Jed Margolin 1981 Empire Rd. Reno, NV 89521-7430
Phone: 775-847-7845 Email: jm@jmargolin.com June 10, 2009

Administrator
NASA Headquarters
Washington, DC 20546

Appeal under the Freedom of Information Act to the NASA Response dated May 14, 2009 and received via email May 18, 2009.

Jed Margolin FOIA 08-270 Filed: June 28, 2008

Sir:

This is an Appeal under the Freedom of Information Act to the NASA Response dated May 14, 2009 and received via email May 18, 2009 [*Appendix NA1 - NA65*] in FOIA Request 08-270 filed June 28, 2008 [*Appendix NA66*].

Because NASA's response was sent (and received) on May 18, 2009 this appeal is timely.

Summary

In its very tardy response to FOIA Request 08-270 by Jed Margolin ("Margolin") NASA withheld documents, citing *5 U.S.C.§552(b(5).*

One of the documents that NASA withheld from Margolin is a letter dated March 19, 2009 that was sent by Gary G. Borda ("Borda") NASA Agency Counsel for Intellectual Property to Optima Technology Group ("OTG"). (This document was given to Margolin by OTG.) In this letter Borda denies Claim I-222 regarding NASA's infringement of U.S. Patent 5,904,724 ('724) in the X-38 project.

Margolin's FOIA 08-270 request to NASA was to produce documents relating to Claim I-222 and NASA withheld the most material document so far.

The Borda letter asserts:

> "… 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."

And states, "… NASA reserves the right to introduce such evidence of invalidity in an appropriate venue, should the same become necessary."

Circulating the patent report solely within NASA or among other federal agencies is not an appropriate venue for NASA to use to have a patent declared invalid. The only appropriate venues for NASA to challenge the validity of a U.S. Patent are in the U.S. Court of Federal Claims and the Court of Appeals for the Federal Circuit. A Court will not accept NASA's word that a patent is invalid due to prior art; NASA would be required to produce the evidence.

Therefore, the exemption under *5 U.S.C.§552(b)(5)* does not apply.

The Borda letter also suggests the existence of other materials and/or documents, especially relating to whether NASA risked the X-38 by failing to provide compensation for the time delays in the synthetic vision flight control loop.

Details

Most of the documents NASA sent to Requestor Jed Margolin ("Margolin") were documents Margolin already had, especially the documents Margolin had himself sent to NASA. There were other documents NASA admits to having but refused to provide [*Appendix NA1*]:

> It has been determined that portions of the records found responsive to your request contain information which is exempt from disclosure under the deliberative process privilege of Exemption 5. This privilege covers advisory opinions, recommendations, and deliberations, which are part of the government decision-making process, 5. U.S.C.§552(b)(5).

The reference *5. U.S.C.§552(b)(5)* states, referring to Section (a) which requires agencies to make information available to the public:

> (b) This section does not apply to matters that are -
>
> .
>
> .
>
> .
>
> (5) inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency;

NASA did not give an *estimate* of the volume of the documents being withheld, in violation of *5 U.S.C.§552(a)(6)(F):*

> (F) In denying a request for records, in whole or in part, an agency shall make a reasonable effort to estimate the volume of any requested matter the provision of which is denied, and shall provide any such estimate to the person making the request, unless providing such estimate would harm an interest protected by the exemption in subsection (b) pursuant to which the denial is made.

And, since NASA did not give even a minimal description of the documents being withheld, that would probably have been the end of the matter. Without even a minimal description of the documents being withheld Margolin would have had no way of knowing if NASA was acting properly and in good faith.

NASA has a record of acting in bad faith toward Margolin. See:

1. Letter from Jed Margolin to Alan Kennedy (NASA Office of the General Counsel) dated January 6, 2004 confirming a portion of the telephone conversation Margolin had with Kennedy on December 10, 2003 [*Appendix NA72*]

2. Fax from Jed Margolin to Acting Administrator Scolese dated April 27, 2009 detailing NASA's almost-6 years of bad faith shown to Margolin. [*Appendix NA73*]

Note that neither document was included in NASA's Response to Margolin's FOIA Request, which suggests NASA withheld them in an attempt to avoid embarrassment to the Agency and for no other reason. *5 U.S.C.§552(b)* does not include "embarrassment to the agency" as a reason to withhold documents.

NASA is still acting in bad faith toward Margolin.

One of the documents that NASA withheld from Margolin is a letter dated March 19, 2009 that was sent by Gary G. Borda ("Borda") NASA Agency Counsel for Intellectual Property to Optima Technology Group ("OTG"). (This document was given to Margolin by OTG.) In this letter Borda denies Claim I-222 regarding NASA's infringement of U.S. Patent 5,904,724 ('724) in the X-38 project. [*Appendix NA80*]

Margolin's FOIA 08-270 request to NASA was to produce documents relating to Claim I-222 and NASA withheld the most material document so far.

The Borda letter is so important that it will be reproduced here in its entirety.

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

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. Kelp 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

***

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

***

3

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 [al 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

The Borda letter is not just a material document, it's a smoking gun.

1. Despite the documents supplied by OTG, and Margolin's confirmation in a telephone conversation with Jan McNutt (Office of the General Counsel), that OTG owns the subject patent, NASA continues to cast doubt on the legal ownership of the patent.

> 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.

2. NASA asserted it had found prior art to invalidate the patent.

> 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.

In order to make this statement, NASA must have produced a patent report showing how each reference is directed to the claims in the '724 patent. This patent report is not exempt under *5 U.S.C.§552(b)(5)* because it is not "inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency;".

The reason it is not exempt is because "NASA reserves the right to introduce such evidence of invalidity in an appropriate venue, should the same become necessary."

Circulating the patent report solely within NASA or among other federal agencies is not an appropriate venue for NASA to use to have a patent declared invalid. The only appropriate venues for NASA to challenge the validity of a U.S. Patent are in the U.S. Court of Federal Claims and the Court of Appeals for the Federal Circuit. A Court will not accept NASA's word that a patent is invalid due to prior art; NASA would be required to produce the evidence.

Since this patent report is material under Margolin's FOIA Request and is not exempt under *5 U.S.C.§552(b)(5)* Margolin requests NASA immediately hand it over to him.

There is another reason NASA needs to hand over the patent report. Although Margolin no longer owns the '724 patent he is still the named inventor. By asserting it has evidence to invalidate the patent, and then withholding that evidence, NASA has defamed Margolin's reputation as an inventor. It also smacks of 1950s McCarthyism (making damaging accusations without providing proper evidence).

Margolin takes such attacks seriously. There is an article in the December 2008 issue of AUVSI's Unmanned Systems Magazine entitled **Synthetic Vision Technology for Unmanned Systems: Looking Back and Looking Forward** by Jeff Fox, Michael Abernathy, Mark Draper and Gloria Calhoun [*Appendix NB58*].

The article consists of a spurious history of synthetic vision. Many of the listed sources are from NASA, such as the HiMat project. [*Appendix NB8*] (While HiMat produced valuable results, it did not use synthetic vision.)

Margolin responded with the article **Synthetic Vision – The Real Story.** [*Appendix NB1*].

Although the editor of AUVSI Magazine had promised Margolin the opportunity to respond in the magazine, he later refused to even mention the controversy about the Abernathy article. [*Appendix NB60*]

NASA should be familiar with the name Mike Abernathy (Rapid Imaging Software). He provided the synthetic vision system for the X-38 project.

NASA should also be interested in the statements made on Abernathy's behalf in a letter from Abernathy's law firm to Optima Technology Group dated October 13, 2006. [*Appendix NA143*]

> As you know, RIS creates computer software, and does not use or manufacture UAV systems or ground control stations. RIS software is used in UAVs to provide situation awareness for sensor operators. It is not used for piloting air vehicles. The sensor operator does not pilot the aircraft, and instead sits at a separate workstation operating a payload containing one or more cameras, which may be controlled using a joystick to point the camera package during search or tracking operations.
>
> As you know, RIS refuses to allow its products to be used as a pilot aid, and RIS product licenses specifically prohibit use for piloting. None of RIS's customers use its software for piloting, for very good reason. Serious military regulations control placement of anything -synthetic vision included- on a pilot workstation. Before anything can be placed on the display in front of a pilot, it has to have met stringent criteria (MIL-STD 1787C, DO-178B, etc.), it must have been thoroughly ground tested, and it must have been fully flight tested. RIS software has never been through this process, and thus is prohibited from use for piloting. Accordingly, UAV manufacturers have purchased RIS products for use on the

> sensor operator console, but none for the pilot console. This is a matter of Army doctrine and applies to Shadow, Warrior and Hunter.
>
> Nor does RIS have its software in a form that would make it marketable for piloting. RIS software products are all based on the Microsoft Windows operating system. This offers many advantages, but is inappropriate to piloting aircraft because it is a not a POSIX compliant real-time operating system. POSIX compliance is required by flight safety regulations. To create such a version would entail a one- to two-year conversion program in which RIS has not invested.
>
> It is important to realize that the market for RIS products is quite different from the relaxed civilian world. If a military pilot chose to use synthetic vision in spite of military regulations or in defiance of a software license agreement, his career would be damaged or destroyed. Military pilots cherish their wings and would not consider risking them on something like synthetic version.
>
> Finally, it appears from your correspondence that you regard research activities like NASA's X-38 prototypes (before the program was cancelled in 2002) as infringing the Margolin patents. This was not the case because of the claim limitations of the Margolin patents. However all RIS work for government agencies, including NASA, was authorized and consented to by the U.S. Government, and is protected under 28 U.S.C. §1498(a). As you are aware, any remedies you may have are against the government and are circumscribed by that statute and related law.
>
> Although we need not discuss the invalidity of the Margolin patents given the above circumstances, you should be aware that both patents were anticipated by profound prior art dating back to 1977. If it should ever become necessary, we are confident that both would be held invalid.

(emphasis added)

He is asserting that Abernathy's synthetic vision software may not be used for piloting an aircraft, either remotely or with the pilot onboard. And yet, it was used for remotely piloting the X-38. [*Appendix NB20*]

From *Appendix NB21*:

> 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.

Did NASA really trust the safety of an expensive test vehicle (X-38) to a synthetic vision system using Microsoft Windows?

To end this section, note that in *5 U.S.C.§552(f)*:

(f) For purposes of this section, the term—

(1) “agency” as defined in section 551 (1) of this title includes any executive department, military department, Government corporation, Government controlled corporation, or other establishment in the executive branch of the Government (including the Executive Office of the President), or any independent regulatory agency; and

(2) “record” and any other term used in this section in reference to information includes—

(A) any information that would be an agency record subject to the requirements of this section when maintained by an agency in any format, including an electronic format; and

(B) any information described under subparagraph (A) that is maintained for an agency by an entity under Government contract, for the purposes of records management.

Under this definition, neither Margolin nor Optima Technology Group (the owner of Claim I-222) is an “agency.” It also means that NASA is required to provide the records between NASA and Rapid Imaging Software (Mike Abernathy) which provided the synthetic vision system for the X-38 project which was referred to in the Borda letter.

3. The basis for NASA's rejection of Claim I-222 in the Borda letter is that the X-38 project did not implement one of the elements in the patent claims.

> 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.)

To be precise, said computer does more than determine and compensate for time delays.

Claim 1 says:

> 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.

Claim 13 says:

> 13. A station for flying a remotely piloted aircraft that is real or simulated comprising:
>
> a database comprising terrain data;
>
> a set of remote flight controls for inputting flight control information;
>
> a computer having a communications unit configured to receive status information identifying said remotely piloted aircraft's position and orientation in three dimensional space, said computer configured to access said terrain data according to said status information and configured to transform said terrain data to provide three dimensional projected image data representing said remotely piloted aircraft's environment, said computer coupled to said set of remote flight controls and said communications unit for transmitting said flight control information to control said remotely piloted aircraft, said computer also to determine a delay time for communicating said flight control information between said computer and said remotely piloted aircraft, and said computer to adjust the sensitivity of said set of remote flight controls based on said delay time; and
>
> a display configured to display said three dimensional projected image data.

Is Borda saying that NASA did not determine and compensate for time delays in the X-38 synthetic vision flight control loop or simply that NASA did not use a computer to do so? If they did not use a computer, what did they use?

NASA is well aware of the problems caused by failing to compensate for time delays in flight control systems.

When a UAV is manually flown by a remote pilot, failure to compensate for delays in the communications link will lead to Pilot-Induced-Oscillation, which frequently leads to the loss of the aircraft.

This is a potential problem in Flight Control Systems even in aircraft with the pilot onboard.

The article **Fly-By-Wire - A Primer for Aviation Accident Investigators** (Air Line Pilot, February 2000, page 18 By F/O Steve Stowe (Delta), Local Air Safety Chairman, Delta Council 16) gives a basic explanation of the Control Systems Engineering analysis of the problem. From *Appendix NA87*:

> Now for the bad news. While FBW technology could make an aerodynamically unstable aircraft flyable, it can also destabilize an otherwise stable airframe.
>
> FBW flight control laws may not be stable for all values of gain or phase angle (the difference between pilot input and airplane response in terms of frequency; exactly opposite would be a 180-degree phase angle) that can be applied. Now costarring with static margin as stability factors are "gain margin" and "phase margin"--measures of how much additional gain or phase-angle lag are available until the system becomes unstable. Computer simulation or flight testing can determine these two margins. But these data are often the manufacturer's proprietary information, so don't look for it on your weight-and-balance sheet.
>
> Highly augmented aircraft, in which fly-by-wire transforms the basic aircraft aerodynamics, can exhibit cliff-like handling qualities.
>
> "One reason is that fly-by-wire systems are susceptible to time delay, from a number of causes, which can seriously degrade the pilot's ability to control the aircraft. Time delay may vary for different sizes or frequencies of inputs. U.S. military standards suggest that time delays should be less than one tenth of a second for good handling qualities and that loss of control may occur with delays more than one quarter of a second (MIL STD 1797)."

(emphasis added)

Fly-By-Wire" means the aircraft surfaces are controlled through a computer instead of being controlled directly by the pilot.

From the same article [*Appendix NA92*]:

> * **Time delay**--Delay from pilot input to FBW aircraft response. Caused by many factors including the effect of filters, computer processing time, task time-sharing by computers and signal processors, "higher order" effects of the feedback control system, digital sampling effects, and/or actuator rate limiting. Time delays of more than 0.25 second can cause enough lag to make the FBW aircraft unstable during certain tasks, especially in "high gain" situations.

(emphasis added)

There was a problem with Pilot-Induced-Oscillation during the development of the Space Shuttle. The following is from NASA Technical Memorandum NASA-TM-81366 **ANALYSIS OF A LONGITUDINAL PILOT-INDUCED OSCILLATION EXPERIENCED ON THE APPROACH AND LANDING TEST OF THE SPACE SHUTTLE** , Author: J. W. Smith, December 1981.

From the Introduction (*Appendix NA96*):

> During the final free flight (FF-5) of the shuttle's approach and landing test (ALT) phase, the vehicle underwent pilot-induced oscillations (PIO's) near touchdown (refs. 1 to 3). The oscillations were present in both the pitch and roll axes and were initiated when the pilot made pitch controller inputs in an effort to control sink rate by changing pitch attitude. Because the control inputs were large and fairly rapid, the elevons rate limited in the pitch axis at the maximum priority rate limit set in the computers. The elevon rate limit also limits the vehicle's roll control capability, and this was partially responsible for the lateral control problem.
>
> Several unpublished studies indicate that time delays as well as priority rate limiting were a significant factor in the PIO's. A simulator study of the effect of time delays on shuttle PIO's is reported in reference 4.
>
> This report describes the combined effect of pilot input rate limiting and time delays. Frequency responses are predicted for various parameters under rate saturated conditions by using nonlinear analysis.

(emphasis added)

Note that the above references were for Flight Control Systems for aircraft with the pilot onboard. When an aircraft is flown manually through a communications link, the delays caused by the communications link become part of the flight control system.

From U.S. Patent 5,904,724 column 8, lines 14 – 36 [*Appendix NA142*]:

> Flying an RPV is further complicated because there are additional time delays in the loop. The computer in the remote aircraft must first determine the aircraft's position and orientation. The additional processing for transmitting a secure signal by encryption and/or spread spectrum techniques may create additional delays. Transmission delay of signals between the remote aircraft and remote pilot station is negligible for a direct path. However, if the signals are relayed through other facilities the delay time may be appreciable, especially if an orbiting satellite is used. There are additional delays in the remote pilot station as the remote aircraft's position

and orientation are used to transform the data from the digital database to present the pilot with the synthesized 3D projected view from the remote aircraft. In one embodiment, the RPV system measures the various delays and modifies the control laws used by the computer in the remote pilot aircraft and in the feedback provided by the computer in the remote pilot station to the remote pilot. For example, the computer may adjust the sensitivity of the User Flight Controls 408 according to the delay (e.g., as the delay increases, the computer will decrease the sensitivity of the flight controls). The system also displays the measured delay to the remote pilot.

The issue of time delay in a UAV communications link was addressed in the literature by the Master's Thesis **Improving UAV Handling Qualities Using Time Delay Compensation** by Andrew J. Thurling (17 Sep 97-24 Feb 00, AIR FORCE INST OF TECH WRIGHT-PATTERSONAFB OH). From *Appendix NA139*:

Abstract

This study investigated control loop time delay and its effect on UAV handling qualities. Compensation techniques to improve handling qualities in the presence of varying amounts of time delay were developed and analyzed. One technique was selected and successfully flight-tested on a UAV.

Flight-testing occurred at a constant flight condition with varying levels of additional time delay introduced into the control loop. Research pilots performed a pitch tracking task and gave Cooper-Harper ratings and comments. Tracking errors were used as a quantitative measure of Pilot/Display/UAV system performance.

Predictive pitch compensation was found to significantly reduce pilot workload and improve Cooper-Harper ratings. Using the predictive display doubled the amount of system time delay that research pilots could tolerate while tracking the task bars. Overall system tracking performance, however, was not improved.

Parameter variations of +/- 20% in the aerodynamic model used to generate the predictive display produced statistically significant, although not operationally significant, changes in both pilot opinion and performance.

Analysis of flight test data and follow-on simulations resulted in predictor improvements that increased predictor accuracy to the point of restoring system tracking performance to equal that of the system with no additional time delay.

From *Appendix NA140*:

Preface

> The effects of control system time delays on manned aircraft handling qualities are well understood. Unmanned aircraft have similar control, system delay, but have an additional latency caused by the datalink of the human operator's commands from control station to aircraft. The purpose of this thesis is to investigate the effects of time delay on the handling qualities of Unmanned Aerial Vehicles (UAV) and develop compensation strategies to mitigate the adverse effects of the delay. It is my hope that with techniques developed and investigated in this thesis future UAV operators will be able to employ UAVs from anywhere in the world thus increasing the flexibility of this already versatile platform.

(emphasis added)

And from the same report (*Appendix NA141*):

> *2.3.4 Time Delay Effects on Handling Qualities*. Control difficulties during the 1977 Space Shuttle Approach and Landing Tests and YF-17 development resulted in efforts to investigate whether time delays associated with digital flight computers might be a contributing factor to the handling qualities problems. As discussed above, delays in flight control systems may come from a variety of sources. The effects of phase lag due to higher order effects, or analog time delay, had been studied (15) and were relatively well understood. A detailed study of the effects of pure delay, transport delay due to digital systems, had yet to be accomplished. In 1978 a NASA study employed an F-8 fighter aircraft modified with a digital flight control system to accomplish a detailed study of the effects of pure time delays on aircraft handling qualities (7, 4, 6). In 1979, Hodgkinson and others (29) conducted a study on the USAF/Calspan NT-33 inflight simulator in which they tested how mismatches between the higher order system and the LOES affected pilot opinion. They also investigated how well the delay term, e^{-ST}, in the LOES approximated the higher order phase lags and if the difference caused variations in pilot opinion. Both studies showed a strong correlation between pilot rating and the magnitude of the time delay, see Figures 2.8 and 2.10. The NT-33 data also showed that the degradation in pilot rating was similar for both digital transport delay and analog delay, or delay due to phase lag from higher order effects. The insidious nature of time delay's effects on handling qualities is demonstrated in a pilot comment during the F-8 research (7)
>
> > Pilots desire some response immediately upon stick input. It doesn't have to be much, but if he doesn't get response, his gains skyrocket.

> The pilots in the NT-33 study also voiced similar concerns with delay after control inputs and the rapidity of the response following the delay. The authors of the F8 study (7) make a further observation that aircraft dynamics have an impact on system sensitivity to time delay.

(emphasis added)

So, is Borda saying that NASA did not determine and compensate for time delays in the X-38 synthetic vision flight control loop or simply that NASA did not use a computer to do so?

Which is it, because when a UAV is manually flown by a remote pilot, failure to compensate for delays in the communications link will lead to Pilot-Induced-Oscillation, which frequently leads to the loss of the aircraft.

Did NASA risk the X-38 by failing to provide compensation for the time delays in the synthetic vision flight control loop?

Conclusion

In its very tardy response to FOIA Request 08-270 by Jed Margolin ("Margolin") NASA withheld documents, citing *5 U.S.C.§552(b)(5).*

One of the documents that NASA withheld from Margolin is a letter dated March 19, 2009 that was sent by Gary G. Borda ("Borda") NASA Agency Counsel for Intellectual Property to Optima Technology Group ("OTG"). (This document was given to Margolin by OTG.) In this letter Borda denies Claim I-222 regarding NASA's infringement of U.S. Patent 5,904,724 ('724) in the X-38 project.

Margolin's FOIA 08-270 request to NASA was to produce documents relating to Claim I-222 and NASA withheld the most material document so far.

The Borda letter asserts:

> "… 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."

And states, "… NASA reserves the right to introduce such evidence of invalidity in an appropriate venue, should the same become necessary."

Circulating the patent report solely within NASA or among other federal agencies is not an appropriate venue for NASA to use to have a patent declared invalid. The only appropriate venues for NASA to challenge the validity of a U.S. Patent are in the U.S. Court of Federal Claims and the Court of Appeals for the Federal Circuit. A Court will not accept NASA's word that a patent is invalid due to prior art; NASA would be required to produce the evidence.

Therefore, the exemption under *5 U.S.C.§552(b)(5)* does not apply.

Margolin requests NASA produce the evidence that Borda refers to when he asserted:

> "… 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."

Margolin also requests that NASA show how such materials and/or documents are directed to the '724 claims.

And, finally, under *5 U.S.C.§552(f)* NASA is required to provide the records between NASA and Rapid Imaging Software (Mike Abernathy) which provided the synthetic vision system for the X-38 project which was referred to in the Borda letter.

Respectfully,

Dated: June 10, 2009

/Jed Margolin/

Jed Margolin
1981 Empire Rd.
Reno, NV 89521-7430
775-847-7845
jm@jmargolin.com