IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF FLORIDA
PENSACOLA DIVISION

ARCH INSURANCE COMPANY,
a Missouri corporation,

Plaintiff,

v. Case No.: 3:09-cv-395-RV-EMT

UNITED STATES OF AMERICA,
and AVENGE, INC., a Virginia
corporation,

Defendants.
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ORDER AND MEMORANDUM OPINION

This aircraft insurance subrogation case was tried before me, without a jury. After close review and careful consideration of all the evidence admitted during the trial (consisting of testimony from 16 witnesses and approximately 50 exhibits), in addition to the pre and post-trial submissions and arguments of counsel, and being otherwise fully advised, I now make the following findings of fact and conclusions of law, as required by Rule 52(a) of the Federal Rules of Civil Procedure.[1]

I. FINDINGS OF FACT

This action arises out of a plane crash that occurred at approximately 11:35 p.m. central time on the evening of July 8, 2008, at the United States Air Force's ("USAF") Hurlburt Field, near Mary Esther, Florida. The crash (or mishap) involved a Pilatus PC-12 aircraft, registration No. N901TR ("Aircraft"), which had been leased to the United States by a private company for use as a training aircraft in the 319th

[1] When used in this order and opinion, citations to the trial exhibits will be in the form "[Ex.]"; citations to the trial transcript will be "[Tr.]"; and citations to the docket will be "[Doc.]."

Special Operations Squadron ("319th SOS"). The crash occurred while the Aircraft was in the process of executing a military landing maneuver known as a "Random Shallow Approach" and it apparently encountered wake turbulence generated by a much larger AC-130U aircraft that had been flying and landing on the same runway during the same time period.[2]

The plaintiff, Arch Insurance Company ("Arch"), paid for the damage to the Aircraft (which was declared a total loss), and was subrogated to the rights of the owner. Arch alleges that the defendants, Avenge, Inc. ("Avenge"), and the United States, share responsibility for the mishap. Before discussing the facts of the case in detail, it will be helpful to describe the impressive expertise and qualifications of the several expert witnesses who provided testimony and opinions in this case, as certain of those opinions will figure prominently in my findings of fact.

Arch's Expert Witnesses

Captain Robert "Hoot" Gibson. Captain Gibson joined the United States Navy after graduating from California Polytechnic State University in 1969, went through aviation officer candidate school, and spent a total of 27 years as a Naval Aviator. He flew in two fighter squadrons (an F-4 Phantom squadron and the Navy's first F-14 Tomcat squadron), flew a combat tour in Vietnam, and served as a Navy test pilot. In 1978, he joined NASA, became NASA's Chief Astronaut, and made five trips to space aboard the Space Shuttle (one as co-pilot, the other four as mission commander). He then worked in the civilian aviation field for a number of years as a pilot (first as co-pilot, then as captain) for Southwest Airlines. Captain Gibson is

[2] Wake turbulence is the term used to describe the vortices that roll up from the wingtips of an aircraft as it passes through the air. When viewed from the rear of the generating aircraft, the left wing's vortice spins clockwise, while the right wing's vortice spins counterclockwise. The strength of the vortices is proportional to the weight of the aircraft. Accordingly, the larger (and heavier) the aircraft, the larger (and stronger) the wake turbulence.

an accomplished and experienced pilot with more than 14,000 flight hours. He has flown a lot of different aircraft, including experimental aircraft, racing aircraft, and the Space Shuttle (however, he has never flown a PC-12). Dr. Gibson was retained by the plaintiff to offer testimony on the standard of care.

Dr. Robert C. Winn. Dr. Winn is a mechanical and aeronautical engineer. He received his Bachelor's degree from the University of Illinois in 1968, his Master's degree from the same university in 1969, and his Doctorate degree from Colorado State University in 1982, all in Mechanical Engineering. He has spent more than 15 years teaching aeronautical and mechanical engineering at the USAF Academy and Colorado Technical University. Dr. Winn was a USAF pilot for 22 years, after which he became a consulting engineer with Engineering Systems, Inc. (ESI). ESI provides professional engineering services and wide range of technical support and accident reconstruction analyses. Dr. Winn has published over 70 technical papers, reports, and articles on a wide-range of issues, including aviation accident reconstruction. He was retained to provide reconstruction analysis of the events leading up to the mishap, interpret the radar data, and ultimately offer his opinion on causation.

Dr. Elizabeth Austin. Dr. Austin is a forensic consulting meteorologist. She received her Bachelor's degree in Atmospheric Science from UCLA in 1987, her Master's degree in Atmospheric Physics from the University of Nevada, Reno, in 1991, and her Doctorate in Physics from that university in 1994. She is a board certified consulting meteorologist --- which is the only certification in this country for consulting meteorologists --- and she has conducted over 700 meteorological investigations for legal matters. She was hired by the plaintiff to offer analysis of the weather and atmospheric conditions on the night of the crash.

Dr. James Hallock. Dr. Hallock is a physicist. He received each of his three degrees (Bachelor's, Master's, and Ph.D) in Physics from MIT. After working as a staff and laboratory physicist at MIT, he went to work for NASA, and, thereafter,

the Department of Transportation. He retired from the DOT in 2008 and began a private consulting firm. His primary area of expertise is aircraft wake vortices, and he has published numerous articles and technical papers on the subject. Dr. Hallock was retained by Arch specifically to rebut the testimony and opinions by the expert witness for Avenge, Robert Rivers.

Avenge's Expert Witness

Robert Rivers. Rivers graduated from the University of North Carolina with a Bachelor's in Mathematics, and from the University of Virginia with a Master's in Aerospace Engineering. He was also a Naval Aviator and a commercial pilot, and a NASA test pilot for 22 years. In total, he has over 13,000 flight hours. In addition, he has received multiple awards and authored or co-authored more than 25 papers on piloting-related issues. While at NASA, Rivers was the chief project pilot on its wake vortex testing program. He has studied wake vortices for many years, and, in order to better understand them, he helped design and construct a special research aircraft capable of penetrating wake vortices and recording information about them. This research aircraft (OV-10) is a turboprop airplane that is about the same weight and has similar handling characteristics as the PC-12. For his research, Rivers flew the aircraft and penetrated several thousand wakes generated by different types of larger aircraft (from 50 feet all the way to about 10,000 feet), including "well over a thousand penetrations behind a C-130" [Tr. 850]. Rivers was retained by Avenge to offer testimony on the cause of the mishap.

United States' Expert Witnesses

Dr. Kenneth L. Orloff. Dr. Orloff is an aviation accident reconstructionist. He holds a Bachelor's and Master's degree in Physics, and a Doctorate in Mechanical Engineering from the University of California. Shortly after receiving his Ph.D., Dr. Orloff went to work as a research scientist for NASA, where he spent the first five (of 13 total) years in its Wake Turbulence Research and Alleviation Group studying

wake flow fields and vortex decay characteristics, trying to find ways to alleviate the wake turbulence hazard. He has taught physics, engineering, aerodynamics, and aeronautics at the university level; published articles and papers on aviation-related issues; been qualified as an expert in many prior cases; and testified before the United States Congress. Dr. Orloff is also a pilot (and certified flight instructor) and has accumulated more than 8000 flight hours. He was retained by the United States to interpret the radar data and provide testimony on causation.

Joseph Lintzenich. Lintzenich is a licensed Airline Transport Pilot with over 20,000 hours of national and international flying experience. He has flown various types and sizes of aircraft, from a small single-engine to the Boeing 747-400. He, in conjunction with others, has spent about 12 years working in the area of wake vortices to understand their mechanics and devise flight standards and procedures so that pilots could better avoid wake turbulence hazards. He has authored papers and articles; made presentations before various aviation groups; and been published by the FAA in the Aeronautical Information Manual (AIM). He is currently President of Airways and Airports Consultants, Inc., an aviation consulting firm that provides, inter alia, aviation accident reconstruction. He was retained by the United States to evaluate the circumstances surrounding the mishap from the pilot's perspective and offer an opinion on causation.

After reviewing all the evidence provided by these expert witnesses, along with the evidence from the fact witnesses, I will now make my findings of fact.

The Aircraft and the 319th SOS at Hurlburt Field

1) The PC-12 is a relatively small, high performance, single-turboprop-engine, fixed-wing civilian airplane. The landing weight of the plane that crashed was estimated to be 7,500 lbs. The pilot and co-pilot seats are positioned in the front of the plane (on the right and left). The Aircraft was configured with six or seven passenger seats in the back.

2) The U-28 is the military version of the PC-12. It has a different global positioning system (GPS), a tactical and secure-capable radio, and various other military features, but otherwise the two aircraft are "basically the same" [Tr. 70-71; see also Tr. 620]. While the U-28 was the version flown in combat areas, the USAF had an ongoing conversion program in which the PC-12s were converted to U-28s. Both versions of the aircraft were flown in the 319th SOS at Hurlburt Field. Notably, for purposes of this case, the PC-12 uses VHF communication radios and the U-28 uses the military's UHF communication radio.

3) In 2008, the 319th SOS was an operational squadron in the midst of rapid growth.[3] At any given time, approximately 40% of the squadron pilots were deployed to combat theaters on a rotating basis. Colonel Jerry Wayne Haynes (the commander of the squadron) testified that the pilots were deploying 60 to 90 days, after which the pilots would return home for 60 to 90 days; "so if you were home, you were always training for your next deployment" [Tr. 644]. One of the missions of the 319th SOS during this period of time was to train and prepare pilots for combat in the U-28. However, because of the operational demands of the ongoing wars in Iraq and Afghanistan, the 319th SOS had limited training resources. Indeed, shortly after the wars began, "all the aircraft and over half of the pilots immediately went to war" [see Tr. 632]. Consequently, the USAF started to use (and rely upon) contract suppliers of instructor pilots and aircraft to keep the squadron fully staffed and operational.

4) In July 2007, Avenge contracted with the United States to provide instructor pilots for the 319th SOS [Ex. 109]. These pilots were tasked, inter alia, with teaching portions of the USAF syllabus in the PC-12. The contract purported

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[3] Lieutenant Colonel Dagvin Robert Anderson was the operations officer for the 319th SOS from August 2007 to April 2009. He testified that there were only 60 pilots in the unit when he first arrived, and there were almost 200 when he left in 2009 [Tr. 801-03].

to establish an independent contractor relationship. It specifically stated that the parties "recognize and agree that no employer-employee relationships exist or will exist under the contract between the Government and Contractor and/or between the Government and the Contractor's employees" [see Ex. 109 at § H-0009]. The contract further provided that the United States "shall not be held responsible for damages to property . . . who [sic] might occur without fault on the part of the Government as a result of, or incident to, performance of the contractor" [see id., at § H-0006].

5) Avenge provided the USAF with five or six instructor pilots under the contract. These pilots were "high quality" and "first rate"; had "great experience"; and "did an exceptional job" at Hurlburt Field [Tr. 814-15]. Because a large number of the USAF pilots during this time were following a regular operational deployment schedule in Iraq or Afghanistan --- which resulted in "long breaks" in their training and thus necessitated that they spend a lot of their flying time getting re-qualified or maintaining currency --- the Avenge pilots flew most of the training and re-qualifying flights and quickly became the primary PC-12 instructors in the 319th SOS [Tr. 803-04; 816-17]. In fact, within six months the Avenge pilots had more experience in the PC-12 than the USAF pilots, and they "were well above [those] instructors" in terms of "expertise" [see Tr. 817]. Due to the growing disparity in instructor flying experience between the Avenge pilots and the USAF pilots, the Air Force instructor pilots were eventually "restricted" from flying and instructing in the PC-12 because, as Colonel Anderson testified at trial, "honestly, [they] didn't have the expertise to do that" [see Tr. 816-17].

6) One of the experienced and "highly regarded" Avenge instructor pilots was Robert Mason "Tripp" Howard. After graduating from the Air Force Academy in 1987, Howard went to Air Force pilot training, joined the special operations unit at Hurlburt Field, and flew a number of aircraft during his military service, including

the MC-130H Combat Talon II; the Antonov 26 and 32; the DC-3; and the CASA 212. He was also an instructor pilot for these aircraft, and he separated from the military with 15 years instructor pilot experience and logged approximately 6,000 flight hours. After separating from the USAF, he went to work for Avenge, where he became a certified instructor pilot for the PC-12 [Tr. 269-79; see also Doc. 155 at 26 ¶14].

7) While Avenge was supplying the USAF with instructor pilots for the PC-12, Sierra Nevada Corporation ("SNC") was supplying the USAF with the PC-12s themselves, under a contract. This contract, along with subsequent Delivery Orders, provided that SNC would carry insurance for all the leased aircraft and, furthermore, by incorporation of a specific Defense Federal Acquisition Regulation, that the government assumed the risk of damage to, or loss or destruction of, the aircraft unless it was "covered by insurance." See 48 C.F.R. § 252.228-7001(e).

8) In June 2008, one of the SNC PC-12s was damaged during a landing. SNC found and leased a replacement PC-12 --- the Aircraft --- from its owner, the Northwest Flying Tigers, LLC, and SNC sub-leased it to the USAF as a substitute airplane. The Aircraft was included in SNC's blanket coverage under an insurance policy issued by Arch, with coverage for physical loss and damage with an agreed hull value of $3.5 million and aircraft liability. The Aircraft was thereafter assigned to the 319th SOS at Hurlburt Field.

9) During the time relevant here, training at the 319th SOS consisted of, inter alia, tactical piloting maneuvers that involve avoiding various combat threats, including what is generally known as the "Random Shallow Approach." This is a maneuver in which the aircraft approaches the airfield from a random direction at a high rate of speed (ending up on a short downwind leg of 200 knots airspeed at an altitude of 500 feet above ground level) in order to limit the time that the airplane is an exposed target, thereby reducing the possibility of encountering threats from the ground (i.e., being shot).

Wake Vortices and Turbulence[4]

10) Wakes are usually invisible and generally believed to move downward and dissipate over time. However, in tests, they can sometimes behave randomly, capriciously, and follow no set path [see, e.g., Ex. 70 at 3]. Therefore, while wake vortices may indeed roll off the wingtips and descend as they gradually dissipate, depending on numerous complex atmospheric and other conditions, they may also remain level or, in fact, rise behind the generating aircraft [see id.; accord Tr. 859].

11) The diameter of the "core" of the vortex is initially about 1% of the distance between the two vortices --- which would be approximately 75% of the wingtip-to-wingtip distance. So, for a C-130, the core would initially be about 1.0 to 1.5 feet in diameter, and gradually expanding.

12) When a smaller aircraft is following a larger aircraft during a take-off or landing, the wingtip vortex generated by the larger (leading) aircraft could bring about wake turbulence with the potential to impact the smaller (following) aircraft [e.g., Ex. 55 at 4; Ex. 65 at 2]. In and of itself, however, this is not necessarily a dangerous condition that will cause a crash. The uplifting effect of both vortices tends to push the following aircraft out of the wake vortex as it approaches from

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[4] Some of my findings of fact regarding wake vortices are taken from the two expert reports and live trial testimony of Avenge's expert witness, Robert A. Rivers. In addition to his extensive qualifications, as previously set forth above, Rivers clearly "did his homework" in this case. Specifically, in preparation for his testimony, he went up in two aircraft to try and recreate the conditions of the flight that night in order to test the opinions and hypotheses that have been offered. He first went up in a Cessna 172, and then he went up in a PC-12 that was "identical" to the Aircraft [Tr. 886-89]. During these tests, he tried "to replicate exactly --- as close as we could the exact condition of the airplane at the time plaintiffs postulate it encountered the vortex" [see Tr. 902] by, inter alia, "loading appropriate fuel" to ensure that his PC-12 was the same weight as the Aircraft at the time of the crash [id. 889]. After close and careful review of his two reports and testimony, and after observing his demeanor during trial, I found him to be both knowledgeable and very credible.

either side. Thus, hitting a vortex in the precise manner necessary to roll the plane and endanger it is very difficult [Ex. 70 at 4-5]. For that to happen, there must be enough time for the vortex to grow large enough in diameter to produce a "couple" (that is, forces on each wingtip of opposite direction) with a sufficiently large moment arm based on the strength of the wake to overcome the opposing aileron-induced rolling moment and the aircraft must hit the vortex in the precisely the right spot (core) [see id.], which is actually "very hard" to do [Tr. 859]. To be sure, the vast majority of wake encounters "are completely benign" [see Tr. 875], and a wake vortex accident is a rare occurrence.[5]

13) Nevertheless, because of the potential for danger, pilots are trained to try and avoid wake turbulence. The standard way to do so --- and the one most at issue in this litigation --- is to "fly high and land long," which means fly above the preceding aircraft's flight path and land beyond that aircraft's touch down point on the runway. For example, the FAA's Aeronautical Information Manual (AIM) states: "Pilots should fly at or above the preceding aircraft's flight path, altering course as necessary to avoid the area behind and below the generating aircraft" [Ex. 70 at 3 (quoting AIM at 7-3-2)]. In addition, the USAF uses various FAA Advisory Circulars for training and information purposes [Tr. 109-110], and Advisory Circular No. 90-23 provides that: "When landing behind a larger aircraft [on the same runway] stay at or above the larger aircraft's final approach flight path. Note touchdown point --- land beyond it." [Ex. 20 at 8]. And the Concept of Operations (CONOPS), which is "required reading" material for USAF pilots undergoing training in the 319th SOS [see Tr. 105, 180], provides that when landing behind a larger aircraft on the same runway, the pilot should: "Stay at or above the larger aircraft's final approach flight

[5] Rivers testified at trial that "you're more likely to win the Power Ball lottery than you are to be involved in a wake vortex accident" [Tr. 987].

path. Land beyond its touchdown point" [Ex. 21 at 32-33].[6]

14) It is important to note, however, that flying above the lead aircraft's flight path does not necessarily guarantee that the second aircraft will avoid the wake vortex because, as previously noted, wakes do not always descend. Instead, wakes may behave randomly, capriciously, follow no set path, and can sometimes rise. Indeed, Rivers testified that he once hit a wake vortex while flying behind a C-130 that was 500 feet above the preceding aircraft's flight path and about 7 miles entrail [Tr. 854-56]. Video of that encounter was introduced and played during trial.

15) Another way to try and avoid wake turbulence is to maintain adequate separation between the two aircraft while landing. The idea is that the vortices will roll off the wingtips of the lead aircraft and dissipate (particularly if the vortices are low and impacting the ground). At the time of the crash, two minutes of separation was recommended --- not required --- under the USAF syllabus training manual [see Tr. 296; 602]. Two minutes is the equivalent of approximately four nautical miles lateral separation with an aircraft landing speed of 120 knots. However, it was not normal or standard practice in the 319th SOS to use a clock or stopwatch to time the separation for landing [Tr. 353-54; 1026, 1038-39]. Instead, the pilots would use the visual or field separation method, whereby they would first ensure that the preceding aircraft was on final approach and passed abeam of the second airplane in the opposite direction, and then continue downwind until the runway threshold was approximately 45 degrees behind the wing before beginning the turn base leg and completing the landing pattern. At the time of the crash in this case, this was the standard method to ensure that there was adequate separation between two

[6] There was no specific training or formal program on wake avoidance in the 319th SOS [e.g., Tr. 289-92, 629-30]. Rather, the Air Force's pilots were generally told about it during basic flight training and SIMCOM, and they were expected to be aware of and adhere to the relevant sections of the AIM, advisory circulars, and CONOPS.

aircraft landing at Hurlburt Field.[7]

16) As with the "fly high and land long" method, the separation method does not necessarily guarantee that a smaller aircraft following a larger aircraft will not encounter a wake vortex. Indeed, as previously discussed, wakes are often unpredictable and can --- depending on various atmospheric conditions and other factors --- persist for up to several minutes. Rivers testified at trial, for example, that during the course of his research he encountered "strong" wakes in excess of 6 minutes and up through 8 minutes old [see Tr. 851; 918-19]. In fact, out of the several thousand wake penetrations that he made in the OV-10, he testified that the strongest wake that he ever encountered --- and the only one strong enough to have induced an uncommanded roll in excess of 90 degrees --- was left by a C-130 that was over 6 minutes old [Tr. 871].

17) In short, given their invisibility, randomness, and unpredictability, the challenge of avoiding wake vortices can be a difficult --- almost impossible --- task. The danger of encountering wake turbulence is greatly increased if the following, smaller aircraft is near to the ground, at a slow airspeed, and already in a rapid rate of descent --- exactly the conditions set up by flying in a random shallow approach.

The Crash

18) On the night of July 8, 2008, the weather conditions at Hurlburt Field were clear, stable, and generally not a problem (at least not in terms of ceiling and visibility) [Tr. 280, 465, 471]. However, there were consistent light southeasterly surface --- or "light quartering" --- tail winds of approximately 3 to 5 knots, varying between 140 and 160 degrees, up to 1,200 feet altitude [see Tr. 465-66]. Notably,

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[7] The fly high and land long method is independent of the visual separation method. This is because, if the pilot stays above the flight path of the lead aircraft and lands beyond its touch down point on the runway, the pilot generally does not worry about separation as the paths will not (ordinarily) cross, and thus separation "doesn't make any difference" [see Tr. 780-81; see also Tr. 406].

however, the designated runway in use at Hurlburt Field that evening was Runway 36 instead of Runway 18. As a result, the aircraft were not landing into the wind, but were landing with a light quartering tailwind. Everyone appears to agree in this case that the atmospheric conditions that night were "ideal" for the formation (and persistence) of wake turbulence [see, e.g., Tr. 406-07, 471-73; see also Tr. 329]. In fact, in an atmosphere like there was on the night of the mishap, "vortices can last two or more times longer" than usual [see Tr. 918]. Despite these atmospheric conditions, the Hurlburt Field tower did not issue a wake turbulence advisory to the pilots flying that night.

19) On the night of the crash, Howard was providing PC-12 training for two Air Force combat pilots: then Captain (now Major) Michael P. Ellis, and then Captain (now Major) Peter R. McWilliam. The crew was assigned the Aircraft for their training sortie, and they were given the call sign "Slayer 28." Maj. Ellis and Maj. McWilliam were not "student pilots" being introduced to the aircraft. Rather, they were both highly experienced, combat-tested PC-12/U-28 pilots undergoing recurrency and proficiency training.[8]

20) The scheduled total time for the training mission was four hours, and it began at about 8:00 p.m. The first part of the mission was flown in daylight, and it consisted of recurrency training for Maj. McWilliam on short field operations. Maj. McWilliam, in the left pilot seat, and Howard, instructing from the right seat, flew a series of landings at other auxiliary airfields near Hurlburt Field.

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[8] Maj. McWilliam was an aircraft commander in the PC-12 and had logged approximately 865 hours in the aircraft. Maj. Ellis, meanwhile, had been a PC-12 instructor himself and had logged about 1,700 hours in the aircraft --- which was actually twice the hours than Howard had logged in the PC-12 [Tr. 792]. He was undergoing "training" on the night of the crash because he had not flown for five weeks while he was on a temporary duty assignment for squadron school in Montgomery, Alabama, and he merely "needed to get recurrent on flight status" [see Tr. 58-59], so he practiced with instrument approaches and night landings.

21) After the sun set, the crew began using night vision goggles ("NVG"), which were about 6 inches long, similar in style to binoculars, and attached to the front of their flight helmets. Because NVGs are designed to enable the user to see in the dark, they are "incompatible" with white light. The presence of white light can cause a "bloom" effect while using NVGs, which can "wash out" or otherwise adversely affect visual acuity (such as decreased depth perception). Because even cockpit lighting can "drive night vision goggles crazy" [Tr. 491], once the crew of Slayer 28 began using NVGs, they landed the Aircraft and taped up some of the cockpit displays with film so the lights from the instruments would not "bloom out" [Tr. 157]. Normally, the use of NVGs requires that the runway lights on the landing field also be dimmed.

22) Maj. McWilliam made a few landings wearing NVGs, after which he and Maj. Ellis "swapped seats" so that Maj. Ellis could take over. Thereafter, Maj. Ellis flew various instrument approaches and landings at nearby airfields to regain currency in NVG operations. Howard remained in the right seat as instructor pilot. Both Maj. Ellis and Howard wore NVGs throughout the rest of the mission. After the seat swap, Maj. McWilliam sat in the right rear passenger seat of the Aircraft, where he remained an active member of the crew and assumed two distinct roles: 1) safety observer (i.e., he was to "speak up" if he saw that the flight was at risk or otherwise following a dangerous path), and 2) student (i.e., he was to try and become a better pilot by plugging into the communications radio and listening to the crew as it flew) [see Tr. 158-60].

23) At around 11:00, the pilots returned to Hurlburt, where Howard and Maj. Ellis practiced an ILS (Instrument Landing System) approach and remained in the VFR (Visual Flight Rules) pattern and performed several touch-and-go landings

[Tr. 68-69].[9] Because the crew of Slayer 28 was using NVGs and they wanted to avoid the blooming effect, they asked the tower to dim the runway lights, but that request was denied (because there were other aircraft in the landing pattern). The presence of the bright runway lights caused their goggles to "fog up", and caused their "visual acuity [to] significantly drop" [Tr. 317].

24) There were two other aircraft performing touch-and-go landings in the pattern that evening. Specifically, there was another PC-12/U-28 with the call sign "Slayer 25," and an AC-130U Hercules Gunship with the call sign "Spur 43." Spur 43 was attached to the 19th Special Operations Squadron (SOS) at Hurlburt Field. Spur 43 arrived back at Hurlburt after having completed its crew training, and it did a "Random Steep Approach" from 7000 feet as a series of spirals over the runway, executed a missed approach, and remained in the landing pattern.

25) The AC-130U is a large gunship equipped with a 25-millimeter Gatling gun, a 40-millimeter Bofors cannon, and a very large 105-millimeter Howitzer. The landing weight of Spur 43 that night was about 125,000 lbs. The AC-130U is not only much heavier than the Aircraft --- over 16 times heavier --- but it is also much heavier, and generates stronger wake turbulence, than other models of the C-130 because of its weapons and ammunition.

26) The AC-130 was equipped with a communications radio on the military's UHF frequency. The PC-12, meanwhile, was equipped with a civilian VHF communications radio. Consequently, the two aircraft could both talk to the tower, but they could not talk to each other, nor could either aircraft hear what the other was telling the tower.

27) Major Meghan Ripple was the acting aircraft commander of Spur 43, and she was at the controls of the AC-130 at the time of the crash. Spur 43 was

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[9] A touch-and-go landing is a maneuver that involves landing an aircraft on the runway and then taking off again without coming to a full stop.

doing initial, not continuation, training that night. Shortly after the Aircraft entered the landing pattern, Maj. Ellis in Slayer 28 asked for clearance to perform a random shallow approach. The tower denied the request at first --- because it could not be sequenced in --- so Slayer 28 continued to perform touch-and-go procedures, while Slayer 25 and Spur 43 did the same. Maj. Ripple testified at trial that during these various approaches the Aircraft (Slayer 28) "was always abeam the approach end of the runway one-eighth on the downwind [when starting its landing approach] which would have been given plenty of spacing" between the two aircraft [see Tr. 247].

28) During one of these approaches, Slayer 25 (the other PC-12/U-28 in the pattern) encountered wake turbulence from Spur 43 [Tr. 919; Ex. 70 at 14-15]. Slayer 25 encountered the vortex even though it had maintained adequate spacing behind the C-130, and even though the "same type of spacing" was sufficient and "had not been an issue" on prior approaches [see Ex. 70 at 14]. However, on this particular approach, Slayer 25 encountered Spur 43's wake vortex, which resulted in an uncommanded "wing dip" roll of about 30 degrees, before the pilot was able to add power and go around. Notably, this encounter occurred approximately three and a half minutes after Spur 43 had most recently passed that location [Tr. 920]. The crew of Slayer 25 did not report this wake turbulence event to the tower or to the other aircraft flying in the pattern at that time.

29) At some point, the crew of Spur 43 also requested permission to fly a random shallow maneuver, and that request was granted. This was (according to some of the testimony in this case) a somewhat unusual request because AC-130 gunships --- as opposed to other variations of the C-130 --- do not usually practice or use the random shallow approach [see Tr. 308-09, 338]. The tower told Slayer 28 that its earlier-denied request for the random shallow approach was now being granted, and it instructed Slayer 28 to follow behind Spur 43. The tower further told Slayer 28 to make a left 180 degree turn and follow the AC-130 for a random

shallow maneuver to Runway 36.[10]

30) The pattern that was actually flown by the AC-130U at this time was a teardrop pattern from the center of the runway, with an extended downwind and extended final, which disrupted the separation.

31) Although Maj. Ellis originally requested the random shallow approach, Howard actually performed it from the right seat, perhaps because the tower had directed both aircraft to use a right hand landing pattern instead of the customary left hand pattern. (Slayer 25 was using a left hand landing pattern). Although Spur 43 had called a left base, it actually flew a right base.

32) As part of Crew Resource Management (CRM), the Air Force teaches that every member of the crew has the obligation and responsibility to "speak up" if he sees or perceives something that needs to be changed or corrected by the command pilot.

33) In positioning the two aircraft for the random shallow approaches, the tower instructed Slayer 28 to make several turns to space Slayer 28 several miles north of the departure end of Runway 36, and the tower then instructed Slayer 28 when to turn south behind Spur 43 to begin Slayer 28's downwind leg. Slayer 28 then descended from 1200 ft to 600 ft indicated altitude (about 500 AGL) at 200 knots, which was the standard procedure for this approach. Slayer 28 was about 3.4 nautical miles behind Spur 43 at that time. However, unknown to Slayer 28, Spur 43 had slowed to approximately 150 knots while the PC-12 was following it downwind at about 200 knots. Thus, the separation was rapidly decreasing.

34) Howard and Maj. Ellis were able to observe Spur 43 make its teardrop turn to final. When Maj. Ellis saw Spur 43 begin its approach, Slayer 28 was still north of the runway.

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[10] Because the winds at Hurlburt Field that night, although light, were from the southeast, Runway 18 should have been used instead of Runway 36.

35) Howard and Maj. Ellis could see that Spur 43 was ahead of them on downwind. However, because they were wearing the NVGs, Spur 43 appeared to them as "a little green blinking light" at an indeterminate distance ahead, as the NVGs reduced the ability to determine distance, and it was thus not possible to determine the rate of closure between the aircraft. However, Howard would not have performed the random shallow approach maneuver at night (beginning the landing approach at 200 knots and 500 feet) without NVGs. It would have been too dangerous as "you can't see the ground when you're that low and that fast" [Tr. 318].

36) As noted, Spur 43 declared that it was performing a random shallow approach prior to the mishap. Although one of the principal purposes --- if not the principal purpose --- of this maneuver is to keep the aircraft in tight to the runway environment and avoid exposing it to areas outside of that environment that might harbor hostile threats and forces, Spur 43 flew a very elongated teardrop approach and greatly extended its downwind. It flew well beyond the airfield boundary, past the barrier island and south over the Gulf of Mexico, without informing anyone that it was extending its approach.

37) Spur 43 also made an unusual (and unexpected to Slayer 28) approach to Runway 36. It should have flown the downwind leg to Runway 36 at 200 knots, but it actually flew the downwind leg at about 150 knots, and later accelerated to about 170 knots as it descended. In addition, it overshot its turn to final, ending up to the west of the extended runway centerline, then it overcorrected and ended up to the east of the extended runway centerline, before it finally straightened out and became established on final and ultimately touched down further down the runway. This extended teardrop pattern was not the standard or "normal" random shallow approach [see, e.g., Tr. 312].

38) Spur 43 also flew a greatly extended and "dragged in" final approach, flying at approximately 100 feet MSL for an extended period of time. The radar

returns also indicate that Spur 43 may have actually climbed in altitude for some of its approach and was maneuvering with up to 45 degrees angle of bank.

39) Spur 43 eventually touched down approximately 2000 to 2500 feet down the runway from the approach end of Runway 36. Such a touch down point is abnormal. Maj. Ripple testified that she normally and "generally" aimed to touch down between 500 and 1000 feet from the threshold for a random shallow approach. Spur 43 thus landed considerably further down the runway than was "normal." Landing long is usually the result of being either too fast or too high (or both) on final. Reconstruction from, and interpretation of, the available radar data by Dr. Orloff (expert witness for the United States) shows that Spur 43's airspeed was slightly over 150 knots and it was maneuvering with almost 45 degree of bank as it approached the end of the runway. Since the radar returns (from the Eglin Air Force Base approach radar several miles away) were 4.6 seconds apart, we cannot precisely determine Spur 43's actual altitude during these maneuvers but it appears to have been between about 100 and 150 feet above ground level as it approached the runway threshold.

40) The crew of Slayer 28 would have (and did) reasonably expect the crew of Spur 43 to execute the random shallow approach as it was customarily performed by C-130's and other aircraft at Hurlburt Field, including flying at the customary speed and landing at the customary landing point.[11]

41) While Slayer 28 was on the downwind, Howard believed that he saw Spur 43 touch down on Runway 36 at approximately 1000 feet down the runway.

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[11] Almost everything that Spur 43 did during its random shallow approach was unusual. Maj. Ripple testified that certain parts of this non-standard approach (specifically, the first overshoot) were done intentionally and for training purposes [see Tr. 225-26]. That may be true, but it does not change the fact that the crew of Slayer 28 reasonably expected --- in the absence of being advised otherwise --- that Spur 43 would fly the approach as it was typically performed at Hurlburt Field at that time.

This is where Howard reasonably expected Spur 43 to touch down. Slayer 28 was approximately abeam the threshold to the east of the runway when Howard made this observation. Using the NVGs, however, neither he nor Maj. Ellis could actually see the touch down spot, which as we now know was actually 2000 to 2500 feet down the runway.

42) Howard testified that he planned to fly above Spur 43's flight path and touch down at a point approximately 1500 feet down the runway, and he voiced these intentions and observations to Maj. Ellis.[12] At this time, Slayer 28 was beginning its landing approach at 200 knots and its altitude was approximately 500 feet above ground level --- both of which were appropriate for the random shallow maneuver that Slayer 28 was executing.

43) Slayer 28 continued on the downwind leg until the threshold of the runway was about 45 degrees aft of its right wing, then Howard commenced the turn to base leg and reconfigured the Aircraft by reducing its power to flight idle, slowing down to approximately 120 knots, and lowering the landing gear and full flaps. Upon reaching 120 knots, Howard began his right turn to final and began his descent, aiming (according to Howard) to touch down about 1500 feet beyond the runway threshold; in other words, approximately 500 feet past the point where he perceived Spur 43 to have touched down.

44) The Random Shallow Approach is a tight landing approach that begins at 500 altitude, instead of the normal 1000 feet. PC-12 pilots in the 319th SOS at the time of the crash typically tried to make the short final portion of their runway approach a five degree glide slope and --- although not required by the maneuver --- tried to perform it in such a manner that it did not require the addition of power to complete the landing. Howard, Maj. Ellis, and Maj. McWilliam testified that Howard

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[12] While Maj. Ellis testified that he did not have any specific recollection of Howard stating his intentions, he does not dispute or deny that Howard did so.

flew the pattern as it was ordinarily done, and that the spacing between Slayer 28 and Spur 43 at the time Slayer 28 was on short final appeared to be about the same that is normally done in flying behind a C-130.

45) Slayer 28 was banked almost 30 degrees to the right as it turned from base to final. As it turned out onto final, the Aircraft rolled from right to left to level out and end the turn. However, the roll did not stop when Slayer 28 was level. Instead, the Aircraft experienced a sudden and uncommanded roll to the left, with a bank angle exceeding 90 degrees --- perhaps as much as 120 degrees. With the initial roll to the left, the nose tracked down. As the Aircraft rolled steeply left, it lost almost all vertical lift and began to drop precipitously.

46) As the left roll started, Howard immediately turned the yoke to apply full right ailerons, and Maj. McWilliam --- in the rear part of the Aircraft --- recalled feeling the right rudder being applied. Referring to it as "fight or flight," Maj. Ellis instinctively joined Howard on the controls and found them already in the correct position to recover from the uncommanded roll. Howard and Maj. Ellis also both applied full power, the standard procedure for initiating a "go-around." The corrective inputs that Howard and Maj. Ellis made eventually had an effect, and the Aircraft began to recover from the left roll. However, it was not able to regain level flight, and it impacted the ground at a 64 degree left angle of bank.

47) The Aircraft's left wingtip hit the ground one foot short of the runway threshold. After the impact, the Aircraft made a progressive veer to the left, going off the runway. It came to rest on Echo Taxiway facing east. Fortunately, the crew was able to escape with no serious injuries.

48) The Aircraft was not equipped with a flight data recorder or similar device that measures and records the details of pilot inputs on the controls, the flight control positions and movements, aircraft pitch, and yaw, or most other performance data. Therefore, the dynamics of the last moments before the crash (specifically, when and where the Aircraft impacted the wake turbulence) cannot

be precisely determined, and the parties' accident reconstructionists have wildly different opinions and calculations. However, the last two minutes of Slayer 28's flight were recorded by the Engine Condition Monitoring System (ECMS), and (when properly adjusted) provide some valuable information, especially for airspeed, altitude, and engine power settings. All this evidence has to be carefully weighted and evaluated. There is persuasive evidence in the record --- including the trial and deposition testimony of the pilots on board and Rivers' analysis --- suggesting that the wake encounter began when Slayer 28 was above the path of Spur 43.

49) Based upon all the evidence in the record, the time between the vortex encounter and impact was greater than the 6.1 seconds as found by Dr. Winn, and the Aircraft must have been higher than 75 feet above the ground at the beginning of that encounter (see note 13, infra). After full review, I find by a preponderance of the evidence that the uncommanded roll started about 1200 to 1400 feet short of the runway threshold [Tr. 738], at an altitude of approximately 200 to 300 feet [Tr. 882-83]. Based on the radar returns and other evidence, this would indeed put Slayer 28 above the flight path of Spur 43 when it hit the wake vortex.

50) The parties agree that, when the Aircraft had the vortex encounter, Slayer 28 was about 46 seconds behind Spur 43 (although Howard thought that he had about 60 seconds of separation). Nevertheless, at the time of the crash, being 46 seconds behind a larger aircraft was not unusual in the VFR pattern at Hurlburt Field [Tr. 1026, 1039].

51) Before the uncommanded roll, the crew of Slayer 28 did not perceive anything about the flight or the approach that was unsafe or in any way abnormal. Neither Maj. Ellis nor Maj. McWilliam perceived anything wrong with the way that Howard was performing the random shallow approach maneuver. It was apparently being flown as it was always flown. If Maj. Ellis or Maj. McWilliam had observed or perceived that anything was wrong with the approach, they would have spoken up

and voiced their concern to Howard.[13]

52) In the moments leading up to the crash, the crew of Slayer 28 did not deviate or do anything different from the standard method of performing a random shallow approach at Hurlburt Field (that is, they determined proper separation by visually ensuring that the lead aircraft in its landing approach had passed abeam in the opposite direction and then continuing downwind past the runway threshold until the threshold was about 45 degrees behind the wing before beginning the turn to base leg and completing the landing pattern).

53) In addition, Howard attempted to --- and I find that he did --- fly above Spur 43's flight path with the expressed intent of touching down beyond Spur 43's touch down point.

54) The Aircraft sustained substantial physical damage as the result of the

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[13] Arch's theory of the case (per its expert witness Dr. Winn) has been that the wake vortex encounter took about 6.1 seconds and occurred 500 feet from the runway with an intended touch down of 1500 feet at an altitude of 75 feet (with a pre-existing 1100 per minute rate of descent) and ground speed of 95 knots. I find, as Avenge has argued, that this scenario is implausible. It would not be the sort of approach that experienced PC-12 pilots would have undertaken. Lieutenant Colonel Brian Betts, who had been teaching the random shallow approach at Hurlburt Field since 2007, testified during the trial that he attempted to fly the PC-12 in the way that the plaintiff's theory postulates, and he had to pull out before hitting 75 feet altitude because he "couldn't take it any more" as it was "becoming unsafe" and "well beyond what I considered a normal anything" [see Tr. 1024-25]. It is simply not credible that experienced PC-12 pilots could have possibly considered such an approach "normal" (see id. at 1025 (referring to that approach as not "anywhere close to normal")]. I agree with Rivers that, if the plaintiff's theory were correct, the crew of Slayer 28 would have detected the dangerous situation they were in long before the uncommanded roll began [Tr. 913]. Given the magnitude of errors in the radar and altitude data, along with assumptions for reaction times and sink rates at 90 degrees angle of bank, it is impossible to determine with certainty the exact parameters of Slayer 28's approach. Nevertheless, a preponderance of the evidence negates Dr. Winn's opinion as to the encounter time, distance from the runway, and altitude at encounter.

crash. The owner filed with Arch an estimate of the costs of repair in the amount of $2,916,733. Arch seeks to recover the amount it paid out against Avenge and the United States.

55) The parties have stipulated that if Arch is entitled to recover in this subrogation action, its maximum recovery is the difference between the Aircraft's fair market value ($3 million) and its post-crash salvage value ($98,400), plus any applicable interest [see Doc. 155 at ¶¶ 54-57]. Arch's ability to recover, however, is necessarily dependent on Howard being negligent.[14]

II. CONCLUSIONS OF LAW

Jurisdiction is proper in this federal court as the claims asserted against the United States have been brought under the Federal Tort Claims Act [see 28 U.S.C. § 2674], and Arch and Avenge are citizens of different states with an amount in controversy that exceeds $75,000 [see 28 U.S.C. §1332]. The parties agree that the substantive law of Florida applies. See 28 U.S.C. § 1652; see also Erie R.R. Co. v. Tompkins, 304 U.S. 64, 58 S. Ct. 817 (1938).

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[14] There is a plausible argument to make --- and, indeed, earlier in this case the argument was made --- that the United States was negligent independent of Howard. The plaintiff argued, for example, that the United States should not have selected Runway 36 that evening (because of the light quartering tail winds); the tower should have issued a wake turbulence advisory; and the crew of Slayer 25 violated regulations by not reporting the turbulence that they encountered earlier that night. (One could also argue that the United States should not have allowed a relatively small PC-12 to perform dangerous low altitude nighttime approaches at the same time as a much larger and heavier AC-130 Hercules gunship). However, Arch expressly abandoned all these claims during trial and argued that the United States was negligent only to the limited extent that Maj. McWilliam and Maj. Ellis violated CRM by failing to "speak up" as Howard negligently attempted the random shallow maneuver. Consequently, to find in favor of the plaintiff, I must first find that Howard was negligent. If he was not, it flows therefrom that the United States was not negligent either. The discussion that follows will thus be limited to Howard and his alleged negligence.

To prevail in a negligence action in Florida, the plaintiff bears the burden of proof and must establish the well-settled elements of a negligence claim. See, e.g., Clampitt v. D.J. Spencer Sales, 786 So.2d 570, 573 (Fla. 2001). Specifically, the plaintiff must show (1) that the defendant owed a duty of reasonable care to the plaintiff; (2) that the defendant breached that duty of care; (3) that the breach was the proximate cause of the injury to the plaintiff; and, (4) that the plaintiff suffered damages. Hasenfus v. Secord, 962 F.2d 1556, 1559-60 (11th Cir. 1992 (applying Florida law). Duty and damages have been established.[15] The case thus boils down to whether Howard breached the relevant standard of care and, if so, whether that breach of care was causally related to the harm that was suffered.

To establish breach, Arch must show that, while Howard was executing the random shallow maneuver, he violated the standard of care, namely, the care that "a reasonably careful [pilot] would use under like circumstances." Daley v. United States, 792 F.2d 1081, 1085 (11th Cir. 1986) (Florida law). Both Arch and Avenge agree that a reasonably careful pilot in Howard's situation would have: "Remain[ed] above the flight path of the preceding aircraft" [see Tr. 913]. Arch's expert witness on the standard of care, Captain Gibson, thus testified that if Howard had remained above Spur 43's flight path, he would have met the applicable standard of care and would not have been negligent [see Tr. 509-10]. Put another way, Arch must prove that Howard was below Spur 43's flight path. As previously stated in my findings

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[15] Avenge does not dispute that the plaintiff sustained damages. However, Avenge argues that it owed no duty to Arch's subrogor, SNC, because the United States was "putative owner" of the Aircraft. Insofar as Avenge had "no knowledge that anyone other than the USAF was owner of the Aircraft," it asserts that it had "no reason to believe that it owed a duty of care to anyone other than the USAF." Avenge has not cited to --- nor have I been able to locate --- any case law holding that an alleged tortfeasor owes no duty to the owner of damaged property unless the tortfeasor knew the owner's true and actual identity at the time of the alleged tort. Avenge's argument on this point fails.

of fact, however, I find by a preponderance of the evidence that the Aircraft was above Spur 43's flight path at the time of the vortex encounter. Accordingly, per Arch's own expert witness, Howard satisfied the applicable standard of care and was not negligent.

Arch strongly disputes the contention that Slayer 28 was above Spur 43's path at the time of the wake vortex encounter. It contends that Avenge has not offered any "plausible explanation" or theory for how Slayer 28 encountered the vortex above Spur 43's path. There are two problems with this.

First, of course, it is not Avenge's burden to offer an explanation (plausible or otherwise) for how the accident happened. It is Arch's burden to explain how the accident happened and prove by a preponderance of the evidence that it was due to Howard's negligence. This Arch has not done. It has put forth (and is now bound by) a theory advanced by its expert witness (Dr. Winn) that is implausible, and ultimately at odds with the laws of physics.

Second, while it was not required to, Avenge actually has put forth (two) possible theories of how the vortex encounter could have happened above Spur 43's flight path. Rivers has opined that, rather than hitting the vortex from Spur 43's last approach, Slayer 28 might have instead encountered the wake from an earlier approach by Spur 43 about 5 minutes and 40 seconds before.[16] Evidence at trial established that wake vortices can persist for upward of six to eight minutes, especially in the atmospheric conditions that existed that night, which were "ideal"

[16] During its cross examination of Rivers (and during its subsequent closing argument), Arch highlighted the fact that Rivers had originally calculated the prior pass as being about 7 minutes earlier. Rivers testified at trial that he had made an error in his original analysis, so he corrected it. The mere fact that Rivers corrected his analysis does not carry the weight that Arch apparently believes, as virtually all of the experts in this case have at one time or another corrected and changed their analyses.

for the formation and persistence of wake turbulence. Arch insists that this theory is "preposterous," and it notes that Rivers is the only expert who has mentioned it as a possibility [see, e.g., Doc. 181 at 1 (highlighting that "[f]our experts" testified the vortex that caused the crash was generated by the last approach, while Rivers is the "lone dissent" in suggesting it may have been an earlier one). However, it is axiomatic that it is not the sheer number of witnesses that counts. Rather, it is the weight and credibility of those witnesses, as determined by the finder of fact. See Jacksonville Traction Co. v. Greene, 113 Fla. 316, 317 (Fla. 1933) ("The maxim of the law is 'Ponderantur testes, non numerantur,' witnesses are not to be counted, but their testimony is to be weighed. It is the general rule in civil cases that a claim or defense can be established by a single witness. As an incident of their province to determine facts the credibility of witnesses is peculiarly a matter for the [finders of fact].") (internal citation omitted). I found Rivers to be credible and persuasive. What he has identified as a possible theory of what led to the mishap is plausible; or, at the very least, it cannot be dismissed as implausible. And in any event, it is certainly no less plausible than Arch's theory behind the crash. See note 13, supra. The evidence at trial was at worst "evenly balanced" and equipoised on this issue; and, in such a situation, the party that carries the burden of proof --- Arch here --- "must lose". See Metropolitan Stevedore Co. v. Rambo, 521 U.S. 121, 137 n.9, 117 S. Ct. 1953, 1963 n.9 (1997).[17]

Another possible explanation for how Slayer 28 could have hit the vortex above Spur 43's path is the wake could have risen. Evidence at trial established

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[17] During the course of explaining why his possible theory is the more likely, Rivers testified that, based on his "well over a thousand" penetrations behind a C-130, "no wake that I ever saw . . . grew to a diameter large enough in 46 seconds, especially in that type of atmosphere in any altitude . . . to cause that upset" [see Tr. 936-37; see also Tr. 876]. I agree that it is highly unlikely for a wake vortex to expand so quickly.

that wakes behave randomly, unpredictably, and capriciously. This is (presumably) particularly so when the generating aircraft is itself maneuvering in all three axis unpredictably. It is not implausible to conclude --- indeed, it is entirely possible --- that, in the atmosphere that night, the wake vortex created by Spur 43 may have risen above its (extremely unusual) flight path. Although there is no test data in the record to reveal how these rather extreme maneuverings [see Ex. 73 at 8 (Fig. 4 of Dr. Orloff's report)] might affect the wingtip vortices, it would seem reasonable to conclude that there could be a significant effect. This could easily cause the wake to rise if the right combination of aileron, rudder, and elevator was used.[18]

Even if it is assumed that Rivers is wrong and that the other experts are right (and that Slayer 28 hit the wake generated by Spur 43's preceding pass, and that it did so because Howard failed to fly above the flight path) that does not necessarily mean Howard was negligent. During the approach, Howard stated that he intended to fly above the flight path of Spur 43. The fact that he (arguably) did not execute his plan successfully does not automatically mean that he violated the standard of care. See Kraver v. Edelson, 55 So.2d 179, 180 (Fla. 1951) ("[n]ot every accident is the result of negligence'"); Belden v. Lynch, 126 So.2d 578, 581 (Fla. 2d DCA 1961) ("negligence may not be inferred from the mere happening of an accident alone"). First, it appears that Spur 43's flight path and touch down point may not have been where a reasonably careful and experienced pilot would have expected them to be. Second, in determining whether Howard failed to use the care that "a reasonably careful [pilot] would use under like circumstances" [Daley, supra, 792 F.2d at 1085], it is, of course, necessary to carefully consider the "circumstances"

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[18] I note once again that Rivers testified at trial --- and introduced a video to support --- that he had previously hit a wake vortex while following behind a C-130 that was 500 feet above the flight path and approximately 7 miles entrail [Tr. 855-56].

under which he was flying at the time of the mishap. Cf. McMahon v. Presidential Airways Inc., 502 F.3d 1331, 1365 (11th Cir. 2007) (explaining that the "flexible standards of negligence law" allow courts to apply different standards of care to "varying fact situations"; thus, a different standard of care might apply to a pilot "flying over Kansas on a sunny day" as opposed to "flying over Afghanistan during wartime"). The circumstances under which Howard was flying and which led up to the crash include:

(1) the light quartering tail winds;

(2) the use of Runway 36;

(3) the tower not issuing a wake turbulence advisory;

(4) the crew practicing a random shallow approach (itself a combat maneuver) at night (with another much larger aircraft in the pattern) while wearing NVGs;

(5) the control tower refused to dim the runway lights;

(6) Slayer 25 not reporting its earlier vortex encounter behind Spur 43;

(7) the fact that Spur 43 --- which, because of its mission as a large gunship, does not typically fly random shallow approaches at all --- flew an unusual and non-standard random shallow approach;

(8) the fact that Spur 43 and the Aircraft were on different radio frequencies and thus could not communicate with one another;

(9) the fact that Spur 43 had flown an extended final and landed long was not communicated to the tower or to Slayer 28;

(10) the hazardous mix at night of the two PC-12s (one flying a left pattern and another a right pattern) and the AC-130 in a right landing pattern, with two of them doing random shallow approaches; and

(11) the fact that Slayer 28 hit the turbulence at the precise point in the vortex where it was capable of rolling the Aircraft.

In short, there are many circumstances and events that may have combined to contribute to the mishap.[19]

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[19] While most of the trial focused on Howard's alleged negligence for failing to "fly high and land long", there was some suggestion that Howard should not have been only 46 seconds behind Spur 43, and that the accident would not have happened if he had maintained 2 minutes separation [see Tr. 388; 405-06 (opining that the mishap would have been "very unlikely" if Howard had been two minutes entrail) (testimony of Dr. Winn)]. This argument fails for three reasons. First, as Dr. Winn further testified, if the Aircraft was above Spur 43's flight path at the time of the wake vortex encounter, it did not matter whether Howard was 46 seconds (or 2 minutes) entrail [id. at 406]. As I previously stated, Arch has failed to prove that Howard was below Spur 43's path. Moreover, even if the Aircraft was below Spur 43's path, it was not negligence to follow 46 seconds behind Spur 43 instead of maintaining the recommended --- not required --- two minutes separation. Howard flew the approach in the same manner that it was always flown in the 319th SOS. See Muncie Aviation Corp. v. Party Doll Fleet, Inc., 519 F.2d 1178, 1180-81 (5th Cir. 1975) (noting in aviation negligence case that the customs and practices in a particular group or organization are evidence of the relevant standard of care). The mere fact that the spacing may have arguably proved inadequate on this occasion does not negligence make. (Of course, separation for a random shallow approach has to be established on the downwind entry. To do the approach correctly, it has to be tight from the 180 position to touch down, so extending downwind for separation would negate the purpose. Thus, when the Aircraft turned downwind behind Spur 43 they were about 3.4 nautical miles apart --- the equivalent of 1 minute and 42 seconds at the assumed approach speeds of 120 knots. The fact that the two aircraft did not maintain that separation was due to Spur 43's non-standard approach and not to anything Howard did.) And lastly, even if I were to assume (contrary to the evidence) that it somehow fell below the standard of care for Howard to use the visual (field) separation method instead of precisely clocking two minutes separation, Arch has not shown that this breach was causally related to the mishap. There is no reason to believe --- and considerable reason to doubt --- that the crash could have been avoided if Howard had been able to extend the final separation an extra minute and 14 seconds. As has been noted several times now, wake vortices can persist for up to several minutes, particularly in atmospheric conditions like existed on the night of the mishap. Indeed, Slayer 25 encountered wake turbulence generated by Spur 43 earlier in the evening that was significant enough to force an uncommanded 30 degree wing dip, even though there was over three and a half minutes of separation between those aircraft at that time. Arch has

After close and careful review of all the evidence, I conclude that Arch has not carried its burden of establishing that Howard deviated from the "reasonably careful pilot" standard of care. By all accounts, Howard was a very well regarded and experienced pilot. He testified --- and I found his testimony credible, and Maj. Ellis and Maj. McWilliam generally confirmed --- that he flew the random shallow approach maneuver that night as he and other pilots in the 319th SOS at Hurlburt Field were trained to do and in the standardized manner and that, before the wake vortex encounter, everything appeared to be normal. The fact that everything was not normal in hindsight does not, by itself, prove breach of the reasonably careful pilot standard of care. Sometimes an accident is just that: an accident. See Kraver, supra, 55 So.2d at 180; Belden, supra, 126 So.2d at 581.

As there was no breach of the standard of care, there can be no causation. See Greene v. Flewelling, 366 So.2d 777, 780 (Fla. 2d DCA 1978) (describing as "rudimentary" the notion that the plaintiff must show that there was a violation of the applicable standard of care that was the cause of the claimed damages).

In rendering this decision, I do not mean to suggest or imply that, because wake vortices can often be random and unpredictable, a pilot involved in a wake-related crash could never be found to have been negligent. I merely find that, on the unique facts of this particular case, the plaintiff has not carried its burden of proof in establishing breach of the duty of care and causation, as opposed to an

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not established that Howard's failure to keep two minutes of separation, assuming arguendo it was negligent, was causally related to the mishap. See, e.g., Stahl v. Metropolitan Dade Cty, 438 So.2d 14 (Fla. 3d DCA 1983) (explaining that Florida courts follow the "but for" causation test, i.e., there must be such a natural, direct, and continuous sequence between the negligent act or omission and the injury that it can be said that "but for" the negligent act or omission the injury would not have occurred).

unfortunate and unavoidable accident.[20]

III. CONCLUSION

In closing, I note that there are many unanswered questions about the crash, and there is evidence of record that could support a number of possible outcomes in this case. There is evidence that Howard was negligent, and there is evidence that the United States was negligent. And there is also evidence that neither was negligent and that the mishap was the result of a "perfect storm" of unfortunate and unforseen circumstances. Some impressive and heavily-credentialed witnesses testified in support of these various points of view. After careful review, I find that a preponderance of the evidence does not support the plaintiff's claims, and because the plaintiff carries the burden of proof, judgment must be entered in favor of the defendants.[21]

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[20] Obviously, as has been argued throughout this case, the crash could have been avoided if Howard had timely executed a "go-around" before encountering the wake vortex. However, the question is not whether Howard could have avoided the crash by abandoning the approach altogether. The question is whether a reasonably careful pilot in his situation --- based on the circumstances that were known or reasonably should have been known to him at that time --- would have thought it necessary to do so, or would have been able to do so. Cf. Smith v. Illinois Central R.R. Co., 486 F.2d 943, 945-46 & n.1 (5th Cir. 1973) (approving the following jury instruction: "Lastly, in connection with negligence and proximate cause the mere happening of an accident does not necessarily mean that someone is negligent. In law we recognize what are termed unavoidable or inevitable accidents. These terms do not mean literally that it was not possible for such an accident to be avoided. They simply denote an accident that occurred without having been caused by negligence, even though such accident should have been avoided by the exercise of exceptional foresight, skill or caution, still no one may be liable for injuries resulting from it."). I conclude that no reasonably careful military pilot in Howard's situation would have thought it necessary to completely abandon the approach.

[21] As I have ruled in favor of the defendants, I need not reach certain of the disputed issues of law that were identified by the parties before and during trial, e.g., whether Howard was a government employee or independent contractor, etc.

For the reasons stated above, the Clerk shall enter judgment in favor of the defendants and against the plaintiff, together with taxable costs.

DONE and ORDERED this 9th day of July, 2013.

/s/ Roger Vinson
ROGER VINSON
Senior United States District Judge