IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL, INC., et al.,	:	
Plaintiffs,	:	
v.	:	C. A. No. 02-359-MPT
UNIVERSAL AVIONICS SYSTEMS CORP., et al.,	:	
Defendants.	:	

OPINION

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Dated: November 12, 2004

Wilmington, Delaware

Thynge, U.S. Magistrate Judge

I. Nature and Stage of the Proceedings

This action, which originated as a patent infringement case, involves technology in the aviation industry. The parties are competitors in the market for terrain warning systems and displays. Honeywell International Inc.[1] and Honeywell Intellectual Properties Inc.[2] (collectively, "Honeywell")[3] manufacture and sell a terrain awareness and warning system, the "Enhanced Ground Proximity Warning System" or "EGPWS." Since February 29, 2000, Universal Avionics Systems Corp. ("Universal")[4] manufactures and sells its terrain awareness and warning system, otherwise known as "TAWS." Sandel Avionics, Inc. ("Sandel")[5] manufactures and sells a terrain awareness and warning system, the "ST3400 TAWS/RMI."

Honeywell commenced this action on May 10, 2002 seeking monetary recovery and injunctive relief for alleged willful infringement of five patents-in-suit: U.S. Patent

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[1] Honeywell International Inc. is a Delaware corporation having its principal place of business in Morristown, New Jersey. Honeywell International Inc. was formed in 1999 when AlliedSignal Inc. merged with the predecessor entity Honeywell Inc. The name of the combined entity was changed to Honeywell International Inc. AlliedSignal Inc. acquired Sundstrand Data Control in 1993. Sundstrand Data Corporation acquired a company called United Control in 1974.

[2] Honeywell Intellectual Properties Inc. is an Arizona corporation having its principal place of business in Tempe, Arizona.

[3] Honeywell Intellectual Properties Inc. is the owner of the patents-in-suit; Honeywell International Inc. is the exclusive licensee. The activities occurring throughout the relevant period by Honeywell International Inc., Honeywell Intellectual Properties Inc., Honeywell Inc., AlliedSignal Inc., Sundstrand Data Control and United Control are deemed to have occurred by "Honeywell" rather than by one of the predecessor entities, unless otherwise noted.

[4] Universal Avionics Systems Corp. is an Arizona corporation with its principal place of business in Tucson, Arizona.

[5] Sandel Avionics, Inc. is a corporation organized and existing under the laws of the State of Delaware with a principal place of business in Vista, California.

Nos. 5,839,080 ("'080 patent"),[6] 6,122,570 ("'570 patent"),[7] 6,219,592 ("'592 patent"),[8] 6,092,009 ("'009 patent")[9] and 6,138,060 ("'060 patent")[10] against Sandel and Universal.[11] On July 17, 2002, Sandel answered the complaint by denying the allegations of willful infringement, and asserted various affirmative defenses and counterclaims for declaratory relief that the patents-in-suit are invalid and not infringed. On July 19, 2002, Universal responded to the complaint by denying the allegations of infringement and willful infringement and raised various affirmative defenses and counterclaims for declaratory relief that the patents-in-suit are invalid and not infringed.

On August 8, 2002, Honeywell replied to the counterclaims of Universal and Sandel. On September 9, 2002, Universal amended its answer by adding counterclaims for attempt to monopolize, tortious interference with business expectations, and unfair competition. Honeywell responded to Universal's amended counterclaims on October 15, 2002.

On February 7, 2003, the parties participated in a tutorial before the court, during

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[6] The '080 patent, the primary patent in this litigation, entitled "Terrain Awareness System," was issued on November 17, 1998 to Hans R. Muller, Kevin J. Conner and Steven C. Johnson.

[7] The '570 patent entitled "System and Method for Assisting the Prevention of Controlled Flight into Terrain Accidents," was issued on September 19, 2000 to Hans R. Muller, Kevin J. Conner and Steven C. Johnson. Donald Bateman was later added as an inventor of the '570 patent through a certificate of correction. Mr. Bateman is a Honeywell chief engineer for flight safety systems. Messrs. Muller, Johnson and Conner were enlisted by Bateman to develop a look ahead ground proximity system, now known as Honeywell's EGPWS.

[8] The '592 patent entitled "Method and Apparatus for Terrain Awareness," was issued on April 17, 2001 to Hans R. Muller, Kevin J. Conner and Steven C. Johnson.

[9] The '090 patent entitled "Aircraft Terrain Information System," was issued on July 18, 2000 to J. Howard Glover.

[10] The '060 patent entitled "Terrain Awareness System," was issued on October 24, 2000 to Kevin Conner and Hans Rudolph Muller.

[11] The complaint also named Goodrich Corp. and Goodrich Avionics Systems, Inc. (collectively, "Goodrich") as defendants. On January 24, 2003, Honeywell and the Goodrich defendants executed a settlement and license agreement. These defendants were dismissed from the case by a Stipulated Order of Dismissal. *See* D.I. 67.

which the technology and the matters at issue were addressed. On February 10, 2003, Universal filed a second motion to amend its answer, in which the affirmative defense of inequitable conduct was added. On February 11, 2003, Sandel moved to amend its answer, and also added the affirmative defense of inequitable conduct. On March 18, 2003, the court granted Sandel and Universal's motions to amend.

On February 19, 2003, the parties filed a joint submission on claim construction, which set forth the disputed claims of each patent-in-suit and the position of each party with respect to each term. On March 7, 2003, the parties filed their initial briefs on claim construction detailing their respective claim interpretation positions. The parties' responsive briefs were filed on April 4, 2003. Pursuant to *Markman v. Westview Instruments, Inc.,* 52 F.3d 967 (Fed. Cir. 1995) (*en banc*), *aff'd*, 517 U.S. 370 (1996) and local practice, a claim construction hearing was held on April 9, 2003. This court construed the disputed claims in a memorandum dated May 30, 2003.

The parties then submitted case dispositive motions. On July 30, 2003, Sandel filed motions for summary judgment of non-infringement and invalidity of certain claims of the '060 and '009 patents based on the prior art. On August 2, 2003, Universal filed a motion for partial summary judgment of non-infringement with respect to the '080, '009, '570 and '592 patents. On August 27, 2003, Sandel and Universal filed a joint motion for summary judgment of invalidity based on the on-sale and public use bars. Universal also filed a supplemental memorandum in support of Sandel's motion of invalidity, converting it into a joint motion for summary judgment.

On September 22, 2003, Honeywell responded to these motions. On September 29, 30 and October 1, 2003, Universal and Sandel filed their reply briefs.

In a memorandum issued on October 16, 2003, this court addressed the motions of invalidity based on the prior art. Relying on its position that the court no longer had jurisdiction based on the lack of a case or controversy, Honeywell did not address the challenge of anticipation of certain claims of the '009 and '060 patents.[12] Universal and Sandel's joint motion was granted and denied in part. Left for trial were the invalidity allegations based on the prior art regarding claims 27-33 of the '009 patent and claims 4-5 of the '060 patent.[13]

In a memorandum dated October 28, 2003, this court found that the accused devices did not infringe the asserted claims of the '080, '570 and '592 system patents and the '009 display patent. Additionally, that opinion determined that Sandel's ST 3400 TAWS did not infringe claim 4 of the '060 display patent,[14] and held that neither Sandel's nor Universal's TAWS contained the "look ahead distance" and "terrain floor boundary" limitations identical to those disclosed and claimed in the '080 patent, as well as, in the remaining patents-in-suit.

Based on this finding, Universal prepared a supplemental memorandum in further support of its motion for summary judgment of non-infringement. This memorandum, filed October 29, 2003, asserted that Universal's TAWS did not infringe upon the '060 display patent because it lacked the required warning logic expressed as

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[12] Prior to responding to the outstanding motions for summary judgment, Honeywell represented to Universal and Sandel that it would not pursue infringement of certain previously asserted claims of the '009 and '060 patents. Based on this representation, Honeywell attempted to withdraw all of the originally asserted display claims, except claims 27-33 of the '009 patent and claims 4-5 of the '060 patent. As a result, Honeywell alleged that this court no longer had subject matter jurisdiction with respect to those claims based on the absence of a case or controversy.

[13] Claims 1-3, 8, 9, 13, 24, 34-36, 41 and 43-45 of the '009 patent and claims 1-3 of the '060 patent were found to be anticipated by the prior art. Universal and Sandel's motions for summary judgment of obviousness were denied.

[14] Universal's motion did not address claims 4 and 5 of the '060 patent in the first instance.

look ahead distance and terrain floor boundary. Consistent with its previous rulings, this court entered partial summary judgment of non-infringement with respect to claims 4 and 5 of the '060 patent. As a result, all claims of infringement were dismissed.

In a companion filing, Universal moved to change the order of proof at trial. This motion was granted on October 29, 2003. Subsequently, the parties agreed to a bench trial for the remaining issues. Thus, Universal and Sandel assumed the role of plaintiffs for all purposes and are referred to as such in this opinion.

The remaining joint motion of invalidity based on the on-sale and public use bars was not decided, and remained an issue for trial. A seven day bench trial was conducted on November 3-7, 10 and 12, 2003. This opinion represents the court's findings of fact and conclusions of law with respect to all trial issues. This court has subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338. Personal jurisdiction and venue are not contested. Incorporated by reference is the construction of the claim terms recited in the May 30, 2003 memorandum and order.

II. The Patents-in-Suit

The patents-in-suit are designed to solve a problem in the aviation industry known as Controlled Flight Into Terrain ("CFIT"). CFIT refers to a category of accidents that occur when an aircraft is flown into the ground during controlled flight. CFIT crashes generally occur as a result of pilot error and are distinguished from other accidents involving loss of control or mechanical failure because a ground collision is not due to system malfunction or failure.

A precursor to the technology described and claimed in the patents-in-suit is the Ground Proximity Warning System ("GPWS"). GPWS uses radar altimeter (also

referred to as radio altitude) input to determine if flight conditions are such that inadvertent contact with the terrain is imminent. Because the GPWS is limited to the downward looking radar altimeter, it has certain disadvantages and cannot prevent all CFIT accidents.

The patents-in-suit relate to Honeywell's research and development to improve or "enhance" GPWS. The basic concept of Honeywell's Enhanced GPWS ("EGPWS") is that it provides "virtual look ahead . . . to be able to actually predict where the airplane was going based on the terrain database and an accurate knowledge of where the aircraft was . . . ." D.I. 236 at 898:11-899:1. This forward looking capability is intended to provide increased alerting time to warn pilots of potentially hazardous terrain ahead. Honeywell's EGPWS also gives "the pilot a picture," that is, a threatening terrain display in addition to a verbal alert.

The Limitations of the Challenged Claims

The '080 patent entitled "Terrain Awareness System," issued to AlliedSignal Inc. on November 17, 1998, was derived from application Serial No. 509,642 ("'642 application"). The challenged independent claims of the '080 patent claim "an apparatus for alerting a pilot of an aircraft of proximity to terrain" and "a method for alerting a pilot of hazardous proximity to terrain." JTX 1 at 49:1-3, 50:10-11.[15] Claim 1 of the '080 patent is a representative claim and contains the basic requirements for the claimed terrain alerting system.[16] Claim 1 requires a database of

[15] Most exhibits relied upon by the parties were joint trial exhibits ("JTX").

[16] Claim 1 of the '080 patent recites:

> An apparatus for alerting a pilot of an aircraft of proximity to terrain, the apparatus comprising:

stored terrain information, an input and an output, a signal processing device, a terrain floor boundary, first and second envelopes, which are determined as a function of flight path angle, look ahead distance and a terrain floor boundary, and the means for outputting an alert. It recites an output of at least a single alert and does not require multiple alerts, cautions or warnings.

The challenged dependent claims of the '080 patent add limitations which relate to the display of images of terrain near the aircraft and the output of alerts in the form of sounds or voice call-outs. *Id.* at 49:48-50:9, 50:33-37, 50:45-47.

> an input for receiving signals representative of a position of the aircraft, a flight path angle of the aircraft and a speed of the aircraft and coupled to a data base of stored terrain information;
>
> an output;
>
> a signal processing device, coupled to said input, and coupled to said output, for:
>
> (a) defining a look ahead distance as a function of the speed of the aircraft;
>
> (b) defining a first alert envelope, indicative of a first severity of terrain threat,
>
> wherein boundaries of said first alert envelope are determined as a first function of the flight path angle, said look ahead distance, and a terrain floor boundary;
>
> (b) [sic] defining a second alert envelope, indicative of a second severity of terrain threat, wherein boundaries of said second alert envelope are determined as a second function of the flight path angle, said look ahead distance and said terrain floor boundary; and
>
> (d) outputting an alert signal when a subset of the stored terrain information is located within the boundaries of at least one of the said first and said second alert envelopes.

Throughout this action, including during the *Markman* proceedings and at trial, the parties focused on Claim 1 of the '080 patent. Claim construction was primarily directed to disputed terms in that claim.

The ‘570 patent, a continuation in part of the ‘080 patent, claims a system or a method “for assisting in the prevention of controlled flight terrain accidents.” JTX 2 at 32:24-25, 33:35-36. The challenged claims of the ‘570 patent encompass all of the limitations of the independent claims of the ‘080 patent, but add the requirement that the alerting system presents a visual display to the pilot of the terrain in the vicinity of the aircraft. *Id.* at 32:24-33:26, 33:35-34:37.

The challenged independent claims of the ‘592 patent claim apparatus and methods “for alerting a pilot of an aircraft of proximity to terrain.” JTX 3 at 32:34-35, 33:22-23, 34:14-15. The challenged claims of the ‘592 patent encompass all of the limitations of the independent claims of the ‘080 patent, and require that the alerting system further define its alert envelopes to include “lateral boundaries” to the sides of the ground track. *Id.* at 32:34-62, 33:14-53, 34:5-38. The algorithms in the specification allow the system to detect horizontal, as well as, vertical terrain threats.

The ‘009 patent claims a system, which displays terrain information, as well as, compares the terrain and aircraft altitude. Based on this comparison, certain aspects of the display are colored. The asserted independent claims of the ‘009 patent claim, in various forms, relate to a “terrain information system for providing a visual display to the pilot of contours of the terrain proximate to the aircraft.” JTX 4 at 39:5-7, 41:1-2, 41:28-29, 42:1-3, 42:20-21, 42:40-41. Independent claim 27 adds the requirement that the terrain information system include “a visual display to the pilot of warning of terrain proximate to the aircraft.” *Id.* at 40:24-28.

The challenged independent claims of the ‘060 patent recite “a warning system for aircraft” and “a method for displaying terrain information to a pilot of an aircraft.” JTX

5 at 38:38, 39:14, 40:1-2. The '060 patent claims a system that causes certain information, including the severity of an alert, to "pop-up" on the cockpit display under certain conditions. *Id.* at 38:38-56, 39:14-40:19.

The patents-in-suit[17] are directed to solving CFIT and the problems of the prior art systems, in particular GPWS, which was used in a variety of aircraft. The patents, therefore, are not limited to any particular type or class of airplane or jet. Further, none of the challenged claims require any specific amount of alerting time, type of alert or minimum level of allowable nuisance alerts. Moreover, neither the algorithms nor the number of algorithms used to implement the look ahead alerts is a recited limitation of any of the asserted claims.

III. Facts-Development of EGPWS

Beginning in May 1993, Honeywell, then AlliedSignal, began development of EGPWS.[18] The most accurate historical record produced of the development process of EGPWS are the "Muller-Grams" or "Design Notes."[19] Hans Muller, deceased, a named co-inventor of the '080, '592, '570 and '060 patents, authored a four-part series of documents between November 8, 1993 and February 2, 1995 which concerned implementation of this forward looking ground proximity warning system. These documents report and record the progress of the system. For clarity and consistency, these documents are referred to as Design Notes throughout this

[17] Throughout the litigation, the '080, '570 and '592 patents were referred to as the "look ahead" patents, while the '060 and '009 patents were referred to as the "display" patents.

[18] Although disputed at trial exactly when the development process began, from the evidence, it is clear that by 1993 the project was up and running, with the named inventors on the patents-in-suit directly involved.

[19] The actual title of these documents is "Terrain Display in Weather Radar Format-Design Notes."

opinion.[20]

The Design Notes are objective, contemporaneous writings of the development of EGPWS. The date on the cover of each set of Design Notes reflect when the writing began. Muller also dated the end of the document when it was completed. As such, Design Notes I was written on November 8, 1993. Design Notes II began on April 7, 1994 and ended April 21, 1994. Design Notes III was written from July 15, 1994 to July 29, 1994. Design Notes IV began on January 26, 1995 and ended February 2, 1995. The diagrams at the end of the Design Notes also bear dates, some of which differ from the inclusive dates of the notes. For example, diagram WX-DET, attached to Design Notes II, contains revision dates which reflect when information was changed on the drawing, although the revisions dates are later than the time covered in this Design Notes.

In general, the Design Notes describe the development and implementation of suggestions or proposals to correct or modify the system. Regarding when changes actually occurred, the Design Notes are not entirely clear. They refer to elements already installed and also comment on features to be instituted. For example, Design Notes II only indicates that the detection algorithms for approach and takeoff have been combined. In Design Notes III, some, but not all, of the proposals have been implemented at the time of the writing. Design Notes IV encompasses everything completed in the system at that time, but does not advise when each completion occurred. Despite these shortcomings, they are the most accurate reflection of the

[20] At trial, Design Notes Part I was entered in the record as JTX 6, Part II as JTX 7, Part III as JTX 9 and Part IV as JTX 431.

status of EGPWS as of the date or dates of each Design Notes.

In addition to the Design Notes, Kevin Conner, another named inventor who primarily worked on the software for the system, kept archived copies of the source code for the prototype during the development process. Unfortunately, no versions of the code exist before July 31, 1994.[21] Software development, including coding of the software, also began in May 1993. The first iteration of the alerting algorithms software was created within a few weeks and, as a result, was ready for testing on a laptop computer.

Design Notes I- November 1993

Design Notes I focuses on the display of terrain information and discusses terrain display formats, threat displays and the associated algorithms to generate a terrain display on a weather radar display within the limitations imposed by that format. It also provides detail about the "threat display algorithms," noting that there are two elements to these algorithms, that is look ahead distance/direction and terrain detection (aircraft altitude relative to terrain altitude). Design Notes I is concerned with the relationship and adaption of these elements to the terrain data base and the input signal sources. In this set of the Notes, two algorithms are proposed for terrain detection: an approach algorithm and an algorithm for all other flight modes (non-approach). In addition to a written description of the terrain detection algorithms in the Notes, they are

[21] As discussed later in this opinion, July 31, 1994 is the critical date for the application of Universal's and Sandal's declaratory judgment claims and affirmative defenses to the patents. The oldest surviving version of the source code is November 1995. A separate document, referred to as the audit trail, briefly notes when various changes to the source code occurred between late 1993 and November 1995. It does not contain an in depth description of the changes, and often just includes a date when a modification was made. *See infra* note 39 and accompanying text.

shown in graph form in Fig. WX-30. Each algorithm contains two alert envelopes (caution-yellow; warning-red), which are functions of look ahead distance and the terrain floor.

Design Notes I discusses the reaction time, in relation to appropriate clearance, for a pilot to respond to an alert, and recognizes that at the top of a 30 degree bank angle, the pilot needs adequate clearance from the terrain ahead. As a result, a minimum look ahead distance, that is proportional to the turn radius plus a safety terrain clearance distance plus a distance equivalent to a reaction time of ten seconds, is recommended.

Contained in Design Notes I is Fig. WX-31 which calculates the terrain floor height below the aircraft in the system to be "equal to the MKV terrain floor which is 100 feet per mile distance from the runway and limited to 800 feet." Eventually, this description, after considerable modification and testing, became the basis for the element, terrain floor boundary, in the '080 patent.

Design Notes II- April 1994

As noted previously herein, Design Notes II was written between April 7 and April 21, 1994. The figures attached to the Notes bear dates of April 19, 1994 and earlier. This writing further describes the development stage of the displays of EGPWS, and advises that a preliminary display has been implement on King Air[22] in which terrain alerts or warnings cause the display to pop-up. The system also allows a pilot to manually call up the display. Design Notes II specifies that "the background terrain

[22] King Air is the name of Honeywell's prop aircraft on which EGPWS was tested and the demonstration flights occurred.

display is relative to the aircraft altitude" and suggests, after conducting experiments, a simulating scan conversion process will provide an acceptable display. In Design Notes II, the two algorithms for terrain detection are consolidated for all flight modes. The single algorithm is similar to the non-approach algorithm described in Design Notes I. This change to a single algorithm addressed the problem of the system distinguishing between the two approaches and resulted in a continuous transition between approach and non-approach situations.

Design Notes II contains modifications to the terrain clearance floor described in Design Notes I from a constant or continuous slope to a step approach to enhance the detection accuracy. Other changes found in Design Notes II are to the cut-off altitude, the beta sink rate enhancement, which caused modifications of the envelopes, and the background display. These changes were in response to data obtained during in-flight and simulator testing of the system.

Design Notes III- July 1994

The opening comments of Design Notes III summarize the development, testing and evaluation of the system over the past three to four months, and note that the system has been tested on King Air and in the simulator and demonstrated to a number of people. Most of the engineering concerns during that time focused on debugging the system and the software which were identified in the flight tests and simulator reports. The analysis of the flight test data included radio altimeter behavior in precipitous terrain. Nine areas are listed in the Notes where changes to the system are

recommended.[23] It also describes additional proposed changes to the alerting algorithms since Design Notes II, that is, splitting the detection algorithms into two parts in an attempt to cure the problem of the absence of a caution before each warning. Design Notes III describes modifications to the look down envelope in relation to the beta angle enhancement.

Lateral boundaries to the look ahead threat detection,[24] originally found in Fig. WX-45A attached to Design Notes I, are further modified in Design Notes III. Figure WX-45A in Design Notes I contains lines offset configurable to a given angle and extending outward. A similar diagram is contained in Design Notes III as Fig. WX-45, which is described as replacing the single threat detection vector, that looks along the aircraft ground track to provide terrain threat detection, with an array of vectors. The purpose of this change was to safeguard against worst case scenarios of errors in either the data base or the GPS. Concerns regarding justification of the applicable algorithm to the FAA were also addressed by the change to an array of vectors.

In Design Notes III, the "wedding cake" layered memory is introduced. This change, which modifies the distance of the terrain displayed ahead of the aircraft, was made in response to comments by pilots to expand the look ahead range. To address these concerns and avoid an explosion of variable resolution of the displays of terrain,

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[23] Those recommendations are: "1. Display update rate too slow following an alert or range change. 2.Terrain display is limited to 20 to 30 nMiles ahead of the aircraft. 3. No accounting for GPW/Data base errors in the single vector look ahead threat detection algorithm. 4. Inconsistency between Caution and Warnings, not all warnings are preceded by a Caution. 5. Lack of Terrain alerts for situations where the airport is on a cliff and the aircraft approaches terrain below airport elevation. 6. Need for a more distinctive display when descending into terrain. 7. Baro altitude setting error effect. 8. Second order lead for high descent rates to be applied to terrain detection algorithm. 9. Look ahead during turns, look along the turn or look into the turn." JTX 9.

[24] The challenged claims of the '592 patent relate to "lateral boundaries."

the wedding cake layered memory was developed whereby the top layer (terrain closest to the aircraft) has the highest resolution and the lower layers, which cover a larger area over a longer distance, have successively less resolution.[25] The wedding cake memory diagram in Design Notes III is Fig. WX-47.[26]

Design Notes III also discusses a meeting on July 28, 1994 between Honeywell and Gulfstream to address the interface between the system and the new jet aircraft.

Software Development

As noted previously herein, the initial software code was sufficiently developed for testing by mid-1993. At that time, the software for the system included features of the display and the look ahead warning algorithms. Shortly after implementation of the original source code, the system's display featured multiple levels of terrain by using different dot densities to distinguish various terrain elevations. By the end of 1993, the display included color-coding the terrain contours based on the degree of terrain threats, which were yellow for caution and red for warning. At that time, the system also included displaying terrain relative to the aircraft altitude. Therefore, both the relative altitude background and the threat display distinguished by color existed in 1993.

In 1993, the first version of the laptop prototype of EGPWS was tested on King Air. Initially, the terrain display was shown on the screen of a laptop computer. Later prototypes showed terrain images on the weather radar display in the King Air airplane.

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[25] To extend the terrain display range from 30nM to 160nM as requested by pilots, who participated in the demonstration flights, would have increased memory and processing time requirements twenty-five fold, and hence, the need to develop a layered memory approach.

[26] Fig. 35 of the '080 patent is very similar to Fig. WX-47 in Design Notes III.

Thereafter, as confirmed in Design Notes I through III, modifications were made to various algorithms and, as a result, to the source code.[27]

Aerospatiale Presentation

One fact relied upon by Universal and Sandel are the contacts with Aerospatiale. The laptop system was demonstrated to two Aerospatiale research engineers on King Air in 1993. In June 1994, Honeywell presented to Aerospatiale the enhanced system for a joint study program. Under the proposal, Aerospatiale would provide simulator time and pilots to assist in the development of EGPWS. The presentation contained general descriptions of the capabilities of the system.

March 8, 1994 Demonstration Flight with Fred George

Universal and Sandel point to the George flight in support of their various defenses against the patents. On March 8, 1994, Honeywell demonstrated the EGPWS laptop prototype to Fred George, a pilot and contributing Editor for *Business & Commercial Aviation* magazine. After the demonstration, George published an article in the June 1994 issue of the magazine. The demonstration consisted of flying two CFIT accident tracks during two night departures, one from San Diego and the other from Palm Springs, California. Steven Johnson, a co-inventor primarily involved in terrain database development and design, computer simulation and flight testing, and Conner demonstrated the laptop EGPWS prototype during the flight. After the demonstration,

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[27] Although Conners, the developer of the source code, could not recall specifically when the multiple alert envelope algorithms, look ahead distance based on two clearance turns, flight path angle as a component of the alerting algorithms, an alert envelope as a function of terrain floor boundary, a terrain floor boundary that varied in proportion to the distance to the nearest runway, the lateral boundaries or an aural alert were first implemented in the source code, he confirmed that the Design Notes were the best source of information regarding the development of EGPWS.

Conner noted that the prototype software functioned reasonably well within its expected behavior during the demonstration.

The George article clearly indicates that the system is in its development phase. The article notes that the demonstration focused primarily on the vicinity around the airports. It points out that the technology includes an airport-vicinity database with a highly precise flight management system, which allows the pilot to view on a display screen the aircraft's position in relation to terrain obstructions. The article discusses a terrain clearance floor ("TCF") which is an outgrowth of envelope modulation that was introduced in 1984. It describes TCF as a bottom-line terrain avoidance feature which provides a gradual series of warning buffers over the terrain elevation contours within a 30 mile radius from the airport. The article contains a diagram of TCF.

The March 1994 Demonstration Video[28]

In late March 1994, Rawlins Production created a video which shows the functions of the system on King Air in several scenarios. The video depicts three demonstrations of EGPWS aboard King Air. It shows the displays and alerts generated by the laptop prototype and demonstrates that the system provided both caution and warning alerts in advance of the traditional GPWS warnings which are also recorded on the video. The system on the film provided two alerts in the proper order.

Demonstration Flight Program

Between late 1993 through mid-1994, approximately 150 people associated with the aviation industry, including individuals from the FAA, observed the

[28] The film is evidence relied upon by Universal and Sandal in support of their positions regarding invalidity and inequitable conduct. The date on the video is March 27, 1994.

system during demonstration flights on King Air. These flights have been referred to as "show-and-tell" flights.[29] The demonstration flight program served to educate the aviation community regarding the safety enhancements in the proposed system which would prevent or substantially reduce CFIT accidents. It also served to advise potential customers of Honeywell's new system.

Participants in the flight demonstrations were given questionnaires to complete. As a result, the demonstrations of the laptop system provided feedback regarding human factors, cockpit integration and pilot acceptance issues. Honeywell reviewed and used this information during its development of EGPWS, including for verification of the system. The questionnaires and other feedback from the flight demonstrations were discussed during the weekly development meetings throughout 1994, as evidenced in Design Notes III.

Observers were not required to sign confidentiality agreements, however, they did not have any direct contact with or control over the laptop computer or the software data. Participation in the demonstration flights was by invitation only.

Flight Testing and Simulations

Another factor relied upon by Universal and Sandal is the quantity of testing of the system by Honeywell. During the development of EGPWS, Honeywell ran thousands of simulations and hundred of flight tests.[30] In a memorandum dated June 16, 1994, Johnson outlined the status of the testing. As of this date, the system, more

[29] Representatives from commercial airplane manufacturers, such as Airbus and Boeing, and avionics manufacturers, such as predecessor Honeywell Inc., participated as observers.

[30] Estimates at trial placed the number of CFIT accidents and incidents tested to be over two hundred.

specifically the alerting algorithms, through simulation or on King Air, had been tested against eleven known nuisance alert scenarios and fourteen known accidents.[31] Johnson's memo advises that additional testing data is needed to evaluate the look ahead algorithms because during some of the prior test flights and demonstrations, the warnings failed to occur. Data, such as test scripts, terrain files and other materials, were required for certain problem airports and other CFIT accidents.

Gulfstream and Collins Documents

Heavily relied upon at trial by Universal and Sandel are the various documents generated from January into July 1994 between Honeywell and Gulfstream Aerospace ("Gulfstream") and Honeywell and Collins Commercial Avionics ("Collins") regarding Honeywell's offers to sell its Enhanced Ground Proximity Warning System.[32] In 1994, Gulfstream and Canadair Global Express ("Canadair") launched developmental luxury airplane programs.

On January 6, 1994, Gulfstream issued a Request for Proposal ("RFP") to Honeywell for 108 shipsets of GPWS for its new jet aircraft, Gulfstream V or G5, program. The RFP emphasized the importance of integration, noting the need to minimize clutter and properly consolidate existing systems into a new cockpit. In response, Donald Bateman, chief engineer for Honeywell's flight safety systems division, made a presentation to Gulfstream on January 11, 1994. The presentation focused on the performance features of an enhanced GPWS which was under

[31] Eight of these simulations are contained in the May 8, 1994 demonstration software, which was submitted into evidence at trial.

[32] At the time of the negotiations, Honeywell was AlliedSignal.

development, and described the future system as including various levels of visual and aural alerts, terrain data, cockpit displays with increasing dot densities for at least three levels of terrain, alert envelopes, human factors issues associated with cockpit integration[33] and an enhanced weather radar for areas not covered by the database. After the presentation, Honeywell followed up with a letter to Gulfstream on January 21, 1994 emphasizing that the proposed system uses a "specialized terrain data base, together with aircraft position, altitude and velocity information, to provide a view of threatening terrain in a clutter-free manner on existing navigation and weather displays."[34] It specifically noted that Honeywell was interested in testing the system's potential terrain display enhancements on the Gulfstream IV test aircraft in the spring and summer of 1994.

On February 4, 1994, Honeywell sent a proposal, with extensive attachments, offering to sell its new system to Gulfstream.[35] In the proposal, Honeywell offers EGPWS as the primary unit, with GPWS as an alternative and quotes various prices for delivery of the system during the years 1995 through 1999. The pricing for either system is similar. The attachments include a Management Volume, Cost Proposal and a Technical Proposal. The Technical Proposal contains eight sub-attachments. The resumes of the key personnel are in attachment A. Attachment B provides the technical description of the enhanced system, including descriptions of terrain ahead alerting,

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[33] The human factors issues addressed during this presentation were similar to those raised in the flight demonstration questionnaires and identified in the proposals to Gulfstream and Collins.

[34] *See* JTX 141.

[35] The proposal advises that the enhanced system was currently under development, but when completed would be designed to fulfill the GPWS requirements for a variety of aircraft. *See* section 4.0 and 9.0 of the proposal.

terrain awareness display and terrain clearance floor, hardware features, a main processor, input and output signals and audio warning and alert output signals. It details a display of terrain information on the weather radar display. Attachment C is a product specification for the system's computer. Attachment D is a compliance matrix/system requirements document, while attachment E is the compliance matrix/statement of work document. Attachment F consists of engineering drawings. Attachment G is the program schedule for the Gulfstream V aircraft. Attachment H contains the software requirement specifications for the envelope modulation database. Although a substantial amount of technical information is provided, not included is a product specification for EGPWS. Section 7.0 of the proposal notes that a specification will be prepared to define the performance requirements of the enhanced system, with only preliminary performance requirements contained in attachment B. However, a product specification for GPWS is included.

Negotiations continued between Honeywell and Gulfstream until July 7, 1994 when they executed a Memorandum of Agreement ("MOA") regarding EGPWS, also known as part no. 956-0976-001. The MOA contains specific terms and conditions consistent with the original proposal, provides delivery schedules, packaging, shipping and warranties and specifies that it supercedes any and all previous communications, representations or agreements regarding the system. It reflects a price of $33,565.00 per unit. The MOA does not contain some of the typical provisions in aviation contracts, such as price penalties for a failure to provide adequate research and development support, the specific levels of engineering resources required from Gulfstream or any standards for the flight test program to evaluate EGPWS. Despite the absence of these

provisions, Gulfstream issued a purchase order which Honeywell acknowledged on November 18, 1994.

During the same time period, Honeywell proceeded in parallel negotiations with Collins. Collins, who was bidding to provide cockpit avionics and other aeronautical devices to Canadair, solicited Honeywell on February 18, 1994 regarding its GPWS for the Canadair program. On March 18, 1994, Honeywell responded with a proposal that contained the same information, provisions and terms that previously had been provided to Gulfstream.[36] No contract of sale was ever executed between Honeywell and Collins.

Design Notes IV- January 26 to February 2,1995

The final set of the Design Notes was completed on February 2, 1995. It reports on the resolution of the issues and changes identified in Design Notes III and discusses the interface and integration issues resolved and those that remain.[37] The inventors clearly felt at the time of Design Notes III that significant problems with the system still existed. One issue was the wedding cake formula which related to the

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[36] The price offered to Collins is similar to the price agreed to in the Gulfstream MOA and is also similar to the price quoted in the George article. Moreover, system details, program schedule, warranties system validation and other terms and conditions in the Collins proposal are practically mirror images of the proposal to and agreement with Gulfstream. For example, Section 5.13 of the Gulfstream proposal is substantially similar to Section 5.13 in the Collins proposal. Both address look ahead alerting and note that two terrain detection algorithms are *proposed*. The rationale for an approach algorithm separate from all other flight modes was because a large number of accidents had occurred during approaches to airports. The algorithm would look all the way to the runway to detect premature descents during step down approaches which could put terrain between the aircraft and the runway. If the *algorithm detects* threatening terrain, then all violating terrain would be painted amber or red during the next radar sweep and a voice alert is sounded. However, this dual algorithm system was changed to a single algorithm as indicated in Design Notes II.

Moreover, the technical experts for both parties agreed that the Gulfstream and Collins proposals were essentially the same.

[37] Between Design Notes III and Design Notes IV, Honeywell and Gulfstream worked closely to deal with the integration and interface matters.

stored terrain database. Because of nuisance alarms, changes to the formula were made after Design Notes III. Other matters addressed were changes in the number of threat detection vectors for the implementation of the lateral boundaries and modifications to the look-up envelope, the beta sink rate enhancement and the cut-off altitude. According to Design Notes IV, as a result of continued testing, the cut-off altitude was changed to solve the "runway on a cliff" situation.[38] Modifications to the beta angle enhancement were made to address the missing cautions problem – a difficulty that arose from changes to the look ahead distance and threat envelopes. The effectiveness of the displays and the auditory warnings to the flight crew remained a significant concern as noted in Design Notes III and adjustments to this part of the system occurred thereafter as indicated in Design Notes IV.

IV. On-Sale and Public Use Bars

Universal and Sandel assert that the inventions recited in the challenged claims of the patents-in-suit were on-sale and/or in the public use one year prior to the filing date of the '080 patent, and therefore, the patents are invalid.[39] This date, July 31, 1994, is referred to as the "critical date" for application of the §102(b) on-sale and public use bars. 35 U.S.C. §102(b) describes the public use bar and on-sale bar to

[38] Evidence at trial suggests that this problem, which relates the forward looking aspects of the system, had not been resolved until 1999 by the introduction of a new alerting algorithm.

[39] The '080 patent derived from the '642 application, was filed on July 31, 1995. The '570 patent – issued from a continuation application filed on July 30, 1997 – relates back to the '642 application. The '592 patent – issued from a continuation application filed on May 8, 1998 – relates back to the '642 application. The '060 patent – issued from a continuation-in-part from the '642 application – was filed on September 2, 1997. The '009 patent was issued from a July 30, 1997 application that claimed priority to a July 30, 1996 provisional application. Accordingly, all five patents-in-suit have "critical dates" no earlier than July 31, 1994.

patentability.[40] A finding that a section 102(b) bar invalidates a patent must be based on clear and convincing evidence. *See Netscape Communications Corp. v. Konrad*, 295 F.3d 1315 (Fed. Cir. 1984). The Patent Act endows patents with a presumption of validity. *See* 35 U.S.C. § 282 (2002). "The burden of proving invalidity always remains with the party asserting invalidity; the burden never shifts to the patentee." *Harrington Mfg. Co. v. Powell Mfg. Co.,* 815 F.2d 1478, 1482 (Fed. Cir. 1987). Nevertheless, there are differences in the analysis of the two bars: the public use bar focuses on the public's reliance on an invention that is thought to be in the public domain, while the on-sale bar centers on any commercialization beyond the one year grace period. *See Western Marine Electronics, Inc. v. Furuno Elec. Co., Ltd.*, 764 F.2d 840, 844 (Fed. Cir. 1985) ("In essence, the policies underlying the bar[s] . . . define [them].").

The on-sale bar allegations are based on three pre-critical date proposals and one pre-critical date MOA made to third parties in connection with the development of two new aircrafts: the Gulfstream V and the Canadair Global Express.[41] The parties dispute whether these proposals – and in relation to the Gulfstream V proposal, the corresponding MOA – embody the claimed inventions and whether the inventions were

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[40] Section 102(b) provides that "a person shall be entitled to a patent unless . . . the invention . . . is in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States." In the Patent Act of 1952, under §102(b), Congress codified the public use and on-sale bars.

[41] The pre-critical date proposals, discussed previously herein, pertain to Honeywell's involvement with two competitors in the business jet market, Gulfstream and Canadair. Honeywell Inc., the predecessor company to the present Honeywell, was also bidding for the Canadair project and received a proposal from AlliedSignal. In all three proposals, AlliedSignal responded by offering a new type of ground proximity warning system that was under development. Since Collins and Honeywell Inc. never received the Canadair contract, AlliedSignal's proposals for the Canadair program were never finalized. Only the proposal made to Gulfstream matured into an agreement for ground proximity systems as outlined by the MOA of July 1994. Pursuant to the terms of the MOA, EGPWS units were eventually delivered, many of which are presently aboard the Gulfstream V.

ready for patenting as of the time the Honeywell products were offered for sale.

Universal and Sandel also allege that the inventions recited in the challenged claims of the patents-in-suit are invalid under Section 102(b) public use. Universal and Sandel assert that the claimed inventions were in public use based on a number of demonstration flights that occurred on Honeywell's King Air aircraft prior to the critical date. The flights in question began in 1993 and continued beyond the critical date, the majority of which occurred between March 8, 1994 and July 31, 1994.[42]

One flight of particular interest is the George flight on March 8, 1994. The parties dispute whether this flight constituted an invalidating public use. The subsequent article regarding this demonstration, published in the June 1994 issue, is the focus of the dispute.[43]

Needless to say, Honeywell disputes that its patents are invalid on any basis, including Section 102(b). Honeywell argues that the evidence supports a conclusion that the patents-in-suit are valid pursuant to the experimental use exclusion to Section 102(b). Otherwise stated, Honeywell contends that, the evidence on which Universal and Sandel rely, was necessary to determine whether EGPWS, and therefore, the patents-at-issue, would work for its intended purpose in the intended environment.

On-Sale Bar

The ultimate determination that a product was placed on sale under 35 U.S.C. § 102(b) is a question of law, based on the underlying facts of the case. *See*

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[42] A number of "show-and-tell" flights occurred during this time frame, which involved members of the aviation industry.

[43] In addition to their § 102(b) arguments, both Sandel and Universal rely upon this article in support of their position on obviousness and inequitable conduct.

Ferag AG v. Quipp, Inc., 45 F.3d 1562, 1566 (Fed. Cir. 1995). On-sale bar prevents an inventor from patenting an invention that he has commercially exploited beyond the statutory term, that is, more than one year prior to filing of the patent application. *See Continental Plastic Containers v. Owens Brockway Plastic Prod., Inc.,* 141 F.3d 1073, 1077 (Fed. Cir. 1998). It prohibits patent protection to inventions that have been placed in the public domain through commercialization. *See Abbott Labs. v. Geneva Pharm., Inc.*, 182 F.3d 1315, 1319 (Fed. Cir. 1999) (citations omitted).

A two-part test, as set forth in *Pfaff v. Wells Electronics, Inc.*, 525 U.S. 55, 67 (1998), is employed for determining when the on-sale bar is triggered. *Pfaff* requires that (1) the invention be the subject of a commercial sale or offer for sale and that (2) the invention be "ready for patenting" at the time of the offer to sell or sale.[44] Even a single offer is sufficient to invalidate the patents. *Id.* An accused infringer may overcome a patent's presumption of validity by presenting clear and convincing evidence of facts showing that the patented device was on-sale before such critical date. *See Massey v. Del Labs., Inc.*, 118 F.3d 1568, 1573 (Fed. Cir. 1997). Both prongs must be proven by this standard and must occur before the critical date. *See EZ Dock, Inc. v. Schafer Sys., Inc.,* 276 F.3d 1347, 1351 (Fed. Cir. 2002).

Subject of Commercial Offer for Sale

Universal and Sandel contend that Honeywell's EGPWS was the subject

[44] "An invention can exist for the purposes of the statutory bar, however, even though it may be later refined or improved." *Baxter Int'l, Inc. v. COBE Labs., Inc.,* 88 F. 3d 1054, 1060 (Fed. Cir. 2003). *See also*, *In re Theis*, 610 F.2d 786, 794 n.11 (CCPA 1979) ("An invention need not function perfectly to be reduced to practice or considered on sale or in public use. The only requirement is that the invention be 'commercially operable.' . . . [I]t may have problems which are not due to 'fundamental defects.'").

of a commercial sale no later than July 7, 1994 – 24 days prior to the critical date.[45] Honeywell strongly disputes this contention. Under *Pfaff*, the first consideration is whether the claimed invention is the subject to a commercial offer for sale, which requires clear and convincing evidence that the subject of the offer for sale met each limitation of the claim. *See Pfaff*, 525 U.S. at 67 (indicating a § 102(b) analysis includes whether the "subject of the barring activity met each of the limitations of the claim, and thus was an embodiment of the claimed invention"); *see also*, *Scaltech Inc. v. Retec/Tetra, L.L.C.*, 178 F.3d 1378, 1383 (Fed. Cir. 1999); *Keystone Retaining Wall Sys. Inc. v. Westrock, Inc.,* 997 F.2d 1444, 1451-52 (Fed. Cir. 1993); *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1572-73 (Fed. Cir. 1986); *B.E. Meyers & Co., Inc. v. U.S.*, 47 Fed.Cl. 200, 204, 206 (Fed. Cl. 2000); *Casco Prods. Corp. v. Knapp-Monarch Co.*, 270 F.Supp. 320, 322 (D. Del. 1967).

The analysis requires a careful examination of the purpose of the use contemplated in a possible barring sale. Only an offer in which the "other party could make into a binding contract by simple acceptance" constitutes an offer for sale for invalidity based on the on-sale bar. *Netscape Communications Corp.*, 295 F.3d at 1323 (quoting *Group One, Ltd. v. Hallmark Cards, Inc.*, 254 F.3d 1041, 1047 (Fed. Cir. 2001), *cert. denied*, 534 U.S. 1127 (2002)); *see also*, *Rhenalu v. Alcoa Inc.*, 224 F.Supp.2d 773, 801 (D. Del. 2002). The court must find that there is a "commercial offer" for sale and that the offer is for the patented invention. *Scaltech Inc.,* 269 F.3d at 1328. "In any given circumstances, who is the offeror, and what constitutes a definite offer, requires

[45] The Gulfstream MOA is dated July 7, 1994. *See* JTX 170.

looking closely at the language of the proposal itself." *Group One, Ltd.,* 254 F.3d at 1047 (citing *Restatement (Second) of Contracts* §§ 24, 26 (1981)).

Application of on-sale bar is precluded when aspects of the invention are developed after the critical date. *See Space Systems/Loral, Inc. v. Lockheed Martin Corp.*, 271 F.3d 1076, 1079 (Fed. Cir. 2001). However, changes to a product that do not address the matter claimed, will not preclude the application of the on-sale bar. *New Railhead Mfg., LLC v. Vermeer Mfg., Co.*, 298 F.3d 1290, 1297-98 (Fed. Cir. 2002) (finding that perfecting or completing an invention to the point of determining that it will work for its intended purpose ends with an actual reduction to practice). Moreover, the delivery of goods subject to the offer need not occur prior to the critical date. *See e.g., STX, LLC v. Brine Inc.*, 211 F.3d 588, 590 (Fed. Cir. 2000) (finding delivery dates after the critical date irrelevant where an offer to sell or a sale transpired before the critical date).

Accordingly, this first prong of *Pfaff* requires that the sale be for a commercial and not an experimental purpose. *Pfaff*, 525 U.S. at 64 ("The law has long recognized the distinction between inventions put to experimental use and products sold commercially. . . . [A]n inventor who seeks to perfect his discovery may conduct extensive testing without losing his right to obtain a patent for his invention – even if such testing occurs in the public eye."); *EZ Dock, Inc.,* 276 F.3d at 1352 ("In *Pfaff*, the Supreme Court expressly preserves the experimental use or sale negation of the section 102 bars."); *see also, Monon Corp. v. Stoughton Trailers, Inc.*, 239 F.3d 1253, 1258 (Fed. Cir. 2001) ("Evidence that the public use or sale of the patented device was primarily experimental may negate an assertion of invalidity."); *Manville Sales Corp. v.*

Paramount Sys., Inc., 917 F.2d 544, 550 (Fed. Cir. 1990) ("A sale that is primarily for experimental purposes, as opposed to commercial exploitation, does not raise an on sale bar.").

The experimental use exception does not apply to experiments performed with respect to unclaimed features. *See In re Smith*, 714 F.2d 1127, 1136 (Fed. Cir. 1983). Thus, when assessing commercial versus experimental sale, under the first prong of *Pfaff*, the issue is whether the transaction constituting the sale was "not incidental to the primary purpose of experimentation," which requires evaluating the nature or purpose of the particular use of the invention at the time of sale, based on an objective analysis of the facts surrounding the transaction. *See Scaltech, Inc.,* 178 F. 3d at 1385; *Seal-Flex, Inc. v. Athletic Track & Court Constr.,* 98 F.3d 1318, 1323 (Fed. Cir. 1996). The inventor's subjective intent to experiment has "minimal value." *Paragon Podiatry Lab., Inc. v. KLM Labs., Inc.,* 984 F.2d 1182, 1186 (Fed. Cir. 1993).

Adequate proof of experimental use negates the statutory bar. *Gould Inc. v. United States,* 579 F.2d 571, 583 (Ct. Cl. 1978) (Experimentation evidence includes "tests needed to convince [the inventor] that the invention is capable of performing its intended purpose in its intended environment."); *see also*, *EZ Dock,* 276 F.3d at 1352. Case law recognizes that substantial testing in a particular environment is often required to ensure that the invention works for its intended purpose. *See Kolmes v. World Fibers Corp.,* 107 F.3d 1534, 1540 (Fed. Cir. 1997). When an inventor can show changes during experimentation, which result in features later claimed in the patent application, such evidence strongly demonstrates that the pre-application activities of the inventor negated any evidence of premature commercial exploitation of an invention ready for

patenting. *EZ Dock,* 267 F.3d at 1353.

When distinguishing commercial from experimental sales, the court must consider a variety of factors including:

> (a) the necessity for public testing; (b) the amount of control over the experiment retained by the inventor; (c) the nature of the invention; (d) the length of the test period; (e) whether payment was made; (f) whether there was a secrecy obligation; (g) whether the records of the experiment were kept; (h) who conducted the experiment; (i) the degree of commercial exploitation during testing; (j) whether the invention reasonably requires evaluation under actual conditions of use; (k) whether testing was systematically performed; (l) whether the inventor continually monitored the invention during testing; and (m) the nature of the contacts made with potential customers.

Baker Oil Tools, Inc. v. Geo Vann, Inc., 828 F.2d 1558, 1564 (Fed. Cir. 1987); *Seal-Flex,* 98 F.3d at 1323.

The court finds that the subject matter of the offers to Gulfstream, Collins and predecessor Honeywell Inc.[46] reflect an early conception of the EGPWS, which did not embody the claimed inventions. Honeywell proposed "the Enhanced MKV"[47] to take advantage of the testing and experimentation opportunities that resulted from these new aircraft development programs. The only pre-critical date offers Honeywell made were for these new aircraft projects, which supports that EGPWS was still in the developmental stages.

The Gulfstream and Collins proposals were for an aircraft terrain ahead alerting system based on FMS (Flight Management System) or GPS (Global Positioning

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[46] Honeywell Inc. and Collins were competing for the same Canadair contract. As with the Collins proposal in relation to its Canadair program, the same product was offered to Honeywell, Inc. and a binding contract for the sale would have been created if accepted.

[47] "Enhanced MKV" was the term used for the new system in the proposals. Later, the reference, "EGPWS," was employed.

System)[48] derived position information and stored terrain data. A component of the system was a terrain clearance floor. Although this element varied based upon distance to the runway, it relied on a radio altitude alert boundary which would cause a display message and oral announcement if the radio altitude became less than the minimum safety clearance. It was not part of the forward looking system as required by the '080 patent. The proposals described an alerting logic, similar to the one outlined in Design Notes I, which is fundamentally different from the patents-in-suit because the system in the proposals does not use flight path angle to modify the alert envelopes. Rather, two different envelopes using approach and non-approach algorithms, which are not functions of flight path angle, are recommended.

Universal and Sandal argue that Honeywell's further development did not directly relate to the claims at issue, but rather to unclaimed elements of the system. However, the manner of the continued development and testing that occurred is the type necessary to determine whether this invention would work for its intended purpose in its intended environment, which has been repeatedly endorsed in cases finding experimental use. Human factors, integration and the other issues involved in the development and testing of the EGPWS were not related only to the Gulfstream and Canadair jets – as implied by Universal and Sandal – but had broad and significant application to any aircraft, old or new. The challenges that accompany a new flight

[48] FMS is a radio navigation device which may or may not have as an input GPS. GPS locates the position of the aircraft in three dimensions: latitude, longitude and altitude. Older airplanes used FMS without GPS and augmented position location by ground based navigation aids. In 1994, most aircraft did not have GPS installed due to the expense. The reduced navigation environment of existing cockpit systems directly related to the effectiveness of the new terrain database and how that information would be integrated with those systems.

safety system, which involved the application of new alerting algorithms, a new terrain database and new display functions and needed to be incorporated in existing cockpit systems are clearly significant. Moreover, since both projects involved experimental aircraft, uncertified equipment, such as EGPWS, may be installed for testing. Being involved in these programs would allow Honeywell to review, evaluate, modify and continue developing the technology for the system in a flight regime – the actual environment of the inventions.

The experimental use exception is not eliminated by pointing to an offer, understanding or acceptance of commercial terms – including a firm fixed price. The facts at trial reveal that the details of these commercial terms – including the offer of a below market price, the proposed EGPWS under development and the explicit lack of certain specifications – corroborate the experimental purpose of the offers. Although the offers include commercial terms, which as to Gulfstream, ultimately resulted in a contract to supply EGPWS, Honeywell originally offered EGPWS as an alternative to GPWS, which would be used in the new aircraft if EGPWS was not fully developed. The commercial provisions, upon which Universal and Sandal rely, apply regardless of the system that was ultimately supplied. Additionally, Honeywell and Gulfstream had previously worked together on improvements to air safety, specifically on the CFIT problem, which further supports experimental use.

Moreover, at the time of and long after the critical date, Honeywell continued to sell GPWS to other customers as evidenced by the proposal to Singapore Airlines in October 1994 – two months after the critical date. No mention of EGPWS is contained in that proposal. The developmental status of EGPWS is further confirmed by the

difficulties that Honeywell experienced in selling GPWS during this time. Documents show that customers did not wish to purchase GPWS in light of the future availability of EGPWS. In fact, Honeywell offered "trade-ins" of GPWS units when EGPWS became available.

Although "commercial offers" for sale were made to Gulfstream, Collins and Honeywell Inc., the burden of proof required has not been met in light of the experimental nature of Honeywell's pre-critical date activities relating to the Gulfstream and Canadair programs. Moreover, while Honeywell offered to sell its existing Enhanced GPWS product, the claimed inventions were not offered for sale. Therefore, the first prong of *Pfaff* has not been met.

Ready for Patenting

Notwithstanding the conclusions set forth above, the court will continue with the *Pfaff* analysis. Under the second prong of *Pfaff*, an invention is ready for patenting if, prior to the critical date, there is either a reduction to practice of the invention, or sufficiently specific drawings or other descriptions of the invention that allow one skilled in the art to practice the invention. *See EZ Dock, Inc.*, 276 F.3d at 1352; *see also*, *Abbott Labs.*, 182 F.3d at 1318 ("The fact that the claimed material was sold . . . in which *no* question existed that it was useful means that it was reduced to practice."). (emphasis added).

Universal and Sandel assert that the *Pfaff* standard has been met as the claimed inventions were ready for patenting in two ways – they were reduced to practice and described in an enabling written description prior to the critical date. Honeywell argues that Universal and Sandel have not shown by clear and convincing evidence that any

enabling written descriptions of the claimed inventions existed or that the inventions were reduced to practice at any time before the critical date.

The inventors conceived of the inventions described and claimed in the patents during development of EGPWS. A "prototype EGPWS" embodied in a laptop computer was tested on Honeywell's King Air aircraft. The laptop computer contained software, which executed algorithms to detect terrain alerts and to display images of the surrounding terrain. Work on the system, including color-coding and software developing, began in May 1993. Within a few weeks, the first alerting software was ready for testing in a laptop system. By the end of 1993, display features, including color-coding based on terrain relative to aircraft altitude, existed.

Universal and Sandel argue that the inventions set forth in patents-in-suit were reduced to practice in the form of this laptop prototype EGPWS prior to the critical date. As evidence of the reduction to practice, Universal and Sandel rely on internal Honeywell documents tracking EGPWS development, referred to and previously described herein as the Design Notes; technical descriptions provided to third parties Gulfstream, Collins and Aerospatiale;[49] pictures and notes associated with the use of the laptop prototype on the King Air aircraft in Bateman's notebook;[50] a demonstration version of the EGPWS software dated May 18, 1994;[51] a videotape of EGPWS filmed in

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[49] On behalf of Honeywell, Don Bateman made a presentation to Aerospatiale in 1994. *See* JTX 169. Universal and Sandel assert that this presentation evidences the patented inventions.

[50] Bateman often participated in the flights abroad Honeywell's King Air. Notes and photographs pertaining o many of these flights were entered into the record. *See* JTX 27; JTX 49.

[51] Conner prepared software to demonstrate the functions of the Honeywell system as it existed on May 18, 1994. The court viewed the operation of this software during trial. The software recreates eight known accident or incident scenarios, which were derived from either flight data recorder information or based on witnesses' descriptions. The software displays multiple terrain contours, by color based on elevation relative to aircraft altitude, different levels of alerts (cautions followed by warnings) and indicates

March of 1994; the *Business & Commercial Aviation International* article published in June 1994, describing the demonstration flight on March 8, 1994; the testimony of certain Honeywell witnesses and the testimony of Sandel's technical expert, Robert Gibson.

Honeywell disputes that the claimed inventions were reduced to practice as of the critical date because they remained the subject of experimentation. Honeywell argues that the invention could not have been reduced to practice any time before the critical date in light of the evidence just before and shortly after that date including: Design Notes III completed two days before the critical date, in which nine areas are identified by the inventors where changes are necessary due to the data obtained as a result of the testing and demonstrations of the system during the preceding three to four months; Bateman's Weekly Engineering Meeting memo of August 1, 1994, the day after the critical date, and each subsequent memo during the month of August 1994, which indicate that the engineers continued to test and evaluate the new algorithms suggested in Design Notes III; Muller and Conner's memos in December 1994 advising of continued problems as identified in Design Notes III; and Johnson's memo of June 22, 1994, which summarizes the state of testing and indicates that adequate or complete validation of the algorithms in numerous, additional accident, incident and airport scenarios is needed to determine whether the invention would work for its intended purpose. His memo directly relates to concerns regarding the accuracy of the terrain

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terrain threat by color coding the terrain yellow or red based on the severity of the threat. It also displays various written messages to represent voice call-outs. *See* JTX 314.

database. Honeywell also relies on the testimony of its witnesses, Daly,[52] Bateman, Conner[53] and Johnson,[54] who did not consider the invention as operational for its intended purpose as of the critical date. Honeywell likewise cites to the opinion of its technical expert, Dr. John Hansman, who testified that Honeywell only succeeded in developing EGPWS because of its significant testing of the invention.

Universal and Sandel also assert that prior to the critical date, the claimed inventions were described in writing by the inventors in sufficient detail, to allow one of ordinary skill in the art to practice them without undue experimentation. In support, they rely upon two groups of documents: Design Notes I, II and III and the technical descriptions and proposals made to Gulfstream, Collins and Aerospatiale prior to the critical date.

Honeywell contends that Design Notes I through III are not, at any time before the critical date, enabling descriptions of the claimed inventions.[55] Moreover, Honeywell

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[52] Frank Daly is the president of Honeywell International's air transport systems division, which designs, produces and sells avionics primarily for large air transport jets and supplies EGPWS.

[53] Kevin Conner is a senior principal engineer with Honeywell's flight safety department. His responsibilities include the research and development of flight safety systems, including the development of software for the forward looking ground proximity warning system.

[54] Steven Johnson is a senior engineer with Honeywell's flight safety department. His primary role in the EGPWS project was terrain database development and design, computer simulation, and flight testing. He developed the terrain databases from accidents, incidents and normal approach data.

[55] Honeywell argues that Robert Gibson (Sandel's technical expert) provided no opinion before trial as to whether Design Notes I through III were enabling written descriptions. At trial, over Honeywell's objection, Sandel presented direct testimony from Gibson that these Design Notes were enabling descriptions.

In his expert report on invalidity, Gibson chronologically outlines the status and development of EGPWS. Gibson openly relies upon Design Notes I and II, as well as, other internal documents in determining the precise timing of the development of EGPWS. Gibson's report also details how changes outlined in the Design Notes were incorporated into the various disclosures and demonstrations that Honeywell made to prospective buyers and members of the industry. Moreover, Gibson definitively addresses Muller's November 8, 1993 memo notes (Design Notes I) and points to changes that were incorporated in EGPWS by the June 1994 issue of *Business & Commercial Aviation*. Gibson also observes that Design Notes II, dated April 7, 1994, contain the same terrain floor figure as Figure 9 in the '080 patent.

maintains that the technical descriptions forwarded to Gulfstream, Collins and Aerospatiale are not for the claimed inventions, and therefore could not be enabling descriptions.

Reduction to Practice

Reduction to practice involves proof that an invention will work for its intended purpose. *See EZ Dock*, 276 F.3d at 1352. Reduction to practice "may require testing, depending on the character of the invention and the problem that it solves." *Slip Track Sys., Inc. v. Metal-Lite, Inc.*, 304 F.3d 1256, 1265 (Fed. Cir. 2002). There can be no reduction to practice until the invention is sufficiently tested to demonstrate that it would work for its intended purpose. *See Space Systems/Loral Inc.*, 271 F.3d at 1080.

Like evidence of experimentation sufficient to negate a statutory bar, reduction to practice involves proof that an invention will work for its intended purpose in its intended environment. *EZ Dock*, 276 F.3d at 1352 (citing *Scott v. Finney*, 34 F.3d 1058, 1061 (Fed. Cir. 1994)). As discussed previously, the continued testing of the Honeywell product was to determine whether the inventions will function for their intended purpose in the intended environment. This testing includes the study of human factors and cockpit integration issues associated with introducing new information into a cockpit, as well as, testing the algorithms against numerous accident, incident and airport approach

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After a detailed analysis of the progression of EGPWS and the supporting documents, particularly Design Notes I and II, Gibson concludes, "[b]ased on the technical specifications and drawings, one of ordinary skill in the art would have been able to practice the inventions claimed in the patents-in-suit based on Honeywell's disclosures . . . before July 31, 1994." Gibson also notes that "[t]hese disclosures, the *Honeywell internal documentation* and the fact that Honeywell was making numerous demonstration flights with persons, such as, reporters and personnel from prospective customers makes it clear to me that the prototype system being demonstrated on the King Air prior to the critical date was fully operational for its intended purpose." (emphasis added). Accordingly, Sandel's questions of Gibson directed to enablement did not violate the court's order of limiting expert's testimony to the scope of their reports.

data to insure the issuance of appropriate alerts and the minimization of nuisance alerts. There is no indication that this type of testing, in particular for a new safety alert system, is uncommon in the aviation industry.

The claimed inventions were developed to improve upon GPWS and to provide warnings in scenarios that were not possible with existing systems. This involved a number of challenges, including designing "threat" detection algorithms, which directly relate to the operation of the alerting envelopes and the functions of flight path angle, look ahead distance and terrain floor boundary, disputed terms in claim 1 of the '080 patent, determining how the information would be displayed, determining how the information and system would be integrated into existing cockpits and how to obtain the necessary input data, which is directly related to receiving "signals representative of," another disputed limitation of claim 1 of the '080 patent. Moreover, language in the specification of the '080 patent emphasizes that purposes of the invention include a terrain awareness system which issues appropriate warnings while minimizing nuisance warnings and provides both a look ahead/look down *and* a look up terrain advisory and warning indications to the flight crew of hazardous conditions based upon the predicted trajectory of the aircraft. Without such improvements, the claimed inventions would not work properly.

Universal and Sandel's heavy reliance on contemporaneous documents before and shortly after the critical date does not sufficiently prove a reduction to practice of the claimed inventions. By July 1994, the system was capable in many circumstances of recognizing certain inputs, including information from an on-board terrain database, and generating caution and warning alerts. However, this does not establish, clearly and

convincingly, that the inventions were working for their intended purpose in the intended environment.

As noted before, the proposals for sale of the system would allow Honeywell to test the inventions in the operating environment and address such “intended environment” issues as proper integration into existing systems in the cockpit, minimization of clutter to provide clear, unambiguous information to the flight crew, avoid impairment of the displays for navigation, weather, predictive windshear and traffic data and their associated alerts and ascertain whether the terrain alert warnings of the inventions were distinguishable from these other alerts.

The testimony at trial shows that continued experimentation was necessary to test certain algorithms of the alerting elements and to collect and analyze the resulting data. Such testimony is supported by documents including the pre-critical date Design Notes, which detail Honeywell’s work and progress on EGPWS. Design Notes III was completed two days before the critical date, and enumerates serious concerns about the system that required changes. Although some of those changes had been implemented, while others had not as of the time of Design Notes III, all required additional testing as evidence by Conner’s testimony, Johnson’s memorandum in June 1994 and Design Notes I through III. Finally, Bateman’s meeting agenda notes of August 1994 document that a remaining unresolved task, recommended in Design Notes III, was the review of the warning algorithms and the latest terrain display, both of which directly relate to the asserted claims. They confirm regular evaluation and testing of the various changes proposed in Design Notes III, such as review and debugging of

the wedding cake terrain algorithms, and review of the status of the airport terrain data and of accident terrain data models. They acknowledge further modifications to the wedding cake software and validations of new algorithms as a result of flight demonstrations. Such evidence confirms that additional testing was necessary to determine whether the system functioned properly, and whether the inventions had been reduced to practice.

The inventors testified regarding the specific changes made to the system after the critical date. Johnson testified, consistent with his June 1994 memorandum, that the proposed changes in Design Notes III had to be tested through simulations, analyses and flight testing to confirm that they did not result in unintended consequences. By this time frame, the alerting algorithms, which effect look ahead distance and terrain floor boundary and as a result, the first and second alert envelopes, had been tested, either by simulation or in the King Air test flights, against eleven known nuisance alert scenarios and fourteen known accidents. However, as Design Notes III and Johnson's memorandum indicate, the database testing was incomplete and the various modifications to certain algorithms, in particular the look ahead algorithms, could result in a domino effect which required additional test data to confirm that the system consistently worked as expected in its intended environment.[56] Although the algorithms, which implement various parts of the system, are not limitations of the dispute claims, they directly effect the elements of the claims, for example, the

[56] The Federal Aviation Administration ("FAA") Technical Standard Order ("TSO") related to TAWS lists certification testing criteria. Such testing is required to ensure compliance with minimum standards for certification. The FAA developed the TSO after working with Honeywell for a period of four years so that EGPWS could achieve FAA certification. Honeywell's testing by simulations and through King Air demonstration flights were reviewed by the FAA.

operation of flight path angle, terrain floor boundary, the database of stored terrain information and the alert envelopes. Because of the interrelationship among these limitations, a modification of an algorithm in one element could directly effect the remaining limitations. Moreover, all of the patents-at-issue are interrelated since they incorporate or reference the look ahead system requirements of the common specification. Thus, a modification to the algorithms that control the limitations to claim 1 of the '080 patent may effect the functions of the disputed claims of the remaining patents.[57]

Honeywell witnesses testified that demonstration testing continued between the time of Design Notes III and Design Notes IV. Although some of the modifications and testing after the critical date were not directly related to the claimed invention under Claim 1 of the '080 patent, others were and resulted in changes being made to the terrain database and look ahead algorithms, which directly effect the first and second alert envelopes. The changes address the concerns found during the demonstrations, such as, the terrain display being limited to 20 to 30 nmiles ahead of the aircraft (the wedding cake formula), missed caution alerts (the beta sink rate), the lack of terrain alerts for airports on a cliff (the cut-off altitude) and the second order lead for high descent rates (look up; look down). Such changes were necessary so that the inventions worked for their intended purposes in the intended environment.[58]

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[57] The parties' emphasis on claim 1 of the '080 patent, where most of the disputed terms are found and on which the evidence at trial focused, confirms this analysis. Only the claim construction for claim 4 of the '060 patent references the algorithms found in the specification. This claim apparently was not significant to the issues during trial.

[58] Dr. Hansman testified that the lack of alerts and inconsistencies between cautions and warnings prevented the system from functioning for its intended purpose as it would impair a pilot's ability to properly respond to the system. Therefore, as of Design Notes III, the system, and thus, the inventions,

Universal and Sandel both emphasize in their arguments for invalidity a notation by Bateman that Honeywell "may have waited too long."[59] Regardless of Bateman's actual subjective intent, the objective evidence presented reveals that the patents were not reduced to practice by July 29, 1994. Therefore, Universal and Sandel have not met their burden to prove reduction to practice under the second prong of the *Pfaff* test.

Written Description Alternative to Reduction to Practice

Proof of the second prong of *Pfaff* by written description requires that "prior to the critical date the inventor had prepared drawings or other descriptions that were sufficiently specific to enable a person skilled in the art to practice the invention." *Pfaff*, 525 U.S. at 67-68. Universal and Sandel assert that prior to the critical date, the inventors described the inventions in sufficient detail to allow one of ordinary skill in the art to practice them without undue experimentation. They rely upon two groups of documents: Design Notes I, II and III and the technical description and proposals made to third parties, Gulfstream, Collins and Aerospatiale collectively.

Since the parties agree that one of ordinary skill in the relevant art would have a bachelor's degree in engineering, such as, aeronautical or electrical engineering and two years experience in avionics or avionics testing, the court adopts such education and experience as the level of ordinary skill for its analysis.

a. Design Notes

As noted previously, Design Notes I through III are all dated prior to the

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did not work for its intended purpose.

[59] *See* JTX 137. At trial, Bateman testified that the statement pertained to his concern whether Honeywell's intellectual property attorneys may not have been provided adequate information related to EGPWS development.

critical date. Gibson details where the claimed limitations are described therein, and emphasizes the similarities between these Design Notes and the specification of the '080 patent. His opinion is that all of the elements of Claim 1 of the '080 patent are disclosed. Moreover, according to Gibson, Design Notes I and II describe the display limitations set forth in the '009 and '060 patent claims such as, a terrain display having pop-up capability, a terrain threat display color-coded based on the severity of the threat and a background terrain display relative to the aircraft altitude, which uses dot density to display various levels of terrain. Further, he opines that Design Notes III discloses the claimed lateral boundaries limitation, relying on the similarity between the diagrams contained in the Design Notes and the common specification. Based on Gibson's opinion, Universal and Sandel assert that Designs Notes I through III are an enabling written description of the claimed invention.

However, a comparison of the '080 patent specification with the pre-critical date Design Notes reveals that significant disclosures in the specification are absent in the Design Notes. In particular, the patents disclose detailed graphs and specific mathematical formulas that are essential to the recited limitations of the asserted claims. Although much of the text, figures and formulas in the Design Notes are virtually identical to the corresponding description in the '080 patent specification, substantial evidence exists to that the pre-critical date Design Notes are not enabling descriptions of the inventions claimed.

During the relevant period, the inventors could not conclude that the inventions worked for their intended purpose and be practiced without undue experimentation. Documents contemporaneous with Design Notes II and III and the testimony of the

inventors, Conner and Johnson, show that significant testing of and modification to the alert envelopes and the database structure occurred between April 1994 through the end of that year.

Universal and Sandel, relying on Gibson's conclusions, argue that the watershed evidence with regard to reduction to practice is found in Design Notes II.

Gibson observes that the preamble of the '080 patent and Design Notes II disclose the use of a laptop computer for running software algorithms for detecting terrain alerts. He concludes that Design Notes II discloses the input limitation which is coupled to a database of stored terrain information and is implemented on a laptop. Of necessity, the input limitation would have been incorporated in the laptop prototype at the earliest stage of development. Further, the output limitation is addressed in Design Notes II. Since the output encompasses a display on the laptop screen, it also would have been included in the initial laptop prototype.

Gibson opines that the signal processing device is disclosed in Design Notes II. Because the signal processing device is integrated in the microprocessor of the laptop, this limitation would have been in the initial prototype. Further, the look ahead distance limitation, as described in Design Notes I, is again disclosed unchanged in Design Notes II.

The terrain floor boundary limitation is disclosed in Design Notes II. Gibson equates terrain floor boundary with terrain clearance floor and relies heavily upon the notation in the audit trail that by February 1994, the terrain clearance floor logic had been added to the Delta H. He also concludes that the first alert envelope, second alert envelope and outputting alert limitations, which includes vocal warnings and terrain

displays, are disclosed in Design Notes II.

Regarding the pop-up display limitation of the ‘060 patent, Gibson comments that this feature, which provides for both a yellow and red alert, is implemented in Design Notes II. Further, this writing discloses details of the alerting algorithms, including the cut-off envelopes and beta sink rate enhancement, neither of which are limitations of the asserted claims.

As a result, Gibson reasons that Design Notes II, particularly when read with Design Notes I, is a sufficient enabling disclosure which completely shows how to design and build the inventions, to implement the algorithms and install the device in the aircraft, and thus, establishes that the claimed inventions, except for the lateral boundaries limitation of the ‘592 patent, had been reduced to practice in the laptop prototype used on King Air in 1993 and early 1994.

Honeywell does not dispute that Design Notes II describes certain features of the laptop prototype as the of the writing of the Notes. It does not dispute that Design Notes II describes alerts, a signal processing device, a look ahead distance as outlined in Design Notes I, a terrain floor or terrain advisory and warning envelopes. Honeywell does contend that the limitations of the ‘080 patent were not reduced to practice at the time of Design Notes II since fundamental issues regarding the inventions remained and changes were needed, which required further testing to make the system work for its intended purpose in its intended environment. Supporting evidence is found in Design Notes III, which reflects at least nine serious areas of concern that directly relate to the asserted claims and shows that the inventions did not operate as anticipated and had problems in need of solutions.

Design Notes II proposes matters that required attention. Specifically, a lab set-up was necessary to further debug both the software and hardware, which required another interface box and a dedicated PC serving as a weather radar simulator. Further modification of King Air was required to adequately confirm the accuracy of the baro corrected altitude, which is a very important part of the terrain ahead detection system. Additional flight tests into difficult airports, including computer runs of accidents and normal approaches, were needed to verify the detection algorithm, and to adjust and finalize all configurable constants. Additionally, a solution for the cut-off altitudes, which may have been preventing legitimate warnings when an aircraft is below the airport elevation, was yet to be confirmed. As such, Design Notes II does not provide an enabling disclosure because, at that time, additional testing of the claim limitations were required. Of note, Gibson acknowledges that serious concerns remained after Design Notes II

Moreover, to adequately test the algorithms or any changes to them, testing through actual flights or a flight simulator was needed, not only to test their accuracy, but to determine if any unintended consequences arose from a change. The data was then collected and analyzed, which may result in further modifications. Design Notes III begins with concerns about the system that the "[d]isplay update rate [is] too slow following an alert or a range change. Terrain-display is limited to 20 to 30 nMiles ahead of the aircraft. . . . Second order lead for high descent rates to be applied to terrain detection algorithm." These comments demonstrate that the restriction on the forward distance, which relates to the look ahead algorithms and the terrain database, remained a substantial concern. During the demonstration flights, pilots complained that the

display in the planning mode was not adequate to view the terrain before the airport and a significantly longer distance was needed to ascertain, while reducing altitude, terrain features of the intended flight path for increased situational awareness. This concern lead to the development of the wedding cake terrain data memory discussed previously. Inconsistencies continued between the cautions and warnings, which could lead to CFIT accidents and degrade the user's confidence in the system.

Gibson believes that the challenged claims of the '592 patent are described in Design Notes I and III. He opines that the lateral boundaries limitation is shown at Fig. WX-45A in Design Notes I. Further, diagram WX-45 in Design Notes III provides a graphical description of the threat detector array implementation of the lateral boundaries. Based on the timing of and disclosures in Design Notes III, Gibson concludes that the asserted claims of the '592 patent, specifically the lateral boundaries limitation, were reduced to practice by July 1994. However, Design Notes III clearly indicates that modification from a single vector to an array of vectors to safeguard against position and data base errors needed to be tested. It is a *proposed* vector array which is shown in Fig. WX-45. Moreover, it is the single vector diagramed in WX-45A.

During trial, Honeywell pointed to specific changes designed to address the concerns in Design Notes III. After Design Notes III, modifications were made to the wedding cake formula of the stored terrain database, to the number of threat detection vectors which implement the lateral boundaries, as well as, the beta sink rate enhancement and the cut-off altitude. Each of these features are addressed in the description of the preferred embodiment of the '080 patent. Johnson and Conner link the modifications to whether the proposed design would work for its intended purpose.

Gibson, Dr. Hansman and Conner link the changes to the claims of the patents, including the differences between the disclosure in the Design Notes and the '080 patent specification as they relate to the limitations of the asserted claims.[60] Gibson confirmed that the changes are implementations of reducing the invention of the claims to practice. However, little evidence was presented to show that the testing identified by the inventors at trial was directed solely or primarily to minor refinements of the preferred embodiment of the inventions. Moreover, Design Notes III discusses interface/integration issues, which include incorporation of the terrain display into the display controller menu, the ability to switch from the navigation display to the terrain display and solutions for dealing with the display of traffic (TCAS monitor) information with the terrain display – all matters directed to application of the inventions in the intended environment. Therefore, the evidence shows that the changes after the critical date were necessary to reduce the inventions to practice and thereby, enable the practice of them by one skilled in the art.

b. The Description of EGPWS to Potential Customers

The proposals made to Gulfstream and Collins did not describe the claimed inventions, nor does Universal and Sandel adequately show how the Aerospatiale presentation describe the patented inventions. In contrast, Dr. Hansman testified that the Aerospatiale presentation did not include sufficient technical detail to

[60] For example, Design Notes III depicts proposals that were considered for the look ahead threat vector. Conner testified that some of the proposals described were not implemented in the algorithm at that time and needed additional testing. However, by the time of Design Notes IV, from December 1994 – January 1995, the focus was on interface issues. Gibson noted that the changes described in Design Notes III, including the cut-off envelope and beta sink rate, were techniques or implementations of the desired features of claim 1 of the '080 patent.

enable one of ordinary skill in the art to practice the invention. This testimony was unrefuted.

Honeywell offered to sell its Enhanced GPWS product to Gulfstream in its initial proposal and the July 7, 1994 MOA.[61] As part of the negotiations leading up to the MOA, Honeywell provided a technical description of the offered "Enhanced MKV" system. The proposal to Collins never materialized into a sale. As a result, the final offer to Gulfstream was more detailed than the Collins proposal. Nevertheless, the documents for the Canadair Global Express project include the system integration requirements and contain similar technical disclosure as the Gulfstream project documents.

Some of the challenged claims are generally described in Honeywell's proposals to Gulfstream and Collins. The proposals include general information regarding the state of development of the system with a focus on performance features. For example, the offer to Gulfstream describes the improvements proposed for the Enhanced MKV including "'[t]errain [a]head' alerting based on FMS or GPS derived position information and stored terrain data," which is one of four improvements recommended to significantly reduce the CFIT. The proposal notes the recent developments in flash memory technology, which made it practical to store terrain data for the entire world. The Gulfstream technical description advises of the development of algorithms, which

[61] *Compare* JTX 145 *with* JTX 311. Similar to the Gulfstream negotiations, as early as February 1994, Collins was investigating the opportunity to work with a select group of partners to provide a complete avionics system for Canadair's new Global Express long-range business jet. In March 1994, AlliedSignal l submitted a proposal to Collins. A subsequent revision to this proposal quoted a price of $34,500 for part number 965-0976-001 – the part number used for EGPWS. Since Canadair did not select Collins to provide the avionic suite for the Global Express, Collins did not purchase the offered system.

consider aircraft position and track and absolute and vertical speed in relation to the stored terrain data, to determine if the projected flight path conflicts with the terrain ahead of the aircraft.

Both the Gulfstream and Collins proposals refer to “sophisticated algorithms” for determining terrain threats. Such algorithms contained “two elements to the threat algorithm: the look ahead distance/direction, and the terrain detection algorithm (aircraft altitude relative to terrain altitude).” Regarding look ahead distance, the technical description provides that “‘Enhanced MKV’ will look ahead two turn radii as a function of ground speed and be limited to 1.5 NM at low speed and to 4 NM at high speeds . . . The assumptions made in determining the value for the look-ahead distance are based on an imminent 30 degree bank turn . . . The minimum look-ahead distance is therefore proportional to the turn radius, plus a safety terrain clearance distance, plus a distance equivalent to pilot reaction time (ten seconds).”

Concerning the system displays, the proposals outline the display of terrain information. The display is connected to the weather radar screen, and operates in two modes: a “background” terrain display, which is brown or a similar color, to designate significant terrain in a non-alerting manner, and a “threat” display, painted in either amber or red depending upon the immediacy of the threat, which is shown only if the aircraft is dangerously close to terrain for a limited range ahead. Activation of the red terrain display results in a voice alert of “terrain ahead.” The system description of terrain display and potential terrain threats disclose several limitations of the disputed claims, including pop up of multiple, color-coded levels of terrain threat, voice alerts, and a background terrain display independent of threat severity. Such displays were

available early on in the EGPWS development process. Later prototypes showed the terrain images on weather radar displays flown on the King Air aircraft.

Gibson testified that the proposals – specifically the technical description of the Gulfstream proposal – was very similar to Design Notes II. However, as discussed previously, Design Notes II is not an enabling description of the patented inventions. Although look ahead distance in the Gulfstream proposal is virtually identical to Design Notes I, a key component of the patented system lacking in either the Collins or Gulfstream proposal is the terrain floor boundary. The "terrain floor boundary" limitation, according to Gibson, is disclosed in Design Notes II and had been implemented on the laptop by February 14, 1994.

At trial, both Dr. Hansman and Daly testified that the terrain clearance floor is not the same as the terrain floor boundary of the patents-in-suit. The language in the proposals indicate that terrain clearance floor is based on radio altimeter readings, not on look ahead alerting algorithms. As such, the terrain clearance floor described in the technical description of the proposals is a fundamentally different concept than the terrain floor boundary claimed in the '080 patent.[62]

The proposals specifically indicate that the Enhanced MKV was under development. Honeywell assured Gulfstream that EGPWS could be interchangeable with GPWS in the Gulfstream V, if the new system could not be delivered. Under the MOA, Honeywell agreed to supply certain hardware and equipment, including the flight

[62] The various changes made to the system source code regarding the terrain floor boundary are reflected to a degree in the audit trail. The audit trail for the February 1994 time period notes that Conner "added TCF floor logic for Delta H (DH)" into the system's software. Gibson opined that this entry shows that the terrain floor boundary limitation was developed by then.

test hardware and materials for the System Aviation Integration Laboratory (SAIL), at no cost to Gulfstream.[63] Honeywell did not test its laptop prototype of EGPWS in a Gulfstream aircraft until February 1995 and the first system Honeywell delivered to Gulfstream pursuant to the MOA were GPWS units.

Other integration issues that required attention are also noted. Design Notes III, completed days before the critical date, discusses the interface/integration issues, which include the integration of the terrain display selection into the existing display controller menu, the ability to switch from the navigation display to the terrain display, the solutions for the display of traffic or TCAS information with the terrain display, and the confusion between GPWS and EGPWS alerts. Design Notes IV outlines remaining integration issues that arose from the introduction of EGPWS into various aircraft, specifically Gulfstream V.

Honeywell contends and the evidence suggests that its primary purpose for entering into the 1994 agreement with Gulfstream – and its pursuit of the Canadair project – was for research and development of EGPWS. Either project would allow Honeywell to test its forward looking ground proximity warning system in its intended operating environment. EGPWS was tested on Gulfstream IV on February 6, 1995, confirming that the algorithms worked for their intended purpose and thus the inventions worked for their intended purpose in the intended environment.[64]

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[63] The SAIL program, also known as the Iron Bird program, was an arrangement instituted by Gulfstream with its vendors and operated under a team approach whereby each vendor would supply free of charge the hardware and models, along with hardware/software support to Gulfstream. Hans Muller served as the liaison or representative for Honeywell in this program.

[64] Although EGPWS had been tested in King Air via the laptop computer, King Air is a turbo prop aircraft. Gulfstream IV is a large commercial jet.

Although offers for sale and a sale occurred before the critical date, Universal and Sandel have not adequately shown that the offers or the sale were incidental to experimentation. Nor have they sufficiently demonstrated the stage of development of the inventions, at the time that the pre-critical date offers to sell and sale occurred. As a result, they have not proven clearly and convincingly that the inventions were ready for patenting before the critical date. The absence of a commercial offer to sell the inventions and the lack of an invention ready for patenting prevent application of on-sale bar.

Public Use

During the same time period as the alleged on-sale bar events, Honeywell demonstrated its developmental system to pilots, other airline personnel and industry regulators through a series of in-flight demonstrations aboard its King Air airplane. Universal and Sandal assert that these demonstrations constitute invalidating public use pursuant to 35 U.S.C. § 102(b).

A "public use" for the purpose of "barring access to the patent system is a use more than one year before the patent filing date, whereby a *completed* invention is used in public, *without restriction* and in circumstances *other than* substantially for the purposes of experimentation." *Allied Colloids Inc. v. America Cyanamid Co.*, 64 F.3d 1570, 1574 (Fed. Cir. 1995) (citing *Smith & Griggs Mfg. Co. v. Sprague,* 123 U.S. 249, 256 (1887)). (emphasis added). Public use "does not necessarily mean open and visible in the ordinary sense," rather, it is the unlimited, unrestricted or non-secret use of the claimed invention by someone other than the inventor. *New Railhead Mfg*., 298 F.3d at 1297 (citations omitted). The public use must enable one of ordinary skill in the

art to practice the invention in order to constitute a bar to patentability. However, what would otherwise appear to be a public use is negated if the inventor was testing claimed features of the invention. *See EZ Dock, Inc.*, 276 F.3d at 1353. When an evaluation period is reasonably needed to determine if the invention will serve its intended purpose, the public use bar will not accrue while such a determination is being made. *See Seal-Flex, Inc.,* 98 F.3d at 1324. However, once the inventor realizes that the invention, later claimed, works for its intended purpose, further experimentation may constitute an invalidating public use. *New Railhead Mfg.*, 298 F.3d at 1297.

Honeywell argues that the flight demonstrations were experimental and necessary for input on cockpit integration and human factors (man-machine interface) issues, so that the inventors could determine whether the invention was "operable for its intended purpose in its intended environment." *See Allied Colloids Inc.,* 64 F.3d at 1574; *see also, Baker Oil Tools, Inc. v. Geo Vann Inc.,* 828 F.2d 1558, 1563 (Fed. Cir. 1987) (noting the experimental use of an invention to determine whether it is operable for its intended purpose in its intended environment does not qualify as statutory public use). Thus, such testing does not constitute invalidating public use. "Each claim of the patent must be considered individually when evaluating a public use bar." *Lough v. Brunswick Corp.*, 86 F.3d 1113, 1122 n.5 (Fed. Cir. 1996). To determine whether the elements of the public use bar exist, the court should consider and weigh factors including:

> [T]he nature of the activity that occurred in public; the public access to and knowledge of the public use; whether there was any confidentiality obligation imposed on persons who observe the use; whether progress records or other indicia of experimental activity were kept; whether persons other than the

> inventor or acting for the inventor conducted the experiments; how many tests were conducted; the scale of the tests compared with commercial conditions; the length of the test period in comparison with tests of similar products; and whether payment was made for the product of the tests.

Allied Colloids Inc., 64 F.3d at 1574 (citations omitted).

Other factors may be relevant to the public nature of the use or any asserted experimental aspect. *Id.* Therefore, a totality of the circumstances test is applied when determining if public use has occurred within the meaning of section 102(b). *See Netscape*, 295 F.3d at 1320. Thus, the experimental use doctrine allows the inventor to publically test in order to refine the invention. The doctrine recognizes that both the interest of the public and the inventor are served by having an invention perfected and properly tested before a patent is granted for it. *Elizabeth v. Am. Nicholson Pavement Co.*, 97 U.S. 126, 137 (1877).

From late 1993 through the critical date, Honeywell conducted many "show and tell" demonstrations and test flights to approximately 150 individuals, who were members of the aviation community, and showcased the development of the EGPWS system in the form of a laptop computer prototype. One such demonstration conducted in March 1994, involved pilot and writer, Fred George. Neither George nor any of the other observers in the demonstration flights were under an obligation of secrecy and most were asked to complete a survey questionnaire evaluation at the conclusion of the demonstration.

The lack of confidentiality does not automatically transform experimental use into public use; the other factors must be considered. The demonstrations were arguably

intended to promote future sales of Honeywell's EGPWS when completed. Such demonstrations undoubtably advertized EGPWS – and the development thereof – to members of the aviation community, including potential customers. Pilots, commercial airline manufacturers, airline executives and FAA regulators were often aboard these flights. In fact, Honeywell admits that the demonstration flights were used to create industry-wide awareness of the safety features of the new system.

Given the complexity of the invention and the environment in which it was to function, the roughly one and a half years of testing, which includes approximately six months of pre-critical date demonstrations, does not constitute excessive public use. The demonstrations clearly focused on addressing the previously discussed significant issues associated with introducing new avionics into a cockpit. The demonstrations included only authorized individuals, many of whom would be using the system in the future. Those involved were asked to provide feedback in the form of survey questionnaires. The questionnaires asked for opinions and criticisms pertaining to the system, including comments related to its effectiveness and use.

Only Honeywell personnel conducted the demonstrations. They also maintained control over them, continually monitored the inventions during the testing and solely had control over the laptop computer and software data. There is no indication that the public was made aware of the internal system, including the forward looking terrain detection algorithms or terrain database configurations. The demonstration flights were conducted on the Honeywell King Air aircraft. Public access was limited by applicable regulations to selected individuals who were essential to the purpose of the flight, in

accordance with the “experimental” FAA designation, under which King Air operated.

The flight demonstrations were conducted in a systematic manner for which extensive records were maintained, including the participants’ responses to questionnaires – information which pilots considered important and useful. The questionnaires also addressed issues pertaining to human factor concerns, similar to those discussed in the Gulfstream and Collins proposals. Such information was reviewed, evaluated and used to verify whether the system functioned as designed and future modifications were made. Design Notes III confirms the importance of such input through its discussion of possible needed changes based on the comments resulting from the demonstrations. Although these flights allowed contact with potential customers, there is no evidence that they were solely or primarily for marketing purposes.

In fact, Honeywell’s marketing department became involved in the demonstration of EGPWS after the conclusion of the development stage, that is after the PDR (Preliminary Design Review). The evidence suggests that the PDR occurred during January 1995. While the testing included members of the public aviation community on a restricted basis, such demonstration flights were not for the primary purpose of selling the system as evidenced by the use of feedback to determine whether the inventions would accomplish their intended purpose, in the intended environment. Therefore, when analyzing the circumstances surrounding the testing, invalidating public use under the required standard has not been shown.

Universal and Sandel downplay the integration and interface issues by noting

that they are not part of the limitations of any claim. In their § 102(b) arguments, they criticize the numerous demonstration flights during the pre-critical date time period, implying that they were purely marketing tactics. Their analysis ignores that an invention must work for its intended purpose and in its intended environment, which for the inventions herein requires input from the intended user in the cockpit. The inventions of the patents-in-suit are used in an environment where seconds count and a reaction time of a few seconds means the difference between life and death. Short alert times and the absence of alerts for landings short of the runway and for precipitous terrain were the major problems of the prior art systems that the inventions address. The effectiveness of displays and the adequacy of the auditory warnings in communicating danger are integral to the elements of the inventions. Inventions, which are to alert a pilot of hazardous terrain ahead, that inconsistently provide warnings or fail to adequately display the terrain ahead are useless for both their intended functions and in their intended milieu. Moreover, a warning system that is not reliable will not be trusted.

The policies considerations which underlie the on-sale and public use bars, such as prompt disclosure of improvements and innovations, limiting the time period for an exclusive monopoly and allowing a reasonable opportunity to determine if an invention is worth patenting, are not offended by Honeywell's demonstration and use of the system prior to the critical date.

V. Inequitable Conduct

Universal and Sandal allege that Honeywell intentionally mislead the patent

examiner during the prosecution of the '080 patent, and thus committed inequitable misconduct. In light of the prosecution history, Universal and Sandel argue that Honeywell's inequitable conduct is relevant to the subsequently prosecuted and related patents-in-suit. Their inequitable conduct allegations are premised on three grounds: (1) Honeywell failed to fully disclose all material information concerning its activities relating to marketing and selling of its system prior to the critical date – the same activities relied upon for the on-sale and public use defenses; (2) the declarations filed during the prosecution of the '080 patent were incomplete and misleading; and (3) Honeywell failed to disclose, as prior art, the 1994 George article on Enhanced GPWS.

Patent applicants and their attorneys "have a duty to prosecute patent applications in the PTO with candor, good faith, and honesty." *Li Second Family Ltd. P'ship v. Toshiba Corp.*, 231 F.3d 1373, 1378 (Fed. Cir. 2000) (citing *Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1178 (Fed. Cir. 1995); 37 C.F.R. § 1.56). A breach of this duty, which requires a failure to disclose or a misrepresentation of material information coupled with an intent to deceive, constitutes inequitable conduct. A determination of inequitable conduct entails a two-step analysis.

First, the court must decide whether the withheld references meet a threshold level of materiality and intent to mislead. Second, the court must weigh the materiality and intent "in light of all the circumstances to determine 'whether the applicant's conduct is so culpable that the patent should be held unenforceable.'" *Purdue Pharma v. Boehringer Ingelheim*, 237 F.3d 1359, 1366 (Fed. Cir. 2001) (quoting *Baxter Int'l, Inc. v. McGaw, Inc.*, 149 F.3d 1321 (Fed. Cir. 1988)); *see also Elk Corp. of Dallas v. GAF Bldg.*

Materials Corp., 168 F.3d 28, 30 (Fed. Cir. 1999) ("Such proof of inequitable conduct may be rebutted by a showing that: (a) the prior art was not material; (b) if the prior art was material, a showing that the applicant did not know of that art; (c) if the applicant did know of that art, a showing that the applicant did not know of its materiality; or (d) a showing that the applicant's failure to disclose the art did not result from an intent to mislead the PTO.") (citations omitted); *Li Second Family Ltd. P'ship*, 231 F.3d at 137*; Merck & Co. v. Teva Pharms. USA, Inc., 288* F. Supp.2d 601, 631 (D. Del. 2003), *aff'd,* 347 F.3d 1367 (Fed. Cir. 2003) (emphasizing that claimants "must prove, by clear and convincing evidence, that material information was *intentionally withheld for the purposes of misleading or deceiving the patent examiner.*"). (emphasis added). Inequitable conduct in the prosecution of any claim renders the patent unenforceable. *See Weatherchem Corp. v. J.L. Clark, Inc.,* 163 F.3d 1326, 1336 (Fed. Cir. 1998) (citing *Kingsdown Med. Consultants Ltd. v. Hollister Inc.,* 863 F.2d 867, 877 (Fed. Cir. 1988)).

Inequitable conduct encompasses affirmative misrepresentations of material fact, failure to disclose material information or submissions of false material information, coupled with an intent to deceive. *See Baxter Int'l, Inc.,* 149 F.3d at 1329. Each applicant has a continuing duty, from the filing of the application until the application is abandoned or issued, to disclose material prior art and all material facts to the Patent Office. *See* 37 C.F.R. § 1.56. The duty of candor "includes a duty to disclose to the [Patent] Office all information known to that individual to be material to patentability." 37 C.F.R. § 1.56(a). The duty of candor extends to the applicant's representatives. *Molins PLC*, 48 F.3d at 1178 (citing *FMC Corp. v. Manitowoc Co.* Inc., 835 F.2d 1411, 1415 n.8

(Fed. Cir. 1987)). Thus, the duty of candor applies to the inventor and all others who are substantially involved in preparing or prosecuting the application. *See Fox Indus., Inc. v. Structural Preservation Sys., Inc.*, 922 F.2d 801, 804 (Fed. Cir. 1990).

Information material to patentability is defined as information that "is not cumulative to information already of record or being made of record in application," *and* establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim or refutes, or is inconsistent with, a position the application takes in either opposing an argument of unpatentability relied on by the examiner, or in asserting an argument of patentability. *See* 37 C.F.R. 1.56(b); *see also, Halliburton Co. v. Schlumberger Tech. Corp.*, 925 F.2d 1435, 1439 (Fed. Cir. 1991) ("Once a threshold level of materiality is proven, the Court must also determine whether the applicant's conduct satisfies a threshold showing of intent to mislead."); *Monsanto Co. v. Mycogen Plant Sci., Inc.*, 61 F. Supp. 2d 133, 196 (D. Del. 1999) ("An applicant has no duty to submit information which is not material to the patentability to any existing claim.").

When deciding whether to allow an application to be issued as a patent, the examiner considers, among other things, whether the claimed invention is anticipated by prior art under 35 U.S.C. § 102(b). In determining whether a particular reference is prior art under § 102(b), examiners decide whether the reference pre-dates the filing date of the patent application and its bearing on the application. In determining patentability, examiners consider references that are before them.

To facilitate the examiner's job of determining patentability, applicants have a duty to disclose material information, including prior art. *See GFI, Inc. v. Franklin Corp.*,

265 F.3d 1268, 1274 (Fed. Cir. 2001); *Critikon, Inc. v. Becton Dickinson Vascular Access, Inc.,* 120 F.3d 1253, 1258 (Fed. Cir. 1997). If a withheld reference actually anticipates a claim, it meets the most stringent standard of materiality. *Fox Indus., Inc.*, 922 F.2d at 804. However, information may be material and a reasonable examiner may consider the reference important in determining patentability, even though the reference ultimately does not invalidate the patent. *See Li Second Family Ltd. P'Ship*, 231 F.3d at 1380. Affidavits filed during prosecution are per se material. *See Refac Intern., Ltd. v. Lotus Development Corp.*, 81 F.3d 1576, 1583 (Fed. Cir. 1996) ("Affidavits are inherently material, even if only cumulative."). However, if "either materiality or intent is not found, then no further analysis need be performed and unenforceability must be denied." *Rhenalu,* 224 F.Supp.2d at 806.

After determining if the applicant withheld information that is material, the court must then determine whether the evidence demonstrates a threshold level of intent to mislead the PTO. *See Baxter Int'l Inc,* 149 F.3d at 1327. Assuming a claimant can prove the threshold levels of materiality and intent, there is "a weighing of the materiality and intent in light of all the circumstances to determine whether the applicant's conduct is so *culpable* that the patent should be held unenforceable." *Dayco Prods. Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1363 (Fed. Cir. 2003). (emphasis in original).

Universal and Sandel assert that any decision regarding invalidity is irrelevant to the issue of inequitable conduct. They argue that the facts relating to the offers made to Gulfstream, Collins and predecessor Honeywell, the George demonstration flight, the resulting article and the other pre-critical date "show and tell" flights are material to the

question of patentability. They also contend that collectively, the true nature and scope of these activities is also material.

Since the inventors played a central role in the development process, they were aware of the status of EGPWS, and thus their inventions, prior to the critical date. Bateman was the manager of the Flight Safety Systems group responsible for the development of EGPWS and the chief architect of the demonstration flight program. Muller developed the look ahead algorithms; Conner wrote the software and software code; Johnson engineered the interface between software code and the hardware, focusing largely on the terrain and accident databases and either Conner, Johnson or both participated in Honeywell's demonstration flights by operating the laptop prototype. Both Conner and Johnson attended the George demonstration flight. However, no inventor filed a declaration addressing the status of the EGPWS prototype or the activities related to the flight demonstrations and the interactions with third parties, including Gulfstream.

The offers to sell EGPWS to Gulfstream, Collins and Honeywell Inc. occurred prior to the critical date. Frank Daly, Vice President and General Manager of the Flight Safety Systems Division during the relevant time period, was directly involved in the negotiations with Gulfstream, Collins and Honeywell Inc., and was familiar with the demonstration flights. In fact, he often accompanied the representatives of the airplane manufacturers and members of the National Transportation Safety Board on several of those flights. In support of its patent application, Honeywell submitted declarations from

Daly and Alan Torget.[65] Mr. Torget was a mechanic for the King Air aircraft.

Universal and Sandel question Daly's verified statement filed in support of the '080 patent application. Although Daly was a high-level executive during the relevant time period, he was not a member of the EGPWS development team and was not responsible for the implementation of the system. He did have overall responsibility for the engineering of EGPWS and to ascertain whether the system was reliable and safe.

Nevertheless, Daly's verified statement confirms his supervisory responsibility for the development and certification of the claimed invention. He describes the invention as providing pilots with additional ground proximity warning capabilities which takes into account human factors to ensure that the invention met its design objective of enhancing flight safety. He notes that prior commercial use was needed to obtain regulatory approval. Thus, his statement confirms that any flight testing on King Air was necessary for feedback on the human factor concerns, for regulatory approval and to assess the overall effectiveness of the invention in the operational flight environment.

Moreover, his verified statement substantiates that flight testing began in March 1993, during which time, various prototypes of the claimed invention were demonstrated. He states that attendees of the flights were briefed and debriefed by Honeywell personnel, and notes that the attendees completed a questionnaire after landing. This information was reviewed at the weekly engineering/design meetings and

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[65] The law firm of Fitch, Even, Tabin & Flannery filed the '080 patent on July 31, 1995. Shortly thereafter, the prosecution was conducted by Jeanne Suchodolski of the Honeywell (then AlliedSignal) legal department. Her associate power of attorney was filed October 27, 1995. While nominally still involved with the application, after October 27, 1994, no further filings were made by the Fitch Even firm and prosecution was conducted solely by Suchodolski and the Honeywell legal department.

used to further develop the design of the claimed invention. His verified declaration also references the July 7, 1994 correspondence sent to Gulfstream and the claimed invention's use on aircraft, including the Gulfstream V.

Alan Torget was the mechanic responsible for maintaining the King Air aircraft and for keeping the necessary paperwork current as required by the FAA for flight authorization. He is neither an inventor of the patents-in-suit, and had no direct involvement in the development of EGPWS nor any knowledge of the underlying algorithms used in the laptop prototype. However, Torget submitted a declaration to the Patent Office during the prosecution of the '080 patent, in which he states that King Air was an "experimental" aircraft under applicable FAA regulations. During his deposition, he testified that King Air was frequently used for marketing and "show and tell" flights.

Both the Daly and Torget declarations were included with the Information Disclosure Statement ("IDS") submitted and signed by Suchodolski.[66] In the IDS, she repeated the characterizations from the Daly declaration that the information gathered during the demonstration flights were required to complete the development and perform certification tests on the invention. However, Suchodowski did not include with the IDS copies of any documents, such as the materials concerning the Gulfstream and Collins negotiations. Nevertheless, Honeywell made an affirmative disclosure to the Patent Office regarding the Gulfstream and Collins proposals. The Daly declaration specifically references the Gulfstream negotiations, but not the negotiations with Collins and former Honeywell, as an incomplete invention under development. The Canadair

[66] *See* JTX 398.

Global Express proposals are cumulative to the negotiations with Gulfstream that were disclosed and which resulted in a final agreement.

In light of the information disclosed to the examiner, Sandel and Universal have not shown that any material misstatement or omission by Honeywell during the prosecution of the patents-in-suit was made with an intent to deceive. In his affidavit, Daly references the King Air demonstration flights and explains that Honeywell collected information from these flights for review. The Torget declaration notes the significance of the "experimental" designation of the flight demonstration tests. The failure to disclose the George article does not negate the fact that the demonstration flights were fundamentally experimental in nature. Additionally, the article does not contradict the submitted declarations.

Finally, there is no indication that Honeywell intended to deceive the examiner by submitting the declarations of Daly and Torget rather than from the inventors. While a declaration from an inventor may have been helpful during prosecution, it is not required and the absence of an inventor's declaration in this instance does not constitute inequitable conduct.

VI. Obviousness

Universal and Sandal argue that the inventions, specifically the challenged claims concerning the "look ahead" algorithm, at the time of the filing of the patents-in-suit were obvious to one of ordinary skill in the art under 35 U.S.C. § 103. Using claim 1 of the '080 patent as a representative claim, they rely upon the combination of U.S. Patent No. 5,488,563 by Xavier Chazelle, *et al.* ("Chazelle"), filed April 12, 1993, and

the George article published in the June 1994. In the alternative, Universal and Sandel assert that the combination of the Chazelle patent and the 1991 article authored by Donald Bateman titled, *How to Terrain-Proof the World's Airline Fleet*, make the challenged claims of the patents-in-suit obvious.[67] Specifically, Universal and Sandel contend that it was obvious to one of ordinary skill in the art to substitute the vertical margin in the alert envelopes of the challenged claims for the vertical margin having the shape of the terrain clearance floor as disclosed in either the Bateman or George articles because of the teachings of Chazelle. This argument is based, in part, on Gibson's opinion that the motivation and teachings in Chazelle, which sought to solve the problem of alerting near an airport, and the George article, which discloses that terrain databases become more accurate as aircraft approach the airport. Honeywell contends that for one of ordinary skill to be motivated to combine these references depends upon hindsight and a mischaracterization of their teachings.[68]

In general, a patent is invalid as obvious "if the differences between the claimed subject matter and the prior art are such that the claimed subject matter would have been obvious to one of ordinary skill in the art at the time of the alleged invention." 35 U.S.C. § 103 (1988). The obviousness inquiry requires that an invention must be judged not only as a whole, but from the perspective of one of ordinary skill in the art, and must be assessed as of the time of the invention. *See Eaton Corp. v. Parker-*

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[67] Both the Chazelle patent and the 1991 Bateman article were before the examiner during the prosecution of the patents-in-suit. However, the examiner was not privy to the George article at that time.

[68] As noted previously herein, it is undisputed by the parties that one of ordinary skill in the relevant art has a bachelor's degree in engineering, such as aeronautical or electrical engineering, and two years experience in avionics or avionics testing.

Hannifin Corp., 292 F.Supp. 555, 577 (D. Del. 2003) ("Clear and convincing evidence must exist to show that "the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.").

In determining whether a patent is obvious the court must consider: (1) the scope and content of the prior art; (2) the differences between the prior art devices and the claimed invention; (3) the level of ordinary skill in the art; and (4) secondary considerations, such as, commercial success, long-felt need, failure of others, and copying. *See Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). Evidence of secondary considerations, however, is relevant only if the patentee shows a nexus between the secondary considerations and the patented invention. *See Avia Group Int'l, Inc. v. L.A. Gear Calif., Inc.*, 853 F.2d 1557, 1564 (Fed. Cir. 1988); *Ashland Oil, Inc. v. Delta Resins & Refractories,* Inc., 776 F.2d 281, 301 (Fed. Cir. 1985). Moreover, a challenger's burden of proof is particularly high when the alleged invalidating material was reviewed by the patent examiner. *See Rhenalu,* 224 F. Supp.2d at 800.

An obviousness analysis begins with an evaluation of the state of art at the time of the claimed invention. *See Sensonics, Inc., v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996). It is improper to use the patents-in-suit as a guide through the prior art. *See Monarch Knitting Mach. Corp. v. Sulzer Morat GMBH*, 139 F.3d 877, 882 (Fed. Cir. 1998); *see also, Crown Operations Int'l Ltd. v. Solutia, Inc.,* 289 F.3d 1367, 1376 (Fed. Cir. 2002) (holding that obviousness cannot be based on the hindsight combinations selectively culled from the prior art).

Universal and Sandel argue that the Chazelle patent teaches virtually every

limitation of the ‘080 patent claim 1, including a vertical margin as part of its alert envelopes. According to Universal and Sandel, the only limitation not taught by Chazelle is that the size of the vertical margin should be proportional to the distance to the closest runway, which is a requirement of the claim term, terrain floor boundary. They rely on Gibson’s testimony that each limitation of claim 1 of the ‘080 patent is found in the Chazelle patent, except for terrain floor boundary. However, his testimony provides no background or information regarding the prior art in general or what the propounded prior art discloses. He does not elaborate on what the Chazelle patent discloses or teaches to one of ordinary skill in the art at the time of the invention. His analysis is merely a comparison of the limitations in the patents-in-suit with the terms in Chazelle.

Dr. Hansman identifies a vertical margin which varies with the distance to a runway, as being a significant contribution to the prior art and notes that the description of the vertical margin set forth in the Chazelle patent is unclear and inconsistent. He also agrees that Chazelle does not disclose the terrain floor boundary limitation as previously construed by the court.

Since Chazelle does not disclose terrain floor boundary as required in the patents, Universal and Sandel argue that this claim term is found in both the Bateman and George articles. They rely on Gibson who equates terrain floor boundary with terrain clearance floor discussed in the aforementioned publications. However, Gibson does not explain how one of ordinary skill in the art would understand the term in either reference. Further, neither the 1991 Bateman article nor the 1994 George article

disclose technical details regarding how the terrain clearance floor functions.

According to Dr. Hansman, fundamental differences exist between terrain clearance floor depicted in the Bateman and George publications and terrain floor boundary set forth in the ‘080 patent. Dr. Hansman concludes that the terrain clearance floor is a fixed envelope or geometrical construct above the runway, which, unlike terrain floor boundary, does not involve the sensing of terrain or alerting the aircraft to the proximity of the terrain. Terrain floor boundary, as distinct from terrain clearance floor, provides a vertical margin either below the aircraft or above the terrain, which varies in proportion to the distance to the runway as depicted in Figure 6 of the ‘080 patent.

Universal and Sandal contend that Dr. Hansman’s opinion is contradicted by other evidence presented at trial. They point to the George article, which notes that, “the [terrain clearance floor] function provides a graduated series of warning buffers over the terrain elevation contours within the 30-mile radius from the airport.” They emphasize Gibson’s interpretation that the above phrase means that the terrain clearance floor is a margin (or buffer) above, and, in reference to, the elevation of the terrain. Gibson opines that the only difference between the terrain clearance floor in the George article and the terrain floor boundary in the ‘080 patent is that, in the George article, reference is to the runway, while in the ‘080 patent, reference is to the aircraft.

Universal and Sandal also rely on the Gulfstream proposal and the May 19, 1994 demonstration software in support of their interpretation of the George and Bateman references. However, neither the proposal nor the software reveal how one of ordinary

skill in the art would have understood the concept and functioning of the terrain clearance floor as disclosed in these articles.

Additionally, Gibson opines that the concept of adding “lateral boundaries” to the alert envelopes, as recited in the ‘592 patent claim 1, is taught in the Chazelle patent. Moreover, according to Gibson, the specific embodiments of lateral boundaries disclosed in the specification and in claim 8 of the ‘592 patent are found in U.S. Patent No. 4,224,669 (“Brame ‘669"). Dr. Hansman describes the system in Brame ‘669, as an alerting device “based on a comparison between the aircraft’s measured altitude and a database of predetermined minimum safe altitudes.” Therefore, Brame ‘669 does not address the expansion of the look ahead area to compensate for errors in the lateral position.

Universal and Sandel’s piecemeal analysis starts with the patent, and then compares it to the prior art, essentially employing a hindsight approach. Using the ‘080 patent as a guide, Gibson identifies every limitation of the patent in Chazelle, with the exception of the terrain floor boundary. In light of this missing element, Gibson surmises that the limitation is found in the Bateman and George articles by contending that the shape of the terrain floor boundary was the same shape as the terrain clearance floor. However, these references do not disclose the technical bases of the function of the terrain clearance floor. Moreover, there is no evidence as to why one skilled in the art would be motivated by Chazelle to look to either the Bateman or George publications. The Chazelle invention attempts to provide a solution to the CFIT problem without a terrain floor boundary as required in the inventions.

In contrast to the patents-in-suit, the terrain clearance floor, described in the Bateman article and the George article, does not include a terrain database or a prediction of the position of the aircraft. Rather, the terrain clearance floor is directed to improving alerts through a geometric construct around the airport that defines the minimum safe clearances in the direct vicinity of the airport. The Bateman article depicts the terrain clearance floor as an extension of the GPWS floor, that is, as an extension of the downward looking radio altimeter system. The terrain clearance floor illustrated in the George article is a geometric construct defined by the airport. Although Chazelle recognizes a vertical margin, it does not reference the vertical margin as proportional to the distance to the closest runway. Similarly, the Bateman and George publications do not reference the vertical margin through the terrain clearance floor. There is no teaching in any of these prior art references to relate a terrain database to the shape of the terrain floor. No explanation is provided by Universal and Sandel as to why or how one of ordinary skill in the art would integrate these references and result in the inventions in the patents-in-suit.

Finally, the secondary considerations undermine any claim of obviousness. EGPWS has been highly successful, both commercially and in preventing CFIT incidents. The prior system, GPWS, could not prevent many CFIT accidents, which remained the leading cause of air transport fatalities. Warnings generated by prior art systems were based on flight conditions of the aircraft and did not employ navigational information. They did not look ahead. They just looked down because they relied on radio altitude. As a result, their warning times were very limited. Claim 1 of the ‘080

patent addresses these concerns since it allows a pilot to "see" ahead to respond to potentially threatening terrain. Despite initial skepticism, the aviation industry now recognizes the contribution of EGPWS to air safety. Thus, Universal and Sandel have not proven by clear and convincing evidence that the challenged claims of the patents-in-suit are obvious in light of the prior art.

VII. Best Mode

Sandel asserts that Honeywell's patents should also be held invalid under 35 U.S.C. § 112 for concealment of the best mode of practicing the invention. A patent specification must "set forth the best mode contemplated by the inventor of carrying out his invention." 35 U.S.C. § 112 (1975). Information that should be disclosed under the best mode requirement includes the inventor's preferred embodiment or preferences that materially affect how the invention is used. *See Bayer AG v. Schein Pharm., Inc.*, 301 F.3d 1306, 1316-18 (Fed. Cir. 2002); *United States Gypsum Co. v. Nat'l Gypsum Co.*, 74 F.3d 1209, 1213 (Fed. Cir. 1996); *Chemcast Corp. v. Arco Indus. Corp.*, 913 F.2d 923, 928-29 (Fed. Cir. 1990), *Dana Corp. v. IPC Ltd. P'ship*, 860 F.2d 415, 418-20 (Fed. Cir. 1989).

In order to find that the best mode requirement is not satisfied, it must be shown that the applicant knew of and concealed a better mode than disclosed. *See Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384-85 (Fed. Cir. 1986). Courts address the best mode analysis as a two prong inquiry. Sandel bears the burden of proving by clear and convincing evidence that the inventors possessed a best mode for practicing the invention at the time of filing the patent application and the written

description did not disclose the best mode to allow its practice by one reasonably skilled in the art. *See Eli Lilly & Co. v. Barr Labs, Inc.*, 251 F.3d 955, 963 (Fed. Cir. 2001). The first prong is a subjective inquiry, focusing on the inventor's state of mind at the time of filing, while the second prong is objective. *Id.* The law does not require that an applicant describe every conceivable and possible future embodiment of his invention. *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1121 (Fed. Cir. 1985). The fact that a commercial embodiment ultimately includes a particular mode is not evidence that the approach was the inventor's best mode at the time of the application. *Engel Indust. Inc. v. Lockformer Co.*, 946 F.2d 1528, 1533 (Fed. Cir. 1991).

The effect of the failure to disclose the best mode is to render the patent invalid. 35 U.S.C. § 112, ¶ 1; *see also, United States Gypsum Co.,* 74 F.3d at 1215-16. For purposes of best mode analysis with respect to a common subject matter, both continuation applications and continuation-in-part applications are evaluated as of the date of the parent application. *See Transco Prod., Inc., v. Performance Contracting, Inc.*, 38 F.3d 551, 555-56 (Fed. Cir. 1994); *Key Pharm., Inc. v. Hercon Lab. Corp.*, 981 F.Supp. 299, 316 (D.Del. 1997).

The inventions recited in the challenged claims of the patents-in-suit generally relate to providing alerts to the pilot of an aircraft of potentially dangerous proximity to terrain. The claimed alerting system stores terrain data in a database, uses look ahead algorithms to define an alert envelope, and compares this alert envelope to the stored terrain to determine if a warning should issue. The independent claims of the '080 patent define two alert envelopes, with each envelope being determined as a function of

look ahead distance, flight path angle and terrain floor boundary.

The look ahead envelope may include a single “threat detection vector” projecting in front of the aircraft along the aircraft’s ground track. The claims of the ‘570 patent encompass all the limitations of the independent claims of the ‘080 patent and requires that the alerting system present to the pilot a visual display of the terrain in the vicinity of the aircraft. The claims of the ‘592 patent encompass all the limitations of the independent claims of the ‘080 patent and require that the alerting system further define its alert envelopes to include lateral boundaries to the sides of the ground track. These lateral boundaries are intended to “widen” the look ahead area to account for errors in lateral position. The claims of the ‘060 patent are directed to a system that provides a display of terrain that “pops-up” automatically on a cockpit display under certain conditions, for example, in the event of a terrain alert. The challenged claims of the ‘060 patent include “means-plus function” limitations, which correspond to the look ahead alerting limitations in the ‘080 patent. The claims of the ‘009 patent are also related to terrain displays. Like the ‘060 patent, the challenged claims of the ‘009 patent contain limitations that correspond to the look ahead alerting limitations in the ‘080 patent.

One possible feature of a look ahead system is the ability of the system to “look into the turn.” At a basic level, looking into the turn means that the alert envelope is expanded or altered to bias it in the direction that the airplane is turning. There is no disclosure in the ‘080 patent of such a “looking into the turn” technique. The ‘080 patent specification discloses fixed alert envelopes having either a single threat detection

vector along the ground track or a group of vectors which include lateral boundaries on either side of the ground track of the aircraft.[69]

In support of its best mode defense, Sandel argues that, in general, a looking into the turn feature would be an improvement over a look ahead system with a "static" alert envelope (an alert envelope that does not change to account for turns) since it provides advanced warning to a pilot of possibly turning into terrain. Gibson confirms that looking into the turn, regardless of the specific method used, is better than fixed envelopes in a look ahead alerting system. Moreover, the evidence offered by Honeywell suggests that looking into the turn was considered during the development of EGPWS, and was acknowledged as an improvement over a fixed alert envelope.

Sandel contends that looking into the turn may be accomplished in a look ahead system that has a single threat detection vector, such as the vector described in the '080 patent. At trial, Conner confirmed that the inventors of the patents-in-suit explored three approaches of looking into the turn. The three "looking into the turn" methodologies considered were: (1) using the fixed shape look ahead envelope and rotating it beyond the ground track angle by a predictor, (2) causing the look ahead envelope to "walk along a curved path" in front of the aircraft, and (3) "slipping" the shape of the alert envelope laterally so that it is skewed toward the turn.

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[69] The applications of the '009 patent, the '060 patent, the '592 patent and the '570 patent (filed July 30, 1996, September 2, 1997, May 9, 1998 and June 19, 1998, respectively) are continuations-in-part to the application of the '080 patent. None contain any disclosure of looking into the turn. The specifications in the four patents are identical to the specification of the '080 patent regarding the look ahead alerting envelopes and algorithms. As such, the best mode argument of looking into the turn is applicable to all claims of the patents-in-suit since they contain and rely on the look ahead alerting limitations.

In Design Notes III, two alternatives for looking into the turn are addressed. Further, Design Notes IV comments that "from recent flight tests . . . there is no good evidence that looking ahead along the turn radius rather than straight ahead when turning will reduce 'Nuisance' warnings enough to warrant to build in a more complex circular look ahead vector." These notes depict and describe a new "trident" look ahead vector at figure WX-45, which is Figure 35 in all the patents-in-suit. This trident feature is also disclosed in each of the specifications.

The above facts establish that Honeywell considered looking into the turn during mid-1994 and decided by early 1995, well in advance of the filing of any of the patents-in-suit, to use the trident look ahead vector as depicted in Design Notes IV Figure WX-45 and Figure 35 in the patents, rather than developing a more complicated vector. Eventually, after the filing of the '080 patent, "rotating a fixed shape by leading into the turn" was the approach used for the looking into the turn feature.

It was not until September 1995, however, that the look ahead vector changed from the trident method to rotating a fixed shape approach. George Lyddane, a former official with the FAA, worked with Honeywell on the certification of EGPWS. On several occasions, while in the employ of the FAA, he flew on King Air. Lyddane testified that Honeywell added the looking into the turn functionality to its alert logic and implemented it on King Air by September 1995. During the pre-flight discussions for a flight in September 1995, Honeywell engineers explained the "turning logic" in the system and confirmed its functionality during the flight by demonstrating it "qualitatively" with examples of turning toward terrain. On all certification flights for the system, including

two that occurred in 1996, Lyddane testified that looking into the turn was always a feature of the EGPWS look ahead algorithms. However, his awareness of this feature of EGPWS occurred after the filing date of the '080 patent.

Although the inventors considered "looking along turning circles," this concept was rejected before the filing of the '080 patent because it was computationally too complicated. No testimony was present that, prior to the filing date of the '080 patent, the inventors conceived of the looking into the turn enhancement *and* considered it better than fixed alert envelopes. Rather, at the time of filing the '080 patent, the inventors determined that the trident look ahead vector was the best mode of practicing the invention. This best mode is disclosed in the '080, '009, '060, '592 and '570 patent specifications. As a result, the challenged claims of the patents-in-suit are not invalid based on the absence of best mode.

VIII. Sandel's Unclean Hands Defense and Universal's Commercial Counterclaims

Sandel asserts that Honeywell's actions constitute misconduct, which precludes Honeywell from profiting from its own "unclean hands." Sandel's unclean hands defense is based on two separate arguments. The first is characterized by an alleged pattern and practice of misrepresentation in securing the patents and the manner in which they were enforced. Sandel argues that Honeywell's material misrepresentations to the PTO regarding the nature and extent of its commercial activity prior to the critical date allowed Honeywell to improperly obtain its patents by concealing the best mode for practicing its inventions. Further, according to Sandel, Honeywell

leveraged its industry power to influence the content of the Technical Standard Order ("TSO") of the FAA, by fashioning it to conform with its existing EGPWS product, and then, carefully concealing that reasonable compliance with the TSO would expose competitors to patent litigation. Finally, Sandel contends that Honeywell encouraged both Sandel and Universal to enter the TAWS marketplace with calculated omissions and misrepresentations, only to sue once the competitive landscape was established.

The second category of misconduct urged by Sandel which evidences unclean hands occurred immediately prior to and during this litigation. Sandel argues that Honeywell failed to undertake any reasonable effort to determine if Sandel and Universal actually infringed its patents before filing suit. Furthermore, it argues that Honeywell compounded this failure by continuing to vigorously litigate this action without any legal or factual basis for infringement or to avoid invalidity.

Honeywell knew that the vast majority of TAWS systems would have to be purchased by the March 2005 compliance date to comply with the FAA's mandate. Accordingly, Sandel contends that this litigation was commenced to stifle competition and allow Honeywell to maintain its dominant market position through the compliance date. As a result, Sandel argues that equity demands that Honeywell's misconduct and misrepresentations preclude enforcement of its patents.

Similarly, Universal argues that Honeywell filed the present lawsuit in bad faith with the knowledge that its patents were invalid under § 102(b) and unenforceable due to inequitable conduct, as part of an overall scheme to monopolize the market and for the purpose of interfering with Universal's actual and prospective business relations.

Relying on internal Honeywell documents, which identify Universal as the "first viable threat" to the EGPWS enterprise, Universal contends that this infringement litigation was solely motivated to directly harm Universal's presence in the TAWS market. Universal's economist, Richard Gering, calculated the potential market for TAWS to include approximately 18,695 aircraft through April 2005. According to that data, Honeywell estimated that Universal would capture between 30-50% of the business and general aviation segment. Based on historical performance and its existing capacity to supply, Universal projected acquiring 15-25% of that TAWS market.

Universal asserts that Honeywell employed negative publicity and the current litigation to disrupt its business relations with potential customers, such as Rockwood Collins, which terminated negotiations for a large purchase of Universal's TAWS device after this action was instituted. Moreover, Honeywell allegedly foreclosed competition and maintained its 98 -100% market share monopoly with a campaign of predatory and anti-competitive behavior. Because of its overall market share, Universal argues that Honeywell has demonstrated the ability and intent to raise prices, restrict entry into the market, maintain market share and discriminate with impunity in the relevant TAWS market. As a result, Universal has been unable to capture any reasonable market share and its lost profits are the consequence of Honeywell's anti-competitive behavior.

In the late 1990s,[70] the FAA issued for public comment, a draft of a technical document known as a TSO relating to terrain awareness and warning systems. The

[70] The involvement of the FAA in the TAWS arena did not occur before the filing of the '080 patent on July 29, 1995.

TSO establishes the minimum performance standards required of a TAWS to obtain FAA approval for installation into certain aircraft. The FAA also issued a draft rule, or mandate, which requires certain aircraft to have a TSO-compliant TAWS installed no later than March 29, 2005. TSO-C151, titled "Terrain Awareness and Warning Systems," issued on August 16, 1999, was later amended, due to some technical revisions, as "TSO-C151a" on November 29, 1999.

At the request of the FAA, Honeywell participated in the creation of the TAWS TSO. At the time of the TSO drafting process, Universal marketed a TAWS device, and interacted with the FAA regarding TAWS TSO under consideration. No evidence was offered about Sandel's interaction with the FAA during this period. None of the Honeywell employees, who testified at trial, discussed the patents-in-suit with the FAA. The '080 patent issued on November 17, 1998, more than ten months before TSO-C151 was promulgated on August 16, 1999 and over one year before TSO-C151a was enacted on November 29, 1999.

Universal asserts that Honeywell intentionally failed to disclose to the FAA the existence of several pending patent applications, which subsequently became the patents-in-suit, during the setting process for TSO-C151a. Moreover, Universal contends that Honeywell did not purchase, review or analyze a Universal or Sandel TAWS unit, nor speak with anyone at Universal or Sandel about the features or functionality of their respective TAWS devices before instituting this action.

Further, at the sixth annual industry conference in May 2001, on an invitation from Honeywell, Sandel and Universal gave detailed presentations regarding their

TAWS products. At no time after their presentations or during the conference did Honeywell mention its patents or patent applications or claim that either system infringed. Honeywell filed the present action one year later on May 10, 2002.

Unclean Hands

Sandel asserts that Honeywell's conduct has infected every aspect of this case, beginning with its calculated effort to mislead the Patent Office regarding the nature and extent of its pre-critical date commercial activity and public use and continuing through its maintenance of this litigation without any reasonable legal or factual basis. To prove the defense of unclean hands, Sandel must show that Honeywell "conducted [itself] so as to shock the moral sensibilities of the judge," *Gaudiosi v. Mellon*, 269 F.2d 873, 882 (3d Cir. 1959), or stated otherwise, that Honeywell's conduct was "offensive to the dictates of natural justice." *Aptix Corp. v. Quickturn Design Sys. Inc.*, 269 F.3d 1369, 1375 (Fed. Cir. 2001). "One who comes in equity must come with clean hands and keep those hands clean throughout the pendency of the litigation even to the time of ultimate disposition by an appellate court." *Gaudiosi,* 269 F.2d at 881; *see also, Aptix Corp.,* 269 F.3d at 1376 (quoting *Keystone Driller Co. v. General Excavator Co.*, 290 U.S. 240, 245 (1933). ("[Courts of equity] apply the maxim requiring clean hands only where some unconscionable act of one coming for relief has immediate and necessary relation to the equity that he seeks in respect of the matter in litigation.").

A fundamental principal upon which equity jurisprudence is found is that before a complainant has standing in court, he must not only show a good and meritorious cause

of action, but also must come into court with clean hands. Therefore, the complainant must be honest with the court. Everything that enables a full and fair determination of the matters in controversy should be placed before the court. *See Keystone*, 290 U.S. at 244. The governing principle is that if a party, who sets the judicial machinery in motion to obtain a remedy, violates conscience, good faith or any other equitable principle "then the doors of the court will be shut" and the court will refuse to acknowledge his right to any remedy. *Aptix Corp.*, 269 F.3d at 1375 (quoting *Keystone*, 290 U.S. at 244-245). The clean hands maxim gives broad discretion to the court's equity power in refusing to aid an unclean hands litigant. *See Gaudiosi*, 269 F.2d at 881. It is not related to the liabilities or claims of the parties, nor fettered by the absence of actual damages. The court is not bound by any formula, restraint or limitation which restricts the free and just exercise of its equitable discretion. *Id.* at 882. Any willful act, which can rightfully be said to transgress equitable standards, is sufficient. *See Precision Instrument Co. v. Automotive Maintenance Mach. Co.*, 324 U.S. 806, 815 (1945). If the wrongdoing occurs during the prosecution of the patent, in the furtherance of obtaining a patent right, then it can render the patent unenforceable. Alternatively, if unclean hands occurs during litigation, it bars any recovery by the offending party. *Aptix Corp.*, 269 F.3d at 1376. The unclean hands doctrine provides a defense to an otherwise valid legal claim when a plaintiff has engaged in "unconscionable" conduct that "has immediate and necessary relation to the equity that [the claimant] seeks in respect of the matter in litigation." *Keystone*, 290 U.S. at 245.

The court does not find that Honeywell engaged in unconscionable conduct

regarding its activities with the FAA during the creation of the TSO nor during the 2001 conference on CFIT. As noted previously herein,[71] neither Sandel nor Universal offer adequate proof that Honeywell consciously and affirmatively sought to mislead the PTO by failing to disclose the full extent of its activities to sell or publicly use its invention prior to the critical date. No sufficient evidence has been presented that Honeywell intentionally withheld the best mode of practicing its inventions, or intended to deceive the PTO by its declarations.

In regard to the TSO, Sandel has not adequately proven that Honeywell's actions demonstrated an intent to employ its influence or political power to attain improper objectives. Honeywell was involved in the TSO drafting process, along with Lyddane and other FAA officials. Such involvement does not constitute unclean hands. Entities have the right to express their views to government agencies regarding the creation and enforcement of rules and regulations. Determination of the propriety of such opinions *cannot* properly be dependant merely upon the exercise of that right. To seek a positive or beneficial response from regulatory agencies that results in a disadvantage to competitors is neither unusual nor illegal. *See Eastern Railroad Presidents Conference v. Noerr Motor Freight, Inc.*, 365 U.S. 127, 136-137 (1961); *applied to actions of administrative agencies, in Cal. Motor Transport Co. v. Trucking Unltd.,* 404 U.S. 508 (1972).

As Lyddane acknowledges, before the issuance of the TSO, Honeywell had installed numerous EGPWS devices in commercial aircraft "with the FAA's blessing and

[71] *See* discussion of *Inequitable Conduct* at pg. 59.

certification." He fully understood that Honeywell had a completely legitimate interest in trying to ensure that when a TSO issued, it would not have to modify the system previously certified. The FAA *asked* Honeywell to actively participate in the TSO process, in part because Honeywell had developed a commercially successful system long *before* a TAWS TSO was enacted. Further, all potential manufacturers of TAWS were aware of the FAA regulatory process, as well, as the proposed TAWS TSO and were given the opportunity to comment and object to its content.

Moreover, Sandel and Universal knew or should have known of the Honeywell patents as of the 2001 conference. By May 2001, all five patents-in-suit had issued, and the '080 patent had been issued for over two years. In fact, Sandel's President, Gerald Block, acknowledged that he knew of the Honeywell patents by early 2000. Sandel failed to provide any evidence that it detrimentally relied upon Honeywell's one year of silence after the May 2001 conference. Although a patentee is generally required to conduct a reasonable investigation prior to initiating an infringement suit in good faith, that does not necessarily require the patentee to reverse engineer a competitor's product to determine if it infringes. Universal and Sandel provided details of their TAWS products during the 2001 CFIT conference when they knew or could have easily known of the Honeywell patents.[72] Based on the previous findings herein and the standard under the unclean hands doctrine, the court finds that Honeywell's

[72] Implicit in Sandel's argument is since Honeywell was unsuccessful in prosecuting its infringement claims, Honeywell performed an inadequate investigation before initiating this action and improperly pursued its claims. A similar rationale could be applied to Sandel and Universal's affirmative defenses of obviousness and inequitable conduct. Furthermore, it is not the law. *See* analysis under *Commercial Counterclaims* herein.

conduct is neither unconscionable nor misleading.

Universal makes a similar claim that Honeywell did not perform a reasonable, good faith investigation prior to initiating this infringement litigation in support of its commercial counterclaims of an attempt to monopolize under § 2 of the Sherman Act, tortious interference, and unfair competition. The analysis set forth under the heading *Commercial Counterclaims* is incorporated herein as it is applicable to Sandel's unclean hands defense.

Commercial Counterclaims

As noted above, Universal contends that Honeywell filed the present lawsuit in bad faith, as part of an overall scheme to monopolize the TAWS market, and to interfere with Universal's actual and prospective business relations. Universal, as the party alleging sham litigation, must first demonstrate that the patentee's suit was objectively baseless. Only after this determination may the court consider the party's subjective motivation in bringing the suit.

Universal argues that Honeywell filed its infringement suit in bad faith. "[A] patentee's infringement suit must begin with the long-established principle that "a patentee's infringement suit is presumptively in good faith and . . . this presumption can be rebutted only by clear and convincing evidence." *Handgards, Inc. v. Ethicon, Inc.*, 601 F.2d 986, 996 (9th Cir. 1979) (*"Handgards I*"). The presumption of good faith is grounded in the principles set forth in *Eastern Railroad Presidents Conference v. Noerr Motor Freight, Inc.*, 365 U.S. at 136-138, that those who petition the government for redress, are generally immune from claims of antitrust or state law liability. *Handgards*

I, 601 F.2d at 993. Under *Noerr*, to establish liability in connection with the lobbying of a government agency requires a showing that such activity was "a mere sham to cover what is actually nothing more than an attempt to interfere *directly* with the business relationships of a competitor. . . ."[73] *Noerr*, 265 U.S. at 144. (emphasis added).

The protection afforded by *Noerr* to citizens who petition the government was extended to "the approach of citizens . . . to courts" in *Cal. Motor Transport Co. v. Trucking Unlimited*, 404 U.S. 508 (1972). The standard of proof of "sham litigation" – conduct that would remove a claimant from the *Noerr* protection – was established by the Supreme Court in *Professional Real Estate Investors, Inc. v. Columbia Pictures Indus., Inc.,* 508 U.S. 49, 56 (1993) ("*PRE"*).

PRE involved a claim for copyright infringement. *See PRE*, 508 U.S. at 52-53. Similar to Universal's assertions herein, the defendant counterclaimed for violation of Section 2 of the Sherman Act and "various state-law infractions," arguing that the plaintiff's copyright action was a "mere sham that cloaked underlying acts of monopolization. . . ." *PRE*, 508 U.S. at 52. Similar to this case, the district court in *PRE* granted summary judgment against the plaintiff on its copyright infringement claim. *PRE*, 508 U.S. at 53. The judgment was affirmed by the appellate court. On remand to address the defendant's counterclaims for sham litigation, the district court granted summary judgment in favor of the plaintiff. Despite having entered summary judgment against the plaintiff on the copyright infringement claim, the court found it "clear from the

[73] *Noerr* specifically rejected the contention that antitrust liability attaches because the attempt to influence the passage or enforcement of laws or regulations was done for the sole purpose of destroying a competitor. *Noerr*, 365 U.S. at 138.

manner in which the case was presented that [plaintiff was] seeking and expecting a favorable judgement. . .” and although the underlying claims were decided against the plaintiff, “the case was far from easy to resolve. . . .” *PRE*, 508 U.S. at 53.

The judgment dismissing the bad faith litigation claims was affirmed by the Court of Appeals and by the Supreme Court in *PRE*. The Supreme Court “outline[d] a two-part definition of sham litigation,” holding that a lawsuit must be “objectively baseless in the sense that no reasonable litigant could realistically expect success on the merits” and must constitute “an attempt to interfere directly with the business relationships of a competitor . . . through the use [of] the government *process* – as opposed to the *outcome* of that process – an anticompetitive weapon.” *PRE*, 508 U.S. at 60-61. (emphasis in original). The Court acknowledged that its two-tiered process “requires the plaintiff [in the sham litigation action] to *disprove* the challenged lawsuit’s *legal* viability *before* the court will entertain evidence of the suit’s *economic* viability.” *Id*. (emphasis in original and emphasis added).

The Supreme Court in *PRE* addressed the fact that the copyright infringement claim had been dismissed on summary judgment. The Court emphasized that when the sham litigation defendant “has lost the underlying litigation, a court must resist the understandable temptation to engage in *post hoc* reasoning by concluding that an ultimately unsuccessful action must have been unreasonable or without foundation.” *PRE*, 508 U.S. at 60 n. 5 (citations and internal quotation marks omitted). The Court also urged that “[t]he court must remember” that “[e]ven when the law or facts appear questionable or unfavorable at the outset, a party may have an entirely reasonable

ground for bringing the suit." *Id.* at 60. (citations and internal quotation marks omitted).

"Probable cause" to initiate litigation does not mean, as Universal suggests, that the litigant must have clear proof on every point of a desired outcome. Rather, as the Supreme Court noted in *PRE*, "probable cause . . . requires no more than a *reasonable* belief that there is a chance that a claim may be held valid upon adjudication." *PRE*, 508 U.S. at 62-63. (emphasis added). The existence of probable cause to institute legal proceedings is an absolute defense and "irrefutably demonstrates that an antitrust plaintiff has not proven the objective prong of the sham exception." *PRE*, 508 U.S. at 63. The principles of *PRE* control Universal's allegations of bad faith litigation.

Because the principles of *PRE* are based on a First Amendment right of petition, those principles also apply to Universal's state law theories.[74]

Citing *Handgards, Inc. v. Eithicon Inc.*, 743 F.2d 1289 (9th Cir. 1974) (*Handgards II*), Universal urges that to find bad faith in the context of an infringement suit, all that is required is evidence that the patent holder knew, either at the time of filing or afterwards

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[74] *Noerr,* 365 U.S. at 138; *See Kottle v. Northwest Kidney Ctrs.*, 146 F.3d 1056, 1059 (9th Cir. 1998) ("The doctrine is a direct application of the Petition Clause, and we have used it to set aside antitrust action premised on state law.") (applying *Noerr-Pennington* doctrine to claim under Washington Consumer Protection Act); *Carroll Touch v. Electro Mech. Sys., Inc.*, 15 F.3d 1573, 1581, 1583 & n.9 (Fed. Cir. 1993) (affirming the district court's application of *Noerr-Pennington* immunity in granting summary judgment against claims of "state unfair competition and abuse of process"), *overruled on other grounds* by*, Nobelpharma AB v. Implant Innovations, Inc.,* 141 F.3d 1059, 1068 (Fed. Cir. 1998) (en banc); *Cheminor Drugs, Ltd. v. Ethyl Corp.*, 168 F.3d 119, 128 (3d Cir. 1999) (affirming the dismissal of claims for tortious interference with prospective economic advantages and unfair competition: "We are persuaded that the same First Amendment principles on which *Noerr-Pennington* immunity is based apply to the New Jersey tort claims."); *Proportion-Air, Inc. v. Buzmatics, Inc.*, 57 F.3d 1085, No. 94-1426, 1995 WL 360549 at *3 (Fed. Cir. June 14, 1995) (unpublished) (reversing the district court's refusal to grant *Noerr* immunity because of a failure to apply proper *PRE* standard: "Since the holdings on the tortious interference, abuse of process and unfair competition counts depend upon rejection of the *Noerr-Pennington* defense, we vacate those holdings as well.").

that the patents were invalid, or that they were not infringed. Universal argues that, in such cases, the patentee's infringement claims are fundamentally "baseless," and the antitrust immunity of *Noerr-Pennington* and *California Motor Transp. Co.*, does not apply. *See C.R. Bard, Inc., v. M3 Systems, Inc.*, 157 F.3d 1340, 1368 (Fed. Cir. 1998).

Universal must prove Honeywell's bad faith by clear and convincing evidence. *See Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 876 (Fed. Cir. 1985), *overruled on other grounds by, Nobelpharma AB,* 141 F.3d at 1059. A heightened burden of proof operates because a patentee's infringement suit is presumed to have been brought in good faith. *See Atari Games Corp. v. Nintendo of Am., Inc.*, 897 F.2d 1572, 1577 (Fed. Cir. 1990) ("As patents are cloaked in a presumption of validity, a patent infringement suit is presumed to be brought in good faith."); *see also, Handgards I*, 601 F.2d at 996.

Generally, a patentee must conduct a reasonable investigation into potential infringement. *See Judin v. United States*, 110 F.3d 780, 784-85 (Fed. Cir. 1997) (finding that neither patentee nor counsel made a reasonable effort to ascertain infringement prior to initiating suit). In this case, there is substantial evidence that Honeywell did so. Daly testified that at the time of the filing of the lawsuit, he had reviewed literature, publically available documents and input from TAWS customers. In addition to Daly's business knowledge of possible infringement by Universal and Sandel, Honeywell commissioned an infringement analysis by counsel before filing suit. Daly approved the filing of the lawsuit based upon information received from outside attorneys that it was very likely that the products manufactured by Universal and Sandel violated the patents-in-suit.

Concerning Universal's sham litigation claims, the objective prong of *PRE* has not been meet. While summary judgment in favor of Universal and Sandel on non-infringement and anticipation was ultimately granted, a reasonable litigant could have expected success on the merits of Honeywell's claim for patent infringement against these parties. Moreover, other objective facts support the reasonableness of Honeywell's lawsuit. Prior to litigation, Honeywell settled with the Goodrich defendants, who were originally named in this action. Additionally, Rockwell Collins, an avionic manufacturer and Honeywell competitor, was involved in negotiations with Universal concerning the possible licensing of Universal's TAWS. During those negotiations, Rockwood Collins expressed concern as to whether Universal's TAWS infringed Honeywell's EGPWS patents. In fact, Rockwood Collins requested that Universal provide a patent infringement opinion letter. While Universal did not produce such a letter, it offered an alternative that included indemnity against a lawsuit.

The expert report of Dr. Hansman also supports a reasonable basis for any litigant to expect a favorable outcome in this case. Although the court disagreed with Dr. Hansman's conclusion on infringement, there is no doubt that Dr. Hansman is highly qualified to address the technical issues in the infringement analysis. He is the head of the Division of Humans and Automation in the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology, a member of the NASA Aeronautics Advisory Committee, and a past member of the FAA Research and Development Advisory Committee. Since the early 1990's, Dr. Hansman has conducted research directly in the area of terrain alerting and is familiar with work by Honeywell

and others in the field. In fact, his research has been cited as prior art by Universal and Sandel in this case.

As discussed previously, probable cause under *PRE* does not mean that a litigant is *certain* that it will prevail at trial. Rather, it requires no more than a *reasonable belief* that an allegation *may* be deemed valid. *See PRE*, 508 U.S. at 63. Because probable cause exists, *Noerr-Pennington* compels judgment in favor of Honeywell on Universal's sham litigation claims.

While the objective prong of the sham litigation exception to *PRE* has not been satisfied, Universal also has not proven the second prong of *PRE* by clear and convincing evidence.

The question posed by the second prong of *PRE* is whether Honeywell's motive in filing suit was "to interfere *directly* with the business relationship of a competitor " by using the court or a governmental agency or process as an anti-competitive weapon. *PRE*, 508 U.S. at 60-61. (emphasis added). Universal has not cited any authority for the proposition that a reasonable pre-filing investigation requires that the patentee obtain the alleged infringer's confidential information about its device. First, this supposes that Universal and Sandel would have provided such information, which is speculative at best. Second, this ignores that the standard for filing suit is *probable cause*, and not absolute certainty.

All that is required of a litigant is to conduct a reasonable investigation prior to filing suit. A litigant is not expected to complete discovery. The law only requires a *reasonable belief* on the part of the patentee. Universal has not shown, in support of its

bad faith litigation claim, that Honeywell publicized this lawsuit to the marketplace in bad faith. Federal patent law only bars the imposition of liability against an infringer when the patentee acted in bad faith. *See Hunter Douglas, Inc. v. Harmonic Design, Inc.*, 153 F.3d 1318, 1336 (Fed. Cir. 1998). Further, because the assertion of a duly granted patent is presumed to be made in good faith, patentees are permitted to make representations about their rights even though they are inaccurate. *See Golan v. Pingel Enterprises, Inc.*, 310 F.3d 1360, 1371 (Fed. Cir. 2002). The presumption of good faith may be overcome only if the party challenging the statements can "present affirmative evidence sufficient for a reasonable jury to conclude that the patentee acted in bad faith" by clear and convincing evidence. *See Id.* at 1371. Nothing has been shown that transforms Honeywell's competitive goals into a finding of bad faith. The evidence offered by Universal and Sandel fails in this regard.

IX. Conclusion

For the reasons stated herein, the court concludes that the challenged claims of the patents-in-suit are not invalid based on obviousness, for failure to disclose the best mode, the on-sale and public use bars, or unenforceable due to inequitable conduct. Sandel's counterclaim based on the clean hands doctrine is denied. Universal's commercial counterclaims are denied. An appropriate order shall be issued and judgment shall be entered accordingly.