IN THE UNITED STATES DISTRICT COURT FOR THE
EASTERN DISTRICT OF VIRGINIA
Alexandria Division

ROLLS-ROYCE PLC,	)	
	)	
Plaintiff,	)	
	)	
v.	)	1:10cv457 (LMB/JFA)
	)	
UNITED TECHNOLOGIES CORPORATION (d/b/a PRATT & WHITNEY),	)	
	)	
Defendant.	)	

MEMORANDUM OPINION

Before the Court are the parties' cross-motions for summary judgment [Dkt. Nos. 525, 532, 617 and 629] concerning plaintiff Rolls-Royce plc's ("Rolls-Royce") allegations that swept fan blades used in certain jet engines manufactured by the defendant, United Technologies Corporation ("UTC"), infringe various independent and dependent claims in Rolls-Royce's U.S. Patent No. 6,071,077 ("'077 Patent"). For the reasons stated in this Memorandum Opinion, Rolls-Royce's motions will be denied in most respects and UTC's motions will be granted as to the GP7200 engine and granted in part as to the GTF series of engines.

I. Background

Rolls-Royce and UTC manufacture engines for various jets including the Airbus A380 jumbo jet. Rolls-Royce produces the Trent 900 engine, and Engine Alliance, a joint venture of UTC and General Electric, manufactures the GP7200 engine. UTC manufactures the GP7200's fan stage, which is the major focus of

this patent infringement action. The fan stage consists of a cascade of fan blades, which are attached to, and extend radially from, the jet engine's central, rotatable hub. The fan blades and hub, driven by a shaft, rotate about the engine's longitudinally extending rotational axis, providing thrust for the jet engine. Fan stages often experience a phenomenon called "passage shock," which occurs because pressure built up behind the fan causes air flowing through the engine to slow down. Passage shock occurs in the air passage between adjacent blades of the fan, near the blade tips. To reduce or eliminate passage shock, both Rolls-Royce and UTC have altered the shape of their fan blades by "sweeping" segments of the leading edge of the fan blades in alternating directions. See Rolls-Royce PLC v. United Techs. Corp., 730 F. Supp. 2d 489, 495-97 (E.D. Va. 2009) (describing fan stage technology).

On June 6, 2000, the United States Patent and Trademark Office ("PTO") issued the '077 Patent to Rolls-Royce. The '077 Patent contains 13 claims. Claims 1 and 8 are the only independent claims. Claims 2 through 7 depend on Claim 1, and Claims 9 through 13 depend on Claim 8.[1]

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[1]UTC has also received a patent covering a jet engine fan stage. On June 5, 2001, UTC filed a second reissue application, no. 09/874,931 ("'931 Reissue Application") based on its earlier Patent No. 5,642,985, which had issued on July 1, 1997. In 2003, UTC convinced the Patent and Trademark Office's Board of Patent Appeals and Interferences to declare an interference between Rolls-Royce's '077 Patent and UTC's '931 Reissue Application.

On May 5, 2010, Rolls-Royce filed this civil action against UTC, accusing the fan blades used in the GP7200 and other engines of infringing the '077 Patent.[2] On March 3, 2011, the parties filed cross-motions for claim construction, and Rolls-Royce moved for summary judgment that the GP7200's swept fan blades infringe Claim 1 of the '077 Patent. UTC did not seek summary judgment of noninfringement.

Claim 1 discloses:

> A fan stage of a ducted fan gas turbine engine, comprising
>
> a fan casing having an inner duct wall which in a fan rotor region is convergent in the downstream direction; and
>
> a fan rotor including a multiplicity of swept fan blades spaced apart around a hub mounted concentrically with respect to the fan duct, each of said swept fan blades having a tip profile which in revolution is convergent so as to substantially correspond to the convergent duct

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Rolls-Royce appealed the interference decision to this Court in 2005, and the Court reversed the PTO's decision. Rolls-Royce PLC v. United Techs. Corp., 730 F. Supp. 2d 489 (E.D. Va. 2009). The Federal Circuit affirmed that decision on May 5, 2010. Rolls-Royce PLC v. United Techs. Corp., 603 F.3d 1325 (Fed. Cir. 2010).

[2]The Amended Complaint does not specify which of the '077 Patent's claims are allegedly infringed by UTC's fan blades, simply alleging infringement of the '077 Patent by UTC fan blades used in three series of engines - the GP7200 series, the GTF series, and the Pratt & Whitney Canada series. All of the damages sought by Rolls-Royce relate to the GP7200 series, and therefore most of this Memorandum Opinion will address that series. At a hearing on April 1, 2011, the Court granted summary judgment as to the Pratt & Whitney Canada series because Rolls-Royce no longer accused that series of infringement. Rolls-Royce only seeks injunctive relief as to the GTF series, which will be addressed in the final section of this Memorandum Opinion.

> wall, a leading edge of variable sweep angle which varies with increasing blade height or distance from the axis of rotation, said sweep angle **having a forward sweep angle in a first height region between the root and a first intermediate radius, a rearward sweep angle in an intermediate height region between the first intermediate radius and a second intermediate radius, a forward sweep angle in a third height region between the second intermediate radius and the tip of the blade,** a stagger angle which increases progressively with blade height.

'077 Patent at Col. 8:4-23. (emphasis on disputed section). The gravamen of this dispute is whether the GP7200 fan blade, which has four regions that are swept, nevertheless violates Claim 1.

Under UTC's proposed construction, Claim 1 covers fan blades whose leading edges have only three sweep regions: 1) a forward sweep starting at the hub; 2) a rearward sweep in the center; and 3) a forward sweep in the third region, continuing to the blade's tip. UTC's First Mot. for Summ. J. at 20. Because the leading edge of the GP7200 fan blade has four sweep regions: 1)rearward starting at the hub, 2) forward, 3) rearward, and 4) forward to the tip, UTC argues that the GP7200 fan blade does not infringe Claim 1.

Rolls-Royce argues that Claim 1 is not limited to a fan blade with just three sweep regions and rejects UTC's argument that the first height region must start at the root/hub. Opp. to UTC's First Mot. for Summ. J. at 15-18. Under Rolls-Royce's construction, Claim 1 covers a fan blade that has any number of sweep regions, as long as the three regions closest to the tip

are swept forward, rearward, and forward.

At the April 1, 2011 claim construction hearing, the Court examined the language of Claim 1 and orally construed it in UTC's favor:

> [I]t goes 'said sweep angle having a forward sweep angle in a first height region between the root and a first intermediate radius,' all right? That's No. 1.
>
> Two -- I'm adding the numbers -- 'a rearward sweep angle in an intermediate height region between the first intermediate radius and a second intermediate radius.'
>
> Three -- I'm adding the number - 'a forward sweep angle in a third height region between the second intermediate radius and the tip of the blade.'
>
> Now, if that's not one-two-three, forward-rearward-forward, I don't know how you could - any way else you could read that.

Tr. at 24. Accordingly, the Court construed Claim 1 to cover a fan blade with only three regions:

> There's a forward sweeping region, rearward sweeping, and forward sweeping. Three, forward-rearward-forward, and then the tip at the end. That's this patent. That's claim 1, and whether or not the defendant's blade infringes that description is another issue.

Tr. at 34.

After the Court construed Claim 1, the parties filed a second round of summary judgment motions. UTC now seeks summary judgment of noninfringement as to all claims in the '077 Patent, and Rolls-Royce has filed a renewed motion for summary judgment of infringement as to Claim 1. UTC argues that because the fan blades in the GP7200 contain four sweep regions, the GP7200 does

not infringe the three-region blade disclosed in the '077 Patent. Rolls-Royce acknowledges that the GP7200 blade has four regions but argues that the first rearward sweep region of the GP7200 blade is entirely confined within the "root," and therefore that counting from the root, the GP7200 blade has the three-region "forward, rearward, forward" sweep that infringes Claim 1.

This Memorandum Opinion will elaborate on the April 1, 2011 oral claim construction decision, construe some additional terms, and consider the parties' second round of summary judgment motions on the issue of infringement.

II. Discussion

A. Claim construction

1. Legal standards for claim construction

The district court has the "power and obligation to construe as a matter of law the meaning of language used in the patent claim." Markman v. Westview Instruments. Inc., 52 F.3d 967, 979 (Fed. Cir. 1995), aff'd, 517 U.S. 370 (1996). As a starting point, a claim term is to be given the "ordinary and customary meaning" it would have had to a person of ordinary skill in the art at the time of the invention. Phillips v. AWH Corp., 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc). To determine that meaning, the Court must first look to how the words of the claims themselves define the scope of the patented invention, and then look to "those sources available to the public that show what a

person of skill in the art would have understood [the] disputed claim language to mean." Phillips, 415 F.3d at 1314. The Court must construe the entire claim, including any preamble, so long as it gives life and meaning to the invention claimed. See Pitney Bowes. Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305 (Fed. Cir. 1999).

For some claim terms, the ordinary meaning may be readily apparent, and construction of those terms therefore "involves little more than the application of the widely accepted meaning of commonly understood words." Phillips, 415 F.3d at 1314. If technical terms are used, the Court may also "consult scientific dictionaries and technical treaties at any time" because "technical terms often have an 'ordinary meaning' as understood by one of skill in the art, although these same terms may not be readily familiar to a judge, or may be familiar only in a different context." Dow Chemical, 257 F.3d at 1372. The meaning of a disputed claim term should be resolved primarily in light of the "intrinsic evidence of record, i.e., the patent itself, including the claims, its specification and, if in evidence, the prosecution history." Vitronics, 90 F.3d at 1582 (describing intrinsic evidence as "the most significant source of the legally operative meaning of disputed claim language"); see also Phillips, 415 F.3d at 1316 (holding that "[t]he construction that stays true to the claim language and most naturally aligns with

the patent's description of the invention will be, in the end, the correct construction").

2. The Court's April 1, 2011 claim construction ruling

During the April 1, 2011 hearing, the Court did not elaborate on its construction of "having" and "intermediate radius," two terms that were essential to its ruling.[3] This section explains the Court's construction of those terms.

a. "Having"

Rolls-Royce defines "having" as "possessing as a characteristic, quality or function; possessing or containing as a constituent part." Rolls-Royce First Mot. for Summ. J. at 11. Under Rolls-Royce's "open" interpretation of the term "having," Claim 1 would not be limited to three sweep regions, but would apply to a fan blade that has an infinite number of sweep regions. In other words, under this open interpretation, Rolls-Royce argues that the three sweep regions are only part of the invention and do not exclude additional unrecited elements such as a fourth sweep region.

Rolls-Royce relies for this view of "having" on Crystal Semiconductor Corp. v. Tritech Microelectronics Int'l, 246 F.3d 1336 (Fed. Cir. 2001), in which the Federal Circuit found "having" to be an open term. But, the Court did so only after

[3]Rolls-Royce also proposes expansive constructions of "including" and "between," but those terms are not necessary to the April 1, 2011 claim construction decision.

"[examining] the claim in its full context to determine whether Crystal's use of 'having' limits claim 1 to its recited elements." Id. at 1348.

UTC correctly argues that the language and specification of the '077 Patent clearly establish that "having" should have a closed interpretation, which essentially means that the term should be construed as "having only." As both parties argued extensively in the earlier interference proceeding, sweep direction and the number of blade regions determine whether a fan blade will reduce or eliminate passage shock. As such, this crucial element of the claim cannot be open-ended. Indeed, Claim 1 explicitly describes a fan blade that has three specific regions: "having a forward sweep angle in a first height region . . . a rearward sweep angle in an intermediate height region ... [and] a forward sweep angle in a third height region." '077 Patent at Col. 8:15-20. (emphasis added). No other regions or angles are mentioned in either Claim 1 or Claim 8 or in the patent's specification. Because the number of sweep regions is an essential element, the only logical way to read "having" is as a closed term. See Aspheric Lens Co. v. Bausch & Lomb, Inc., No. 07 C 4098, 2009 WL 255621 (N.D. Ill. Jan. 29, 2009) (construing "having" to be a closed term because it describes an "essential structure").

The '077 Patent's specification provides further support for

this construction of "having." See Bridgelux, Inc. v. Cree, Inc., No. 9:06-cv-240, 2008 WL 235623 (E.D. Tex. June 3, 2008) ("'having' must be interpreted in light of the specification to determine whether open or closed language is intended") (citing Manual of Patent Examining Procedure § 2111.03 (8th Ed. Rev. 2006)). The Abstract describes a swept fan blade with "a leading edge swept forward near the hub up to a first radial height, then rearward up to second radial height, and finally . . . swept forward again up to the blade tip." As with the plain text of Claim 1, the Abstract clearly describes a blade that has only three sweep regions.

Moreover, Rolls-Royce's proposed construction of "having" is so broad that it would render Claim 1 invalid for a lack of written description. 35 U.S.C. § 112 requires a patent to contain "such full, clear, concise and exact terms as to enable any person skilled in the art . . . to make and use the same." This description "must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed." In re Gosteli, 872 F.2d 1008, 1012 (Fed. Cir. 1989). Rolls-Royce's specification describes a fan blade with only three sweep regions. Yet Rolls-Royce's proposed construction would cover fan blades that have an infinite number of sweep regions, as long as the final three regions were swept forward-rearward-forward. Such a blade could have four regions (rearward-forward-

rearward-forward), five regions (forward-rearward-forward-rearward-forward), and so on. This construction is far broader than the specification's three-region fan blade, and therefore the construction would violate Section 112. For all these reasons, the Court construes the term "having" to mean "having only."

b. "Intermediate radius"

UTC argues that "intermediate radius" indicates a change of sign in the sweep angle. A positive sweep angle indicates a rearward sweep, and a negative sweep angle indicates a forward sweep. UTC's First Mot. for Summ. J. at 22. Rolls-Royce argues that Claim 1 contains no such limitation:

> While Claim 1 does require at least three sweep angles along the blade in a forward-rearward-forward progression towards the tip, the claim nowhere limits the change of a height region to a change of sign in sweep angle. Instead, the claim merely requires that the first height region be 'between the root and a first intermediate radius'; that and (sic) intermediate height region be 'between the first intermediate radius and a second intermediate radius'; and that the third height region be 'between the second intermediate radius and the tip of the blade.'

Opp. to UTC's First Mot. for Summ. J. at 23-24.

By selectively quoting from Claim 1, Rolls-Royce misrepresents the claim. Claim 1 explicitly discloses a forward sweep angle "between the root and a first intermediate radius," a rearward sweep angle "between the first intermediate radius and a second intermediate radius," and a forward sweep angle "between

the second intermediate radius and the tip." The sign of the sweep angle, therefore, must change at each intermediate radius.

The specification also strongly supports UTC's construction. Figures 5a and 5b of the specification depict a blade with three regions, swept forward-rearward-forward. The specification states: "Particularly noticeable are the two changes of sign of the sweep angle of the leading edge." '077 Patent at Col 5:11-12. Further, the specification states:

> Referring to FIGS. 5a, 5b, 5c and FIG. 6 the rotor blade leading edge 10 from the root radially outwards with increasing radial height is swept forward from the hub 4 or root segment S_1 (FIG. 6) to a maximum forward segment S_5 at approximately mid-height from where the leading edge is swept rearwards through segments S_6 to S_{10}. At about 75% of radial height the increasing rearward sweep is begun to be blended out until at around segment S_{10} there is a change of sign in the inclination of the leading edge 10. Near the blade tip 14 the inclination of the leading edge changes to forward sweep in the segment S_{11}.

'077 Patent at Col. 5:23-33. As UTC correctly argues, the two changes of sign result in three - and only three - sweep regions. Moreover, as described above, the Abstract describes a swept fan blade design with "a leading edge swept forward near the hub up to a first radial height, then rearward up to a second radial height and finally is swept forward again up to the blade tip." This description is crystal clear: the sign of the sweep angle changes between the regions, there are only two changes in the angle, and therefore, only three regions for the blade.

The prosecution history also supports UTC's interpretation

of "intermediate radius." Rolls-Royce described the invention to the PTO as a three region, forward-rearward-forward blade:

> A negative or forward swept angle near the hub changes to a positive or rearward swept angle as distance from the center axis increases. As the tip of the blade is approached the swept angle again becomes negative, which is known as a forward swept angle.

Ex. 17 to UTC's First Mot for Summ. J.

Rolls-Royce argues that UTC's interpretation of Claim 1 would violate the principles of claim differentiation. Rolls-Royce First Mot. for Summ. J. at 19. Under the principles of claim differentiation, "different words or phrases used in separate claims are presumed to indicate that the claims have different meanings and scope." Andersen Corp. v. Fiber Composites, LLC, 474 F.3d 1361, 1369 (Fed. Cir. 2007) (internal quotations marks and citation omitted). Claim 1 discloses "said sweep angle having a forward sweep angle in a first height region between the root and a first intermediate radius." Claim 8 recites "an inner region adjacent the hub, the inner region defining a forward sweep angle." Based on this different language, Rolls-Royce argues that Claim 8 recites an inner sweep region adjacent the hub, but that Claim 1 does not require the first height region to start near the hub. UTC correctly responds that claim differentiation does not apply here because other limitations distinguish Claims 1 and 8. For example, only Claim 1 recites a "stagger angle" and a "tip profile which in

revolution is convergent." See Kraft Foods, Inc. v. International Trading Co., 203 F.3d 1362, 1368 (Fed. Cir. 2000) ("That the patentee chose several words in drafting a particular limitation of one claim, but fewer (though similar) words in drafting the corresponding limitation in another, does not mandate different interpretations of the two limitations[.]"). Because Claims 1 and 8 have other distinguishing characteristics, the Court does not find any material difference between the phrases "between the root and a first intermediate radius" and "an inner region adjacent the hub."

For all these reasons, the Court construes the term "intermediate radius" to mean "change of sign in the sweep angle."

3. "Root"

In its renewed summary judgment motion Rolls-Royce also argues that despite having four distinct regions, the GP7200 blades infringe Claim 1. Central to Rolls-Royce's argument is its new proposed definition of "root."[4]

Throughout this litigation, Rolls-Royce has argued that "root" referred to the point at which the fan blade meets the hub. For example, in his expert report, Rolls-Royce's expert,

[4]Rolls-Royce presents this new definition of "root" as part of its renewed summary judgment motion, and it does not explicitly request a claim construction. Because the outcome of the summary judgment motion depends on how the Court defines "root," the Court first must construe the term.

Harri Kytömaa, wrote that "[t]he blade connects to the hub at its root. The opposite end the [sic] blade, nearest to the casing, is the tip. The blade span is the distance from the root to the tip." Ex. 3 to UTC's Opp. to Rolls-Royce's Second Summary Judgment Mot, at ¶ 46. In response to an interrogatory, Rolls-Royce stated that the first height region "reads on a region approximately from 0% to 33% along the span" of the fan blade, with 0% representing the point at which the fan blade meets the hub and 100% representing the blade tip. Ex. 5 to Opp. to Rolls-Royce's Second Mot. for Summ. J. At the April 1, 2011 hearing, the Court asked Rolls-Royce's counsel what the term "root" means. Counsel responded: "Root is the same place as where the hub. It's right where the, the blade connects to the hub." Tr. at 33.

Now that the Court has rejected Rolls-Royce's first claim construction proposal, Rolls-Royce has changed its definition of "root," arguing that the "root" of the fan blade is an undefined area between the hub and the first sweep region. Rolls-Royce contends that the root is "wholly irrelevant" to determining whether a fan blade conforms to Claim 1's three-region, forward-rearward-forward sweep. Rolls-Royce Second Mot. for Summ. J. at 7. Under Rolls-Royce's construction, the GP7200 fan blade's initial rearward sweep is part of the root, with the forward-rearward-forward sections beginning after that root.

In response, UTC argues that the root is where the fan blade

connects to the hub. Opp. to Rolls-Royce's Second Mot. for Summ. J. at 5-6. The '077 Patent's specification supports UTC's construction of "root." Figure 5 of the '077 Patent depicts a fan blade with three sweep regions: forward-rearward-forward, with the initial forward sweep beginning at the point at which the blade connects with the hub.

As with its earlier claim construction, Rolls-Royce's definition of "root" would render Claim 1 invalid as indefinite and for lack of a written description. Nothing in the claim language or specification provides a clear explanation of exactly what constitutes this "irrelevant" root. Indeed, Rolls-Royce argues that the root portion "can have forward sweep, rearward sweep, no sweep, or any combination of these." Rolls-Royce's Second Mot. for Summ. J. at 18. In essence, Rolls-Royce would make the root portion of the blade a continually moving target.

Rolls-Royce also attempts to rely on the interference proceeding, in which the Court found that a blade for a Rolls-Royce engine, the Trent 8104, embodied the '077 Patent's "forward-rearward-forward" sweep design. Rolls-Royce argues that because the Trent 8104 actually has a small, initial rearward sweep, this Court "recognized that a small portion of rearward sweep in the root of a blade is irrelevant to the '077 Patent." Rolls-Royce's Second Mot. for Summ. J. at 21. UTC correctly responds that this argument fails because during that litigation,

Rolls-Royce presented Proposed Findings of Fact that stated that the Trent 8104 sweep profile has three regions, with "two reversals of sweep direction, with a forward sweep angle in an inner region, a rearward sweep angle in an intermediate region, and a forward sweep angle in a tip region[.]" Ex. 7 to Opp. to Rolls-Royce's Second Mot. for Summ. J. at ¶ 462. A four-region blade was not before the Court. Therefore, Rolls-Royce's reliance on this Court's opinion is of no help.

Rolls-Royce also tries to rely on the '077 Patent specification to support its new construction of "root." Rolls-Royce argues that Figures 7a and 7b of the specification depict eleven "segments," S_1 through S_{11}, which the specification describes as "eleven blade segment profiles references S_1-S_{11} taken at equidistantly spaced radial heights from blade root to tip . . ." '077 Patent, at Col. 5:17-22. Rolls-Royce then points to Figure 8, which describes the sweep angle between each eleven the 11 segments shown in Figures 7a and 7b. Because Figure 8 does not contain information about a sweep angle between the hub and segment S_1, Rolls-Royce argues that the initial "root segment S_1" is irrelevant to the '077 Patent. Rolls-Royce Second Mot. for Summ. J. at 14-16. This argument is unavailing, however, because Figure 8 also does not provide a sweep angle for the region from segment S_{11} to the tip. Therefore, under Rolls-Royce's logic, the sweep angle at the tip of the fan blade also

would be irrelevant to the invention described in the '077 Patent. This clearly is not the case; in the interference action, the Court found that the forward sweep at the tip was a critical feature of the invention. Moreover, the term "root segment" does not appear anywhere in Claim 1. Rolls-Royce's assumption that "root" and "root segment S_1" are interchangeable terms has no basis in either Claim 1 or 8. Finally, Rolls-Royce's interpretation of Figure 8 ignores Figure 5, which clearly depicts segment S_1 as beginning at the hub, with no gap. Therefore, the specification does not support Rolls-Royce's new construction of "root."

Rolls-Royce also characterizes the initial rearward sweep of UTC's blade as "aerodynamically irrelevant" to the invention because there is no concern for controlling passage shock in the root. Rolls-Royce Second Mot. for Summ. J. at 20, n.12. Rolls-Royce argues that the aerodynamic flow "is dictated primarily by the geometry of the hub." Id. at 20. The patent specification, however, contradicts this view of the invention. The specification states that the airflow is "deflected away from both the hub and the tip, and follows a curved trajectory towards the mid-height passage region." '077 Patent, at Col 6:5-8. Moreover, the specification states that "[f]orward sweep is employed near the hub 4 to counteract the rearward sweep of the outboard sections of blade 30 in order to make the design

mechanically feasible." Id. at Col. 3:30-33. Therefore, the patent specifically states that an initial forward sweep is important to the aerodynamic flow. The initial sweep region is not "irrelevant," as Rolls-Royce contends.

Finally, Rolls-Royce relies on an internal UTC document that allegedly illustrates the "preferred embodiment" of the '077 Patent as having a rearward sweep angle at the root. Opp. to UTC's Second Mot. for Summ. J. at 23. The diagram is a plot of UTC's PW6000 engine, which is not accused of infringement. This diagram does not reflect the preferred embodiment because it comes from UTC - not the inventor. Moreover, the document contradicts Figure 8 of the '077 Patent specification, which clearly shows a blade with only three sweep regions, forward-rearward-forward.

In sum, Rolls-Royce does not cite any evidence to support its new definition of "root," a definition that would render Claim 1 indefinite and therefore invalid. For all these reasons, the Court will construe "root" to mean "the point at which the fan blade meets the hub."

4. Claim 1 summarized under the Court's construction of the relevant terms

Applying the above claim constructions, Claim 1 discloses a fan stage with swept fan blades "having only a forward sweep angle in a first height region between the point at which the fan blade meets the hub and a first change of sign in the sweep

angle, then a rearward sweep angle in an intermediate height region between the first change of sign in the sweep angle and the second change of sign in the sweep angle, and lastly a forward sweep angle in a third height region between the second change of sign in the sweep angle and the tip of the blade, with a stagger angle which increases progressively with blade height."

5. Construction of Claim 8

Although the initial claim construction briefs and arguments focused on Claim 1, Rolls-Royce, in its April 29, 2011 Opposition brief, argues for the first time that the GP7200 fan blade also infringes Claim 8, which discloses:

> A fan stage of a ducted fan gas turbine engine that is at least in part rotatable about an axis of rotation and defines a downstream direction along the axis of rotation, comprising:
>
> a fan casing that defines an inner duct wall having a fan rotor region, the inner duct wall of the fan casing at the fan rotor region being convergent;
>
> a hub disposed concentrically relative to the fan casing;
>
> a fan rotor that includes multiple swept fan blades, the swept fan blades being spaced apart around the hub, each of the multiple swept fan blades having:
>
> a tip profile that is convergent so as to substantially correspond to the convergent inner duct wall of the fan casing;
>
> a leading edge that defines a variable sweep angle in a direction perpendicular to the axis of rotation, the leading edge including:
>
> an **inner region** adjacent the hub, the inner region defining a **forward** sweep angle;
>
> an **intermediate region** between the inner region and the fan casing, the intermediate region defining a **rearward** sweep angle; and
>
> an **outer region** between the intermediate

> region and the fan casing, the outer region defining a **forward** sweep angle.

'077 Patent at Col. 8:58-67; Col. 9:1-14.(emphasis on terms relevant to this construction). To resolve that issue, it is necessary to construe only one term: "adjacent the hub."

Throughout this litigation, Rolls-Royce has argued that Claim 8 discloses a swept fan blade with three regions, starting at the hub. For example, during the April 1, 2011 hearing, Rolls-Royce's counsel sought to differentiate Claim 8 from Claim 1 by arguing that Claim 8 is a three-region blade that starts at the hub:

> [I]n Claim 8, it states 'in a region adjacent the hub.' Claim 8 was very specific the region starts at the hub. If you look at claim 1, it says 'a forward sweep angle in a height region between the root and a first intermediate radius.' The fact that claim 8 is more narrow, it uses the word 'adjacent,' makes clear that we're looking at starting at the hub.

Tr. at 32.

Now that the Court has rejected Rolls-Royce's construction of Claim 1, Rolls-Royce has presented a new interpretation of Claim 8. Rolls-Royce now argues that because the first of three regions need only begin "adjacent the hub," Claim 8 would allow another sweep region between the hub and the first region. Opp. to UTC's Second Summary Judgment Mot. at 29. Rolls-Royce argues that "the 'inner region adjacent the hub' having a forward sweep angle need not start 'at' or 'contacting' the hub[.]" Id. UTC argues that Claim 8, like Claim 1, is limited to three regions,

the first of which begins at the hub. Reply in Support of UTC's Second Mot. for Summ. J. at 18.

As with Claim 1, the ordinary and customary meaning that Claim 8 would have had to a person of ordinary skill in the art at the time of the invention is a three-region, forward-rearward-forward fan blade, beginning at the hub. The first region, which begins at the hub, has a forward sweep. The intermediate region has a rearward sweep. Finally, the outer region has a forward sweep. Claim 8 does not disclose any other sweep regions. Once again, Rolls-Royce is attempting to impute a fourth sweep region that is not disclosed either in the claim or specification.

The three-region construction is consistent with Rolls-Royce's representations and the Court's opinion in the interference proceeding, which involved Claim 8. Paul Rowlands, Rolls-Royce's inventor for the '077 Patent, testified that the blade had "forward sweep in the inner region and rearward sweep in the intermediate region but then additionally another region of forward sweep near the tip of the blade." Ex. 22 to Opp. to Rolls-Royce's First Mot. for Summ. J. The Court therefore held that Claim 8 discloses a blade with three regions:

> The improved Rowlands swept fan blade, therefore, has a blade profile that is forward swept in the inner region, rearward swept in the intermediate region, and forward swept in the outer region. In short, the blade has forward-rearward-forward sweep.

Rolls-Royce PLC v. United Techs. Corp., 730 F. Supp. 2d 489, 499

(E.D. Va. 2009). That construction was not disturbed by the Federal Circuit when it affirmed the interference decision.

For all these reasons, the Court will construe "adjacent the hub" to mean "beginning at the hub."

B. Summary judgment

Both parties have moved for summary judgment on Rolls-Royce's infringement claim. UTC has moved for summary judgment that the GP7200 does not infringe any claim of the '077 patent, and Rolls-Royce has moved for summary judgment that the GP7200 infringes Claim 1.

1. Standard of review for summary judgment

Summary judgment is appropriate where the record demonstrates "that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(c). A genuine issue of material fact exists "if the evidence is such that a reasonable jury could return a verdict for the nonmoving party." Anderson v. Liberty Lobby. Inc., 477 U.S. 242, 247-48 (1986). The Court must view the record in the light most favorable to the nonmoving party. See Bryant v. Bell Atl. Md., Inc., 288 F.3d 124, 132 (4th Cir. 2002). However, the "mere existence of a scintilla of evidence in support of the [nonmovant's] position will be insufficient; there must be evidence on which the jury could reasonably find for the [nonmovant]." Anderson, 477 U.S. at 252.

Thus, if a nonmoving party bears the burden of proof on a claim at trial, the moving party may prevail on its Rule 56 motion by showing that there is a lack of evidence to carry the other party's burden as to any essential element of the cause of action. See Celotex Corp. v. Catrett. 477 U.S. 317, 322-23 (1986). Once the moving party has met its burden of demonstrating the absence of an issue of material fact, the party opposing summary judgment may not rest on mere allegations or inferences, but must instead proffer specific facts or objective evidence showing that a genuine issue of material fact exists requiring further proceedings. Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 586 (1986).

2. Summary Judgment as to the GP7200 engine

Rolls-Royce has the burden of proving literal infringement. To do so, it "must present proof that the accused product[s] meet[] each and every claim limitation." Forest Labs. Inc. v. Abbott Labs, 239 F.3d 1305, 1310 (Fed. Cir. 2001). As discussed above, Claims 1 and 8 disclose a swept fan blade that has only three sweep regions. It is undisputed that the GP7200 blade has four sweep regions. As Rolls-Royce concedes in its renewed summary judgment motion, it is "undisputed that from 0%-6% of [the GP7200 fan blade's] leading edge span, the accused GP7200 fan blade has a rearward sweep angle." Rolls-Royce's Second Mot. for Summ. J. at 23.

Therefore, the GP7200 fan blade does not literally infringe Claims 1 and 8, which are limited to having three sweep regions: forward, rearward, and forward. Because the GP7200 fan blade does not infringe the only two independent claims in the '077 Patent, it also does not literally infringe the dependent claims at issue in this litigation. See Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318, 1329 n.5 (Fed. Cir. 2008) ("A conclusion of noninfringement as to the independent claims requires a conclusion of noninfringement as to the dependent claims.")

Rolls-Royce has also attempted to assert infringement under the doctrine of equivalents. At the April 1, 2011 claim construction hearing, counsel for Rolls-Royce stated that it has alleged infringement under the doctrine of equivalents "on claim 2 only, and the other claims, we haven't even alleged or even brought forth evidence on those." Tr. at 35. In its April 29, 2011 brief opposing UTC's second summary judgment motion, however, Rolls-Royce stated that if the Court does not adopt its proposed construction of "root" and "adjacent the hub," Rolls-Royce "will seek leave to assert doctrine of equivalents infringement based on the existing record evidence." Opp. to UTC's Second Mot. for Summ. J. at 6. UTC correctly argues that Rolls-Royce expressly waived the doctrine of equivalents for any claims other than Claim 2. Reply in Supp. of UTC's Second Summ. J. Mot. at 2-3. The Court agrees and will only consider this

theory of infringement as to Claim 2.

As to Claim 2, UTC has moved for summary judgment under a theory of prosecution history estoppel.[5] The Supreme Court has held that prosecution history estoppel ensures that "the doctrine of equivalents remains tied to its underlying purpose." Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 734 (U.S. 2002):

> Where the original application once embraced the purported equivalent but the patentee narrowed his claims to obtain the patent or to protect its validity, the patentee cannot assert that he lacked the words to describe the subject matter in question. The doctrine of equivalents is premised on language's inability to capture the essence of innovation, but a prior application describing the precise element at issue undercuts that premise. In that instance the prosecution history has established that the inventor turned his attention to the subject matter in question, knew the words for both the broader and narrower claim, and affirmatively chose the latter.

Id. at 735-35. UTC correctly argues that prosecution history estoppel precludes application of the doctrine of equivalents as to Claim 2 because Rolls-Royce's patent application was not approved until after it added the limitation of a three-region sweep to the blade, with forward sweep at the tip. UTC's First Mot. for Summ. J. at 12-13. Given that history, Rolls-Royce

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[5]Dependent Claim 2 adds details about the blade tip, specifically claiming "[a] fan stage of a ducted fan gas turbine engine as claimed in claim 1 wherein the blade has a tip region of up to about 20% of blade height characterised in that the stagger angle increases to approximately 70° at the tip relative to airflow direction." '077 Patent at Col. 8:24-28.

cannot now argue that the doctrine of equivalents applies to a four-region blade. In its Opposition brief, Rolls-Royce fails to counter UTC's argument that prosecution history estoppel bars reliance on the doctrine of equivalents. Accordingly, summary judgment will be granted in favor of UTC as to Rolls-Royce's doctrine of equivalents argument for Claim 2.

3. Summary Judgment as to the GTF series engines

Rolls-Royce also alleges that the fan blades in UTC's GTF engine series infringe the '077 Patent. The GTF series, also known as the PW1000G series, includes the PW1100G series (engines for the Airbus A320NEO), PW1200G series (engines for the Mitsubishi Regional Jet), PW1400G series (engines for Irkut), and PW1500G series (engines for the Bombardier C-Series); however, Rolls-Royce has only provided an infringement opinion for the PW1500G series. Rolls-Royce argues that it did not produce an expert opinion regarding the other engines because UTC failed to provide sufficient discovery regarding those engines. In its first summary judgment motion, UTC moved for partial summary judgment as to all engines but the PW1500G series.

At the April 1 hearing, the parties were directed to provide supplemental briefs addressing the discovery issues regarding the GTF series. UTC's supplemental brief demonstrates that it provided sufficient discovery regarding the PW1200G series. On this record, Rolls-Royce's expert had ample opportunity to

produce an infringement opinion as to the PW1200G series and PW1500G series, but only did so on the PW1500G series. Therefore, summary judgment will be granted to UTC as to the PW1200G series of engines.

As to the PW1100G, PW1400G, and PW1500G series, for which Rolls-Royce seeks only injunctive relief, UTC has agreed to consent to an injunction, with no award of damages. UTC's Reply in Supp. of the Supplemental Briefing on the GTF Series Engines at 4. Given UTC's concession, and the fact that only injunctive relief was sought, a trial as to the PW1100G, PW1400G, and PW1500G series is unnecessary. Therefore, the Court will direct the parties to draft an injunction that prevents UTC from producing fan blades for the PW1100G, PW1400G, and PW1500G series engines that contain the '077 Patent's forward-rearward-forward leading edge blade profile for the duration of the patent term.

III. Conclusion

For all the above stated reasons, United Technologies Corporation's Motion for Summary Judgment, Dismissal, and Entry of Proposed Claim Constructions [Dkt. No. 525] will be granted in part, Rolls-Royce plc's Motion for Claim Construction and Summary Judgment [Dkt. No. 532] will be denied in part, UTC's Motion for Summary Judgment of Noninfringement [Dkt. No. 617] will be granted, and Rolls-Royce plc's Renewed Motion for Summary Judgment of Infringement of Claim 1 of U.S. Patent No. 6,071,077

by UTC's GP7200 Fan Stage [Dkt. No. 629] will be denied by an Order to be issued with this Opinion.

Entered this 20th day of May, 2011.

Alexandria, Virginia

/s/
Leonie M. Brinkema
United States District Judge