE: Rapid Imaging Software, Inc. patent infringement

Please work with Mr. Fein on a time to call. I can 'sneak' away from any activity tomorrow to join a conference call.

thanks,

Frank

---

From: Mike Abernathy [mailto:] *b(6)*  
Sent: Sun 9/24/2006 6:38 PM  
To: Fein, Edward K. (JSC-AL); Delgado, Francisco J. (JSC-ER2)  
Subject: Rapid Imaging Software, Inc. patent infringement

Gentlemen,

I strongly believe that these two patents are defective, but more important I feel strongly that NASA and RIS did not infringe either one of them, in spite of these accusations.


I would like to ask for your help urgently since these people are threatening to sue us and since they have falsely accused us of infringement.

I therefore would like to ask both of you to read my letter attached below which has been sent to Mr. Adams, to make sure that I am stating things properly. Would it be possible for me to call you tomorrow on the phone?

Mike Abernathy

Rapid Imaging Software, Inc.

---

From: Mike Abernathy [mailto:] *b(6)*  
Sent: Sunday, September 24, 2006 5:29 PM  
To: 'Robert Adams'  
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I have just returned from business travel, and have not had a chance to look over your communications in detail. Thank you very much for bringing your concerns to our attention. Let me assure you that we will do everything in our power, now and in the future, to avoid infringement of these or any patents. We have already begun another careful analysis of them and will act swiftly upon what we learn, should any problems be found. We have been aware of these patents for some years and have not ever infringed upon them, and will not do so. When we first learned of them we carefully examined our activities and those of our customers to make sure there was no possible infringement of them. As soon as we learned of it, we also informed the legal departments of our major customers to alert them to the existence of USP 5,904,724, but so far no UAV manufacturers have been seriously interested in offering synthetic vision for their UAV pilot stations.

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More important however, is that all UAV control systems with which we are familiar require a device called an autopilot which is not contemplated at all in the subject patent. This device is similar to ones in modern manned aircraft, but it is used to control the aircraft flight in the pitch, heading, and roll axes. On UAVs, the communications delay is not handled by determining the delay and adjusting the control sensitivity as Margolin prescribes. Instead, an autopilot is installed onboard the aircraft where it senses changes in pitch, heading, and roll locally on board the aircraft. The pilot still makes control inputs to fly the airplane, but only via the autopilot on board the aircraft. The autopilot corrects attitude drift instantaneously avoiding the problem of substantial communication delays, and allows the pilot to control the vehicle in a more stable manner.

Most important, the autopilot is absolutely required to deal with the frequent communications outages which occur between the UAV and the ground control segment (This can be anywhere from a second to an hour in length, generally). In the system of Margolin, a communications outage would often result in the loss of the aircraft, because the pilot would be unable to correct attitude drift during communication link loss and the air vehicle would go out of control and could crash. In the last decade of working with UAVs never have I witnessed a flight in which the communication link was not lost at least once during the flight. If the control communication link goes down, no control inputs can be made to the aircraft from the pilot on the ground, but the autopilot keeps the airplane from crashing by flying straight and level or gently banking until the link is restored. The system of Margolin does not recognize the problem of link loss, and fails to offer any solution. The autopilot functionality can be located in various components in the X38 it was in the on board GNC (Guidance Navigation and Control) computer, as I recollect.

There is another on-board component called a SAS or Stability Augmentation System found on most large modern UAVs such as Predator, and which performs additional real-time stabilization to that done by the autopilot. Again, the SAS is not contemplated by the Margolin patent, yet is required to dampen control system oscillations in order to safely operate a UAV in systems that may suffer from communications delays to remote user control inputs. There are many more differences that we found when we first examined it, but as you can see we have never worked with a vehicle upon which your system could have been implemented and safely flown, and therefore we realized that it is impossible for us to have infringed this patent 5,904,724. You may easily independently verify the fact of these profound and fundamental differences from your system by examining the printed published materials regarding UAV control system and NASA's many publications on X-38 control systems.

We have never allowed our software to be used as an aid in piloting manned aircraft and thus cannot have infringed 5,566,073. If you are aware of anyone doing this with our software, kindly inform us immediately, and we will ask them to desist.

04670

Finally, let me set your mind at ease by informing you that our software product license currently explicitly contains the following clause: "The user is prohibited from using this software to pilot manned or unmanned aircraft." Alas, the requirements of our current company insurance policy, combined with the profound lack of a market for this possible application of our technology facilitated this business decision. Your letter said we recognize the "value" of this technology, but in view of the current situation "lack of value" is probably more appropriate.

We will get back to you just as soon as we have had a chance to study these patent claims further. For now, is there anything else that our company can reasonably do in regard to the concern that you expressed?

Sincerely,

Mike Abernathy

Rapid Imaging Software, Inc.

From: Robert Adams [mailto: [REDACTED] b(6)]  
Sent: Tuesday, September 19, 2006 7:53 AM  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

September 19, 2006

Michael F. Abernathy

Rapid Imaging Software, Inc.

[REDACTED] b(6)

Sent via US MAIL, FAX & EMAIL

Mr. Abernathy,

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

I am sure that Mr. Francisco Delgado of NASA and your other clients would agree with your company having a proper license of our intellectual property.

Hence as a legal formality, we are inviting your company to license our technology seeing that your company is already commercially using and selling said technology as covered by our IP listed below:

United States Patent 5,566,073 Margolin October 15, 1996 Pilot aid using a synthetic environment

United States Patent 5,904,724 Margolin May 18, 1999, Method and apparatus for remotely piloting an aircraft

We are pleased that you recognize the value of using Synthetic Vision to allow UAV's to See-and-Avoid other aircraft; this is covered by our patents as noted above.

Please contact us so that we can a proper legal license with our attorneys for your use of our technology and/or you may contact our attorneys (HYPERLINK "<http://by106fd.bay106.hotmail.msn.com/cgi-bin/compose?mailto=1&msg=0BE8FF07-CD08-47B5-A58D-A825698FD5EB&start=0&len=6480> &src=&type=x&to=[redacted]&cc=&bcc=&subject=&body=&curmbox=00000000-0000-0000-0000-000000000001 &a=ad17460c4976d4c8a2dcf004b74ca88163cef3516fe0531abada331a64870d4c[redacted] to arrange a proper license of said intellectual property. You have 15 days to do so.

b(c)

Sincerely,

Robert Adams, CEO

Optima Technology Group

RA/cp

-enclosure links-

**RE: Rapid Imaging Software, Inc. patent infringement**

From: Delgado, Francisco J. (JSC-ER2) <[redacted]>

To: Mike Abernathy <[redacted]> Fein, Edward K. (JSC-AL) <[redacted]>

b(c)

Date: Sep 25 2006 - 1:13am

Please work with Mr. Fein on a time to call. I can 'sneak' away from any activity tomorrow to join a conference call.

thanks,

Frank

04672

From: Mike Abernathy [mailto: [REDACTED] b(e)  
Sent: Sun 9/24/2006 6:38 PM  
To: Fein, Edward K. (JSC-AL); Delgado, Francisco J. (JSC-ER2)  
Subject: Rapid Imaging Software, Inc. patent infringement

Gentlemen,

I strongly believe that these two patents are defective, but more important I feel strongly that NASA and RIS did not infringe either one of them, in spite of these accusations.

I would like to ask for your help urgently since these people are threatening to sue us and since they have falsely accused us of infringement.

I therefore would like to ask both of you to read my letter attached below which has been sent to Mr. Adams, to make sure that I am stating things properly. Would it be possible for me to call you tomorrow on the phone?

Mike Abernathy

Rapid Imaging Software, Inc.

From: Mike Abernathy [mailto: [REDACTED] b(e)  
Sent: Sunday, September 24, 2006 5:29 PM  
To: 'Robert Adams'  
Subject: RE: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

Dear Mr. Adams,

I have just returned from business travel, and have not had a chance to look over your communications in detail. Thank you very much for bringing your concerns to our attention. Let me assure you that we will do everything in our power, now and in the future, to avoid infringement of these or any patents. We have already begun another careful analysis of them and will act swiftly upon what we learn, should any problems be found. We have been aware of these patents for some years and have not ever infringed upon them, and will not do so. When we first learned of them we carefully examined our activities and those of our customers to make sure there was no possible infringement of them. As soon as we learned of it, we also informed the legal departments of our major customers to alert them to the existence of USP 5,904,724, but so far no UAV manufacturers have been seriously interested in offering synthetic vision for their UAV pilot stations.

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More important however, is that all UAV control systems with which we are familiar require a device called an autopilot which is not contemplated at all in the subject patent. This device is similar to ones in modern manned aircraft, but it is used to control the aircraft flight in the pitch, heading, and roll axes. On UAVs, the communications delay is not handled by determining the delay and adjusting the control sensitivity as Margolin prescribes. Instead, an autopilot is installed onboard the aircraft where it senses changes in pitch, heading, and roll locally on board the aircraft. The pilot still makes control inputs to fly the airplane, but only via the autopilot on board the aircraft. The autopilot corrects attitude drift instantaneously avoiding the problem of substantial communication delays, and allows the pilot to control the vehicle in a more stable manner.

Most important, the autopilot is absolutely required to deal with the frequent communications outages which occur between the UAV and the ground control segment (This can be anywhere from a second to an hour in length, generally). In the system of Margolin, a communications outage would often result in the loss of the aircraft, because the pilot would be unable to correct attitude drift during communication link loss and the air vehicle would go out of control and could crash. In the last decade of working with UAVs never have I witnessed a flight in which the communication link was not lost at least once during the flight. If the control communication link goes down, no control inputs can be made to the aircraft from the pilot on the ground, but the autopilot keeps the airplane from crashing by flying straight and level or gently banking until the link is restored. The system of Margolin does not recognize the problem of link loss, and fails to offer any solution. The autopilot functionality can be located in various components in the X38 it was in the on board GNC (Guidance Navigation and Control) computer, as I recollect.

There is another on-board component called a SAS or Stability Augmentation System found on most large modern UAVs such as Predator, and which performs additional real-time stabilization to that done by the autopilot. Again, the SAS is not contemplated by the Margolin patent, yet is required to dampen control system oscillations in order to safely operate a UAV in systems that may suffer from communications delays to remote user control inputs. There are many more differences that we found when we first examined it, but as you can see we have never worked with a vehicle upon which your system could have been implemented and safely flown, and therefore we realized that it is impossible for us to have infringed this patent 5,904,724. You may easily independently verify the fact of these profound and fundamental differences from your system by examining the printed published materials regarding UAV control system and NASA's many publications on X-38 control systems.

We have never allowed our software to be used as an aid in piloting manned aircraft and thus cannot have infringed 5,566,073. If you are aware of anyone doing this with our software, kindly inform us immediately, and we will ask them to desist.

Finally, let me set your mind at ease by informing you that our software product license currently explicitly contains the following clause: "The user is prohibited from using this software to pilot manned or unmanned aircraft." Alas, the requirements of our current company insurance policy, combined with the profound lack of a market for this possible application of our technology facilitated this business decision. Your letter said we recognize the "value" of this technology, but in view of the current situation "lack of value" is probably more appropriate.

We will get back to you just as soon as we have had a chance to study these patent claims further. For now, is there anything else that our company can reasonably do in regard to the concern that you expressed?

Sincerely,

Mike Abernathy

Rapid Imaging Software, Inc.



From: Robert Adams [mailto: [REDACTED] b6)  
Sent: Tuesday, September 19, 2006 7:53 AM  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: [Norton AntiSpam] Rapid Imaging Software, Inc. patent infringement

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

September 19, 2006

Michael F. Abernathy

Rapid Imaging Software, Inc.  
[REDACTED] b6)  
[REDACTED]

Sent via US MAIL, FAX & EMAIL

Mr. Abernathy,

It has come to our attention that your company provides Synthetic Vision to fly UAV both in real time and in simulation.

I am sure that Mr. Francisco Delgado of NASA and your other clients would agree with your company having a proper license of our intellectual property.

Hence as a legal formality, we are inviting your company to license our technology seeing that your company is already commercially using and selling said technology as covered by our IP listed below:

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We are pleased that you recognize the value of using Synthetic Vision to allow UAV's to See-and-Avoid other aircraft; this is covered by our patents as noted above.

Please contact us so that we can a proper legal license with our attorneys for your use of our technology and/or you may contact our attorneys (HYPERLINK "<http://by106fd.bay106.hotmail.msn.com/cgi-bin/compose?mailto=1&msg=0BE8FF07-CD08-47B5-A58D-A825698FD5EB&start=0&len=6480>

&src=&type=x&to=[redacted]&cc=&bcc=&subject=&body=&curmbox=00000000-0000-0000-0000-0000000000001 b(6)  
&a=ad17460c4976d4c8a2dcf004b74ca88163cef3516fe0531abada331a64870d4c' [redacted] to  
arrange a proper license of said intellectual property. You have 15 days to do so.

Sincerely,

Robert Adams, CEO  
Optima Technology Group

RA/cp

-enclosure links-

**RE: US Patents 5566073 and 5904724**

From: FEIN, EDWARD K. (JSC-HA) (NASA) <[redacted]>  
To: Barry V. Gibbens, LaRC <[redacted]>  
CC: Linda B. Blackburn <[redacted]>  
Date: Sep 01 2004 - 4:33pm

b(6)

Rats! I guess I'd should research things better before I blindly send them out. Btw, the real Bahamas get hurricanes too.

-----Original Message-----

From: Barry V. Gibbens, LaRC [mailto:[redacted]]  
Sent: Wednesday, September 01, 2004 3:26 PM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Cc: Linda B. Blackburn  
Subject: RE: US Patents 5566073 and 5904724

b(6)

Very nice! I went to the Nassau Bay website, and looked under "New Things . . . Check It Out." Three of the highlights were "Storm Preparedness Information," "Hurricane Tracking Chart," and "You Can Now Pay Traffic Fines On Line." Sounds like my kind of place!!!

BG

At 02:44 PM 9/1/2004 -0500, you wrote:

No need to telecommute from the Bahamas, Barry. Nassau Bay is right across the street from JSC! Check out <http://www.nassaubay.com/>. See -- we got it all! And please do pass the word. I'd even risk the wrath of Linda and Kathy to snag one of you guys.

b(5)

[Large redacted block]

[Redacted]

b(5)

Take care ...

-Ed

-----Original Message-----

From: Barry V. Gibbens, LaRC [mailto:Barry.V.Gibbens@NASA.GOV]  
Sent: Wednesday, September 01, 2004 2:21 PM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Subject: RE: US Patents 5566073 and 5904724

Thanks Ed - I'll pass the word. Just for future reference, if any of us were to apply for the job, how would you feel about tele-commuting from, say, the Bahamas?????

b(5)

[Redacted]

At 12:30 PM 9/1/2004 -0500, you wrote:

[Redacted]

b(5)

[Redacted]

Best regards ...

-Ed

Btw, Jim Cate is retiring at the end of the month, and we definitely will be filling the slot. So please spread the word. Good things about JSC is the high locality pay differential in Houston, and the relatively low cost of living here. The downside is that the poor person will have to deal with my bad a\*\* on a daily basis.

Take care ...

-----Original Message-----

From: Barry V. Gibbens, LaRC [mailto:[Redacted]]  
Sent: Wednesday, September 01, 2004 11:29 AM  
To: Mike Abernathy; 'Kennedy, Alan'  
Cc: Linda B. Blackburn; Dan Baize; 'Trey Arthur'; DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA); FEIN, EDWARD K. (JSC-HA) (NASA); BOE, ERIC A., LTCOL. (JSC-CB) (NASA)  
Subject: Re: US Patents 5566073 and 5904724

b(6)

Hi Alan (and others),

Just to clarify the message below, I spoke with Mike Abernathy this morning, and I've spoken with Dan Baize on a number of occasions concerning this topic. I've also spoken with you (Alan) briefly, and with Linda Blackburn, Patent Counsel here at Langley (not Linda "Blackwell" :-). It seems clear that the technical folks have determined that the Margolin patent on Synthetic Vision creates a substantial problem for many of our partners in the aviation safety industry for a variety of reasons. It also seems clear that there is substantial prior art in existence to make an argument for re-examination of the Margolin patent. Linda has stated that we at Langley are willing to support an analysis of this situation at the Center level. She has, however, also told me that we first need to perform a formal infringement analysis to confirm (from a legal perspective) that we are in fact practicing the patent as described by its claims. If that analysis shows probable

infringement, then we can proceed with a re-examination request, which Dan Baize has indicated he would be willing to fund. It is my understanding that you (again Alan) gave your blessing this morning for us to proceed at the Center level on these activities. If that is the case, I'll go ahead and begin moving on the formal infringement analysis, keeping you apprised of progress as it develops. Please let me know if you are in agreement with the situation as I have described it. If so, I'll begin work here shortly.

Thanks,  
Barry

At 09:33 AM 9/1/2004 -0600, Mike Abernathy wrote:

Good Morning Alan,

Per our discussions this morning I called both Dan Baize and Barry Gibbens at Langley to discuss the resolution of questions surrounding patents 5566073 and 5904724. When we spoke earlier you indicated that based on the evidence of prior art uncovered so far, that NASA might move for an Ex-Parte re-examination of patent 5566073, provided that NASA patent counsel at LARC concurs. Mr. Baize feels that this patent may be invalid because of copious prior art, and that it is therefore a significant impediment to the development of life-saving synthetic vision technologies. Mr. Gibbens has indicated that he and Ms. Blackwell feel it is now appropriate for NASA LARC to proceed to request a re-examination. We will therefore forward them the same information on prior art that I forwarded to HQ. Please let us know how we can continue to be of help.

Best regards,  
Mike Abernathy  
Rapid Imaging Software, Inc.

  
[www.rapidform.com](http://www.rapidform.com)

HYPERLINK "<http://www.visualflight.com/>"[www.visualflight.com](http://www.visualflight.com)

b(6)



Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

  
phone:   
fax:   
email:   
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

b(6)

NEW E-MAIL ADDRESS: Please note that effective immediately, my e-mail address is now [Barry.V.Gibbens@nasa.gov](mailto:Barry.V.Gibbens@nasa.gov). Please update your mail systems accordingly. Thanks.

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

  
phone: (757) 864-7141  
fax: (757) 864-9190  
email:   
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

b(6)

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Intellectual Property Law Team - Office of Chief Counsel

[Redacted]

phone: [Redacted] b(6)  
fax: [Redacted]  
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**RE: US Patents 5566073 and 5904724**

From: FEIN, EDWARD K. (JSC-HA) (NASA) <[Redacted]>  
To: Barry V. Gibbens, LaRC <[Redacted]> b(6)  
BCC: ROAN, BERNARD J. (JSC-AL) (NASA) <[Redacted]>

Date: Sep 01 2004 - 2:44pm

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[Redacted]

Take care ...

-Ed

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To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Subject: RE: US Patents 5566073 and 5904724

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[Redacted]

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Sent: Wednesday, September 01, 2004 11:29 AM  
To: Mike Abernathy; 'Kennedy, Alan'  
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Subject: Re: US Patents 5566073 and 5904724.

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Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.

[REDACTED] y(6)  
[www.landform.com](http://www.landform.com)

HYPERLINK "<http://www.visualflight.com/>"[www.visualflight.com](http://www.visualflight.com)

04680

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

[Redacted]

phone: [Redacted]  
fax: [Redacted]  
email: [Redacted]  
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

b(6)

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Please update your mail systems accordingly. Thanks.

b(6)

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel  
Mail Stop 212  
Hampton, VA 23681-0001

phone: (757) 864-7141  
fax: (757) 864-9190  
email: [Redacted]  
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

b(6)

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Please update your mail systems accordingly. Thanks.

**FW: US Patents 5566073 and 5904724**

From: FEIN, EDWARD K. (JSC-HA) (NASA) <[Redacted]>  
To: RO, THEODORE U., JD (JSC-HA) (NASA) <[Redacted]>  
CATE, JAMES M., JD (JSC-HA) (NASA) <[Redacted]>  
CC: KRISHEN, KUMAR (JSC-HA) (NASA) <[Redacted]>  
WHITTINGTON, JAMES (JSC-HA) (USA) <[Redacted]>  
>, HAINES, DAVID D. (JSC-HA) (NASA) <[Redacted]>  
>, HIEGER, COLLIN (JSC-HA) (UNK) <[Redacted]>  
>, LANE, HELEN W. (JSC-AD) (NASA) <[Redacted]>  
>, HAYES, GREG W. (JSC-AD) (NASA) <[Redacted]>  
>, ROAN, BERNARD J. (JSC-AL) (NASA) <[Redacted]>  
>, REMINGTON, DANIEL R. (DAN) (JSC-AL) (NASA) <[Redacted]>

b(6)

(NASA) <[Redacted]>  
Date: Sep 01 2004 - 12:51pm

[Large redacted block]

b(5)

-Ed

-----Original Message-----

From: Mike Abernathy [mailto:[Redacted]]

b(6)

04681

Sent: Wednesday, September 01, 2004 12:25 PM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Subject: RE: US Patents 5566073 and 5904724

Here it is.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.  
[REDACTED]

b(6)

[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto:[REDACTED]]  
Sent: Wednesday, September 01, 2004 11:19 AM  
To: 'Mike Abernathy'  
Subject: RE: US Patents 5566073 and 5904724

b(6)

Barry Gibbens is a good man, Mike, and no, you haven't sent me the claims analysis. I am pleased to learn that the Agency is moving on this.

-Ed

-----Original Message-----

From: Mike Abernathy [mailto:[REDACTED]]  
Sent: Wednesday, September 01, 2004 11:45 AM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Cc: DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)  
Subject: RE: US Patents 5566073 and 5904724  
Hi Ed,

b(6)

Happy to keep you involved. I appreciated that article you sent me on the topic. The one thing that concerned me in the article is that I realized if Alan just sends the claims analysis to the PTO without requesting a re-exam then the owner will have the leisure to think up excuses for why this is not so, and prepare a defense maybe even ask for his own re-exam. Yikes! If NASA does not ask for the re-exam upon finding the prior art, we are basically strengthening his position to sue NASA by allowing him the time to synthesize a defense against the defects of his patent. It appears that Barry Gibbens is ready to press forward, happily.

Have I sent you the claims analysis yet?

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.  
[REDACTED]

b(6)

[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto:[REDACTED]]  
Sent: Wednesday, September 01, 2004 10:06 AM  
To: 'Mike Abernathy'  
Subject: RE: US Patents 5566073 and 5904724

b(6)

Thanks, Mike, for keeping me in the loop.

-Ed

-----Original Message-----

From: Mike Abernathy [mailto:[REDACTED]]  
Sent: Wednesday, September 01, 2004 10:33 AM

04682



To: 'Kennedy, Alan'

Cc: 'Barry V. Gibbens, LaRC'; Dan Baize; 'Trey Arthur'; DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA); FEIN, EDWARD K. (JSC-HA) (NASA); BOE, ERIC A., LTCOL. (JSC-CB) (NASA)

Subject: US Patents 5566073 and 5904724  
Good Morning Alan,

Per our discussions this morning I called both Dan Baize and Barry Gibbens at Langley to discuss the resolution of questions surrounding patents 5566073 and 5904724. When we spoke earlier you indicated that based on the evidence of prior art uncovered so far, that NASA might move for an Ex-Parte re-examination of patent 5566073, provided that NASA patent counsel at LARC concurs. Mr. Baize feels that this patent may be invalid because of copious prior art, and that it is therefore a significant impediment to the development of life-saving synthetic vision technologies. Mr. Gibbens has indicated that he and Ms. Blackwell feel it is now appropriate for NASA LARC to proceed to request a re-examination. We will therefore forward them the same information on prior art that I forwarded to HQ. Please let us know how we can continue to be of help.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.

[REDACTED]

☐ **RE: US Patents 5566073 and 5904724** b(6)

From: Mike Abernathy <[REDACTED]>  
To: 'FEIN, EDWARD K. (JSC-HA) (NASA)' <[REDACTED]>  
Date: Sep 01 2004 - 12:44pm  
Sir,

Could you read this and let me know what you think of it? I know it will evolve a lot in Barry's hands – which is good. But I would like your thoughts on it for my own and Frank's edification.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.

[REDACTED]

[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto:[REDACTED]]  
Sent: Wednesday, September 01, 2004 11:41 AM  
To: 'Mike Abernathy'  
Subject: RE: US Patents 5566073 and 5904724

b(6)

thanks!

-----Original Message-----

From: Mike Abernathy [mailto:[REDACTED]]  
Sent: Wednesday, September 01, 2004 12:25 PM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Subject: RE: US Patents 5566073 and 5904724  
Here it is.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.

[REDACTED]

[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto:[edward.k.fein@nasa.gov](mailto:edward.k.fein@nasa.gov)]  
Sent: Wednesday, September 01, 2004 11:19 AM  
To: 'Mike Abernathy'  
Subject: RE: US Patents 5566073 and 5904724

(5) [REDACTED]

-Ed

-----Original Message-----

From: Mike Abernathy [mailto:[\[REDACTED\]](mailto:)] b(6)  
Sent: Wednesday, September 01, 2004 11:45 AM  
To: FEIN, EDWARD K. (JSC-HA) (NASA)  
Cc: DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)  
Subject: RE: US Patents 5566073 and 5904724  
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Have I sent you the claims analysis yet?

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Mike Abernathy  
Rapid Imaging Software, Inc.

[REDACTED] b(6)  
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[www.visualflight.com](http://www.visualflight.com)

-----Original Message-----

From: FEIN, EDWARD K. (JSC-HA) (NASA) [mailto:[\[REDACTED\]](mailto:)]  
Sent: Wednesday, September 01, 2004 10:06 AM  
To: 'Mike Abernathy'  
Subject: RE: US Patents 5566073 and 5904724

Thanks, Mike, for keeping me in the loop. b(6)

-Ed

-----Original Message-----


From: Mike Abernathy [mailto:[\[REDACTED\]](mailto:)]  
Sent: Wednesday, September 01, 2004 10:33 AM  
To: 'Kennedy, Alan'  
Cc: 'Barry V. Gibbens, LaRC'; Dan Baize; 'Trey Arthur'; DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA); FEIN, EDWARD K. (JSC-HA) (NASA); BOE, ERIC A., LTCOL. (JSC-CB) (NASA)  
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Best regards,

04684

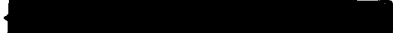
Mike Abernathy  
Rapid Imaging Software, Inc.

 b(6)  
[www.landform.com](http://www.landform.com)  
[www.visualflight.com](http://www.visualflight.com)



Claims Analysis of  
Patent.doc ...

**Re: US Patents 5566073 and 5904724**

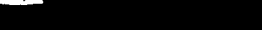

From: Barry V. Gibbens, LaRC 

To: Mike Abernathy , 'Kennedy, Alan' <  


CC: Linda B. Blackburn </>, Dan Baize <  


, Trey Arthur </>, DELGADO

FRANCISCO J. (FRANK) </>, FEIN, EDWARD

K. (JSC-HA) (NASA) </>, Eric Boe <  


Date: Sep 01 2004 - 11:29am

Hi Alan (and others),

Just to clarify the message below, I spoke with Mike Abernathy this morning, and I've spoken with Dan Baize on a number of occasions concerning this topic. I've also spoken with you (Alan) briefly, and with Linda Blackburn, Patent Counsel here at Langley (not Linda "Blackwell" :-). It seems clear that the technical folks have determined that the Margolin patent on Synthetic Vision creates a substantial problem for many of our partners in the aviation safety industry for a variety of reasons. It also seems clear that there is substantial prior art in existence to make an argument for re-examination of the Margolin patent. Linda has stated that we at Langley are willing to support an analysis of this situation at the Center level. She has, however, also told me that we first need to perform a formal infringement analysis to confirm (from a legal perspective) that we are in fact practicing the patent as described by its claims. If that analysis shows probable infringement, then we can proceed with a re-examination request, which Dan Baize has indicated he would be willing to fund. It is my understanding that you (again Alan) gave your blessing this morning for us to proceed at the Center level on these activities. If that is the case, I'll go ahead and begin moving on the formal infringement analysis, keeping you apprised of progress as it develops. Please let me know if you are in agreement with the situation as I have described it. If so, I'll begin work here shortly.

Thanks,  
Barry

At 09:33 AM 9/1/2004 -0600, Mike Abernathy wrote:

Good Morning Alan,

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Best regards,

Mike Abernathy

Rapid Imaging Software, Inc.

[REDACTED] b(6)

[www.landform.com](http://www.landform.com)

HYPERLINK "<http://www.visualflight.com/>"[www.visualflight.com](http://www.visualflight.com)

Barry V. Gibbens  
NASA Langley Research Center  
Intellectual Property Law Team - Office of Chief Counsel

[REDACTED]

phone: [REDACTED]  
fax: [REDACTED]  
email: [REDACTED]  
wwwwebsite: <http://tech-transfer.larc.nasa.gov/>

b(6)

NEW E-MAIL ADDRESS: Please note that effective immediately, my e-mail address is now [REDACTED]  
Please update your mail systems accordingly. Thanks.

---

**From:** McNutt, Jan (HQ-MC000)  
**Sent:** Wednesday, August 06, 2008 1:36 PM  
**To:** Fein, Edward K. (JSC-AL)  
**Cc:** Borda, Gary G. (HQ-MC000); Rotella, Robert F. (HQ-MA000)  
**Subject:** Patent Infringement claim from Jed Margolin; NASA Case No. I-222

Hello Mr. Fein,

I am a new attorney working commercial law and also helping out Gary and Bob. Do you remember working on this infringement claim, and if so, what was the outcome, if any? See attached.

<< File: Kennedy to JSC.pdf >> << File: Margolin FOIA.pdf >> << File: Letter from Optima 20080714.pdf >>

Thank you,

Jan S. McNutt  
Attorney-Advisor (Commercial)  
Office of the General Counsel  
NASA Headquarters



b(6)

From: "FEIN, EDWARD K. (JSC-HA) (NASA)" <[REDACTED]>  
 To: "Mike Abernathy" <[REDACTED]>  
 Cc: "Kennedy, Alan" <[REDACTED]>  
 "DELGADO, FRANCISCO J. (FRANK) (JSC-ER2) (NASA)" <[REDACTED]>

b(6)

Subject: RE:

Date: Mon, 28 Jun 2004 14:54:17 -0500

X-Mailer: Internet Mail Service (5.5.2657.72)

X-imss-version: 2.5

X-imss-result: Passed

X-imss-approveListMatch: \*@nasa.gov

Very interesting, Mike. Much thanks! I'm cc'ing Alan Kennedy, in the Office of General Counsel, who has been coordinating this matter.

-Ed

-----Original Message-----

**From:** Mike Abernathy [mailto:[REDACTED]]  
**Sent:** Monday, June 28, 2004 2:43 PM  
**To:** FEIN, EDWARD K. (JSC-HA) (NASA)  
**Subject:**

b(6)

Hi Ed,

Here is a summary plus a few more things that we found.

In patent #5566073 the owner asserts claim on what can be generally described as a method for "Pilot aid using a synthetic environment" which involves using the information about the airplane flight status to drive a synthetic reality display by creating a 3D synthetic scene. This technology is called synthetic vision by other researchers. He also asserts claim for a version of this system to unmanned aerial vehicles in patent 5904724.

I do not understand how the first patent can be valid given that there was widely published research and flight testing being conducted in this field prior to this time. A good example of the prior art is shown in the DELPHIN I synthetic vision developed at the U of Delft in Holland and flown in 1994.

This patent claims in the 1995 application that it developed the method of pilot aid using a 3D synthetic environment. But at this webpage, you can see that a Dutch university had already flown such an environment in 1994:

<http://www.synthetic-vision.tudelft.nl/>

(See First flight of the DELPHINS Tunnel-in-the-sky display at the bottom of the list of links).

Here is an example of papers published in widely distributed engineering journals describing what seems to me to be a very similar system.

H. Möller, G. Sachs:

Synthetic Vision for Enhancing Poor Visibility Flight Operations.

IEEE Aerospace and Electronic Systems Magazine, Volume 9, No. 3, S. 27-30, 1994

G. Sachs, H. Möller, K. Dobler, G. Schänzer, K. Möhlenkamp:

Bodenrollführung durch synthetische Sicht und Präzisionsnavigation.

Jahrbuch 1994 I der Deutschen Gesellschaft für Luft- und Raumfahrt, Bonn, S. 475-482, 1994

G. Sachs, H. Möller, K. Dobler, G. Schänzer, K. Möhlenkamp:

Computer Generated Vision for Improving On-Board Guidance and Control of Surface Movement.

ECAC/APATSI and EC Workshop on Surface Movement Guidance and Control Systems,

Frankfurt/Main, 6.4.-8.4. 1994, European Civil Aviation Conference, Bretigny-sur-Orge, France,

ECAC/APATSI Paper S. 1-10, 1994

04698

EDWARD K. (ISC HA) (AIAA) 00 51 PM 6/20/2004 21:00 PM  
G. Sachs, H. Möller, K. Dobler, G. Schänzer, K. Möhlenkamp:

Synthetic Vision and Precision Navigation for Aircraft Taxi Guidance in Low Visibility.

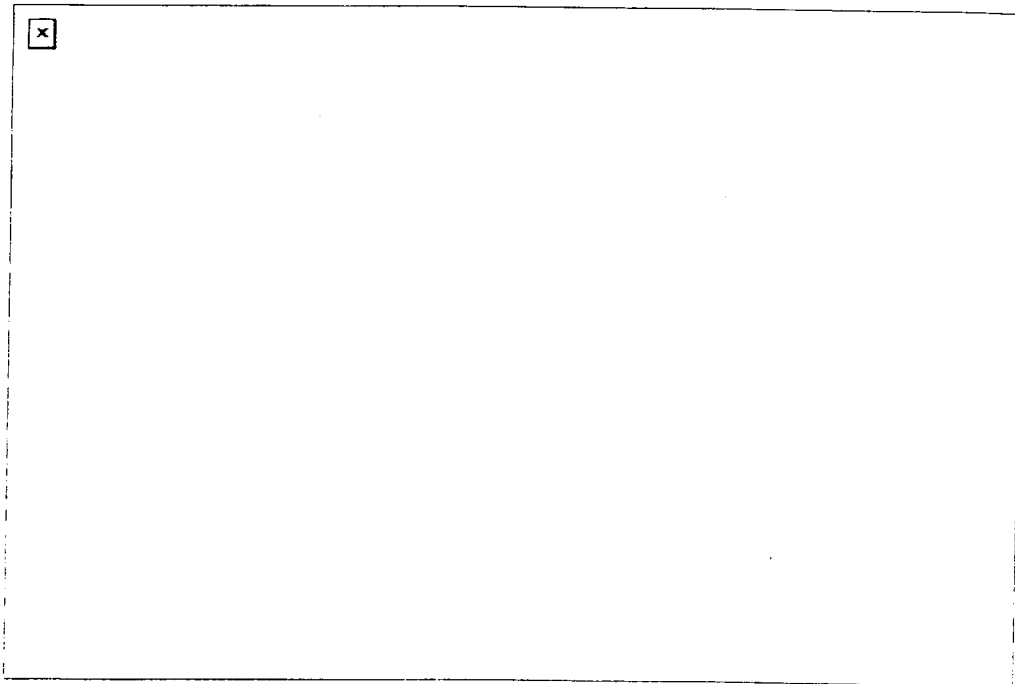
AIAA Guidance, Navigation and Control Conference Proceedings, Scottsdale, AZ, August 1.-3., S. 1202-1211, 1994

Finally, please look at this history of perspective flightpath displays. In light of this I cannot understand the basis for a these two patents.

<http://www.delphins.tudelft.nl/history.html>

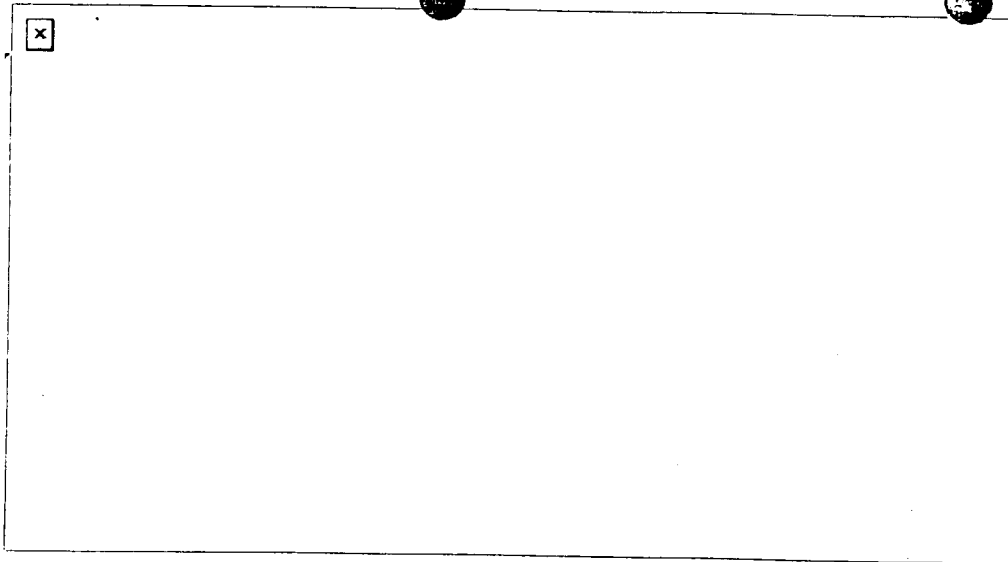
## DELPHINS first flight test

The first flight test of the DELPHINS system took place in december 1994. To achieve this, the Radionavigation group rented the Citation II laboratory aircraft that is jointly owned by Delft University and the National Aerospace Laboratory NLR. All display hardware and software that was used in this flight test was developed by the Radionavigation group of the Faculty of Electrical Engineering, nowadays part of the Faculty of Information Technology and Systems

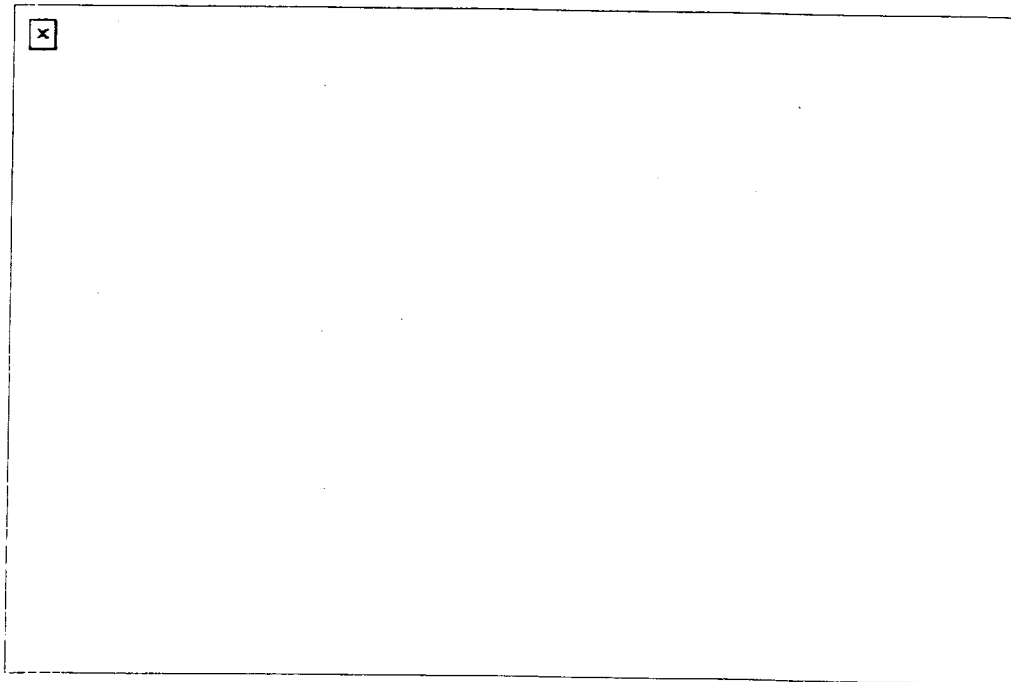


Installation of the experimental display in the cockpit of the Citation II

04699



Erik Theunissen (TU Delft, Faculty of Electrical Engineering) preparing the system the evening before first flight. The yellow marking shows the experimental display in the cockpit




First test flight of the DELPHINS Tunnel-in-the-Sky display (december 19, 1994) from Amsterdam to Aberdeen

I look forward to reading your thoughts.

Best regards,

Mike Abernathy  
Rapid Imaging Software, Inc.

  
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*b(4)*

04700





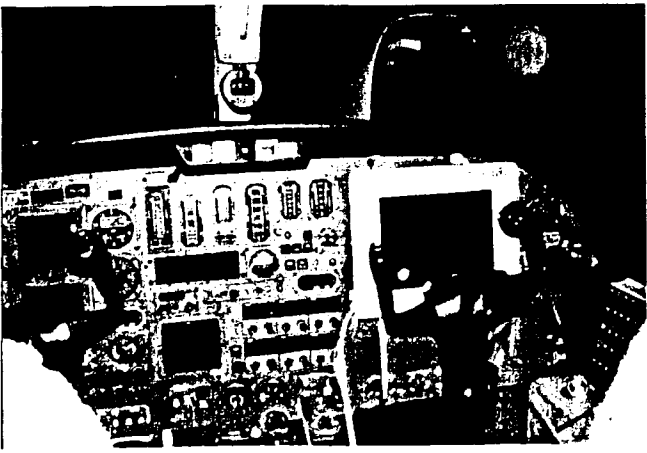
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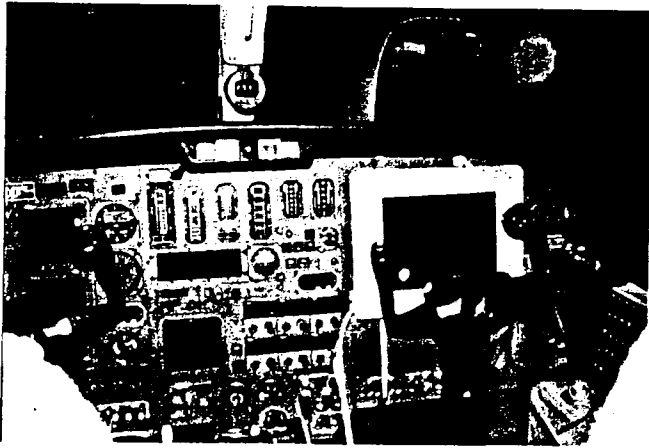
image002.jpg



image003.jpg



04702



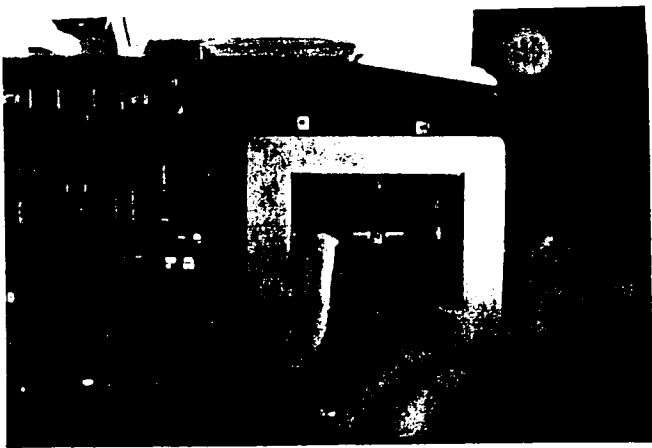
04703



04704



04705



04706



04707

# De rust van een fuik

NAVIGATIE  
door MARK TRAA

In een oogopslag zien of je op de juiste koers zit is er voor piloten nu nog niet bij. Een vluchtdiek vol klokjes en meterjes geeft een overdosis informatie. Maar in de toekomst wordt de essentie van het vliegen afgebeeld op een beeldscherm dat de piloot veilig door een kunstmatige tunnel voert.

Het grote verschil tussen een vliegtuig en een auto is dat de laatste zich over de weg begeeft. Het klikt als een open deur (en dat is het ook), maar juist dit gegeven maakt vliegen zo veel moeilijker dan autorijden.

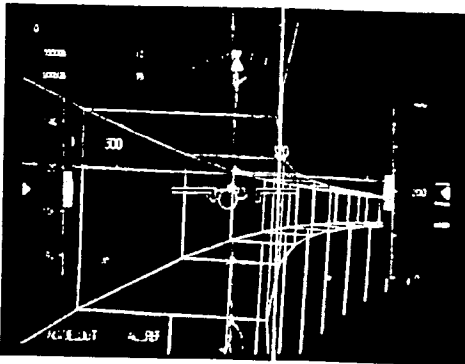
Navigeren op de snelweg is een eufje. Het asfalt strekt zich tientallen, soms honderden meters of nog verder voor de auto uit en dat maakt anticiperen mogelijk. Een piloot heeft het moeilijker. Hij beweegt zich in drie dimensies en heeft amper aanknopingspunten: geen strepen, geen vangrails, geen bordjes. Koers houden doet een piloot door metertjes af te lezen die onder meer de stand van het vliegtuig, de snelheid, de hoogte, de kompasrichting en de stijgsnelheid aangeven. Bij de nadering van een vliegveld zijn er wel kaarten beschikbaar, maar die willen nogal eens afleiden en moeten bovendien door de piloot worden 'vertaald' naar de werkelijke situatie.

Doordat het luchtverkeer steeds drukker wordt, zal de nadering van een vliegveld in de toekomst lastiger worden - dichtger in elk geval. Nu zorgt een piloot dat hij bij het aanvliegen in het vliegveld van de landingsbaan komt en

in de greep raakt van bakens die radiosignalen uitzenden. Dan is het zaak om een paar schuivende naalden op de kunstmatige horizon in de cockpit te volgen: ietsje naar beneden, een tikje naar rechts. Dat lijkt eenvoudig, op een vrijwel rechte weg zo'n naald achterna sturen. Het wordt lastiger als er bochten in het traject komen. Probeer het maar eens in de auto: als je even naar de strepen in het midden van de weg tuurt, er voor zorgt dat je er hooguit een paar van tevoren ziet aankomen, rijd je direct een stuk krampachtiger. Je bent geneigd, een overdreven grote ruk aan het stuur te geven zodra de strepen lijken af te buigen. Komt er een scherpe bocht of een flauwe? Een afrit misschien?

## Vangrail

Het is duidelijk dat er wat verbeterd kan worden aan de *situational awareness* van de piloot. Hij moet zich bewust zijn van de situatie om hem heen en de plaats van zijn eigen toestel. Dat kan door een weg aan te leggen voor het vliegtuig. Of beter nog - vanwege die drie dimensies - een tunnel. Een tunnel in de sky, daarover ging de lezing die dr. Erik Theunissen gisteren hield op het luchtvaartsymposium 'Looking Ahead' in de RAI. Theunissen is verbonden aan de faculteit Elektrotechniek van de TU Delft en hoopt te promoveren op een project dat hij in 1990 begon het *DELTA Program for Hybridized Instrumentation and Navigation Systems* (DELPHINS). Wat hem betreft stuurt de piloot van de toekomst zijn



Vliegen door een tunnel: voor piloten een veel ontspannender manier van oriënteren dan metertjes aflezen in het vrije luchtruim. FOTO: TUO

toestel als in een videospelletje door een tunnel die is geprojecteerd op een beeldscherm.

„Dat is inderdaad vaak de eerste reactie, het lijkt wel een videospelletje”, zegt Theunissen als hij op een computerscherm een vliegtuigsymbool behendig door een rechthoekige tunnel stuurt. De tunnel is niet dicht, maar is opgebouwd als een draadmodel; daardoor is het verdere verloop ervan tot aan de (kunstmatige) horizon te zien. Over anticiperen gesproken.

Theunissen: „Onderweg, op grote hoogte, heb je als piloot heel weinig visuele feedback; je ziet buiten amper het resultaat van een manoeuvre. Dat is bij een landing juist het tegenovergestelde. Dan komt er een geweldige hoeveelheid informatie op je af. In beide gevallen is de piloot gebaat bij een natuurlijk beeld van de omgeving en niet bij heel abstracte informatie: symbooltjes die op een schaalte beweging of driehoekjes die over een lijntje schuiven.”

„Doordat hij straks steeds meer bochten moet gaan maken, is het mentale plaatje van de vlieger ingewikkelder geworden. Voor hem is het heel belangrijk dat hij een idee heeft waar hij is, waar hij naartoe moet en hoe hij daar komt. Daarvoor dient zo'n tunnel. Als de piloot die op zijn scherm ziet, hoeft hij alleen nog te zorgen dat hij erin komt. In een oogopslag ziet hij vervolgens hoe het traject verder loopt en of hij dreigt af te wijken. Dat hele intensieve getuig naar de instrumenten hoeft dan niet meer. Naar buiten kijken blijft overigens gewoon mogelijk; het tunnelscherm wordt ingebouwd in het vluchtdiek tussen de andere instrumenten.”

Het is niet zo dat de luchtunnel in één klap alle cockpitinstrumenten vervangt. De belangrijkste meters blijven prima onder te brengen in het tunnelplaatje dat de piloot ziet. Dat gold onder meer voor de stand van het vliegtuig en de kompasrichting. Andere gegevens, zoals de snelheid en de hoogte, blijft de piloot aflezen op een cijferschaal. Die kan echter geprojecteerd worden op het tunnelscherm, zodat het exact aflezen mogelijk blijft zonder dat de piloot alsnog zijn aandacht op een meterje eiders in de cockpit hoeft te richten.

## Losse pois

Theunissen: „Als je een bepaalde stuuractie inzet, dan weet je dat je dat niet met onnodige nauwkeurigheid kunt doen. Je bent dus gebaat bij informatie die aangeeft hoe veel je afwijkt. Als je dichtbij de randen van de tunnel komt - in teorie de vangrail - is het wel

zaak dat je die informatie gebruikt.” Het is volgens Theunissen niet de bedoeling dat piloten overmoedig gaan worden en met de losse pois door zo'n tunnel gaan sjezen. De tunnel is immers niet breder dan absoluut noodzakelijk; dat bevordert de nauwkeurigheid waarmee wordt gestuurd. Ook blijft het gewoon opletten geboden, hoewel de intensiteit van het sturen wordt vermindert. De schuivende naalden in de 'oude' cockpit zijn vervangen door een vliegtuigsymbooltje dat door de tunnel vliegt. In een oogopslag zie je of dat ding de goede kant op gaat, is dat niet het geval, dan kan ingrijpen gewenst zijn. Kan, want dank zij het tunnelzicht zie je meteen of het wel zo'n ramp is als je toestel wat naar links afwijkt, als er straks toch naar links moet worden gegraaid, dan is een correctie misschien helemaal niet nodig.

In een tijd dat vliegtrajecten ingewikkelder worden en cockpits worden volgestopt met allerlei nieuwe wetten, stoffen, zou de kunstmatige luchtunnel voor enige verlichting kunnen zorgen. Vooral bij de nadering van een landingsbaan kan zo'n visuele 'fuik' - de tunnel wordt immers steeds smaller naarmate er preciezer moet worden gevlogen - een aardig hulpmiddel zijn. De piloten die DELPHINS inmiddels in een simulator zonder uitnoering enthousiast. Als het onderzoeksproject aan de TU Delft is afgerond, is het wachten op een fabrikant van vliegtuigapparatuur die in de tunnel wil duiken.



# De rust van een fuik

NAVIGATIE  
door MARK TRAA

In een oogopslag zien of je op de juiste koers zit is er voor piloten nu nog niet bij. Een vluchtdiek vol klokjes en meterijes geeft een overdosis informatie. Maar in de toekomst wordt de essentie van het vliegen afgebeeld op een beeldscherm dat de piloot veilig door een kunstmatige tunnel voert.

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Navigeren op de snelweg is een eitje. Het asfalt strekt zich tientallen, soms honderden meters of nog verder voor de auto uit en dat maakt anticiperen mogelijk. Een piloot heeft het moeilijker. Hij beweegt zich in drie dimensies en heeft amper aanknopingspunten: geen strepen, geen vangrails, geen bordes. Koers houden doet een piloot door meterijes al te lezen die onder meer de stand van het vliegtuig, de snelheid, de hoogte, de kompasrichting en de stijgsnelheid aangeven. Bij de nadering van een vliegveld zijn er wel kaarten beschikbaar, maar die willen nogal eens afleiden en moeten bovendien door de piloot worden vertaald naar de werkelijke situatie.

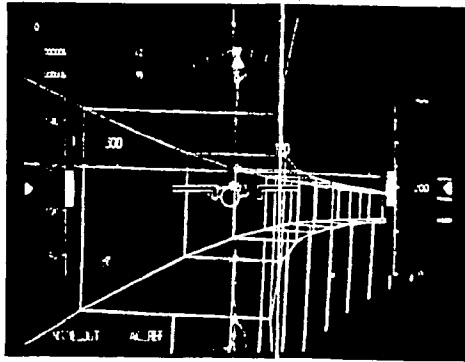
Doordat het luchtverkeer steeds drukker wordt, zal de nadering van een vliegveld in de toekomst lastiger worden. Bochtiger in elk geval. Nu zorgt een piloot dat hij bij het aanvliegen in het verlengde van de landingsbaan komt en

in de greep raakt van bakens die radiosignalen uitzenden. Dan is het zaak om een paar schuivende naalden op de kunstmatige horizon in de cockpit te volgen: ietsje naar beneden, een lijn naar rechts.

Dat lijkt eenvoudig, op een vrijwel rechte weg zo'n naald achterna sturen. Het wordt lastiger als er bochten in het traject komen. Probeer het maar eens in de auto: als je even naar de strepen in het midden van de weg tuurt, er voor zorgt dat je er hooguit een paar van tevoren ziet aankomen, rijd je direct een stuk krampachtiger. Je bent geneigd, een overdreven grote ruk aan het stuur te geven zodra de strepen lijken af te buigen. Komt er een scherpe bocht of een slauwe? Een afrit misschien?

## Vangrail

Het is duidelijk dat er wat verbeterd kan worden aan de *situational awareness* van de piloot. Hij moet zich bewust zijn van de situatie om hem heen en de plaats van zijn eigen toestel. Dat kan door een weg aan te leggen voor het vliegtuig. Of beter nog - vanwege de drie dimensies - een tunnel. Een tunnel in the sky, daarover ging de lezing die ir. Erik Theunissen gisteren hield op het luchtvaartsymposium 'Looking Ahead' in de RAI. Theunissen is verbonden aan de faculteit Elektrotechniek van de TU Delft en hoopt te promoveren op een project dat hij in 1990 begon: het *DELFT Program for Hybridized Instrumentation and Navigation Systems* (DELPHINS). Wat hem betreft stuurt de piloot van de toekomst zijn



Vliegen door een tunnel: voor piloten een veel ontspannender manier van oriënteren dan meterijes aflezen in het vrije lichtruim. FOTO: IJOO

toestel als in een videospelletje door een tunnel die is geprojecteerd op een beeldscherm.

„Dat is inderdaad vaak de eerste reactie: het lijkt wel een videospelletje”, zegt Theunissen als hij op een computerscherm een vliegtuigsymbool behendig door een rechthoekige tunnel stuurt. De tunnel is niet dicht, maar is opgebouwd als een draadmodel, waardoor is het verdere verloop ervan tot aan de (kunstmatige) horizon te zien. Over anticiperen gesproken.

„Doordat hij straks steeds meer bochten moet gaan maken, is het mentale plaatje van de vlieger ingewikkelder geworden. Voor hem is het heel belangrijk dat hij een idee heeft waar hij is, waar hij naartoe moet en hoe hij daar komt. Daarvoor dient zo'n tunnel. Als de piloot die op zijn scherm ziet, hoeft hij alleen nog te zorgen dat hij erin komt. In een oogopslag ziet hij vervolgens hoe het traject verder loopt en of hij dreigt af te wijken. Dat hele intensieve getuig naar de instrumenten hoeft dan niet meer. Naar buiten kijken blijft overigens gewoon mogelijk; het tunnelscherm wordt ingebouwd in het vluchtdiek tussen de andere instrumenten.”

Het is niet zo dat de luchtunnel in een klap alle cockpitinstrumenten vervangt. De belangrijkste meters bleken prima onder te brengen in het tunnelplaatje dat de piloot ziet. Dat gold onder meer voor de stand van het vliegtuig en de kompasrichting. Andere gegevens, zoals de snelheid en de hoogte, blijft de piloot aflezen op een cijferschaal. Die kan echter geprojecteerd worden op het tunnelscherm, zodat het exact aflezen mogelijk blijft zonder dat de piloot alsnog zijn aandacht op een meterijes elders in de cockpit hoeft te richten.

## Losse pols

Theunissen: „Als je een bepaalde stuuractie inzet, dan weet je dat je dat niet met oneindige nauwkeurigheid kunt doen. Je bent dus gebaat bij informatie die aangeeft hoe veel je afwijkt. Als je dichter bij de randen van de tunnel komt - in te veel van de vangrail - is het wel

zaak dat je die informatie gebruikt.” Het is volgens Theunissen niet de bedoeling dat piloten overmoedig gaan worden en met de losse pols door zo'n tunnel gaan sjezen. De tunnel is immers niet breder dan absoluut noodzakelijk; dat bevordert de nauwkeurigheid waarmee wordt gestuurd. Ook blijft het gewoon opletten geblazen, hoewel de intensiteit van het sturen wordt vermindert. De schuivende naalden in de 'oude' cockpit zijn vervangen door een vliegtuigsymbooltje dat door de tunnel vliegt. In een oogopslag zie je of dat ding de goede kant op gaat. Is dat niet het geval, dan kan ingrijpen gewenst zijn. Kan, want dank zij het tunnelzicht zie je meteen of het wel zo'n ramp is als je toestel wat naar links afwijkt; als er straks toch naar links moet worden geredraaid, dan is een correctie misschien helemaal niet nodig.

In een tijd dat vliegtuigtrajecten ingewikkelder worden en cockpit worden volgestopt met allerlei nieuwe wetenschappelijke snuffjes, zou de kunstmatige luchtunnel voor enige verlichting kunnen zorgen. Vooral bij de nadering van een landingsbaan kan zo'n visuele 'fuik' - de tunnel wordt immers steeds smaller naarmate er preciezer moet worden gevlogen - een aardig hulpmiddel zijn. De piloten die DELPHINS inmiddels in een simulator hebben getest, zijn volgens Theunissen zonder uitzondering enthousiast. Als het onderzoeksproject aan de TU Delft is afgerond, is het wachten op een fabrikant van vliegtuigapparatuur die in de tunnel wil duiken.

In Synthetic Vision (NASA's term), the aircraft's position and orientation are used with a terrain database (such as the Digital Elevation Database) to produce a 3D projected view of the terrain over which the aircraft is flying. One of the advantages of this system is that the pilot is able to "see" the terrain regardless of weather conditions or whether it is day or night.

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,566,073 Pilot Aid Using a Synthetic Environment** issued October 15, 1996 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed August 9, 1995, and was a continuation of Application Ser. No. 08/274,394, filed July 11, 1994.

With synthetic vision it is not necessary for the pilot to be in the aircraft. I believe the X-38 project used this method.

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,904,724 Method and Apparatus For Remotely Piloting an Aircraft** issued May 18, 1999 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed January 19, 1996.

#### X-38 Project

I became aware that NASA was using synthetic vision in the X-38 project in the January 2003 issue of NASA Tech Briefs, page 40, "**Virtual Cockpit Window**" for a **Windowless Aerospacecraft**. The article is available at:  
<http://www.nasatech.com/Briefs/Jan03/MSC23096.html>

This led me to Rapid Imaging Software, Inc. and their press release (<http://www.landform.com/pages/PressReleases.htm>) which states:

*"On December 13th, 2001, Astronaut Ken Ham successfully flew the X-38 from a remote cockpit using LandForm VisualFlight as his primary situation awareness display in a flight test at Edwards Air Force Base, California. This simulates conditions of a real flight for the windowless spacecraft, which will eventually become NASA's Crew Return Vehicle for the ISS. We believe that this is the first test of a hybrid synthetic vision system which combines nose camera video with a LandForm synthetic vision display. Described by astronauts as "the best seat in the house", the system will ultimately make space travel safer by providing situation awareness during the landing phase of flight.*

The RIS press release provided a link to an article in Aviation Week & Space Technology:  
[http://www.aviationnow.com/avnow/news/channel\\_space.jsp?view=story&id=news/sx381211.xml](http://www.aviationnow.com/avnow/news/channel_space.jsp?view=story&id=news/sx381211.xml)

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,904,724 Method and Apparatus For Remotely Piloting an Aircraft** issued May 18, 1999 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed January 19, 1996.

The patent can be downloaded from the UPTO Web site ([www.uspto.gov](http://www.uspto.gov)) in html (no drawings) or in an odd tif format (with the drawings) that requires a special viewer.

The exact link to the html version is too long to have much chance of making it through email in one piece.

It would be easier to go to <http://patft.uspto.gov/netahtml/srchnum.htm> and enter the patent number **5,904,724** .

An even easier way to view and download the patent is through my Web site, on which I have posted the patent in both html and PDF formats. The link is <http://www.imargolin.com/patents2/rpv.htm> .

While I have no way of knowing exactly what method(s) NASA used in controlling the X-38 (unless you are willing to make a full disclosure) my patent covers techniques as exemplified by claim 1.

*1. A system comprising:*

*a remotely piloted aircraft including,*

*a position determining system to locate said remotely piloted aircraft's position in three dimensions; and*

*an orientation determining system for determining said remotely piloted aircraft's orientation in three dimensional space;*

*a communications system for communicating flight data between a computer and said remotely piloted aircraft, said flight data including said remotely piloted aircraft's position and orientation, said flight data also including flight control information for controlling said remotely piloted aircraft;*

*a digital database comprising terrain data;*

*said computer to access said terrain data according to said remotely piloted aircraft's position and to transform said terrain data to provide three dimensional projected image data according to said remotely piloted aircraft's orientation;*

*a display for displaying said three dimensional projected image data; and*

*a set of one or more remote flight controls coupled to said computer for inputting said flight control information, wherein said computer is also for determining a delay time for communicating said flight data between said computer and said remotely piloted aircraft, and wherein said computer adjusts the sensitivity of said set of one or more remote flight controls based on said delay time.*

Although the X-38 project has been canceled the methods developed to fly it are too good to waste and should be used in follow-up projects like CRV.

## Synthetic Vision

I became aware of NASA's Synthetic Vision program perhaps two years ago from a program on NASA TV. I was unable to follow it up at that time due to health problems and the demands of my other patenting activity.

According to the NASA Aviation Safety Program Web site ([http://avsp.larc.nasa.gov/program\\_svs.html](http://avsp.larc.nasa.gov/program_svs.html))

### *Synthetic Vision Systems*

#### **TECHNOLOGY WOULD REDUCE AIRLINE FATALITIES** *Synthetic Vision would give pilots clear skies all the time*

*A revolutionary cockpit display system being developed with seed money from NASA would help prevent the world's deadliest aviation accidents.*

And I agree.

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,566,073 Pilot Aid Using a Synthetic Environment** issued October 15, 1996 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed August 9, 1995, and was a continuation of Application Ser. No. 08/274,394, filed July 11, 1994.

The patent can be downloaded from the USPTO Web site ([www.uspto.gov](http://www.uspto.gov)) in html (no drawings) or in an odd tif format (with the drawings) that requires a special viewer.

The exact link to the html version is too long to have much chance of making it through email in one piece.

It would be easier to go to <http://patft.uspto.gov/netahtml/srchnum.htm> and enter the patent number **5,566,073**.

An even easier way to view and download the patent is through my Web site, on which I have posted the patent in PDF format at <http://www.imargolin.com/patents2/pilot.htm>

As with the X-38 program I have no way of knowing exactly what method(s) NASA used in its Synthetic Vision program (unless you are willing to make a full disclosure). My patent covers techniques as exemplified by claim 1.

*1. A pilot aid which uses an aircraft's position and attitude to transform data from a digital data base to present a pilot with a synthesized three dimensional projected view of the world comprising:*

*a position determining system for locating said aircraft's position in three dimensions;*

*a digital data base comprising terrain data, said terrain data representing real terrestrial terrain as at least one polygon, said terrain data generated from elevation data of said real terrestrial*

terrain;

*an attitude determining system for determining said aircraft's orientation in three dimensional space;*

*a computer to access said terrain data according to said aircraft's position and to transform said terrain data to provide three dimensional projected image data according to said aircraft's orientation; and*

*a display for displaying said three dimensional projected image data.*

### NASA's Visits to My Web Site

As I mentioned in our telephone conversation, NASA has been visiting my Web site ([www.jmargolin.com](http://www.jmargolin.com)) regularly since I started it in December 2000. (I have no objection to NASA's visits; I am flattered that NASA considers my Web site worth visiting.)

A listing of NASA access statistics follows the end of this email.

I also have regular visits from <http://cap.nipr.mil>, which I understand is a secure gateway to other military networks. I don't know if NASA uses nipr so I have not included it in my listing.

The Web Statistics software provided by my Web Hosting Service tell me who is visiting my Web site and what people are looking at but not who is looking at what, (In January of this year I discovered there are raw Web log files containing this information but my Web Hosting Service does not keep backup log files older than the previous month.)

I am including an example of the detailed Web log data; it's understandable why my Web Hosting Service abstracts it into a less detailed form.

The article being referenced is **Unit Vector Math for 3D Graphics** ([www.jmargolin.com/uvmath/uvmenu.htm](http://www.jmargolin.com/uvmath/uvmenu.htm))

Now that I can see what people are looking at I have noticed a great deal of interest in this article as well as **The Relationship between Unit Vector Rotations and Euler Angle Functions** . ([www.jmargolin.com/uvmath/euler.doc](http://www.jmargolin.com/uvmath/euler.doc))

These articles also seem to interest military contractors like Lockheed Martin (lmco.com), Boeing (boeing.com), Northrop Grumman (northgrum.com), and SAIC (saic.hq.nasa.gov) as well as a large number of educational institutions.

Some accesses are obviously just for fun, to articles such as to **Gas Music From Jupiter** ([www.jmargolin.com/qmfj/qmfj.htm](http://www.jmargolin.com/qmfj/qmfj.htm))

There are also visits from most of our national labs. I expect they are interested in **U.S. Patent 6,377,436 Microwave Transmission Using a Laser-Generated Plasma Beam Waveguide** issued April 23, 2002 to Jed Margolin.

**Abstract**

*A directed energy beam system uses an ultra-fast laser system, such as one using a titanium-sapphire infrared laser, to produce a thin ionizing beam through the atmosphere. The beam is moved in either a circular or rectangular fashion to produce a conductive shell to act as a waveguide for microwave energy. Because the waveguide is produced by a plasma it is called a plasma beam waveguide. The directed energy beam system can be used as a weapon, to provide power to an unmanned aerial vehicle (UAV) such as for providing communications in a cellular telephone system, or as an ultra-precise radar system.*

There is a possibility that this device could be used to make a linear Tokamak.  
([www.jmargolin.com/debs/debs.htm](http://www.jmargolin.com/debs/debs.htm))

**Conclusion**

I realize that this is a great deal of material to wade through, but I would appreciate a return email to verify you have received it and, if possible, an estimate as to when I can expect to hear NASA's decision on this claim.

Hopefully, then we can discuss compensation.

Sincerely yours,

Jed Margolin

[Redacted]  
Phone: [Redacted]  
Email: [Redacted]

b(6)

Here are NASA's visits to my Web site:

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June 2001  
nasa.gov

| Total hits | Files | Pageview | Bytes sent  | Hostname   |
|------------|-------|----------|-------------|------------|
| 2 0.02%    | 1     | 2        | 73232 0.02% | [Redacted] |

b(6)

July 2001  
nasa.gov

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|            |       |          |            |          |

[Redacted]

24 0.27% 24 1 216909 0.08% | [REDACTED]  
1 0.01% 1 1 96274 0.04% | [REDACTED]

25 0.28% 25 2 313183 0.11%

August 2001

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

40 0.38% 40 1 184514 0.06% | [REDACTED]  
24 0.23% 24 1 216909 0.07% | [REDACTED]

64 0.61% 64 2 401423 0.12%

October 2001

nasa.gov

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1 0.01% 1 1 549657 0.11% | [REDACTED]

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November 2001

nasa.gov

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48 0.39% 24 2 216909 0.06% | [REDACTED]  
42 0.34% 42 1 532111 0.14% | [REDACTED]  
1 0.01% 1 1 21505 0.01% | [REDACTED]

91 0.73% 67 4 770525 0.21%

December 2001

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

1 0.01% 1 1 90494 0.01% | [REDACTED]

February 2002

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

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| 1 | 0.01% | 1 | 0 | 120832 | 0.03% | [REDACTED] |
| 1 | 0.01% | 1 | 1 | 504805 | 0.11% | [REDACTED] |
| 2 | 0.01% | 2 | 1 | 625637 | 0.13% |            |

March 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname      |            |
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| 58         | 0.35% | 45       | 5          | 319389 0.05%  | [REDACTED] |
| 6          | 0.04% | 5        | 4          | 1299302 0.22% | [REDACTED] |
| 1          | 0.01% | 1        | 0          | 120832 0.02%  | [REDACTED] |
| 65         | 0.39% | 51       | 9          | 1739523 0.29% |            |

April 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname     |            |
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| 1          | 0.01% | 1        | 1          | 5735 0.00%   | [REDACTED] |
| 1          | 0.01% | 1        | 0          | 120832 0.02% | [REDACTED] |
| 49         | 0.29% | 49       | 4          | 356383 0.06% |            |

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May 2002

nasa.gov

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| 1          | 0.00% | 1        | 0          | 120832 0.02% | [REDACTED] |
| 1          | 0.00% | 1        | 1          | 96274 0.02%  | [REDACTED] |
| 6          | 0.03% | 2        | 1          | 217106 0.03% |            |

June 2002

nasa.gov

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3 0.02% 1 1 96694 0.02% | [REDACTED]

July 2002  
nasa.gov

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|------------|-------|----------|--------------|------------|
| 43 0.19%   | 43    | 4        | 190275 0.03% | [REDACTED] |
| 42 0.19%   | 42    | 3        | 189552 0.03% | [REDACTED] |
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| 1 0.00%    | 1     | 1        | 350096 0.06% | [REDACTED] |
| 1 0.00%    | 1     | 1        | 93686 0.02%  | [REDACTED] |
| 89 0.39%   | 89    | 11       | 831411 0.14% |            |

August 2002  
nasa.gov

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| 24 0.11%   | 24    | 1        | 216909 0.03% | [REDACTED] |
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| 1 0.00%    | 1     | 1        | 142144 0.02% | [REDACTED] |
| 26 0.12%   | 26    | 3        | 449547 0.06% |            |

b(6)

September 2002  
nasa.gov

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| 1 0.00%    | 1     | 0        | 120832 0.02% | [REDACTED] |
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October 2002  
nasa.gov

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| 1 0.00%    | 1     | 0        | 120832 0.02% | [REDACTED] |

1 0.00% 1 0 285696 0.04% | [REDACTED]

101 0.47% 101 15 1283515 0.16%

November 2002

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

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7 0.03% 7 2 45342 0.01% | [REDACTED]

2 0.01% 2 2 1155686 0.15% | [REDACTED]

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37 0.17% 35 6 2057408 0.26%

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December 2002

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

7 0.03% 7 2 45269 0.01% | [REDACTED]

January 2003

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

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February 2003

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

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April 2003

nasa.gov

Total hits Files Pageview Bytes sent | Hostname

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8 0.03% 5 4 40212 0.00% | [REDACTED]

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| 4 | 0.02% | 3 | 3 | 63471  | 0.01% |
| 3 | 0.01% | 3 | 3 | 29881  | 0.00% |



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|----|-------|----|----|--------|-------|
| 60 | 0.25% | 52 | 11 | 439606 | 0.05% |
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Example of Detailed Web Log Data

This is an example of the detailed Web log data, so it's understandable why my Web Hosting Service abstracts it into a less detailed form.

The article being referenced is Unit Vector Math for 3D Graphics  
[www.jmargolin.com/uvmath/uvmenu.htm](http://www.jmargolin.com/uvmath/uvmenu.htm)

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/fig1.gif HTTP/1.1" 200 2590 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m1.gif HTTP/1.1" 200 2237 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

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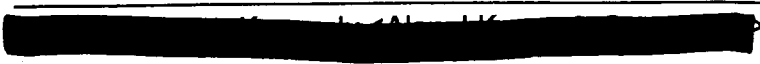
khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m3.gif HTTP/1.1" 200 715 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

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khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m5.gif HTTP/1.1" 200 1738 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m7.gif HTTP/1.1" 200 1549 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m8.gif HTTP/1.1" 200 1939 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"



khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m6.gif HTTP/1.1" 200  
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--end



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS UNITED STATES AIR FORCE  
WASHINGTON, DC

13 Aug 02

HQ USAF/XO

[REDACTED]

Mr. Jed Margolin

[REDACTED]

b(6)

Dear Mr. Margolin

On behalf of Secretary Roche, thank you for providing your ideas on ways to improve UAV control technology. As you know, we are now operating the Global Hawk and Predator systems in reconnaissance roles, and envision expanding unmanned aircraft applications into the weapons delivery mission area with the UCAV and the Predator/Predator B aircraft. Certainly we see a growing role for UAVs in the Air Force as technology advances and we gain experience in their operation. The improved control methods you have patented may well play a part in future UAV design. I suggest that you present these concepts to the various UAV manufacturers who are in the business of designing systems to meet our operational requirements. They can offer the best assessment on the overall feasibility of integrating your technology. I suggest a similar approach regarding your patented laser techniques.

Again, thank you for taking the time to offer these suggestions. I admire your ingenuity, and appreciate your desire to help us improve our national defense capabilities.

Sincerely

CHARLES F. WALD, Lt Gen, USAF  
Deputy Chief of Staff  
Air & Space Operations

cc:  
SAF/AQ  
AF/XOR

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- Complete items 3, 4a, and 4b.
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- The Return Receipt will show to whom the article was delivered and the date delivered.

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| <p>3. Article Addressed to:</p> <p>DR. L. ADAMS CEO<br/>DEPT. TERA SPECIALS</p> <p>[Redacted Address]</p> | <p>4a. Article Number<br/>7007 268000012116</p> <p>4b. Service Type<br/>Registered <input type="checkbox"/> Certified <input checked="" type="checkbox"/></p> <p><input type="checkbox"/> Express Mail <input type="checkbox"/> Insured</p> <p><input type="checkbox"/> Return Receipt for Merchandise <input type="checkbox"/> COD</p> <p>7. Date of Delivery</p> |
| <p>5. Received By: (Print Name)</p> <p>X</p>                                                              | <p>8. Addressee's Address (Only if requested and fee is paid)</p>                                                                                                                                                                                                                                                                                                  |
| <p>6. Signature: (Addressee or Agent)</p>                                                                 |                                                                                                                                                                                                                                                                                                                                                                    |

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OF THE RETURN ADDRESS, SOLD AT DOTTED  
**CERTIFIED MAIL**

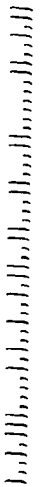


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04726

National Aeronautics and Space Administration  
Headquarters  
Washington, DC 20546-0001



March 19, 2009

Reply to Attn of:

Office of the General Counsel

CERTIFIED MAIL

Dr. Robert Adams, CEO  
Optima Technology Group

[Redacted] b(6)

RE: Administrative Claim for Infringement of US Patent No. 5,904,724;  
NASA Case No. I-222

Dear Dr. Adams:

This letter concerns the above-identified administrative claim for patent infringement.

NASA received the initial notification of this claim in an email dated May 12, 2003, from Mr. Jed Margolin addressed to attorneys at the NASA Langley Research Center claiming that "NASA may have used one or more of [Mr. Margolin's] patents in connection with the X-38 project and may be using one or more of my patents in other projects using Synthetic Vision". Mr. Margolin identified two patents that he believed NASA may be infringing; the subject patent and Patent No. 5,566,073. On June 7, 2003, Mr. Margolin submitted his claim by fax to the NASA HQ attorney, Mr. Alan Kennedy. Mr. Kennedy responded by letter dated June 11, 2003 acknowledging the administrative claim and requesting that Mr. Margolin give a more detailed breakdown of the exact articles or processes that constitute the claim. Mr. Margolin responded by letter dated June 17, 2003, withdrawing his claim with regard to U.S. Patent No. 5,566,073, leaving the remaining claim for the subject patent. NASA is aware of the long pendency of this matter and we regret the delay.

On July 14, 2008 Optima Technology Group sent a letter addressed to Mr. Kennedy stating that they were the owners of the Jed Margolin patents due to an assignment and requesting that NASA now license the technology of the subject patent. With an email dated August 6, 2008 from Optima, NASA received a copy of a Patent Assignment, dated July 20, 2004, executed by Jed Margolin, the sole inventor on the subject patent, by which the entire right, title and interest in the patent has been assigned to Optima Technology Group, Inc. We previously noted in a letter dated August 20, 2008 from Mr. Jan McNutt of our office addressed to you that NASA believes there are certain irregularities surrounding this and collateral assignment documents associated with the subject patent. However, NASA will at this time forestall a detailed consideration of that issue. Instead, we will assume your *bona fides* in asserting that you are the legitimate owner of the subject patent and communicate

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our findings directly with you. To the extent that Mr. Margolin has any interest in this matter, formally or informally, we will leave it up to you whether or not to communicate with him.

In light of the prior claim by Mr. Margolin, we consider your license proffer as an administrative claim of patent infringement. We turn now to the substance of your claim. In response to your initial letter dated July 14, 2008, Mr. McNutt's August 20, 2008 letter posed a number of questions, the purpose of which was to enable NASA to fully evaluate the details of your claim. Your organization failed to respond to these questions and, further, advanced the position that this matter does not involve a *new claim* (*Adams letter to McNutt, August 25, 2008*). We disagree that this is not a new claim. Nevertheless, NASA proceeds – in order to bring closure to this matter – on the basis that this claim centers around allegations that infringement arose from activities associated with NASA's X-38 Program, as advanced by Mr. Margolin. Accordingly, our investigation of this claim necessarily reflects the answers previously furnished by Mr. Margolin in response to NASA's June 11, 2003 letter to him containing substantially the same set of questions.

U.S. Patent No. 5,904,724 issued with twenty claims, claims 1 and 13 being the sole independent claims.

In order for an accused device to be found infringing, each and every limitation of the claim must be met by the accused device. To support a finding of literal infringement, each limitation of the claim must be met by the accused device exactly, any deviation from the claim precluding a finding of infringement. See *Lantech, Inc. v. Keip Mach. Co.*, 32 F.3d 542 (Fed. Cir. 1994). If an express claim limitation is absent from an accused product, there can be no literal infringement as a matter of law. See *Wolverine World Wide, Inc. v. Nike, Inc.*, 38 F.3d 1192, 1199 (Fed. Cir. 1994).

In applying these legal precepts, reproduced below are the relevant portions of claims 1 and 13.

Claim 1. A system comprising:

a computer

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said computer is . . .for *determining a delay time* for communicating said flight data between said computer and said remotely piloted aircraft, and wherein said computer adjusts the sensitivity of said set of one or more remote flight controls based on said delay time. (emphasis added.)

Claim 13. A station for flying a remotely piloted aircraft that is real or simulated comprising:

a computer

\*\*\*

\*\*\*

said computer. . . to *determine a delay time* for communicating. . . flight control information between said computer and [a] remotely piloted aircraft, and said computer to adjust the sensitivity of [a] set of remote flight controls based on said delay time. . . (emphasis added.)

NASA has investigated activities surrounding the X-38 program at its Centers that conducted X-38 development efforts and has determined that no infringement has occurred. This result is compelled because none of NASA's X-38 implementations utilized a computer which is "for determining a delay time for communicating said flight data between said computer and said remotely piloted aircraft," as required by claim 1, nor a "computer . . . to determine a delay time for communicating . . . flight control information between said computer and [a] remotely piloted aircraft," as required by the limitations of claim 13.

Given that a computer which measures delay time is lacking from the NASA X-38 configuration, it follows that the NASA X-38 configuration had no "adjusting of the sensitivity of [a] set of one or more remote flight controls based on said delay time", as required in claim 1. Similarly, because the NASA X-38 configuration had no "computer to determine a delay time for communicating . . . flight control information between said computer and [a] remotely piloted aircraft, the configuration also had no adjusting of "the sensitivity of [a] set of remote flight controls based on said delay time", as called for by claim 13.

For at least the above-explained exemplary reasons, claims 1 and 13 have not been infringed. It is axiomatic that none of the dependent claims may be found infringed unless the claims from which they depend have been found to be infringed. *Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546 (Fed. Cir. 1989). One who does not infringe an independent claim cannot infringe a claim dependent on, and thus containing all the limitations of, that claim. *Id.* Thus, none of claims 2-12 and 14-20 have been infringed.

NASA's X-38 development efforts ended in 2002. There may also be other features in NASA's X-38 development efforts that, upon further analysis, would reveal yet more recited claim limitations that are lacking in the NASA configuration related to those efforts.

We also note as a point of particular significance that the limitations included in claims 1 and 13 discussed above were added by amendment during the prosecution of the patent application. It is clear from an analysis of the patent application file wrapper history that the individual prosecuting the application stressed the importance of "the measurement of a communication delay in order to adjust the sensitivity of flight controls based on that delay." Also noted is the distinguishing arguments that these claims require that there be a "computer . . . located in the pilot station" and that "at least one real time measurement of the delay and some adjustment is contemplated." (See *Applicant's Amendment and Remark*, February 27, 1998 and *Response Under 37 C.F.R. § 1.116*, July 6, 1998). Clearly, the Patent Office Examiner allowed the application based on these prosecutorial arguments.

We have completed our investigation regarding the claim of patent infringement of U.S. Patent No. 5,904,724 and have determined that there is no patent infringement by, or

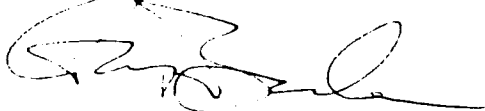
unauthorized use on behalf of, NASA. The above detailed discussion explains the basis for NASA's analysis and decision regarding the subject administrative claim.

As an aside, during NASA's investigation, numerous pieces of evidence were uncovered which would constitute anticipatory prior knowledge and prior art that was never considered by the U.S. Patent and Trademark Office during the prosecution of the application which matured into Patent No. 5,904,724. In view of the clear finding of lack of infringement of this patent, above, NASA has chosen to refrain from a discussion that would demonstrate, in addition to non-infringement, *supra*, invalidity of the subject patent. However, NASA reserves the right to introduce such evidence of invalidity in an appropriate venue, should the same become necessary.

This is a FINAL agency action and constitutes a DENIAL of the subject administrative claim for patent infringement.

Pursuant to 35 U.S.C. § 286, the statute of limitations for the filing of an action of patent infringement in the United States Court of Federal Claims is no longer tolled. Thus, any further appeal of this decision must be made by filing a claim for patent infringement in the United States Court of Federal Claims, pursuant to 28 U.S.C. § 1498(a).

Sincerely,



Gary G. Borda  
Agency Counsel for Intellectual Property

04730



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[FAQs](#)

## Track & Confirm

### Search Results

Label/Receipt Number: 7007 2680 0001 2216 4563

Associated Label/Receipt:

Detailed Results:

- Unclaimed, April 06, 2009, 11:58 am, RENO, NV
- Notice Left, March 31, 2009, 12:47 pm, RENO, NV 89511
- Notice Left, March 26, 2009, 10:25 am, RENO, NV 89521

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FOIA



04731

National Aeronautics and Space Administration  
Headquarters  
Washington, DC 20546-0001



January 22, 2009

Reply to Attn of: Office of the General Counsel

Mr. Jed Margolin

[Redacted]

b(6)

Re: FOIA Request No. 10-F-2008-270

Dear Mr. Margolin,

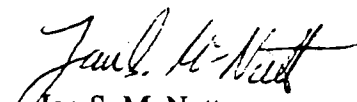
Please contact our Freedom of Information Act (FOIA) Office below concerning the above FOIA request. That office should be providing you with a response to your FOIA request.

NASA Headquarters  
300 E Street, SW

[Redacted]

b(6)

Sincerely,

  
Jan S. McNutt  
Attorney-Advisor

04732

b(6)

Jed Margolin

Ph: [REDACTED]

[REDACTED]

email: [REDACTED]

[REDACTED]

January 21, 2009

Mr. Jan S. McNutt  
Office of the General Counsel  
National Aeronautics and Space Administration  
Headquarters

[REDACTED]

Fax: [REDACTED]

b(6)

Dear Mr. McNutt.

I filed a FOIA Request on June 30, 2008. It was given a designation of HQ 08-270.

On August 5, 2008 you asked me to give NASA a 90-day extension. I agreed, which extended NASA's deadline to around November 5, 2008.

You failed to confirm the terms of my agreement to extend NASA's time to respond and you have failed to respond to the FOIA request.

Please confirm that:

1. NASA has no intention of complying with the FOIA.
2. I have exhausted all of NASA's administrative remedies in this matter.

Sincerely yours,

/Jed Margolin/  
Jed Margolin

Cc: Robert Cobb, NASA Inspector General

[REDACTED]

b(6)



**Jed Margolin**

**From:** "Jed Margolin" <[REDACTED]>  
**To:** "McNutt, Jan (HQ-MC000)" <[REDACTED]>  
**Sent:** Friday, August 08, 2008 10:18 AM  
**Attach:** jm\_nasa\_foia\_x.pdf  
**Subject:** Re: NASA FOIA HQ 08-270

b(6)

Dear Mr. McNutt.

I will agree to the 90 day extension you have requested for NASA to respond to my FOIA Request (HQ 08-270) if NASA acknowledges that my FOIA request is entirely separate from Optima Technology Group's Claim Case No. I-222.

Please see attached letter.

Sincerely yours,

Jed Margolin

[REDACTED]  
[REDACTED]

b(6)

----- Original Message -----

**From:** "McNutt, Jan (HQ-MC000)" <[REDACTED]>  
**To:** "Jed Margolin" <[REDACTED]>  
**Sent:** Wednesday, August 06, 2008 6:44 AM  
**Subject:** RE: NASA Case I-222

Dear Mr. Margolin,

Please see the attached. Hard copy to follow.

Jan S. McNutt  
Attorney-Advisor (Commercial)  
Office of the General Counsel  
NASA Headquarters

[REDACTED]  
[REDACTED]  
[REDACTED]

b(6)

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unintended recipients or in a manner inconsistent with its provision is not authorized and may be unlawful.

-----Original Message-----

From: Jed Margolin [mailto:[REDACTED]]  
Sent: Tuesday, August 05, 2008 1:56 PM  
To: McNutt, Jan (HQ-MC000)  
Subject: NASA Case I-222

Dear Mr. McNutt.

I have attached the documents we discussed.

Regards,

Jed Margolin

National Aeronautics and Space Administration  
Headquarters  
Washington, DC 20546-0001



August 5, 2008

Reply to Attn of: Office of the General Counsel

Mr. Jed Margolin  
[Redacted] b(e)

Re: Administrative Claim of Jed Margolin for Infringement of U.S. Patent Nos. 5,566,073 and 5,904,724; NASA Case No. I-222.

Dear Mr. Margolin,

We are in receipt of the Freedom of Information Act Request (FOIA) conveyed to us by email dated June 30, 2008 in which you request copies of all documentation relating to your administrative claim of infringement of U.S. Patent Nos. 5,566,073 and 5,904,724.

We regret the delay in processing your claim and assure you that we are now undertaking measures to provide a resolution of your claim as soon as possible. Unfortunately, Mr. Alan Kennedy retired from NASA earlier this year and the action on your claim was not conveyed to management in a timely manner. In addition the local attorney responsible for review of your claim also departed from NASA. We are now cognizant of the importance of proceeding with a review of the claim and will contact you when we have reached a decision.

As to your FOIA request, as the investigation of your claim is ongoing, we kindly request that you allow us a 90 day extension to answer this request. Within that time period we should be able to obtain a better picture of our position vis-à-vis your claim and the request for documents may no longer be required.

We should inform you that we have received a separate communication from a company Optima Technology Group, claiming to have been assigned both of the patents in question. You informed me telephonically that this is the case; however, we have no record of any assignment of your patents to this firm and will need confirmation through appropriate attested documents delivered to the agency in order to recognize any claim of ownership by a party other than the inventor.

Thank you for your patience in this matter. Please contact the undersigned at [Redacted] email [Redacted] if you have any additional questions or comments. b(e)

Sincerely,  
  
Jan S. McNutt  
Attorney-Advisor

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Reference 1 (1 Page)

National Aeronautics and  
Space Administration  
Langley Research Center



b(6)

May 14, 2003

Reply to Attn of:

212

Jed Margolin

b(6)

Subject: Infringement Inquiry

Dear Mr. Margolin,

I received notice of your belief that NASA may have infringed one or more of your U.S. patents. In order to address your concerns, we need to receive some more detailed information. Please provide the titles and patent numbers of any patents you feel NASA may have infringed. Please also provide a description of any actions by NASA leading to your belief of possible infringement. Finally, please specify in detail how those actions constitute infringement of your patent(s). This information will allow us to evaluate your assertion and respond and/or react appropriately. Thanks for contacting us. I look forward to hearing from you soon, and discussing your concerns further.

Cordially,

A handwritten signature in cursive script, appearing to read "Barry V. Gibbens".

Barry V. Gibbens  
Patent Attorney  
Technology Commercialization  
Program Office

04738

Jed Margolin

Phone: [REDACTED]

Email: [REDACTED]

May 18, 2003

Mr. Barry V. Gibbens  
National Aeronautics and Space Administration  
Langley Research Center

b(6)

Attn: 212

Dear Mr. Gibbens,

This is in response to your letter dated May 14, 2003.

As we discussed in our telephone conversation on May 16, the information you have requested was supplied in my email to Mr. Kurt Hammerle on May 12, 2003.

After I emailed my inquiry to Mr. Jesse Midgett on May 12, I discovered the web page for the Patent Counsel Office and contacted Mr. Hammerle by telephone.

I apologize for any confusion this may have created.

As a result of more searching I have discovered a link to a Johnson Space Center SBIR Phase II award to Rapid Imaging Software at <http://sbir.gsfc.nasa.gov/SBIR/successes/ss/9-058text.html>.

It includes a particularly relevant paragraph:

*The Advanced Flight Visualization Toolkit (VisualFlight™) project is developing a suite of virtual reality immersive telepresence software tools which combine the real-time flight simulation abilities with the data density of a Geographic Information System (GIS). This technology is used for virtual reality training of crews, analysis of flight test data, and as an on-board immersive situation display. It will also find application as a virtual cockpit, and in teleoperation of remotely piloted vehicles.*

{ The emphasis on teleoperation of remotely piloted vehicles is mine. }

A search of the SBIR archive shows the following entries.

For 2001 Phase I:

Rapid Imaging Software, Inc.

[REDACTED]

Mike Abernathy ([REDACTED])

b(6)

Integrated Video for Synthetic Vision Systems

For 2001 Phase II:

Rapid Imaging Software, Inc.

[Redacted]  
Carolyn Galceran  
[Redacted]

b(6)

Integrated Video for Synthetic Vision Systems

If there is any additional information regarding my patents that you would find helpful please let me know.

Sincerely yours,

*Jed Margolin*

Jed Margolin



# NASA SBIR SUCCESSSES

Johnson Space Center  
1998 Phase II

LandForm VisualFlight™

Rapid Imaging Software, Inc.

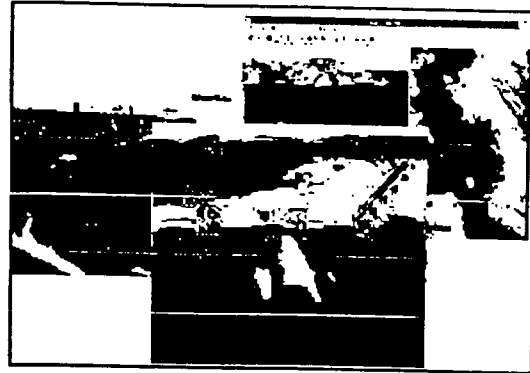
Albuquerque, NM

## INNOVATION

LandForm VisualFlight™ is the power of a geographic information system (GIS) and the speed of a flight simulator, accessible from any Windows application.

## ACCOMPLISHMENTS

- The Advanced Flight Visualization Toolkit (VisualFlight™) project is developing a suite of virtual reality immersive telepresence software tools which combine the real-time flight simulation abilities with the data density of a Geographic Information System (GIS). This technology is used for virtual reality training of crews, analysis of flight test data, and as an on-board immersive situation display. It will also find application as a virtual cockpit, and in teleoperation of remotely piloted vehicles.
- AFVT will enhance the ability of analysts and operators to interact with large amounts of multidimensional data using the most natural paradigm available: 3D immersion. This operator/data interaction technology will be an advancement comparable to the invention of the Heads-Up Display (HUD). AFVT will move the HUD into the third dimension.
- A simplified user interface, it will fuse real-time 3D displays of terrain with digital maps, satellite data, vehicles, flight paths, and waypoints. This unique and innovative approach will build upon recent software technology research and development from Rapid Imaging Software. VisualFlight™ permits users to construct and deploy their own immersive multidimensional display applications on Windows-based computer platforms.



Optional Powerpoint file

## COMMERCIALIZATION

- VisualFlight™ is sold as a development kit starting with 5 run-time licenses. Users who wish to distribute more applications

## GOVERNMENT/SCIENCE APPLICATIONS

- The firm's VisualFlight™ System was used to fly the X-38 on it's latest test flight. The flight vehicle was piloted by astronaut (Ken Ham) using LandForm VisualFlight

using LandForm VisualFlight™ technology can purchase additional run-time licenses as needed.

system as his digital cockpit window.

- VisualFlight™ 1.0 has been available to qualified users for several months now, and the response is excellent. VisualFlight™ has been deployed to display live real-time flight data broadcast over a network. Please visit this page for the latest VisualFlight™ developments.
- LandForm V/O Video Overlay plug-in for LandForm C3 or Flight Vision is available for the Matrox Corona board only. The price is \$4995 for a # single users license. Site license is available for \$6995.

For more information about this firm, please send e-mail to: [company representative](#)

[Return to NASA SBIR Success Listings](#)

Curator: [SBIR Support](#)



**Jed Margolin**

**Phone:** [REDACTED]

**Email:** [REDACTED]

**June 7, 2003**

Mr. Alan J. Kennedy  
Office of the General Counsel  
National Aeronautics and Space Administration

[REDACTED]

b(6)

Dear Mr. Kennedy,

Mr. Barry Gibbens of your Langley Research Center suggested I contact you. I missed you when I called on Friday so I am sending this fax to provide background.

I believe that NASA may have used one or more of my patents in connection with the X-38 project and may be using one or more of my patents in other projects using Synthetic Vision.

This fax contains a number of Internet links. If you would like an email version of this fax containing active links please send me an email [REDACTED] with your email address.

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Summary

In Synthetic Vision (NASA's term), the aircraft's position and orientation are used with a terrain database (such as the Digital Elevation Database) to produce a 3D projected view of the terrain over which the aircraft is flying. One of the advantages of this system is that the pilot is able to "see" the terrain regardless of weather conditions or whether it is day or night.

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,566,073 Pilot Aid Using a Synthetic Environment** issued October 15, 1996 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed August 9, 1995, and was a continuation of Application Ser. No. 08/274,394, filed July 11, 1994.

With synthetic vision it is not necessary for the pilot to be in the aircraft. I believe the X-38 project used this method.

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,904,724 Method and Apparatus For Remotely Piloting an Aircraft** issued May 18, 1999 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed January 19, 1996.

X-38 Project

I became aware that NASA was using synthetic vision in the X-38 project in the January 2003 issue of NASA Tech Briefs, page 40, "**Virtual Cockpit Window**" for a **Windowless Aerospacecraft**. The article is available at: <http://www.nasatech.com/Briefs/Jan03/MSC23096.html>

This led me to Rapid Imaging Software, Inc. and their press release (<http://www.landform.com/pages/PressReleases.htm>) which states:

*"On December 13th, 2001, Astronaut Ken Ham successfully flew the X-38 from a remote cockpit using LandForm VisualFlight as his primary situation awareness display in a flight test at Edwards Air Force Base, California. This simulates conditions of a real flight for the windowless spacecraft, which will eventually become NASA's Crew Return Vehicle for the ISS. We believe that this is the first test of a hybrid synthetic vision system which combines nose camera video with a LandForm synthetic vision display. Described by astronauts as 'the best seat in the house', the system will ultimately make space travel safer by providing situation awareness during the landing phase of flight."*

The RIS press release provided a link to an article in Aviation Week & Space Technology: [http://www.aviationnow.com/avnow/news/channel\\_space.jsp?view=story&id=news/sx381211.xml](http://www.aviationnow.com/avnow/news/channel_space.jsp?view=story&id=news/sx381211.xml)

As a result of more searching I have discovered a link to a Johnson Space Center SBIR Phase II award to Rapid Imaging Systems at <http://sbir.gsfc.nasa.gov/SBIR/successes/ss/9-058text.html>.

It includes a particularly relevant paragraph:

*The Advanced Flight Visualization Toolkit (VisualFlight™) project is developing a suite of virtual reality immersive telepresence software tools which combine the real-time flight simulation abilities with the data density of a Geographic Information System (GIS). This technology is used for virtual reality training of crews, analysis of flight test data, and as an on-board immersive situation display. It will also find application as a virtual cockpit, and in teleoperation of remotely piloted vehicles.*

{The emphasis on teleoperation of remotely piloted vehicles is mine.}

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For 2001 Phase I:

Rapid Imaging Software, Inc.

Mike Abernathy

Integrated Video for Synthetic Vision Systems

For 2001 Phase II:

Rapid Imaging Software, Inc.

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Carolyn Galceran [REDACTED] b(6) 3  
01-2-H6.02-8715 JSC  
Integrated Video for Synthetic Vision Systems

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,904,724 Method and Apparatus For Remotely Piloting an Aircraft** issued May 18, 1999 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed January 19, 1996.

The patent can be downloaded from the UPTO Web site ([www.uspto.gov](http://www.uspto.gov)) in html (no drawings) or in an odd tif format (with the drawings) that requires a special viewer.

An easier way to view and download the patent is through my Web site, on which I have posted the patent in PDF format. The link is <http://www.jmargolin.com/patents2/rpv.htm>.

While I have no way of knowing exactly what method(s) NASA used in controlling the X-38 (unless you are willing to make a full disclosure) my patent covers techniques as exemplified by claim 1.

*1. A system comprising:*

*a remotely piloted aircraft including,*

*a position determining system to locate said remotely piloted aircraft's position in three dimensions; and*

*an orientation determining system for determining said remotely piloted aircraft's orientation in three dimensional space;*

*a communications system for communicating flight data between a computer and said remotely piloted aircraft, said flight data including said remotely piloted aircraft's position and orientation, said flight data also including flight control information for controlling said remotely piloted aircraft;*

*a digital database comprising terrain data;*

*said computer to access said terrain data according to said remotely piloted aircraft's position and to transform said terrain data to provide three dimensional projected image data according to said remotely piloted aircraft's orientation;*

*a display for displaying said three dimensional projected image data; and*

*a set of one or more remote flight controls coupled to said computer for inputting said flight control information, wherein said computer is also for determining a delay time for communicating said flight data between said computer and said remotely piloted aircraft, and wherein said computer adjusts the sensitivity of said set of one or more remote flight controls based on said delay time.*

Although the X-38 project has been canceled, the methods developed to fly it are too good to waste and should be used in follow-up projects like CRV.

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## Synthetic Vision

I became aware of NASA's Synthetic Vision program perhaps two years ago from a program on NASA TV. I was unable to follow it up at that time due to health problems and the demands of my other patenting activity.

According to the NASA Aviation Safety Program Web site ([http://avsp.larc.nasa.gov/program\\_svs.html](http://avsp.larc.nasa.gov/program_svs.html))

### **Synthetic Vision Systems**

**TECHNOLOGY WOULD REDUCE AIRLINE FATALITIES**  
***Synthetic Vision would give pilots clear skies all the time***

***A revolutionary cockpit display system being developed with seed money from NASA would help prevent the world's deadliest aviation accidents.***

And I agree.

My U.S. Patent that pertains to this use of synthetic vision is: **U.S. Patent 5,566,073 Pilot Aid Using a Synthetic Environment** issued October 15, 1996 to Margolin. (I am the inventor and owner of the patent.) The patent application was filed August 9, 1995, and was a continuation of Application Ser. No. 08/274,394, filed July 11, 1994.

The patent can be downloaded from the USPTO Web site ([www.uspto.gov](http://www.uspto.gov)) in html (no drawings) or in an odd tif format (with the drawings) that requires a special viewer.

The patent can also be downloaded from my Web site in PDF format at:  
<http://www.jmargolin.com/patents2/pilot.htm>

As with the X-38 program I have no way of knowing exactly what method(s) NASA used in its Synthetic Vision program (unless you are willing to make a full disclosure). My patent covers techniques as exemplified by claim 1.

*1. A pilot aid which uses an aircraft's position and attitude to transform data from a digital data base to present a pilot with a synthesized three dimensional projected view of the world comprising:*

*a position determining system for locating said aircraft's position in three dimensions;*

*a digital data base comprising terrain data, said terrain data representing real terrestrial terrain as at least one polygon, said terrain data generated from elevation data of said real terrestrial terrain;*

*an attitude determining system for determining said aircraft's orientation in three dimensional space;*

*a computer to access said terrain data according to said aircraft's position and to transform said terrain data to provide three dimensional projected image data according to said aircraft's orientation; and*

*a display for displaying said three dimensional projected image data.*

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### NASA's Visits to My Web Site

There is good reason to believe that NASA was aware of my work in these areas through visits to my Web site. NASA has been visiting my Web site ([www.jmargolin.com](http://www.jmargolin.com)) regularly since I started it in December 2000. (I have no objection to NASA's visits; I am flattered that NASA considers my Web site worth visiting.)

A listing of NASA access statistics follows the end of this fax.

I also have regular visits from <http://cap.nipr.mil>, which I understand is a secure gateway to other military networks. I don't know if NASA uses nipr so I have not included it in my listing.

The Web Statistics software provided by my Web Hosting Service tell me who is visiting my Web site and what people are looking at but not who is looking at what, (In January of this year I discovered there are raw Web log files containing this information but my Web Hosting Service does not keep backup log files older than the previous month.)

I am including an example of the detailed Web log data; it's understandable why my Web Hosting Service abstracts it into a less detailed form.

The article being referenced is **Unit Vector Math for 3D Graphics**  
([www.jmargolin.com/uvmath/uvmenu.htm](http://www.jmargolin.com/uvmath/uvmenu.htm))

Now that I can see what people are looking at I have noticed a great deal of interest in this article as well as **The Relationship between Unit Vector Rotations and Euler Angle Functions**.  
([www.jmargolin.com/uvmath/euler.doc](http://www.jmargolin.com/uvmath/euler.doc))

These articles also seem to interest military contractors like Lockheed Martin ([lmco.com](http://lmco.com)), Boeing ([boeing.com](http://boeing.com)), Northrop Grumman ([northgrum.com](http://northgrum.com)), and SAIC ([saic.hq.nasa.gov](http://saic.hq.nasa.gov)) as well as a large number of educational institutions.

Some accesses are obviously just for fun, to articles such as to **Gas Music From Jupiter**  
([www.jmargolin.com/gmfj/gmfj.htm](http://www.jmargolin.com/gmfj/gmfj.htm))

There are also visits from most of our national labs. I expect they are interested in **U.S. Patent 6,377,436 Microwave Transmission Using a Laser-Generated Plasma Beam Waveguide** issued April 23, 2002 to Jed Margolin.

#### *Abstract*

*A directed energy beam system uses an ultra-fast laser system, such as one using a titanium-sapphire infrared laser, to produce a thin ionizing beam through the atmosphere. The beam is moved in either a circular or rectangular fashion to produce a conductive shell to act as a waveguide for microwave energy. Because the waveguide is produced by a plasma it is called a plasma beam waveguide. The directed energy beam system can be used as a weapon, to provide power to an unmanned aerial vehicle (UAV) such as for providing communications in a cellular telephone system, or as an ultra-precise radar system.*

There is a possibility that this device could be used to make a linear Tokamak.  
([www.jmargolin.com/debs/debs.htm](http://www.jmargolin.com/debs/debs.htm))

Conclusion

I realize this is a great deal of material to wade through, but I would appreciate confirmation that you have received it and, if possible, an estimate as to when I can expect to hear NASA's decision on this claim.

Hopefully, then we can discuss compensation. The '724 patent is available for sale if NASA wishes to purchase it to avoid setting the precedent of the U.S. Government paying compensation for each flight of an aircraft using my patent. (I don't think this would be popular with DOD.) I expect that the first UAV to crash due to Pilot Induced Oscillation (or just Flight Computer Induced Oscillation, as occurred in the first flight of the Predator) would cost more than the cost of buying my patent. I believe this patent also has commercial applications like using UAVs for traffic reporting and in Law Enforcement so your Commercialization Department may be able to generate income with it.

Sincerely yours,

*Jed Margolin*

Jed Margolin

Phone: [Redacted]  
Email: [Redacted]

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Here are NASA's visits to my Web site:

June 2001

nasa.gov

| Total hits | Files | Pageview | Bytes sent  | Hostname   |
|------------|-------|----------|-------------|------------|
| 2 0.02%    | 1     | 2        | 73232 0.02% | [Redacted] |

July 2001

nasa.gov

| Total hits | Files | Pageview | Bytes sent   | Hostname   |
|------------|-------|----------|--------------|------------|
| 24 0.27%   | 24    | 1        | 216909 0.08% | [Redacted] |
| 1 0.01%    | 1     | 1        | 96274 0.04%  | [Redacted] |
| 25 0.28%   | 25    | 2        | 313183 0.11% |            |

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August 2001

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname |
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|    |       |    |   |        |       |            |
|----|-------|----|---|--------|-------|------------|
| 40 | 0.38% | 40 | 1 | 184514 | 0.06% | [REDACTED] |
| 24 | 0.23% | 24 | 1 | 216909 | 0.07% | [REDACTED] |
| 64 | 0.61% | 64 | 2 | 401423 | 0.12% |            |

October 2001

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname                  |
|------------|-------|----------|------------|---------------------------|
| 1          | 0.01% | 1        | 1          | 549657 0.11%   [REDACTED] |

November 2001

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname                  |
|------------|-------|----------|------------|---------------------------|
| 48         | 0.39% | 24       | 2          | 216909 0.06%   [REDACTED] |
| 42         | 0.34% | 42       | 1          | 532111 0.14%   [REDACTED] |
| 1          | 0.01% | 1        | 1          | 21505 0.01%   [REDACTED]  |
| 91         | 0.73% | 67       | 4          | 770525 0.21%              |

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December 2001

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname                 |
|------------|-------|----------|------------|--------------------------|
| 1          | 0.01% | 1        | 1          | 90494 0.01%   [REDACTED] |

February 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname                  |
|------------|-------|----------|------------|---------------------------|
| 1          | 0.01% | 1        | 0          | 120832 0.03%   [REDACTED] |
| 1          | 0.01% | 1        | 1          | 504805 0.11%   [REDACTED] |
| 2          | 0.01% | 2        | 1          | 625637 0.13%              |

March 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname                   |
|------------|-------|----------|------------|----------------------------|
| 58         | 0.35% | 45       | 5          | 319389 0.05%   [REDACTED]  |
| 6          | 0.04% | 5        | 4          | 1299302 0.22%   [REDACTED] |
| 1          | 0.01% | 1        | 0          | 120832 0.02%   [REDACTED]  |

65 0.39% 51 9 1739523 0.29%

April 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent   | Hostname   |
|------------|-------|----------|--------------|------------|
| 40 0.23%   | 40    | 1        | 184514 0.03% | [REDACTED] |
| 7 0.04%    | 7     | 2        | 45302 0.01%  | [REDACTED] |
| 1 0.01%    | 1     | 1        | 5735 0.00%   | [REDACTED] |
| 1 0.01%    | 1     | 0        | 120832 0.02% | [REDACTED] |
| 49 0.29%   | 49    | 4        | 356383 0.06% |            |

May 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent   | Hostname   |
|------------|-------|----------|--------------|------------|
| 4 0.02%    | 0     | 0        | 0 0.00%      | [REDACTED] |
| 1 0.00%    | 1     | 0        | 120832 0.02% | [REDACTED] |
| 1 0.00%    | 1     | 1        | 96274 0.02%  | [REDACTED] |
| 6 0.03%    | 2     | 1        | 217106 0.03% |            |

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June 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent  | Hostname   |
|------------|-------|----------|-------------|------------|
| 3 0.02%    | 1     | 1        | 96694 0.02% | [REDACTED] |

July 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent   | Hostname   |
|------------|-------|----------|--------------|------------|
| 43 0.19%   | 43    | 4        | 190275 0.03% | [REDACTED] |
| 42 0.19%   | 42    | 3        | 189552 0.03% | [REDACTED] |
| 2 0.01%    | 2     | 2        | 7802 0.00%   | [REDACTED] |
| 1 0.00%    | 1     | 1        | 350096 0.06% | [REDACTED] |
| 1 0.00%    | 1     | 1        | 93686 0.02%  | [REDACTED] |
| 89 0.39%   | 89    | 11       | 831411 0.14% |            |

August 2002

nasa.gov

| Total hits | Files | Pageview | Bytes sent   | Hostname   |
|------------|-------|----------|--------------|------------|
| 24 0.11%   | 24    | 1        | 216909 0.03% | [REDACTED] |



9

|    |       |    |   |        |       |            |
|----|-------|----|---|--------|-------|------------|
| 1  | 0.00% | 1  | 1 | 90494  | 0.01% | [REDACTED] |
| 1  | 0.00% | 1  | 1 | 142144 | 0.02% | [REDACTED] |
| 26 | 0.12% | 26 | 3 | 449547 | 0.06% |            |

September 2002  
nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname     |            |
|------------|-------|----------|------------|--------------|------------|
| 5          | 0.02% | 1        | 0          | 121528 0.02% | [REDACTED] |
| 1          | 0.00% | 1        | 0          | 285696 0.04% | [REDACTED] |
| 1          | 0.00% | 1        | 0          | 120832 0.02% | [REDACTED] |
| 7          | 0.03% | 3        | 0          | 528056 0.08% |            |

October 2002  
nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname      |            |
|------------|-------|----------|------------|---------------|------------|
| 98         | 0.45% | 98       | 14         | 827297 0.11%  | [REDACTED] |
| 1          | 0.00% | 1        | 1          | 49690 0.01%   | [REDACTED] |
| 1          | 0.00% | 1        | 0          | 120832 0.02%  | [REDACTED] |
| 1          | 0.00% | 1        | 0          | 285696 0.04%  | [REDACTED] |
| 101        | 0.47% | 101      | 15         | 1283515 0.16% |            |

b(6)

November 2002  
nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname      |            |
|------------|-------|----------|------------|---------------|------------|
| 27         | 0.12% | 25       | 1          | 506284 0.06%  | [REDACTED] |
| 7          | 0.03% | 7        | 2          | 45342 0.01%   | [REDACTED] |
| 2          | 0.01% | 2        | 2          | 1155686 0.15% | [REDACTED] |
| 1          | 0.00% | 1        | 1          | 350096 0.04%  | [REDACTED] |
| 37         | 0.17% | 35       | 6          | 2057408 0.26% |            |

December 2002  
nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname    |            |
|------------|-------|----------|------------|-------------|------------|
| 7          | 0.03% | 7        | 2          | 45269 0.01% | [REDACTED] |

January 2003  
nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname |  |
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|            |       |          |            |          |  |

|   |       |   |   |       |       |    |            |
|---|-------|---|---|-------|-------|----|------------|
| 2 | 0.01% | 2 | 2 | 29129 | 0.00% | 10 | [REDACTED] |
|---|-------|---|---|-------|-------|----|------------|

February 2003

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname    |            |
|------------|-------|----------|------------|-------------|------------|
| 2          | 0.01% | 2        | 2          | 29138 0.00% | [REDACTED] |

b(6)

April 2003

nasa.gov

| Total hits | Files | Pageview | Bytes sent | Hostname     |            |
|------------|-------|----------|------------|--------------|------------|
| 40         | 0.17% | 40       | 1          | 184514 0.02% | [REDACTED] |
| 8          | 0.03% | 5        | 4          | 40212 0.00%  | [REDACTED] |
| 5          | 0.02% | 1        | 0          | 121528 0.01% | [REDACTED] |
| 4          | 0.02% | 3        | 3          | 63471 0.01%  | [REDACTED] |
| 3          | 0.01% | 3        | 3          | 29881 0.00%  | [REDACTED] |
| 60         | 0.25% | 52       | 11         | 439606 0.05% |            |

Example of Detailed Web Log Data

This is an example of the detailed Web log data, so it's understandable why my Web Hosting Service abstracts it into a less detailed form.

The article being referenced is Unit Vector Math for 3D Graphics ([www.jmargolin.com/uvmath/uvmenu.htm](http://www.jmargolin.com/uvmath/uvmenu.htm))

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/fig1.gif HTTP/1.1" 200 2590  
 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m1.gif HTTP/1.1" 200 2237  
 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m2.gif HTTP/1.1" 200 1464  
 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m3.gif HTTP/1.1" 200 715  
 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m4.gif HTTP/1.1" 200 1720  
 "http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m5.gif HTTP/1.1" 200 1738  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m7.gif HTTP/1.1" 200 1549  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m8.gif HTTP/1.1" 200 1939  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m6.gif HTTP/1.1" 200 1762  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m9.gif HTTP/1.1" 200 4152  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m10.gif HTTP/1.1" 200 2732  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m11.gif HTTP/1.1" 200 2572  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m12.gif HTTP/1.1" 200 2580  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m13.gif HTTP/1.1" 200 3915  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m14.gif HTTP/1.1" 200 2591  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m15.gif HTTP/1.1" 200 2224  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m16.gif HTTP/1.1" 200 1858  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m17.gif HTTP/1.1" 200 1742  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m18.gif HTTP/1.1" 200 2642  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m19.gif HTTP/1.1" 200 1738  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m20.gif HTTP/1.1" 200 1762  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:14 -0500] "GET /uvmath/m21.gif HTTP/1.1" 200 1696  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m22.gif HTTP/1.1" 200 2224  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m23.gif HTTP/1.1" 200 1858  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m24.gif HTTP/1.1" 200 1711  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig6.gif HTTP/1.1" 200 3304  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig7.gif HTTP/1.1" 200 995  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig8.gif HTTP/1.1" 200 4441  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig11.gif HTTP/1.1" 200 3186  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig12.gif HTTP/1.1" 200 3743  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov -- [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig14.gif HTTP/1.1" 200 1936  
"<http://www.jmargolin.com/uvmath/uvmath.htm>" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/fig16.jpg HTTP/1.1" 200 61706  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m25.gif HTTP/1.1" 200 1358  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m26.gif HTTP/1.1" 200 1413  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m27.gif HTTP/1.1" 200 1052  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m28.gif HTTP/1.1" 200 1017  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m29.gif HTTP/1.1" 200 1673  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:15 -0500] "GET /uvmath/m30.gif HTTP/1.1" 200 2224  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:24 -0500] "GET /uvmath/uvmath.htm HTTP/1.1" 200 40231  
"http://www.google.com/search?q=+%22euler+angle%22+normal+openGL&hl=en&lr=&ie=UTF-8&oe=UTF-8&start=10&sa=N" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

khgmac.larc.nasa.gov - - [01/Apr/2003:09:32:24 -0500] "GET /uvmath/fig3.gif HTTP/1.1" 200 2524  
"http://www.jmargolin.com/uvmath/uvmath.htm" "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0; Q312461; .NET CLR 1.0.3705)"

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---end

National Aeronautics and  
Space Administration  
**Headquarters**  
Washington, DC 20546-0001

Reference 4 (2 pages)



June 11, 2003

Reply to Attn of: GP (02-37016)

Mr. Jed Margolin



b(6)

Re: Administrative Claim of Jed Margolin for Infringement of  
U.S. Patent Nos. 5,566,073 and 5,904,724; NASA Case No. I-222

Dear Mr. Margolin:

Thank you for your letter dated June 7, 2003 regarding possible unauthorized uses by NASA of inventions protected by U.S. Patent Nos. 5,566,073 and 5,904,724. You have identified possible unauthorized uses in the X-38 project and other projects involving synthetic vision technology. NASA considers this matter to be an administrative claim for patent infringement, and has assigned the claim NASA Case No. I-222. An investigation will now be conducted to identify any unauthorized uses of the inventions claimed in the subject patents. In order to proceed further with this investigation, we need you to provide us with the following information:

- (1) The identification of all claims of the patent(s) alleged to be infringed.
- (2) The identification of all procurements known to the claimant or patent owner which involve the alleged infringing item or process, including the identity of the vendor or contractor and the Government procuring activity.
- (3) A detailed identification of the accused articles or processes, particularly where the article or process relates to a component or subcomponent of the item procured, an element by element comparison of the representative claims with the accused article or process. If available, this identification should include documentation and drawings to illustrate the accused article or process in suitable detail to enable verification of the infringement comparison.
- (4) The names and addresses of all past and present licenses under the patent(s), and copies of all license agreements and releases involving the patent.
- (5) A brief description of all litigation in which the patent(s) has been or is now involved, and the present status thereof.

04756

- 6) A list of all persons to whom notices of infringement have been sent, including all departments and agencies of the Government, and a statement of the ultimate disposition of each.
- 7) A description of Government employment or military service, if any, by the inventor and/or patent owner.
- 8) A list of all Government contracts under which the inventor, patent owner, or anyone in privity with him performed work relating to the patented subject matter.
- 9) Evidence of title to the patent(s) alleged to be infringed or other right to make the claim.
- 10) A copy of the Patent Office file of the patent, if available, to claimant.
- 11) Pertinent prior art known to claimant, not contained in the Patent Office file, particularly publications and foreign art.

In addition to the foregoing, if claimant can provide a statement that the investigation may be limited to the specifically identified accused articles or processes, or to a specific procurement, it may materially expedite determination of the claim.

If you have any questions, please feel free to contact me on [REDACTED]

b(6)

Cordially,



Alan J. Kennedy  
Director, Infringement Division  
Office of the Associate General Counsel  
(Intellectual Property)

**Jed Margolin**

**Phone:** [REDACTED]

**Email:** [REDACTED]

[REDACTED]  
**June 17, 2003**

Mr. Alan J. Kennedy  
Director, Infringement Division  
Office of the Associate General Counsel  
National Aeronautics and Space Administration  
Headquarters  
[REDACTED]

b(6)

b(6)

Attn: GP(02-37016)

Dear Mr. Kennedy,

I have received your letter dated June 11, 2003.

In my contacts with NASA personnel I have repeatedly stressed my desire that this matter be resolved in a friendly manner. However, since NASA has rejected my request to consider a license proffer and in view of your letter of June 11, it is clear that NASA has decided to handle this in an adversarial manner.

Before I respond to your letter in detail, I want to make things easier for me by withdrawing my U.S. Patent **5,566,073 Pilot Aid Using a Synthetic Environment** from this administrative claim in order to focus more directly on NASA's infringement of my U.S. Patent **5,904,724 Method and Apparatus For Remotely Piloting an Aircraft**. However, I reserve the right to file a claim concerning the '073 patent at a later time.

**(1) The identification of all claims of the patent(s) alleged to be infringed.**

As I stated in my email of May 13, 2003 to Mr. Hammerle of LARC and in my fax of June 7, 2003 to you, I have no way of determining exactly which claims the X-38 project may have infringed unless NASA makes a full and complete disclosure to me of that project. I also have no way of determining if NASA has (or has had) other projects that also infringe on my patent unless NASA makes a full and complete disclosure of those projects as well.

Therefore, in order to answer your question, I must request that NASA make a full and complete disclosure to me of the X-38 project as well as any other current or past projects that may infringe on my patent.

If this information requires a security clearance (I have none) I suggest you start the required security investigation immediately. If there is further information that you require in this regard feel free to contact me.

04758



- (2) *The identification of all procurements known to the claimant or patent owner which involve the alleged infringing item or process, including the identity of the vendor or contractor and the Government procuring activity.*

As I stated in my fax to you of June 7, 2003, I became aware that NASA was using synthetic vision in the X-38 project in the January 2003 issue of NASA Tech Briefs, page 40, "**Virtual Cockpit Window for a Windowless Aerospacecraft**". The article is available at:  
<http://www.nasatech.com/Briefs/Jan03/MS23096.html>

This led me to Rapid Imaging Software, Inc. and their press release (<http://www.landform.com/pages/PressReleases.htm>) which states:

*"On December 13th, 2001, Astronaut Ken Ham successfully flew the X-38 from a remote cockpit using LandForm VisualFlight as his primary situation awareness display in a flight test at Edwards Air Force Base, California. This simulates conditions of a real flight for the windowless spacecraft, which will eventually become NASA's Crew Return Vehicle for the ISS. We believe that this is the first test of a hybrid synthetic vision system which combines nose camera video with a LandForm synthetic vision display. Described by astronauts as 'the best seat in the house', the system will ultimately make space travel safer by providing situation awareness during the landing phase of flight."*

The RIS press release provided a link to an article in *Aviation Week & Space Technology*:  
[http://www.aviationnow.com/avnw/news/channel\\_space.jsp?view=story&id=news/sx381211.xml](http://www.aviationnow.com/avnw/news/channel_space.jsp?view=story&id=news/sx381211.xml)

As a result of more searching I discovered a link to a Johnson Space Center SBIR Phase II award to Rapid Imaging Systems at <http://sbir.gsfc.nasa.gov/SBIR/successes/ss/9-058text.html>.

It includes a particularly relevant paragraph:

*The Advanced Flight Visualization Toolkit (VisualFlight™) project is developing a suite of virtual reality immersive telepresence software tools which combine the real-time flight simulation abilities with the data density of a Geographic Information System (GIS). This technology is used for virtual reality training of crews, analysis of flight test data, and as an on-board immersive situation display. It will also find application as a virtual cockpit, and in teleoperation of remotely piloted vehicles.*

The emphasis on *virtual reality immersive telepresence* and *teleoperation of remotely piloted vehicles* is mine.

A search of the SBIR archive shows the following entries.

For 2001 Phase I:

Rapid Imaging Software, Inc.

Mike Abernathy

Integrated Video for Synthetic Vision Systems

04759

For 2001 Phase II:

Rapid Imaging Software, Inc.

[REDACTED]  
 Carolyn Galceran [REDACTED]  
 [REDACTED]

(b)(6)

Since my sources of information are limited to those available to the public (magazines such as *Aviation Week & Space Technology* as well as whatever I can find on the Internet) I have no way of knowing if there are other procurements, vendors, contractors, and Government procuring activity related to Claim I-222.

I believe that NASA is in a better position to know what it is (or has been) working on than I am.

- (3) *A detailed identification of the accused articles or processes, particularly where the article or process relates to a component or subcomponent of the item procured, an element by element comparison of the representative claims with the accused article or process. If available, this identification should include documentation and drawings to illustrate the accused article or process in suitable detail to enable verification of the infringement comparison.*

I believe I have answered this in section (2) as much as I am able to without NASA's cooperation.

- (4) *The names and addresses of all past and present licenses under the patent(s), and copies of all license agreements and releases involving the patent.*

There are no past licenses for this patent, and as of this date there are no present licenses for this patent. Naturally, I reserve the right to license this patent in the future as I see fit.

- (5) *A brief description of all litigation in which the patent(s) has been or is now involved, and the present status thereof.*

There has been no past litigation involving this patent, and as of this date there is no present litigation regarding this patent.

- (6) *A list of all persons to whom notices of infringement have been sent, including all departments and agencies of the Government, and a statement of the ultimate disposition of each.*

As of this date NASA is the only agency or department of the Government against which I have filed a claim.

5/11/03 – sent email to [comments@hq.nasa.gov](mailto:comments@hq.nasa.gov)

*I believe that NASA may have infringed on one or more of my U.S. Patents. How do I file a claim and whom do I contact?*

5/11/03 – Received reply:

*Date: Sun, 11 May 2003 17:48:46 -0400 (EDT)  
 From: "PAO Comments" <comments@bolg.public.hq.nasa.gov>.  
 Message-ID: <200305112148.h4BLmkhJ011314@bolg.public.hq.nasa.gov>  
 To: <jm@jmargolin.com>  
 Subject: Thank you for your email.*

*Thank you for your message to the NASA Home Page. The Internet Service Group will attempt to answer all e-mail regarding the site, but cannot guarantee a response by a particular time. The group will not be able to answer general inquiries regarding NASA, which should instead be sent to [public-inquiries@hq.nasa.gov](mailto:public-inquiries@hq.nasa.gov)*

-----  
 5/11/03 – Sent email to <public-inquiries@hq.nasa.gov>

*I believe that NASA may have infringed on one or more of my U.S. Patents. How do I file a claim and whom do I contact?*

*Jed Margolin*

As far as I can tell I did not receive a response.

*b(6)*

-----  
 5/12/03 – Sent email to [REDACTED] (found on Web site)

*I believe that NASA may have infringed on one or more of my U.S. Patents  
 How do I file a claim and whom do I contact?  
 (Or is my only recourse to sue in Federal Court?)*

*Jed Margolin*

5/12/03 – Received reply:

*Mr. Margolin,*

*Thank you for contacting NASA with your concerns. I have referred this matter to the Patent Counsel Office, and they will be contacting you to work with you on this issue.*

*Best wishes,  
Jesse Midgett*

-----  
5/12/03 – Given my experience with trying to contact Government officials via email (or mail, or fax) I hadn't waited for the reply from J. Midgett. I had found the web site for the LARC (NASA Langley) Patent Counsel Office, and called up. I was connected to Kurt Hammerle and we had a nice talk. I sent him an email the next day (May 13, 2003).

I received a phone call from Barry Gibbens (757-864-7141) who, apparently, was calling because of my email to J.C.Midgett and hadn't seen the email I sent to K. Hammerle. (I explained to him what I had done.) We had a nice talk. He said he had already sent me a letter.

I received his letter and sent a reply on May 18, 2003 (USPS), adding to the email I had sent K. Hammerle.

-----  
Thursday, June 5, 2003 – Received message from B. Gibbens, asking me to call him because I should contact Alan Kennedy at NASA Headquarters (202-358-2065).

-----  
Friday, June 6, 2003 - I called B. Gibbens. Then I called A. Kennedy but he was out.

-----  
Saturday, June 7, 2003 – Sent a fax to A. Kennedy. The first number I tried (202-358-4341) only accepted 4 pages (out of 13). I tried a few times. Then I tried 202-358-2741. It turned out that 4341 was the correct number and that 2741 was another group. As a result, A. Kennedy initially only got 4 pages.

-----  
Monday, June 9, 2003 – Received message from A. Kennedy and called him back.

He had not gotten the fax so he went and found it. I learned the next day that he had only gotten 4 pages.

We had a "free and frank" discussion. I stressed that I wanted to resolve it in a friendly manner and that I preferred to have NASA buy the patent for the Government.

-----  
Tuesday, June 10, 2003 – Received a message from A. Kennedy and called him back.

He said that his Manager has turned down my request that NASA consider a license proffer and has decided to handle it as a Claim, and that the investigation would take 3-6 months.

However, NASA is not the only agency or department of the Government I have contacted.

7/5/1999 Email to: [redacted] b(6)  
Dr. Birckelbaw, Project Manager for the UCAV contract awarded to Boeing.

Introduced myself and asked if DARPA was interested in my patent.  
Response: none

-----  
7/26/1999 USPS Mail to:  
Dr. Larry Birckelbaw  
Program Manager, Aerospace Systems  
DARPA Tactical Technology Office

[redacted] b(6)

Introduced myself and asked if DARPA was interested in my patent. Enclosed copy of patent.  
Response: none

-----  
Office of the Secretary of Defense (OSD)  
Mr. E.C. "Pete" Aldridge  
Under Secretary of Defense for Acquisition, Technology, and Logistics  
U.S. Department of Defense  
Contact Method: Email: webmaster@acq.osd.mil  
Response: none

May 3, 2002 and June 6, 2002

-----  
Army - AATD, Fort Eustice, VA.  
Col. Wado Carmona, Commander  
Applied Aviation and Training Directorate (AATD)  
Army Aviation and Missile Command  
Ft. Eustice, VA

Contact Method:  
Email: Ms. Lauren L. Sebring [redacted]

[redacted] fax: [redacted]

June 1, 2002

Phone Call Followup: She suggested I talk to Mr. Jack Tansey  
Mr. Jack Tansey, Business Development [redacted] b(6)  
Email Followup: jtansey@aatd.Eustis.army.mil

June 18, 2002  
June 18, 2002

-----  
Air Force Research Laboratory (AFRL)  
Dr. Barbara Wilson  
Contact Method: email [redacted]  
Response - none

July 17, 2002

Air Force Research Laboratory (AFRL)  
 Dr. R. Earl Good, Director,  
 Directed Energy Directorate  
 Air Force Research Laboratory

[REDACTED]  
 Response: none

July 23, 2002

-----  
 Department of the Air Force  
 Dr. James G. Roche  
 Secretary of the Air Force  
 Washington, DC

Contact Method: Fax [REDACTED]

July 28, 2002

Response: Letter from  
 Lt. General Charles F. Wald  
 Deputy Chief of Staff, Air & Space Operations, USAF

August 13, 2002

- (7) *A description of Government employment or military service, if any, by the inventor and/or patent owner.*

I have never been employed by the U.S. Government (or any other government). Likewise, I have never been in military service (in the United States or elsewhere). In the interests of full disclosure, I worked for three summers (1967, 1968, 1969) at the RCA Astro-Electronics Division in Hightstown, NJ. (They had a summer job program for students.)

- (8) *A list of all Government contracts under which the inventor, patent owner, or anyone in privity with him performed work relating to the patented subject matter.*

None. I did this entirely on my own dime.

(9) *Evidence of title to the patent(s) alleged to be infringed or other right to make the claim.*

This appears to be a two-part question. Does the patent belong to Jed Margolin, and am I that Jed Margolin?

**Part 1** - If you look at the front page of the '724 patent you will see that it was, indeed, issued to Jed Margolin. [REDACTED] b(6)

If you contact the U.S. Patent and Trademark Office, Document Services Department [REDACTED] you can order an Abstract of Title to verify that I own the patent. According to 37 CFR 1.12, assignment records are also open to public inspection at the United States Patent and Trademark Office.

**Part 2** - If you look up Jed Margolin, [REDACTED], in a telephone directory you will find assigned to it the telephone number [REDACTED] b(6)

When you called me on June 9 and June 10, that was the number you called.

Other than my affirming that I am, indeed, the Jed Margolin in question, I can only suggest that you contact my cousin Lenny (oops, I mean Dr. Len Margolin) who is employed by Los Alamos National Laboratory, and ask him if he has a cousin Jed who is an engineer and an inventor, and who possesses the Margolin gene for being very persistent. (Some say stubborn.) The last time I saw him was in Ann Arbor, Michigan, after he had just passed the orals for his doctorate. (He bought me a beer at a place on South University.)

(10) *A copy of the Patent Office file of the patent, if available, to claimant.*

I do not have a copy of the USPTO's patent file. What I have is my prosecution file which contains, among other things, privileged communications between my patent attorney and myself.

Besides, in our telephone conversation of June 10, you stated that one of the research centers (I believe it was LARC) had already ordered the file.

(11) *Pertinent prior art known to claimant, not contained in the Patent Office file, particularly publications and foreign art.*

I have found no relevant prior art.

However, there is an interesting article in the June 2, 2003 issue of *Aviation Week & Space Technology* on pages 48-51 entitled **GA Riding 'Highway-in-the-Sky'** which describes, among other things, the work of Dennis B. Berlinger, lead scientist for flight deck research at the FAA's Civil Aeromedical Institute (CAMI) regarding what is called **Performance-Controlled Systems**. In the Specification of my '724 patent I call it **First Order RPV Flight Control Mode**. In Claim 18:

18. The station of claim 13, wherein said set of remote flight controls are configured to allow inputting absolute pitch and roll angles instead of pitch and roll rates.

An Internet search turned up Mr. Berlinger's report **Applying Performance-Controlled Systems, Fuzzy Logic, and Fly-By-Wire Controls to General Aviation** as DOT/FAA/AM-02/7.

I am pleased that Mr. Berlinger's May 2002 study confirms the value of Performance-Controlled Systems in piloted aircraft and I believe that teaching it in my '724 patent (filed January 19, 1999) gave an additional novel and useful aspect to my invention.

(The article also describes the Synthetic Vision system used in the FAA's Capstone program.)

If you have any further questions, please contact me.

Sincerely yours,

Jed Margolin

Enclosed: Response from General Wald  
AWST article  
Berlinger Report  
U.S. Patent 5,904,724

04766





DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS UNITED STATES AIR FORCE  
WASHINGTON, DC

13 Aug 02

HQ USAF/XO  
[REDACTED]

Mr. Jed Margolin  
[REDACTED]

b(6)

Dear Mr. Margolin

On behalf of Secretary Roche, thank you for providing your ideas on ways to improve UAV control technology. As you know, we are now operating the Global Hawk and Predator systems in reconnaissance roles, and envision expanding unmanned aircraft applications into the weapons delivery mission area with the UCAV and the Predator/Predator B aircraft. Certainly we see a growing role for UAVs in the Air Force as technology advances and we gain experience in their operation. The improved control methods you have patented may well play a part in future UAV design. I suggest that you present these concepts to the various UAV manufacturers who are in the business of designing systems to meet our operational requirements. They can offer the best assessment on the overall feasibility of integrating your technology. I suggest a similar approach regarding your patented laser techniques.

Again, thank you for taking the time to offer these suggestions. I admire your ingenuity, and appreciate your desire to help us improve our national defense capabilities.

Sincerely

CHARLES F. WALD, Lt Gen, USAF  
Deputy Chief of Staff  
Air & Space Operations

cc:  
SAF/AQ  
AF/XOR

04767



US005904724A

# United States Patent [19]

[11] Patent Number: **5,904,724**

Margolin

[45] Date of Patent: **May 18, 1999**

[54] **METHOD AND APPARATUS FOR REMOTELY PILOTING AN AIRCRAFT**

[76] Inventor: **Jed Margolin, 3570 Pleasant Echo, San Jose, Calif. 95148**

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"US GeoData Digital Line Graphs", U.S. Dept. of the Interior, U.S. Geol. Surv. Earth Sci. Info Ctr. (Factsheet) Jun. 1993.

"US GeoData Digital Elevation Models", U.S. Dept. of the Interior, U.S. Geol. Surv. Earth Sci. Info Ctr. (Factsheet) Jun. 1993.

Shifrin, Carole A., "Gripen Likely to Fly Again Soon." *Aviation Week & Space Technology*, Aug. 23, 1993, pp. 72-73.

[21] Appl. No.: **08/587,731**

[22] Filed: **Jan. 19, 1996**

[51] Int. Cl.<sup>6</sup> ..... **G06F 165/00; H04N 7/18**

[52] U.S. Cl. .... **701/120; 701/2; 701/24; 244/189; 244/190; 348/114**

[58] **Field of Search** ..... **364/423.099, 424.012, 364/424.013, 424.021, 424.022, 449.2, 449.7, 460, 439, 424.028; 340/825.69, 825.72, 967, 989, 991, 992, 993; 244/189, 190, 181, 17.13, 3.11, 3.15; 348/42, 51, 113, 114, 117, 123, 143; 382/154; 395/118, 119, 125**

*Primary Examiner*—Tan Q. Nguyen  
*Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor and Zafman LLP

### [56] References Cited

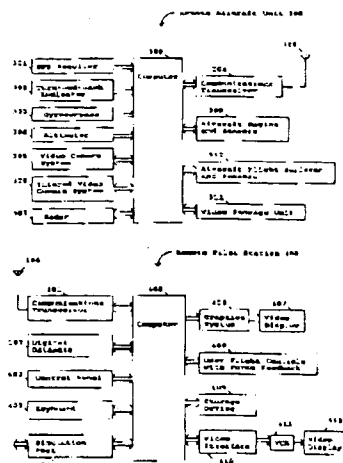
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### [57] ABSTRACT

A method and apparatus that allows a remote aircraft to be controlled by a remotely located pilot who is presented with a synthesized three-dimensional projected view representing the environment around the remote aircraft. According to one aspect of the invention, a remote aircraft transmits its three-dimensional position and orientation to a remote pilot station. The remote pilot station applies this information to a digital database containing a three dimensional description of the environment around the remote aircraft to present the remote pilot with a three dimensional projected view of this environment. The remote pilot reacts to this view and interacts with the pilot controls, whose signals are transmitted back to the remote aircraft. In addition, the system compensates for the communications delay between the remote aircraft and the remote pilot station by controlling the sensitivity of the pilot controls.

20 Claims, 7 Drawing Sheets



04768

# GA Riding 'Highway-in-the-Sky'

General aviation sector reaps the benefits of research originally conducted for military, commercial transport cockpits

BRUCE D. NORDWALL/WASHINGTON and OKLAHOMA CITY

**G**eneral aviation aircraft are finally catching up with some of the advances found in the latest commercial transports and military cockpits, and in one particular sphere—display innovations—GA is actually taking the lead.

Researchers in industries and universities around the world have been pursuing a more intuitive guidance display for pilots for years. In general, this elusive presentation is referred to as highway-in-the-sky (HITS) (*AW&ST* Apr. 20, 1998, p. 58). In a twist that may foreshadow future advances, it was a general aviation aircraft that received the FAA's first certification of HITS technology for navigation guidance.

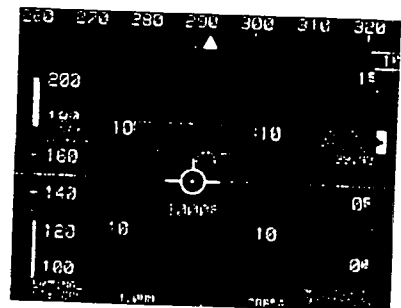
Instead of following course deviation

indicators and altimeters, a pilot using this HITS presentation flies through a series of 3D boxes on a multifunction display. By maneuvering through the 400 X 320-ft. boxes spaced at 2,000-ft.

**Flying through "boxes in the sky" keeps pilots on course and altitude during a simulated curved instrument approach down the mountainous Gastineau Channel to Juneau, Alaska.**

intervals along the planned GPS route of flight, the pilot keeps the aircraft on course and altitude, which is particularly helpful for a descending, curved instrument approach.

L.A.B. Flying Service's Piper Seneca made the first commercial revenue flight



using HITS in Juneau, Alaska, on Mar. 31. It followed an optimized area navigation (RNAV) route through airspace that would be inaccessible with conventional avionics.

The system was built by Chelton Flight Systems as part of the second

phase of the imaginative Capstone program, an FAA industry/academic partnership in Alaska. The cockpit employs a Chelton FlightLogic electronic flight information system-synthetic vision (EFIS-SV) using two glass displays, one for primary flight guidance and one for navigation.

The big innovation is the use of synthetic vision symbology to present information to pilots. The initial EFIS systems digitally replicated the rudimentary attitude and flight-director symbols of electro-mechanical instruments from an earlier era. Now, in addition to the flight path, pilots see a real-time 3D view of the terrain and obstacles on the primary flight display. These are complemented by a moving map on the navigation display and by aural terrain warnings.

Among the other "firsts" claimed by Capstone Phase II on the Juneau flight were the use of forward-looking 3D terrain and HUD symbology on a certified primary flight display, and commercial

Automatic Dependent Surveillance-Broadcast (ADS-B) equipment (*AW&ST* Sept. 18, 2000, p. 68). With GPS as the enabling technology, that phase indicated that a low-cost system could give bush pilots many of the safety benefits long-standard for commercial jet transports. The emphasis was on reducing controlled flight into terrain accidents for these pilots, who usually operate out of the range of navigation aids or radar help from ATC. Phase II with HITS and synthetic vision greatly expands those capabilities.

**CAMI tested a four-axis side-arm controller in a simulator as a replacement for stick and throttle in a fly-by-wire performance control system.**

use of the GPS wide-area augmentation system (WAAS).

Capstone has equipped three aircraft in Alaska with the Chelton Flight Systems' cockpit, and plans to outfit every commercial operator in SE Alaska within the next 18 months. The contract for 125 aircraft could expand to up to 200, according to Gordon Pratt, Chelton's president. The FAA is providing the equipment at no charge in Alaska to any commuter and on-demand (FAA Part 135) operator of fixed-wing aircraft or

The next major safety enhancement for GA aircraft could come from "performance control," according to Dennis B. Beringer, lead scientist for flight deck research at the FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City. While known more for assisting FAA's Aircraft Certification Service and Flight Standards in defining requirements for both aircraft and pilots, CAMI is also an active partner in human factors research to improve cockpits.

## With performance control, non-pilots could learn to fly a simulator in 15 min.

helicopters. A supplemental type certificate for helicopters was scheduled to be delivered on May 31. An additional 10 aircraft are being outfitted in the contiguous U.S., Pratt said, but at the expense of aircraft owners.

The first phase of the Capstone Program started as a demonstration that equipped a number of commuter and air taxi aircraft in the Yukon-Kuskokwim River delta area with a low-cost GPS, a terrain database, data link and

The performance-control concept was introduced in the 1970s, before electronics were sufficiently advanced for implementation. Beringer said that now some of the fly-by-wire military and commercial aircraft use what could be legitimately called performance-control logic, which not only make aircraft easier to fly, but can also add flight envelope protection.

With conventional flight controls, a pilot has direct command of the aero-



**The navigation display shows GPS WAAS position and an approach not possible with conventional navigation aids due to a 20-30-deg. turn after the GASTN waypoint to align with the runway.**



dynamic surfaces. With performance control, his movements would be transmitted via a fuzzy-logic controller to a flight management system or an auto pilot that would guide the aircraft to carry out the

desired performance goal. But unlike a simple autopilot, which directs a change in heading at a limited rate of turn, performance-control logic changes control laws so that a pilot commands the rate of turn and bank, and rate of climb or descent. It simplifies command of more complicated maneuvers, and is a compromise between automated maneuvering and manual flight control, Beringer said. Safety is further enhanced using a self-centering (spring-loaded) side stick which returns to the centered position when the pi-

lot relaxes pressure, thus bringing the aircraft to straight and level flight.

The reduced number of control movements is one reason flying is easier. Going into a turn with conventional controls, the pilot has to initiate the roll, and then neutralize the ailerons when he achieves the desired bank angle. But with performance controls, one movement establishes the desired bank angle/turn rate. One downside to performance control with envelope protection is the inability to do aerobatics, such as an aileron roll or loop, Beringer said.

In the four-axis side-arm controller (above), rotating the wrist governs the rate of turn, flexing the wrist vertically directs the rate of climb or descent, and fore and aft movement varies the airspeed. Interest in performance controls was renewed with NASA's Agate (Advanced General Aviation Transport Experiments) program, which was concerned with simplifying the flight task and reducing ab initio training requirements. Agate has also been a strong supporter of HITS.

Researchers had previously found that with performance control, non-pilots could learn to fly a simulator in 15 min. Beringer tested the system in a simula-

tor configured as a Piper Malibu at CAML. It used HITS displays and a four-axis side-arm controller. Twenty-four individuals with varying flight experience participated: six high-flight-time pilots; six low-flight-time pilots; six student pilots, and six non-pilots. Each flight involved a takeoff into instrument conditions, a continuous climb while turning downwind, a turn to intercept the instrument landing system glidepath, and a descent to landing. Flights were divided between use of a conventional yoke and the side-arm controller.

The findings were consistent. The aircraft was more stable and had less variations in course and altitude using performance control than with conventional controls. Although experienced pilots

## The **big** **innovation** is use of synthetic vision symbology

always outperformed less-experienced individuals, with either system, all agreed the effort required was nearly halved.

Performance control is not apt to be seen in Piper Cubs, but perhaps in Beech Bonanzas and Piper Malibus. A lot of them already have two- or three-axis autopilots, so a significant capability could be achieved by rigging a side-stick control to the autopilot, Beringer said.

But two large problems must be overcome for performance controls to appear in the next generation of GA aircraft. The first is cost. Affordable and certifiable computer controls and servos would have to drop to a level competitive with more conventional systems.

Second, a fly-by-wire debate must be resolved. Could an affordable system be built with sufficient reliability using triple- or quad-redundancy, or would a costly manual-reversion be required? A mechanical backup would add cost for installation and for training pilots to operate the two systems.

Complicating that issue is the question of the level of reliability required. The FAA's current standard for a flight-critical system is a failure rate of  $10^{-9}$ . While this is a standard for NASA, it might not be reasonable for general aviation aircraft. Beringer points out that the failure rate for humans is about  $10^{-3}$ . ●

Reference 6 (1 page)

Jed Margolin [REDACTED]

Phone: [REDACTED]

Email: [REDACTED]

[REDACTED]  
January 8, 2004

Mr. Alan J. Kennedy  
Director, Infringement Division  
Office of the Associate General Counsel  
National Aeronautics and Space Administration

b(6)

[REDACTED]

b(6)

Attn: GP(02-37016)

Dear Mr. Kennedy,

I am disappointed to hear that the investigation that you promised would take 3-6 months has not been completed.

As per our telephone conversation of 10 December 2003, please confirm that you believe the Statute of Limitations gives NASA the right to take up to six years to rule on my claim for compensation for the use of my patent.

Also, please confirm that you expect NASA to reject my claim for compensation on the grounds that the X-38 never flew.

Sincerely yours,

*Jed Margolin*

Jed Margolin

04772

[REDACTED]

**From:** Robert Adams-OTG ([REDACTED] b(6))  
**Sent:** Wednesday, August 06, 2008 11:17 AM  
**To:** McNutt, Jan (HQ-MC000)  
**Subject:** RE: Jan, please forward me a copy of the letter that you stated was sent out last Friday.. [REDACTED]  
**Attachments:** jm\_assign.pdf

[REDACTED] b(4)

Jan,

Based on the conversation with you and Jed, I was told by Jed that he walked you through the Patent & Trade Mark office's website and you had access to see the assignment.

If that was not acceptable, then please see the attachment concerning the fully executed assignment.

[REDACTED]

I look forward to hearing from you shortly. b(4)

Thank you,

Dr. Adams

**From:** McNutt, Jan (HQ-MC000) [REDACTED] b(6)  
**Sent:** Wednesday, August 06, 2008 6:23 AM  
**To:** Robert Adams-OTG  
**Subject:** RE: Jan, please forward me a copy of the letter that you stated was sent out last Friday...OFFER TO COMPROMISE, SUBJECT TO RULE 408 FED. R. EVID.

Dr. Adams,

Please see attached.

Jan S. McNutt  
Attorney-Advisor (Commercial)  
Office of the General Counsel  
NASA Headquarters

[REDACTED] b(6)

04773

[REDACTED]

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**From:** Robert Adams-OTG [mailto: [REDACTED] b(6)]  
**Sent:** Tuesday, August 05, 2008 3:06 PM  
**To:** McNutt, Jan (HQ-MC000)  
**Subject:** FW: Jan, please forward me a copy of the letter that you stated was sent out last Friday.. [REDACTED]

**From:** Robert Adams-OTG [mailto:radams@optimatechnologygroup.com]  
**Sent:** Monday, August 04, 2008 6:21 PM  
**To:** 'mcnuttj@ncr.disa.mil'  
**Cc:** 'M. Lawrence Oliverio'  
**Subject:** Jan, please forward me a copy of the letter that you stated was sent out last Friday.. [REDACTED]

CONFIDENTIAL

Jan,

Can you please forward me a copy of the letter that you stated was sent out last Friday? Considering that we have already started licensing (see attached non-exclusive) said technology and are actively conducting talks with other infringers, it's in our best interest to enforce said IP. We also have recently starting suing infringers in Federal court and one is settling now as we speak. We may consider a Technology Transfer depending on the interest and offer.

Our goal with NASA is to resolve this infringement matter quickly and peacefully verse wasting any more time on the matter.

As to statute of limitations waiver, at this time we would not be agreeable but we may consider a tolling agreement.

Thank you,

Dr. Robert Adams – CEO  
Optima Technology Group  
[REDACTED] Phone b(6)  
[REDACTED] Fax

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04774



04775

**From:** McConnell, Stephen (HQ-NB000)  
**Sent:** Monday, June 30, 2008 8:13 AM  
**To:** Robinson, Kellie N. (HQ-NB000)  
**Subject:** Fw: FOIA Request

**Attachments:** jm\_nasa.pdf



jm\_nasa.pdf (106 KB)

----- Original Message -----

**From:** Jed Margolin [REDACTED] b(e)  
**To:** nasafoia@nasa.gov [REDACTED]  
**Sent:** Sat Jun 28 21:05:56 2008  
**Subject:** FOIA Request

This request is made pursuant to the Freedom of Information Act.

I would like all documents related to the Administrative Claim of Jed Margolin for Infringement of U.S. Patent Nos. 5,566,073 and 5,904,724; NASA Case No. I-222.

I am attaching a letter dated June 11, 2003 from Alan Kennedy, Director, Infringement Division, Office of the Associate General Counsel as file jm\_nasa.pdf. I provided the information requested, it was received by Mr. Kennedy, and thereafter Mr. Kennedy refused to respond to my attempts to find out the results of the investigation.

I believe NASA has had enough time to have completed its investigation by now.

Jed Margolin  
[REDACTED] b(e)

[www.jmargolin.com](http://www.jmargolin.com) <<http://www.jmargolin.com>>

04777

08-270

National Aeronautics and  
Space Administration

Headquarters

[REDACTED]

b(6)



June 11, 2003

Reply to Attn of: GP (02-37016)

Mr. Jed Margolin

[REDACTED]

b(6)

Re: Administrative Claim of Jed Margolin for Infringement of  
U.S. Patent Nos. 5,566,073 and 5,904,724; NASA Case No. I-222

Dear Mr. Margolin:

Thank you for your letter dated June 7, 2003 regarding possible unauthorized uses by NASA of inventions protected by U.S. Patent Nos. 5,566,073 and 5,904,724. You have identified possible unauthorized uses in the X-38 project and other projects involving synthetic vision technology. NASA considers this matter to be an administrative claim for patent infringement, and has assigned the claim NASA Case No. I-222. An investigation will now be conducted to identify any unauthorized uses of the inventions claimed in the subject patents. In order to proceed further with this investigation, we need you to provide us with the following information:

- (1) The identification of all claims of the patent(s) alleged to be infringed.
- (2) The identification of all procurements known to the claimant or patent owner which involve the alleged infringing item or process, including the identity of the vendor or contractor and the Government procuring activity.
- (3) A detailed identification of the accused articles or processes, particularly where the article or process relates to a component or subcomponent of the item procured, an element by element comparison of the representative claims with the accused article or process. If available, this identification should include documentation and drawings to illustrate the accused article or process in suitable detail to enable verification of the infringement comparison.
- (4) The names and addresses of all past and present licenses under the patent(s), and copies of all license agreements and releases involving the patent.
- (5) A brief description of all litigation in which the patent(s) has been or is now involved, and the present status thereof.

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- (6) A list of all persons to whom notices of infringement have been sent, including all departments and agencies of the Government, and a statement of the ultimate disposition of each.
- (7) A description of Government employment or military service, if any, by the inventor and/or patent owner.
- (8) A list of all Government contracts under which the inventor, patent owner, or anyone in privity with him performed work relating to the patented subject matter.
- (9) Evidence of title to the patent(s) alleged to be infringed or other right to make the claim.
- (10) A copy of the Patent Office file of the patent, if available, to claimant.
- (11) Pertinent prior art known to claimant, not contained in the Patent Office file, particularly publications and foreign art.

In addition to the foregoing, if claimant can provide a statement that the investigation may be limited to the specifically identified accused articles or processes, or to a specific procurement, it may materially expedite determination of the claim.

If you have any questions, please feel free to contact me on [REDACTED]

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Cordially,



Alan J. Kennedy  
Director, Infringement Division  
Office of the Associate General Counsel  
(Intellectual Property)

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