

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

GENERAL ELECTRIC COMPANY,  
Petitioner,

v.

UNITED TECHNOLOGIES CORPORATION,  
Patent Owner.

---

Case IPR2017-00425  
Patent 8,448,895 B2

---

Before HYUN J. JUNG, MITCHELL G. WEATHERLY, and  
GEORGE R. HOSKINS, *Administrative Patent Judges*.

WEATHERLY, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
35 U.S.C. § 318(a), 37 C.F.R. § 42.73

I. INTRODUCTION

A. BACKGROUND

General Electric Company (“GE”) filed a petition (Paper 1, “Pet.”) to institute an *inter partes* review of claims 1–21 (the “challenged claims”) of U.S. Patent No. 8,448,895 B2 (Ex. 1001, “the ’895 patent”). 35 U.S.C. § 311. Petitioner supported the Petition with a Declaration from Reza Abhari, Ph.D. (Ex. 1003). United Technologies Corporation (“UTC”) timely

filed a Preliminary Response. Paper 6. On July 3, 2017, based on the record before us at the time, we instituted an *inter partes* review of all challenged claims as listed in the table below. Paper 8 (“Institution Decision” or “Dec.”).

| References                                                                                                                       | Basis    | Claims                |
|----------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| Bruce E. Wendus et al., <i>Follow-On Technology Requirement Study for Advanced Subsonic Transport</i> (“Wendus”) (Ex. 1005)      | § 103    | 1, 2, 4–11, and 16–21 |
| William S. Willis, <i>Quiet Clean Short-Haul Experimental Engine (QCSEE) Final Report</i> (“Willis”) (Ex. 1011)                  | § 103    | 1 and 12–15           |
| Mark Daly, <i>Pratt &amp; Whitney PW1000G (formerly GTF Geared Turbofan)</i> , Jane’s Aero-Engines, Issue 27 (“Daly”) (Ex. 1027) | § 102(b) | 1                     |
| Daly                                                                                                                             | § 103    | 3                     |

Dec. 2, 27.

After we instituted this review, Patent Owner filed a Patent Owner Response in opposition to the Petition (Paper 18, “PO Resp.”) that was supported by a Declaration from Jack D. Mattingly, Ph.D. (Ex. 2012). Petitioner filed a Reply in support of the Petition (Paper 24, “Reply”) along with a second declaration from Dr. Abhari (Ex. 1041). Patent Owner did not move to amend any claim of the ’895 patent. UTC filed observations on the cross examination of Dr. Abhari, Paper 31, and GE filed a response, Paper 33.

GE filed a motion to exclude certain portions of Dr. Mattingly’s declaration testimony. Paper 30 (“Motion” or “Mot.”). UTC opposed the

Motion. Paper 34 (“Opposition” or “Opp.”). GE filed a reply in support of the Motion. Paper 35 (“Mot. Reply”).

We heard oral argument on March 15, 2018. A transcript of the argument has been entered in the record (Paper 38, “Tr.”).

We have jurisdiction under 35 U.S.C. § 6. Petitioner must prove propositions of unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

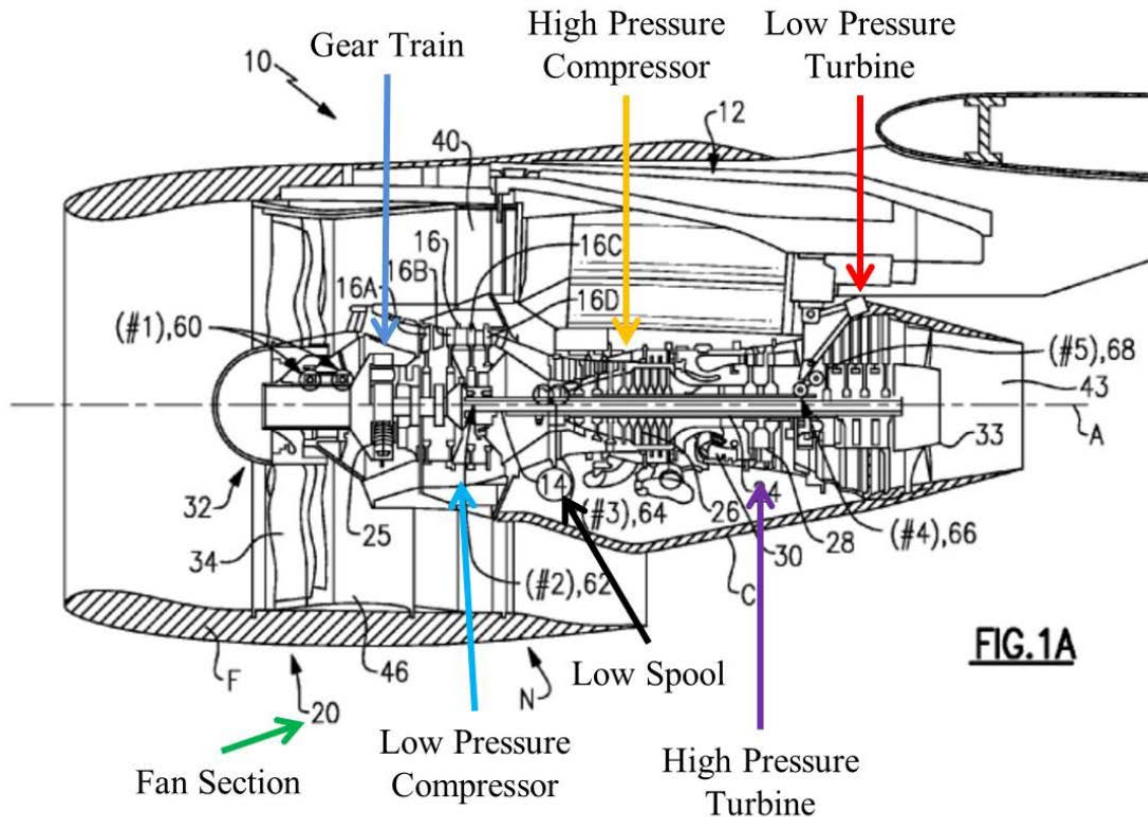
For the reasons expressed below, we conclude that Petitioner has demonstrated by a preponderance of evidence that claims 1–21 are unpatentable. We also deny GE’s Motion to Exclude.

#### B. RELATED PROCEEDINGS

GE identified as related proceedings IPR2016-00531 and IPR2016-00533 because the ’895 patent asserts priority to an application in the chain of priority for the patent at issue in those proceedings. Pet. 1. UTC further identifies IPR2017-00428 and IPR2017-00431 as related to this proceeding because those proceedings involve petitions for review of a patent that claims priority to an application in the priority chain of the ’895 patent. Paper 4, 1–2.

#### C. THE ’895 PATENT

The ’895 patent relates to a “turbofan gas turbine engine” for an aircraft. Ex. 1001, 1:14–16. The pertinent portion of UTC’s annotated version of Figure 1A from the ’895 patent illustrates an exemplary embodiment of the gas turbine engine and is reproduced below.



UTC's annotated Figure 1A of the '895 patent is a schematic sectional view through a gas turbine engine along its longitudinal axis. PO Resp. 6.

Turbofan engine 10 includes two spools, low spool 14 and high spool 24, each of which rotates around longitudinal axis A of engine 10. *Id.* at 3:41–42, 3:50–51. Low spool 14 includes low pressure compressor 16 and low pressure turbine 18 and, in the embodiment illustrated in Figure 1A, drives fan section 20 through gear train 25. *Id.* at 3:42–46. High spool 24 includes high pressure compressor 26 and high pressure turbine 28. *Id.* at 3:47–48. Use of gear train 25 permits the use of a lighter weight low pressure turbine 18 with a reduced number of stages, which increases the efficiency of engine 10. *Id.* at 4:27–29, 4:35–39.

Claims 1 and 16, which are the independent claims, recite:

1. A gas turbine engine comprising:

a fan section;

a low spool that includes a low pressure compressor section, said low pressure compressor section includes eight (8) or less stages;

a high spool that includes a high pressure compressor section said high pressure compressor section includes between eight to fifteen (8–15) stages, an overall compressor pressure ratio provided by the combination of said low pressure compressor section and said high pressure compressor; and

a gear train defined along an engine centerline axis, said low spool operable to drive said fan section through said gear train.

*Id.* at 7:60–8:6.

16. A gas turbine engine comprising:

a gear train defined along an engine centerline axis, said gear train defines a gear reduction ratio of greater than or equal to about 2.3; and

a spool along said engine centerline axis which drives said gear train, said spool includes a low pressure turbine with three to six (3–6) stages and a low pressure compressor with eight (8) or less stages.

*Id.* at 8:45–52.

## II. ANALYSIS

### A. LEVEL OF ORDINARY SKILL

GE contends a person of ordinary skill in the art pertaining to the '895 patent, at the time of invention, “would include someone who has a M.S. degree in Mechanical Engineering or Aerospace Engineering as well as at least 3–5 years of experience in the field of gas turbine engine design and

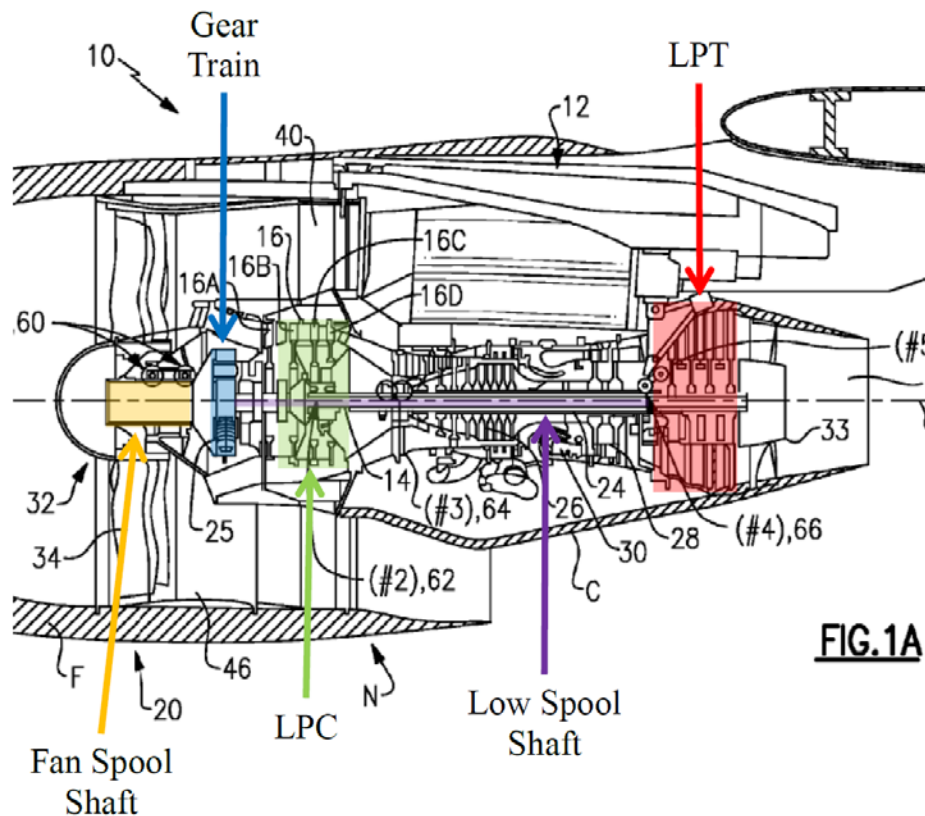
analysis.” Pet. 16, n.4; Ex. 1003 ¶ 4. UTC does not address expressly the level of ordinary skill in the art in the Patent Owner Response. Although UTC’s witness, Dr. Mattingly, believes GE understates the level of ordinary skill, he nonetheless expresses opinions “from the perspective of one with the skill level [Petitioner] identified.” Ex. 2012 ¶¶ 46–50. In considering the issues presently before us, we have adopted and applied GE’s proposed identification of the level of ordinary skill in the art, which is consistent with the ’895 patent and the asserted prior art.

#### B. CLAIM INTERPRETATION

“A claim in an unexpired patent . . . shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b); *see also* *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016) (affirming that USPTO has statutory authority to construe claims according to Rule 42.100(b)). When applying that standard, we interpret the claim language as it would be understood by one of ordinary skill in the art in light of the specification, and absent any special definition, we give claim terms their ordinary and customary meaning. *See In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260 (Fed. Cir. 2010); *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (“The ordinary and customary meaning is the meaning that the term would have to a person of ordinary skill in the art in question.” (internal quotation marks omitted)). Only terms which are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. “Low Spool” of Independent Claim 1 and “Spool” of Independent Claim 16

Claim 1 recites a “low spool that includes a low pressure compressor section,” Ex. 1001, 7:62–63, and claim 16 recites a “spool” that “includes . . . a low pressure compressor,” *id.* at 8:49–52. UTC contends, based on testimony from Dr. Mattingly, that both claims require a “single shaft connecting the low pressure turbine and low pressure compressor” that also “drives the gear train.” PO Resp. 9 (citing Ex. 2012 ¶ 52). UTC contends that its annotated version of Figure 1A of the ’895 patent, reproduced below, depicts such an arrangement having “only one shaft that connects both the LPT and the LPC and drives the gear train.” PO Resp. 12–13.



UTC’s annotated Figure 1A is a cross section view of a jet engine having a low spool shaft (purple) connecting LPT 18 (red) and LPC 16 (green) and driving fan section 20 through gear train 25 (blue). Relying

solely upon Dr. Mattingly's testimony, UTC argues that by "expressly reciting that the LPC is included on the 'low spool'/'spool,' the '895 patent claims do not cover embodiments where the LPC is on a separate shaft." *Id.* at 14 (citing Ex. 2012 ¶ 56). Based almost entirely on Dr. Mattingly's testimony, UTC argues that "low spool" of claim 1 and "spool" of claim 16 refer to "a *single shaft* that rotates at the same speed as the other components included on the same spool." *Id.* at 11 (citing Ex. 2012 ¶ 55). We disagree.

The claims and the Specification uniformly use "spool" to refer to a collection of components that "includes" a compressor and a turbine, and neither the claims nor the Specification use "spool" to refer solely to a single shaft. For example, the Specification states:

The low spool 14 includes a low pressure compressor 16 and low pressure turbine 18. The low spool 14 drives a fan section 20 connected to the low spool 14 either directly or through a gear train 25.

The high spool 24 includes a high pressure compressor 26 and high pressure turbine 28. A combustor 30 is arranged between the high pressure compressor 26 and high pressure turbine 28. The low and high spools 14, 24 rotate about an engine axis of rotation A.

Ex. 1001, 3:42–51. Each of the two "spools" is described to "include" one compressor and one turbine. The Specification never recites "shaft" when describing either spool or states that the LPC must be "on" a shaft. Rather, the Specification more broadly describes the LPC and LPT as being "rotationally coupled" to each other. *Id.* at 4:25–27.

The claims similarly fail to recite expressly any shaft as being a component of the "low spool" of claim 1 or "spool" of claim 16. *Id.* at 7:60–8:6 (claim 1), 8:45–52 (claim 16). However, the claims recite that the "low spool" or "spool" includes certain components. Claim 1 merely

recites that the “low spool . . . includes a low pressure compressor section” without expressly reciting a turbine, or a shaft between the turbine and the compressor. *Id.* at 7:60–8:6. Claim 5, which depends directly from claim 1 further requires that the “low spool includes a low pressure turbine.” *Id.* at 8:13–14. Claim 16 recites its “spool” as one that “includes a low pressure turbine . . . and a low pressure compressor” without expressly listing a shaft among the components of the “spool.” *Id.* at 8:45–52. The use of the open-ended transitional word “includes” in both claims indicates that the scope of the claimed spools may encompass other components beyond those expressly recited.<sup>1</sup>

Dr. Mattingly testifies regarding the way in which an ordinarily skilled artisan understands the terms “low spool” of claim 1 and “spool” of claim 16 in the context of two classes of turbofan engines, direct drive turbofans and gear-driven turbofans. Ex. 2012 ¶¶ 53–55. He neither cites nor comments upon any portion of the Specification in his testimony on these issues. *Id.* Dr. Mattingly explains that, in direct drive turbofans, the fan is mounted directly on the same shaft as the low pressure turbine and low pressure compressor and all three components spin at the same speed. *Id.* ¶ 53. Dr. Mattingly opines that because all these components, including the fan, rotate at the same speed, an ordinarily skilled artisan would refer to all these components as the low spool. *Id.* In geared turbofans, the fan is mounted on a shaft connected to a low-speed side of a gear train. *Id.* ¶ 54.

---

<sup>1</sup> Our reviewing “court has consistently interpreted ‘including’ and ‘comprising’ to have the same meaning, namely, that the listed elements . . . are essential but other elements may be added.” *Lucent Techs., Inc. v. Gateway, Inc.*, 525 F.3d 1200, 1214 (Fed. Cir. 2008).

The low pressure turbine is mounted on a shaft connected to the other, high-speed, side of the gear train. *Id.* The “speed differences” between components on opposite sides of the gear train lead those of ordinary skill to consider a geared fan to be on a different spool from the LPT. *Id.*

Dr. Mattingly further testifies that skilled artisans refer to components being included on a spool when they rotate at the same speed on a single shaft. *Id.*

¶ 55.

Based on this testimony, we conclude that components rotating at the same speed would be considered to be a defining characteristic of components that are included on the same spool. Dr. Mattingly’s testimony that an ordinarily skilled artisan would further restrict the meaning of “spool” as referring to a single shaft is inconsistent with the Specification’s description of low spool as including a low pressure compressor and a low pressure turbine that are merely “rotationally connected” without expressly referring to only one shaft. Because his testimony that “spool” refers to a single shaft is inconsistent with the Specification, we accord it no weight. *Hayward Indus., Inc. v. Pentair Water Pool & Spa, Inc.*, 721 F. App’x 974, 977–78 (Fed. Cir. 2018) (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1584 (Fed. Cir. 1996) (“[T]he expert testimony, which was inconsistent with the specification and file history, should have been accorded no weight.”)).

Based on our consideration of the record, we conclude that “low spool” in claim 1 and “spool” in claim 16 refers to the collection of components including at least a low pressure compressor<sup>2</sup> that are

---

<sup>2</sup> The “spool” of claim 16 also expressly includes a low pressure turbine.

rotationally coupled to spin at the same speed. The low pressure compressor need not be “on the same shaft as the LPT” as UTC argues.

*2. Controller of Claim 15*

Claim 15 depends from claim 12, Ex. 1001, 8:40, which depends from claim 1, *id.* at 8:31. Claims 12 and 15 recite:

12. The gas turbine engine as set forth in claim 1, further comprising a fan variable area nozzle to vary a fan nozzle exit area and adjust a pressure ratio of a fan bypass airflow of said fan section during engine operation.

*Id.* at 8:31–34.

15. The engine as recited in claim 12, further comprising: a controller operable to control said fan variable area nozzle to vary a fan nozzle exit area and adjust the pressure ratio of the fan bypass airflow to reduce a fan instability.

*Id.* at 8:40–44.

The Specification does not provide details of an algorithm for controlling fan nozzle exit area to reduce fan instability. Instead, UTC relies upon one passage in the Specification as describing the claimed controller.

PO Resp. 15–16 (citing Ex. 1001, 4:48–58). This passage states:

The variable area fan nozzle (“VAFN”) 42 operates to effectively vary the area of the fan nozzle exit area 44 to selectively adjust the pressure ratio of the bypass flow B in response to a controller C. Low pressure ratio turbofans are desirable for their high propulsive efficiency. However, low pressure ratio fans may be inherently susceptible to fan stability/flutter problems at low power and low flight speeds. The VAFN 42 allows the engine to change to a more favorable fan operating line at low power, avoiding the instability region, and still provide the relatively smaller nozzle area necessary to obtain a high-efficiency fan operating line at cruise.

*Id.* at 4:48–58. The Specification thus indicates that the engine uses a smaller nozzle exit area at cruise for high efficiency and a more favorable operating line at low power and low flight speeds to avoid “the instability region.” *Id.* The danger of instability stems from the susceptibility of low pressure ratio fans to fan stability/flutter problems at low power and low flight speeds. *Id.* at 4:52–54. The Specification provides no other details regarding the control of the VAFN to reduce a fan instability.

Based on the plain language of the claim and the relevant portions of the Specification, we conclude that the “controller” must operate to change the fan nozzle exit area to a more favorable fan operating line at low power and low flight speeds to avoid fan instability.

#### C. THE PARTIES’ POST-INSTITUTION ARGUMENTS

In our Institution Decision, we concluded that the argument and evidence adduced by GE demonstrated a reasonable likelihood that claims 1–21 were unpatentable as obvious based on the challenges identified in the table in Part I.A above. Dec. 2, 27. We must now determine whether GE has established by a preponderance of the evidence that the specified claims are unpatentable over the cited prior art. 35 U.S.C. § 316(e). We previously instructed UTC that “any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived.” Paper 9, 6; *see also In re Nuvasive, Inc.*, 842 F.3d 1376, 1381 (Fed. Cir. 2016) (holding that patent owner’s failure to proffer argument at trial as instructed in scheduling order constitutes waiver). Additionally, the Board’s Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

D. LEGAL STANDARDS

GE challenges the patentability of claims 1–21 on the grounds that the claims are either anticipated or obvious in light of various references including: Wendus, Willis, and Daly. To prevail in its challenges to the patentability of the claims, GE must establish facts supporting its challenges by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). “In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden never shifts to UTC. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review).

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), reaffirmed the framework for determining obviousness as set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The *KSR* Court summarized the four factual inquiries set forth in *Graham* that we apply in determining whether a claim is unpatentable as obvious under 35 U.S.C. § 103(a) as follows: (1) determining the scope and content of the prior art, (2) ascertaining the differences between the prior art and the

claims at issue, (3) resolving the level of ordinary skill in the pertinent art, and (4) considering objective evidence indicating obviousness or nonobviousness. *KSR*, 550 U.S. at 406 (citing *Graham*, 383 U.S. at 17–18). In this *inter partes* review, GE cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Thus, to prevail GE must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable. With these standards in mind, we address each challenge below.

E. CLAIMS 1, 2, 4–11, AND 16–21  
OBVIOUSNESS IN VIEW OF WENDUS

GE argues that Wendus in view of the background knowledge of an ordinarily skilled artisan renders claims 1, 2, 4–11, and 16–21 unpatentable as obvious. Pet. 22–35. For the reasons expressed below, we conclude that GE has demonstrated by a preponderance of evidence that Wendus and the background knowledge of an ordinarily skilled artisan renders claims 1, 2, 4–11, and 16–21 unpatentable as obvious.

1. *Overview of Wendus*

Wendus describes a study relating to an engine for a subsonic commercial aircraft potentially to enter service in 2005 called the Advanced Ducted Propulsor (“ADP”). Ex. 1005, 11. Wendus describes the ADP as combining “an ultra-high bypass ratio, variable pitch fan with a derivative of the Advanced Technology Common Core. Engine OPR [overall pressure ratio] and bypass ratio are 55 and 16.7, respectively.” *Id.* at 16. The ADP includes an engine in which a “variable pitch fan is followed by a six-stage variable geometry low-pressure compressor, both of which are powered by a six-stage low-pressure turbine through a 4.2:1 gearbox.” *Id.* Wendus also

indicates that he evaluated whether to include a six-stage or eight-stage high pressure compressor in the ADP. *Id.* at 18. The configuration of the ADP with an eight-stage high pressure compressor is illustrated schematically in Figure 6 from Wendus, which is reproduced below.

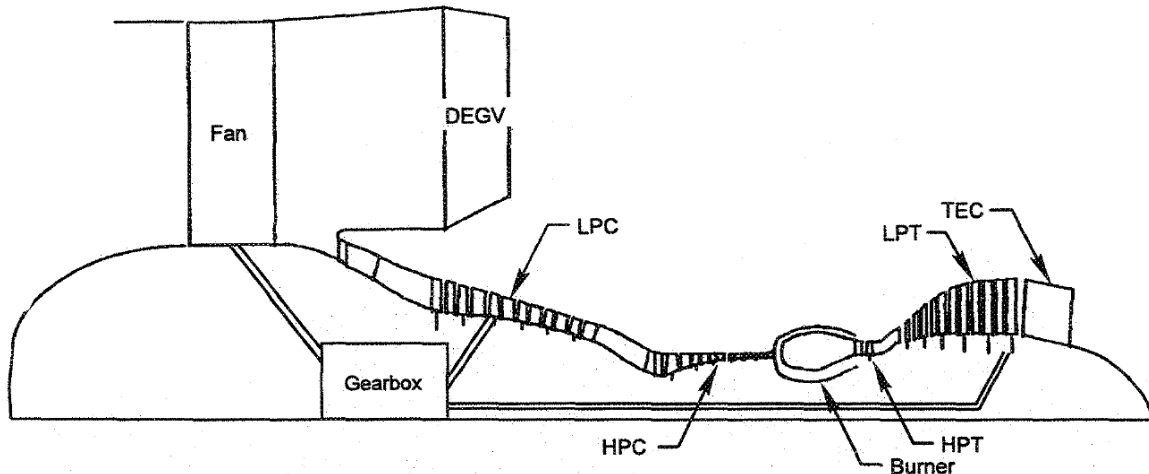


Figure 6 of Wendus illustrates in a highly schematic partial cross section view the turbomachinery, gearbox, and fan of the ADP.

Wendus focused his study on the ADP having a six-stage high pressure compressor even though the eight-stage high pressure compressor was estimated to be one percent more efficient than the six-stage high pressure compressor. *Id.* at 20–21. Wendus selected the six-stage high pressure compressor for his detailed cost analysis because it weighed less and was likely less expensive to manufacture and maintain than the eight-stage high pressure compressor. *Id.* at 21.

## 2. GE's Arguments Relating to Independent Claims 1 and 16

GE identifies in detail the manner in which the ADP includes all elements of claim 1 except for a “high spool” and a “high pressure compressor section include[ing] between eight to fifteen (8-15) stages.” Pet. 23–28 (citing Ex. 1005, 13–18, 20, 21, 44). GE supports its contentions

with testimony by Dr. Abhari. *Id.* (citing Ex. 1003 ¶¶ 85–91). Regarding the “high spool,” GE contends that even though Wendus does not explicitly illustrate a high spool connecting the high pressure compressor and high pressure turbine in its Figure 6, an ordinarily skilled artisan would have found it obvious to include a high spool in the ADP. *Id.* at 25–26 (citing Ex. 1003 ¶ 90); *see also* Ex. 1005, 51 (referring to core of ADP as “using a derivative of the Advance Technology Common Core (ATCC) for the high spool”).

Regarding the use of a high pressure compressor having 8–15 stages, GE contends that an ordinarily skilled artisan would have found it obvious to incorporate Wendus’ eight-stage high pressure compressor rather than the six-stage high pressure compressor into the ADP. Pet. 26–27 (citing Ex. 1005, 20, 21; Ex. 1003 ¶¶ 89–91). More specifically, GE argues that: “The fact that the six-stage HPC was ultimately selected for the STS1046 is irrelevant because an 8-stage configuration is explicitly disclosed and Wendus does not teach away from using an eight-stage configuration.” *Id.* at 26 (citing *In re Fulton*, 391 F.3d 1195, 1200–01 (Fed. Cir. 2004) (“[t]he prior art’s mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed”)). GE also argues that the “reason for this choice was that even though the eight-stage HPC was slightly more efficient, it came at the cost of a longer rotor and more airfoils.” *Id.* (citing Ex. 1005, 20–21; Ex. 1003 ¶ 91).

GE provides a claim chart that sets forth in detail the manner in which Wendus describes all elements of independent claim 16. *Id.* at 32–33. Unlike claim 1, claim 16 recites a low pressure turbine as a component of

the low “spool.” *Compare* Ex. 1001, 7:62–64 (reciting “low spool” of claim 1), *with id.* at 8:49–52 (reciting “spool” of claim 16). Claim 16 requires that the low pressure turbine has three to six stages. *Id.* at 8:49–52. GE contends that Wendus describes a six-stage low pressure turbine included within the same spool as a six-stage low pressure compressor. Pet. 33 (citing Ex. 1005, 16, 21, 44).

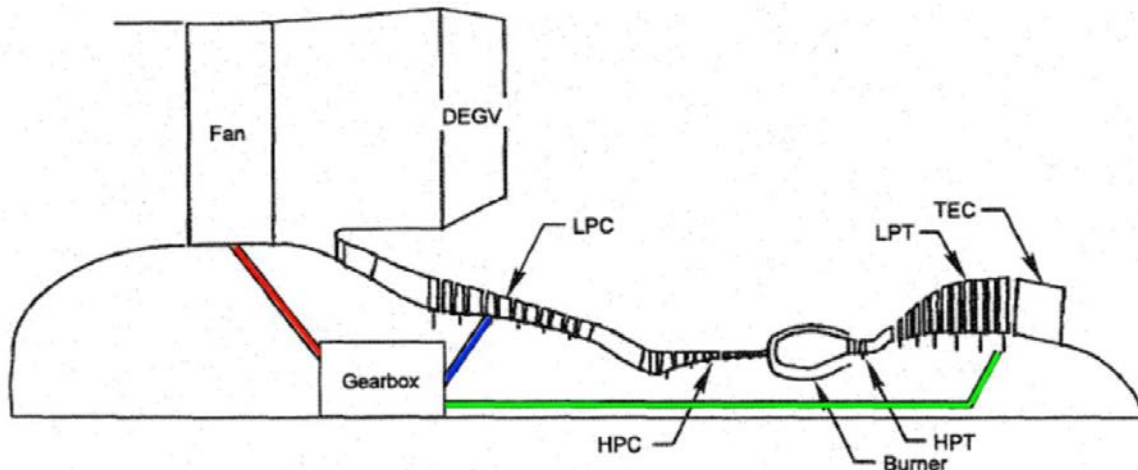
### 3. Analysis of UTC’s Counterarguments

UTC argues that Wendus fails to render claims obvious for two reasons. PO Resp. 18–33. First, UTC argues that Wendus fails to describe an LPC on the shaft that drives the gear train as required in independent claims 1 and 16 and their respective dependent claims 2, 4–11, and 21 and 17–20. *Id.* at 18–24. Second, UTC argues that Wendus teaches away from using an eight-stage HPC as required in independent claim 1 and its dependent claims 2, 4–11, and 21. *Id.* at 25–33. For the reasons expressed below, we determine that GE’s argument and evidence is more persuasive than UTC’s on both points.

#### a) Wendus Fails to Describe the Claimed “Low Spool” of Claim 1 and the “Spool” of Claim 16

UTC argues that Wendus fails to describe an LPC “located on the low spool and shaft that drives the fan section” as required in independent claims 1 and 16. *Id.* at 18. UTC contends that, instead, Wendus describes an LPC that is “*driven by the gear train.*” *Id.* UTC relies upon Wendus’ statement that the “variable pitch fan is followed by a six-stage variable geometry **low-pressure compressor, both of which are powered** by a six-stage low-pressure turbine **through** a 4.2:1 **gearbox.**” *Id.* at 19 (quoting Ex. 1005, 16). Dr. Mattingly testifies that an ordinarily skilled artisan would understand this passage of Wendus to be describing a gearbox positioned between the LPC

and the low spool shaft. Ex. 2012 ¶¶ 68–69. UTC also relies upon its annotated version of Figure 6 of Wendus, which we reproduce below.



UTC’s colorized annotated version of Figure 6 from Wendus is a schematic illustration of Wendus’ ADP in which UTC purports to identify three separate driven shafts in the ADP. PO Resp. 20.

UTC contends, for example, that the ADP has three shafts, one shaft (green) that connects the low pressure turbine to the gearbox, a second shaft (blue) that connects the gearbox to the low pressure compressor, and a third shaft (red) that connects the gearbox to the fan section. PO Resp. 19–20. Based on the cited text and Figure 6 from Wendus and testimony from Dr. Mattingly, UTC argues Wendus describes: “(1) a low spool shaft connecting the LPT to the gearbox, and (2) a separate shaft and truncated cone connecting the LPC to the gearbox, rotating at the same rate as the LPT, and being driven by the gearbox.” *Id.* at 20 (citing Ex. 2012 ¶ 75). UTC also contends that its position is “consistent with Wendus’s teaching that its LPC is ‘[c]oupled to the high speed side of the gearbox.’” *Id.* (citing Ex. 2012).

GE responds that Wendus explicitly describes the “low spool” as including a “LPC, low shaft, LPT and bearings,” Reply 5 (quoting Ex. 1005, 44), and the LPC being “[c]oupled to the high speed side of the gearbox,” *id.*

(quoting Ex. 1005, 18). Based on Wendus and testimony from Drs. Abhari and Mattingly, GE further argues that an ordinarily skilled artisan would understand that Wendus' use of a single-ratio, planetary gearbox necessarily means that the gearbox has one input and one output. *Id.* at 5–6 (citing Ex. 1005, 18; Ex. 1041 ¶ 15, Ex. 1032, 46:10–47:2). GE points out that both experts agree that the LPC of Wendus rotates at the same speed as its LPT. Ex. 1003 ¶ 88; Ex. 2012 ¶ 68.

Based on the record before us, we determine that GE has established by a preponderance of evidence that Wendus describes a “low spool” as recited in claim 1 and a “spool” as recited in claim 16. Our determination rests upon our interpretations of “low spool” (claim 1) and “spool” (claim 16) that do not require the low pressure compressor of either spool to be “on the same shaft as the LPT” as UTC argues. Rather, the low pressure compressor of each spool must merely be rotationally coupled to the other components of the spool such that they all spin at the same speed. *See* Part II.B.1 above.

The parties disagree about whether Wendus describes an LPC that is rotationally coupled with the LPT via one shaft (GE's position) or two shafts coupled to the high-speed side of the gearbox (UTC's position). Reply 4. In support of UTC's position Dr. Mattingly testifies that Wendus' LPC is rotationally coupled with and rotates at the same speed as Wendus' LPT. Ex. 2012 ¶ 67 (Wendus teaching that “its low pressure compressor is ‘[c]oupled to the high-speed side of the gearbox.’” (quoting Ex. 1005, 18)), ¶ 70 (“a person of ordinary skill would have read Figure 6 and page .018 of Wendus *together* as indicating that the shaft driving the low pressure compressor turns at the same speed as the shaft through which the low

pressure turbine drives the gearbox.”). Dr. Mattingly further opines that Wendus’ Figure 6 illustrates that its LPC is physically connected to its gearbox via a truncated cone. Ex. 2012 ¶ 75.

We need not resolve the factual dispute over which of the two arrangements Wendus describes because both arrangements meet the requirement of a “low spool that includes a low pressure compressor section” as recited in claim 1 and a “spool” that “includes . . . a low pressure compressor” as recited in claim 16. The parties agree that Wendus describes an LPC that is rotationally coupled to the LPT. UTC contends that a gearbox and a truncated cone are components between Wendus’ low shaft and LPC. However, even if true, Wendus still lists “LPC, low shaft, LPT and bearings” as components of its “low spool.” Ex. 1005, 44. Wendus also describes its LPC as “[c]oupled to the high speed side of the gearbox.” *Id.* at 18. Dr. Mattingly testifies that Wendus describes its LPT as being coupled to the same side of the gearbox as the LPC. Ex. 2012 ¶ 75. Dr. Mattingly also testifies that Wendus’ LPC rotates at the same speed as its LPT. *Id.* ¶ 70. This testimony establishes that Wendus’ LPC is rotationally coupled to the LPT to spin at the same speed as the LPT and the low shaft.

We interpret the “low spool” of claim 1 and the “spool” of claim 16 such that they may encompass other components beyond a turbine, a shaft, and a compressor. *See* Part II.B.1 above. Accordingly, we determine that Wendus describes the “low spool” of claim 1 and the “spool” of claim 16 regardless of whether the LPC is directly connected to the low spool shaft or rotationally coupled via intervening components such that the LPC spins at the same speed as the LPT.

b) Alleged Teaching Away from an Eight-Stage HPC of Claims 1, 2, 4–11, and 21 by Wendus

UTC argues that Wendus teaches away from using an 8-stage HPC because Wendus selected a 6-stage HPC for the ADP. PO Resp. 25–33. UTC argues that if Wendus “‘criticize[s], discredit[s], or otherwise discourage[s] the solution claimed,’ then the disclosure teaches away and does not demonstrate obviousness.” *Id.* at 26 (citing *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009)). UTC relies upon the following passage in Wendus as expressly teaching away from using an 8-stage HPC in the ADP engine:

Based on the added core length of 1.5 in. (increased weight) and the 595 additional airfoils (increased manufacturing and maintenance costs) required by the lower rotational speed [of the 8-stage HPC], the six-stage high-pressure compressor was selected for the STS1046 ADP.

*See id.* at 29 (citing and quoting portions of the passage quoted above). UTC concedes that Wendus also identified a potential increase in efficiency of one percent from “lower shock losses” from using an 8-stage rather than a 6-stage HPC in the ADP engine. *Id.* However, UTC contends that an ordinarily skilled artisan would have understood that a one percent increase in efficiency would “provide no benefit at all in Wendus’s four-engine aircraft.” *Id.* at 29–30 (citing Ex. 2012 ¶¶ 80, 86–88; Ex. 1005, 12). UTC relies upon testimony by Dr. Mattingly to support this contention in which he explains his use of AEDsys software included with a textbook that he authored to analyze the 8-stage ADP. Ex. 2012 ¶ 86. Based on that analysis, Dr. Mattingly testifies that the higher efficiency 8-stage HPC would reduce the fuel burned by “about 380 pounds.” *Id.* ¶ 87. Dr. Mattingly also estimates that the 8-stage HPC would add “substantially more” than 380

pounds to the ADP due to its additional 595 airfoils alone. *Id.* Because the 8-stage HPC would add more weight than it saved in required fuel, Dr. Mattingly concluded that an aircraft incorporating an ADP with an 8-stage HPC (the “8-stage ADP”) would require more fuel than the aircraft with an ADP, *id.* ¶ 88, and thus “result in a less efficient aircraft,” *id.* ¶89.

GE responds that Wendus expressly recognizes advantages and disadvantages of an 8-stage ADP when compared to the ADP. Reply 9–10. GE contends that an ordinarily skilled artisan would understand that “Wendus discloses that the six-stage HPC has lower weight, fewer parts, and shorter length, while the eight-stage HPC is more efficient.” *Id.* at 10 (citing Dr. Abhari’s testimony at Ex. 1041 ¶ 23). Dr. Abhari testifies that an ordinarily skilled artisan would have understood that the 8-stage ADP would be preferred for some engine applications calling for increased efficiency, and he supports his conclusion with a specific example in the prior art, the development of the PW6000 engine by UTC’s subsidiary, Pratt & Whitney. Ex. 1041 ¶ 24 (citing Ex. 1037, 2, 5).

Based on our consideration of all the evidence, we are persuaded that Wendus does not teach away from using an 8-stage ADP.

Although a reference that teaches away is a significant factor to be considered in determining unobviousness, the nature of the teaching is highly relevant, and must be weighed in substance. A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.

*In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

We accord little weight to Dr. Mattingly’s study comparing the efficiency of an aircraft using an 8-stage ADP rather than the ADP for two reasons. First, Dr. Mattingly rests the conclusions of his study on a specific

set of assumptions relating to the aircraft and its flight conditions including, for example, using the engine in a four-engine aircraft designed for a 4000 nm range that is operating at maximum climb flight conditions. Ex. 2012 ¶¶ 86–87. Dr. Abhari explains that Dr. Mattingly’s assumptions are inconsistent with the manner in which an ordinarily skilled artisan would analyze the overall efficiency of an 8-stage ADP. Ex. 1041 ¶¶ 28–29. For example, Dr. Abhari points out that analyzing an engine only at “maximum climb” flight conditions does not comport with Dr. Mattingly’s own recommendations for analyzing engine performance. *Id.* ¶ 29 (quoting Ex. 1014, 88 (“The analysis of engine performance requires a model for the behavior of each engine component over its actual range of operation . . . . [T]he usual industrial practice is to use data or correlations . . . in the form of component ‘maps.’”)). Dr. Abhari also notes that Dr. Mattingly’s analysis may have no bearing on how an 8-stage ADP would perform in aircraft having a different number of engines or designed with a different flying range. *Id.* ¶ 30.

Second, Dr. Mattingly offers no opinion on whether an 8-stage ADP would have offered similar benefits as the ADP when the 8-stage ADP is compared to Wendus’ baseline turbofan. Wendus found that the ADP provided a 14.6 percent gain in thrust specific fuel consumption along with many other operational advantages over the baseline turbofan, Ex. 1005, 1, despite the ADP weighing 448 pounds more than the baseline engine, *id.* at 36. The configuration of the 8-stage ADP was essentially the same as the ADP, but with even more fuel efficiency at the expense of somewhat higher

weight.<sup>3</sup> *See id.* at 13–21 (setting forth characteristics of the ADP and the 8-stage ADP before selecting the ADP for deeper analysis). The ADP was also heavier than the baseline turbofan, but the advantage of its higher fuel efficiency overcame the disadvantage of its added weight. *Id.* at 36.

Dr. Abhari testifies that an ordinarily skilled artisan routinely considers this precise trade-off when designing engines. Ex. 1041 ¶ 23. When determining whether Wendus taught away from using an 8-stage ADP, we consider it more important to know whether an 8-stage ADP was also an improvement over the baseline turbofan in Wendus’ study. Dr. Mattingly’s failure to provide this analysis weakens the probative value and credibility of his testimony in our view.

For the reasons expressed above, we determine that Dr. Mattingly’s study is entitled to little weight when deciding whether Wendus teaches away from using an 8-stage ADP. We also determine that Wendus describes the 8-stage ADP as an option having known advantages and disadvantages when compared to the 6-stage ADP. In such circumstances, we conclude that Wendus does not teach away from incorporating an 8-stage ADP into at geared turbofan like the ones of claims 1 and 16.

#### 4. Conclusion

Based on the record developed at trial, we conclude that GE has demonstrated by a preponderance of evidence that Wendus and the knowledge of an ordinarily skilled artisan renders independent claims 1 and 16 unpatentable as obvious. We also adopt as our own GE’s argument

---

<sup>3</sup> Dr. Mattingly testifies that the 8-stage ADP would weigh “substantially more” than his estimated fuel weight savings of 380 pounds without specifying how much more. Ex. 2012 ¶ 87.

and evidence as the basis for our conclusion that GE has also demonstrated that Wendus renders dependent claims 2, 4–11, and 17–21 unpatentable as obvious.

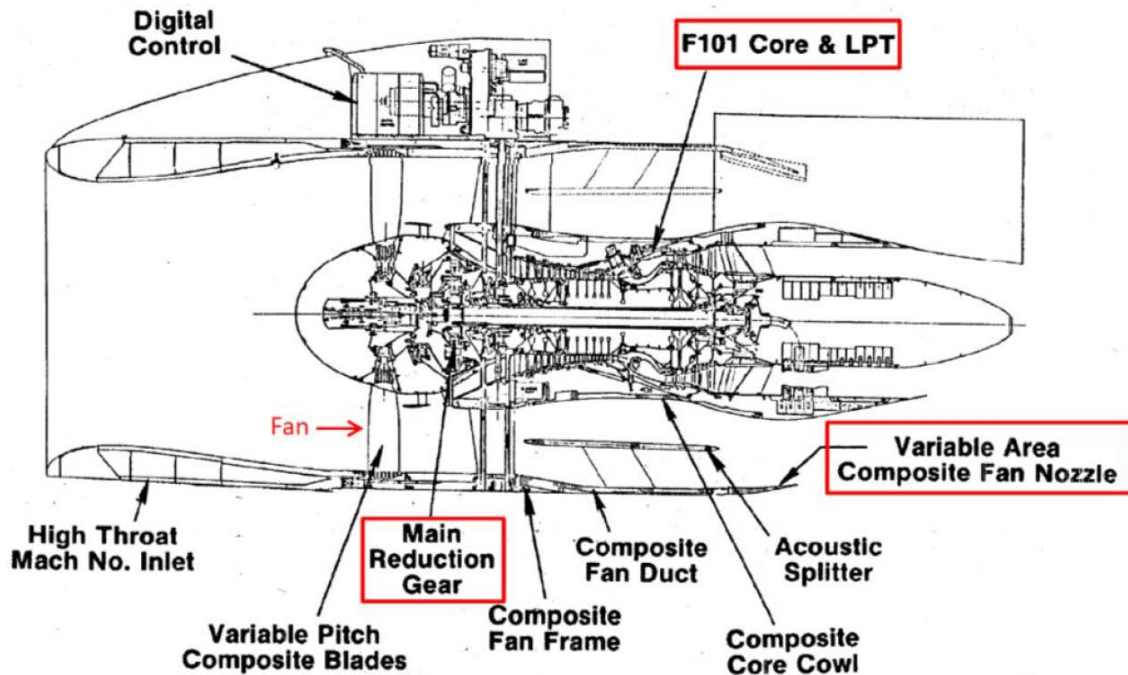
F. CLAIMS 1 AND 12–15  
OBVIOUSNESS IN VIEW OF WILLIS

GE argues that Willis in view of the background knowledge of an ordinarily skilled artisan renders claims 1 and 12–15 unpatentable as obvious. Pet. 35–50. UTC separately identifies alleged flaws in GE’s argument for independent claim 1 and dependent claim 15, but does not separately identify flaws with GE’s arguments and evidence supporting the alleged the unpatentability of dependent claims 12–14. *See* PO Resp. 33–55 (only discussing patentability of claims 1 and 15). For the reasons expressed below, we conclude that GE has demonstrated by a preponderance of evidence that Willis coupled with the knowledge of an ordinarily skilled artisan renders claims 1 and 12–15 unpatentable as obvious.

*1. Claim 1*

a) GE’s Arguments

GE contends that the under the wing (“UTW”) engine of Willis includes a fan section driven by a low pressure turbine through a main reduction gear. Pet. 35–36 (citing Ex. 1011, 19, 24, 32, 33, 88, Figure 8; Ex. 1003 ¶ 116). GE identifies the components of the Willis UTW engine in the reproduction of Willis’ Figure 8 below, with GE’s annotations in red.



Willis' Figure 8 is a schematic cross section of the UTW engine.  
Pet. 36.

Willis discloses the results of a program conducted by General Electric under contract from NASA for developing a technology demonstrator engine call the Quiet Clean Short-haul Experimental Engine ("QCSEE"). Ex. 1011, 19. The program included the "design, fabrication, and testing of two advanced turbofan propulsion systems." *Id.* at 24. One of the propulsion systems was designed for "an Under-the-Wing (UTW) . . . application." *Id.* at 19. The UTW turbofan included "a lightweight, high-speed, power turbine driving a slower speed, quiet fan . . . [which] required a compatible, compact, lightweight, high-power-capability, main reduction gear." *Id.* at 88. The core used in the UTW turbofan was a modified version of the F101 core, *id.* at 32, Figure 8, 296 (Table XXXIII), which had a nine-stage HPC, a single-stage HPT, and two-stage LPT, Ex. 1003 ¶ 124 (citing Ex. 1022, 1–2). Willis explains that the "low fan-tip speed, used in

conjunction with a 2.5-reduction gear ratio, permitted the use of a conventional high-speed, low-pressure turbine.” *Id.* at 32.

GE recognizes that Willis’ UTW engine “does not include a low pressure compressor section.” Pet. 37. Nevertheless, GE argues that an ordinarily skilled artisan would have understood Willis to have suggested adding a low pressure compressor to the low spool shaft in the UTW engine. *Id.* at 38. Willis notes that “[t]he use of a low-pressure-ratio fan with [the YF101] core [shown in Figure 8] resulted in an overall cycle pressure ratio lower than desired.” Ex. 1011, 26. To address this deficiency, Willis suggests that a “more optimum cycle could have been produced by adding booster stages to the fan or by increasing the pressure ratio of the core.” *Id.* The “cycle” Willis suggests optimizing is the “overall cycle pressure ratio,” which Willis describes as “lower than desired” because the UTW engine has a “low-pressure-ratio fan.” *Id.* Willis explains that booster stages were not added because “this technology is already well in hand and was not considered to be worth the added program cost” for the QCSEE research program. *Id.* Dr. Abhari testifies that an ordinarily skilled artisan would have understood “booster stages” to refer to low pressure compressor stages. Ex. 1003 ¶ 121 (citing Ex. 1014, 109 (as revealing background knowledge of an ordinarily skilled artisan)).

Based on Willis’ explicit suggestion to add booster stages and the understanding of an ordinarily skilled artisan, GE argues that it would have been obvious to incorporate low pressure compressor stages in the UTW engine in order to optimize the engine. Pet. 39. GE also contends that an ordinarily skilled artisan would have found it obvious to use fewer than nine stages in the low pressure compressor. *Id.* GE relies upon testimony from

Dr. Abhari in which he opines that choosing the number of stages in a low pressure compressor is a matter of optimization and that an ordinarily skilled artisan would not consider using more than eight stages in a low pressure compressor in either of a direct drive turbofan or a geared turbofan.

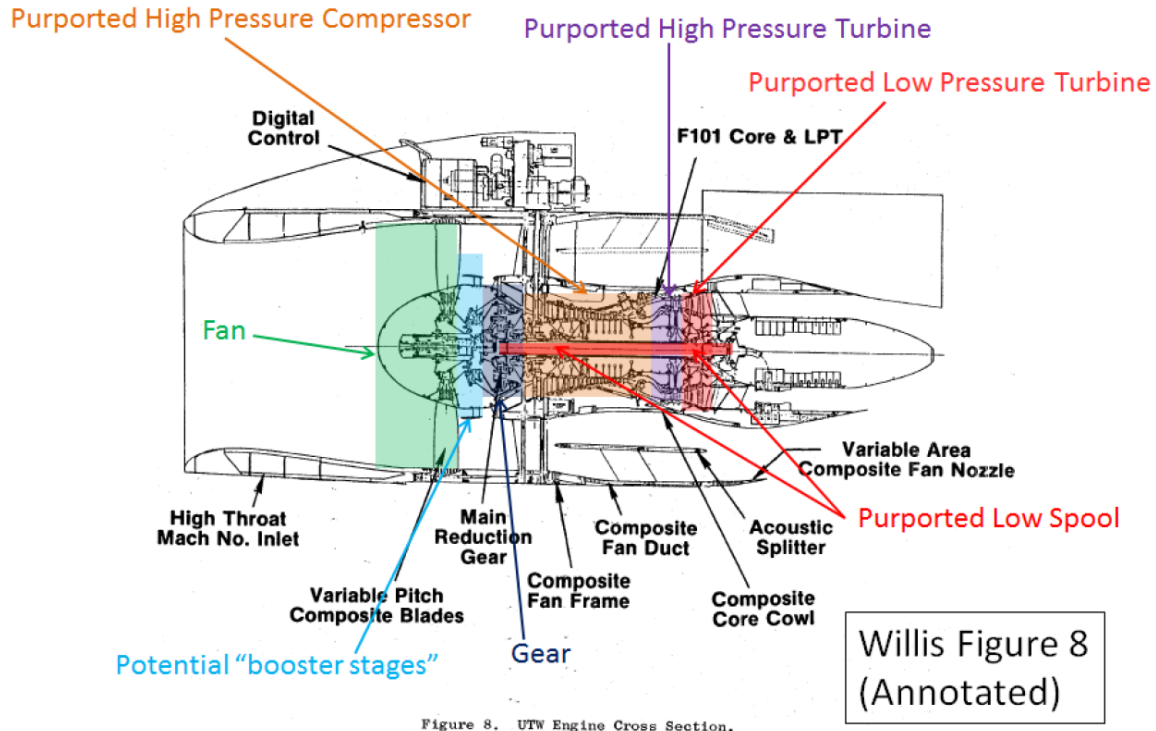
Ex. 1003 ¶ 122. Dr. Abhari also testifies that he is not aware of any two-spool turbofan between 1979 and 2011 that included a low pressure compressor with more than eight stages, but that he is aware of numerous examples of such engines (both geared and direct drive) having eight or fewer stages. *Id.* ¶¶ 122–23 (citing Ex. 1019, 64–65, 106–07, 113–14, 129–30, 133, 319–20, 385; Ex. 1015, 10; Ex. 1017, 5).

b) Analysis of UTC’s Counterarguments

UTC argues that an ordinarily skilled artisan would not have added an LPC to the UTW engine of Willis for two reasons. PO Resp. 33–51. As explained below, we find GE’s argument and evidence to be more persuasive than UTC’s.

*(1) No Motive to Add an LPC to Low Spool of UTW Engine*

UTC argues that Willis expressly suggests adding booster stages to the fan rather than the low spool of the UTW engine. *Id.* at 33–43. Willis expressly states “[a] more optimum cycle could have been produced by adding booster stages **to the fan** or by increasing the pressure ratio of the core.” Ex. 1011, 26 (emphasis added). UTC illustrates the location of the booster stages added to the fan in the region highlighted light blue in the annotated version of Willis’ Figure 8, which we reproduce below.



UTC's annotated version of Willis' Figure 8 is an elevational cross-section view of the UTW engine with the area for "Potential 'booster stages'" identified in light blue. PO Resp. 40.

UTC correctly points out that adding booster stages to the low-speed shaft on which the fan rotates fails to meet the requirement that the "low spool that includes a low pressure compressor section" as recited in claim 1.

PO Resp. 35. Based on Dr. Mattingly's testimony, UTC argues that "the only space available in Willis's engine for adding booster stages (light blue) is on the output, or low-speed side, of the gear, between the gear (dark blue) and the separate fan section (green)." *Id.* at 39–40 (citing Ex. 2012 ¶ 101). Dr. Mattingly cites no objective evidence to support his conclusion.

GE responds by pointing out that Willis' suggestion of adding booster stages to produce a "more optimum cycle," expressly refers to adding an LPC on the low spool because ordinarily skilled artisans by the time of the invention, including Dr. Mattingly, referred to LPC stages on the low spool

of a geared turbofan as a “booster.” Reply 14 (quoting Ex. 1029, 17); *see also* Ex. 1009, 21, Figure 18 (illustrating geared turbofan with two booster stages on low spool).

When deciding where to place booster stages to optimize the cycle, GE contends that an ordinarily skilled artisan would place the booster stages on the high-speed, low spool shaft because such booster stages provide more than six times the increase in pressure ratio of adding them to the low-speed, fan shaft. *Id.* at 14–15 (citing Ex. 1041 ¶¶ 32–34). Dr. Abhari explains that because pressure ratio is proportional to the square of rotational speed, Ex. 1041 ¶ 32 (citing Ex. 1038, 9), the 2.5:1 speed difference between the fan shaft and the low spool shaft leads to a pressure ratio increase of 6.25:1 for the low spool shaft over the fan shaft, *id.* An ordinarily skilled artisan would have known that adding one booster on the low spool shaft would be equivalent to adding 3 to 6 booster stages to the fan shaft. *Id.* Accordingly, an ordinarily skilled artisan would understand that the best way of optimizing the cycle as suggested by Willis would be to add booster stages to the low spool shaft rather than the fan shaft. *Id.*

GE also disputes UTC’s contention that the fan shaft is the “only space” that Willis suggests placing booster stages. When cross-examined, Dr. Mattingly conceded that the space he identified for booster stages on the fan shaft of the UTW engine is occupied by stator vanes and thus would also require redesign to accommodate them. *Id.* at 15 (citing Ex. 1032, 69:14–25); *see also* Ex. 1011, Figure 10 (identifying “Inner Stator” at location for booster stages suggested by UTC). According to Willis, the addition of “booster stages” was “well in hand.” Ex. 1011, 26. Soon after Willis was

published and still decades before the critical date of the '895 patent,<sup>4</sup> Rolls Royce developed a geared turbofan technology demonstrator that placed a five-stage LPC on the low spool shaft. Ex. 1035, 5. This Rolls Royce engine is illustrated in the annotated version of Figure 1 of Exhibit 1035, which we reproduce below.

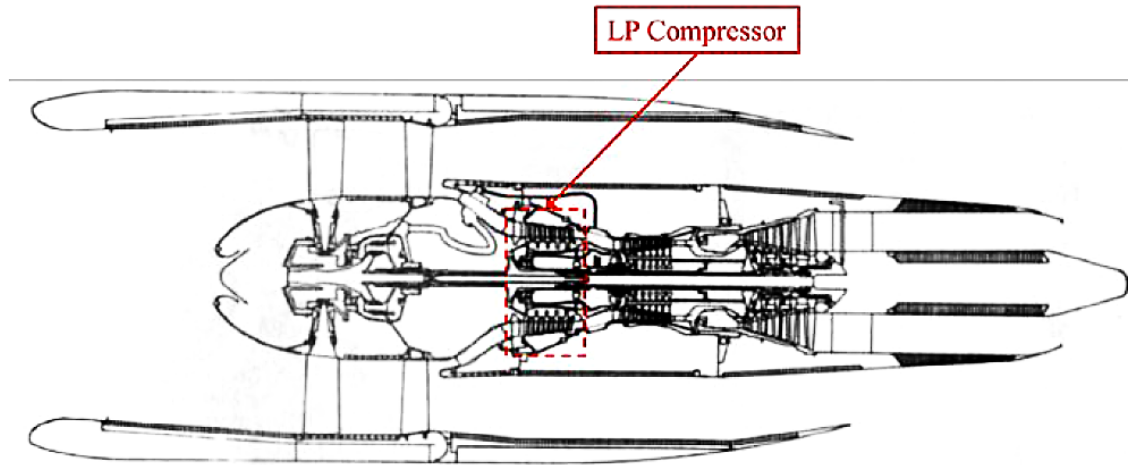


**Fig 1. General Arrangement M45SD-02 Demonstrator Engine**

The annotated version of Figure 1 of Exhibit 1035 is a cross sectional view of the M45SD-02 technology demonstrator engine in which the LPC is identified by Dr. Abhari.

Ex. 1041 ¶ 44. The Rolls Royce effort establishes that, by 1980, ordinarily skilled artisans were well aware of how to incorporate booster stages onto the low spool shaft in engines like the UTW engine. *Id.*

---

<sup>4</sup> Exhibit 1035 is a design study from 1976 by Rolls Royce Ltd and Dowty Rotol Ltd of a geared turbofan engine called the M.45SD-02 having a variable pitch fan capable of providing reverse thrust, which expressly refers to Willis' QCSEE. Ex. 1035, 1–6. Exhibit 1036 presents test and evaluation experience with a full scale “demonstrator” version of the M.45SD-02 engine in September 1980. Ex. 1036, 2.

*(2) Willis' UTW Engine with an LPC on the Low Spool Is Inoperable for Its Intended Purpose*

UTC argues that adding an LPC to the low spool in Willis' UTW engine would have been "inconsistent with the stated goals and intended purpose of Willis's engine" and thus render it inoperable for that intended purpose. PO Resp. 46–47. UTC argues that we should reject GE's argument for obviousness because of this inconsistency. *Id.* at 46–51.

Willis developed the UTW engine to meet the "stringent noise, exhaust emissions, performance, weight, and transient thrust-response requirements of future short-haul aircraft," Ex. 1011, 19, while simultaneously not "seriously compromising the economics of the transport system," *id.* at 23. UTC points out that, to meet these goals, Willis proposed a UTW engine with "a very specific set of features, including low fan pressure ratios, low jet velocities, low fan-tip speeds, a high bypass ratio, a low pressure-ratio UTW cycle, and an effective thrust reverser." PO Resp. 48. UTC contends that adding the booster stages to the low spool would "put at risk many of Willis's objectives and would require a substantial redesign." *Id.* (citing Ex. 2012 ¶ 117). UTC, based on Dr. Mattingly's testimony, contends that the substantial redesign involves increasing the "very low fan pressure ratio," "low-pressure-ratio UTW cycle," and "low-jet velocity," while also decreasing "correspondingly high bypass ratios" of Willis. *Id.* at 48–49 (citing Ex. 2012 ¶ 117). UTC further contends that proposed modification of the UTW engine also jeopardizes the reverse thrust performance of the UTW engine, *id.* at 49 (citing Ex. 2012 ¶ 117), and would require "a cascade of additional engine modifications" to the LPT, gearbox, low spool shaft, HPC, combustor, and HPT, *id.* (citing

Ex. 2017, 25, 26, 32; Ex. 2018, 57; Ex. 2019 ¶¶ 81–82; Ex. 2020, 19;  
Ex. 2018 ¶ 118).

GE persuasively rebuts each of UTC’s contentions with testimony from Dr. Abhari supported by objective evidence. First, GE correctly points out that UTC’s argument rests solely upon Dr. Mattingly’s testimony, which is not supported by objective evidence. Reply 18. Under 37 C.F.R. § 42.65, such unsupported testimony may be “entitled to little or no weight.” Second, GE supplies testimony from Dr. Abhari that is supported by objective evidence. Reply 18–19 (citing Ex. 1041 ¶¶ 33, 44). For example, Dr. Abhari testifies that the Rolls Royce M45SD-02 was a geared turbofan with an LPC on the low spool shaft that also had a high bypass ratio (8.73), low fan pressure (1.27), low jet velocity (274 m/s), and effective thrust reverse for short take-off and landing like the UTW engine. Ex. 1041 ¶ 44 (citing Ex. 1035, 3–5, Figure 1).

Dr. Abhari also testifies that because adding an LPC to the input side of the gearbox does not increase the power required to drive the fan, an ordinarily skilled artisan would understand that the gearbox need not be redesigned as Dr. Mattingly opines. *Id.* ¶ 40 (citing Ex. 1011, 94). Dr. Abhari explains that additional LPT stages, which supply more power to drive the LPC on the high-speed, input-side of the gearbox, do not affect the load imposed on the gearbox by the unaltered fan on the low-speed, output side of the gearbox. *Id.* On balance we credit Dr. Abhari’s testimony over Dr. Mattingly’s and find that GE’s proposed modifications to the UTW engine would not render the UTW engine inoperable for its intended purpose.

c) Conclusion

For the reasons expressed above, we determine that GE has established that an ordinarily skilled artisan would have been motivated to add an LPC to the low spool shaft of the UTW engine to produce a more optimum overall cycle pressure ratio. We also determine that an ordinarily skilled artisan would have had a reasonable expectation of succeeding in doing so. Accordingly, we conclude that GE has established that Willis renders claim 1 unpatentable as obvious.

*2. Dependent Claims 12–14*

GE sets forth its argument and evidence allegedly demonstrating that claims 12–14, which depend directly or indirectly from claim 1, are unpatentable as obvious in view of Willis. Pet. 43–45. UTC does not separately identify any reasons why Willis fails to render claims 12–14 obvious. See PO Resp. 33–55 (arguing in support of claims 1 and 15 without addressing distinct reasons that GE’s evidence fails to establish unpatentability of claims 12–14). We adopt as our own the reasoning and evidence proffered by GE relating to the unpatentability of claims 12–14 and conclude on that basis that GE has demonstrated by a preponderance of evidence that Willis renders claims 12–14 unpatentable as obvious.

*3. Dependent Claim 15*

Claim 15 depends from claim 12, Ex. 1001, 8:40, which depends from claim 1, *id.* at 8:31. Claims 12 and 15 recite:

12. The gas turbine engine as set forth in claim 1, further comprising a fan variable area nozzle to vary a fan nozzle exit area and adjust a pressure ratio of a fan bypass airflow of said fan section during engine operation.

*Id.* at 8:31–34.

15. The engine as recited in claim 12, further comprising:  
a controller operable to control said fan variable area nozzle to  
vary a fan nozzle exit area and adjust the pressure ratio of the fan  
bypass airflow to reduce a fan instability.

*Id.* at 8:40–44. The parties do not dispute that the UTW engine includes the fan variable area nozzle introduced in claim 12. Pet. 43–44 (citing Ex. 1011, 26, 38, Figure 8; Ex. 1003 ¶¶ 128–29); see PO Resp. (not addressing distinct reasons that GE’s evidence fails to establish unpatentability of claim 12). Accordingly, the dispute regarding claim 15 rests upon whether Willis describes or suggests the “controller” introduced in claim 15. Based on the record before us, we conclude that GE has established by a preponderance of evidence that Willis describes the controller of claim 15 and thus also establishes that claim 15 is unpatentable as obvious.

a) GE’s Arguments

GE contends that Willis refers to the claimed controller as “Digital Control” in Figure 79, an annotated version of which is reproduced below. Pet. 46 (citing Ex. 1011, Figure 79; Ex. 1003 ¶ 132).

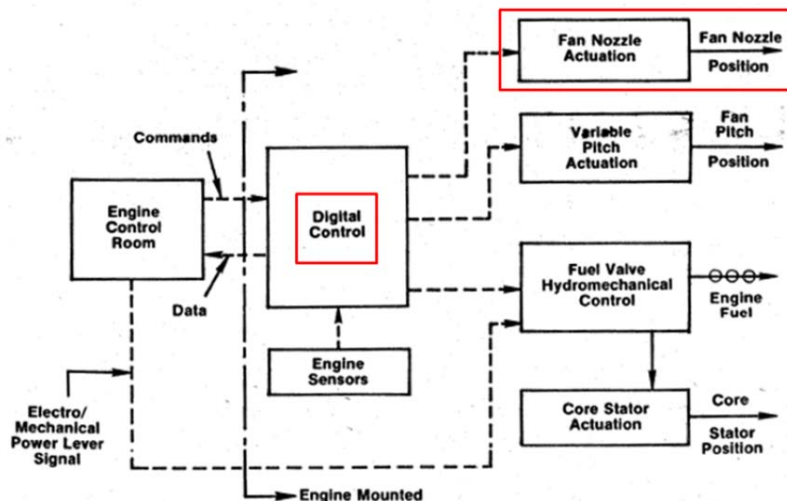


Figure 79. UTW Control System Schematic.

Figure 79 of Willis is a schematic block diagram of the UTW control system with annotations identifying its control of fan nozzle actuation to affect fan nozzle position.

Ex. 1011, 143; Ex. 1003 ¶ 132. Willis describes that the “takeoff point was selected to be on a low operating line, at a bypass stream pressure ratio of 1.27, to keep jet velocity low for reduced noise . . . . The maximum cruise point pressure ratio of 1.38 is on a higher operating line, reached by closing the variable exhaust nozzle.” Ex. 1011, 38. Dr. Abhari explains that this passage of Willis discloses that the fan nozzle exit area was reduced at the cruise condition to increase the bypass stream pressure ratio from 1.27 to 1.38. Ex. 1003 ¶ 133. GE contends that one of the functional effects of adjusting the fan nozzle area is reducing turbulence produced by the fan rotor, a form of instability. Pet. 48 (citing Ex. 1003 ¶ 134 (citing Ex. 1025, 35)). GE also contends that Willis expressly discloses controlling the nozzle exit area to reduce the likelihood of instability at low flight speeds by indicting that the “takeoff point was selected to be on a low operating line.” *Id.* at 49 (quoting Ex. 1011, 38). Dr. Abhari testifies that an ordinarily skilled artisan would understand this passage in Willis to reveal that Willis lowers the operating line during takeoff by reducing the bypass pressure ratio, which increases fan stability. Ex. 1003 ¶ 135 (citing Ex. 1011, Figure 11 (illustrating low operating line at takeoff appearing well below surge line)). GE concludes that Willis discloses the controller of claim 15. Pet. 50.

#### b) Analysis of UTC’s Counterarguments

UTC argues that Willis’ controller fails to “control said fan variable area nozzle . . . to reduce a fan instability.” PO Resp. 51–55. More specifically, UTC contends that Willis’ controller alters the fan nozzle exit

area solely to maintain inlet Mach number of 0.79 rather than “to reduce fan instability.” *Id.* at 52–54 (citing Ex. 1011, 148; Ex. 2012 ¶ 126). UTC contends that Willis uses inlet Mach number as the sole control variable for varying fan nozzle exit area and then only to reduce fan noise. *Id.* at 53 (quoting with emphasis Ex. 1011, 141 (“Previous experiments have shown that operation with a high inlet-throat Mach number provides a substantial reduction in fan noise. *To achieve this noise-reduction benefit, it is necessary to provide automatic control of inlet-throat Mach number at high power settings.*”)). UTC also contends that Willis controls fan instability by adjusting the pitch of the fan blades based on fan speed. *Id.* at 54 (citing Ex. 1011, 38; Ex. 2012 ¶ 127).

Based on our review of Willis, we determine that GE has demonstrated that the UTW engine includes a controller that performs the type of control described in the Specification, which is within the scope of the claimed controller. Willis expressly states that its controller “opens [the VAFN] part way for takeoff.” Ex. 1011, 32. The effect of opening the VAFN for takeoff results in a “low operating line, at a bypass stream pressure ratio of 1.27.” Ex. 1011, 38. For maximum cruise conditions, the controller sets the fan pressure ratio to “1.38 . . . on a higher operating line.” *Id.* The Specification describes the same variation of fan nozzle exit area, which has the effect of avoiding fan instability during low-speed flight at takeoff while increasing efficiency without instability at cruise. Ex. 1001, 4:48–58.

UTC’s reliance on Willis’ disclosure of using inlet Mach number as the sole variable for controlling fan nozzle exit area is unpersuasive. The same portion of Willis’ disclosure indicates that Willis chooses

“combinations of cycle parameters and manipulated variables which result in small variations in . . . stall margin” and analyzes “potential control modes on the basis of . . . stability” among other considerations. Ex. 1011, 148.

Willis expressly states that its control of the VAFN to maintain an inlet Mach number of 0.79 does not apply to low power settings for the fan. *Id.* (“in the lower percent power setting region (<70%) the nozzle is scheduled to the maximum area, and inlet Mach number varies.”) Willis indicates that, at low power, its controller sets the fan nozzle to “maximum area.” *Id.* Only at power settings above 70%, does Willis’ controller close the fan nozzle to maintain a constant inlet Mach number. *Id.*; *see also id.*, Figure 82

(illustrating relationship between fan nozzle area and inlet Mach number vs. percent power setting). This disclosure is consistent with the portions of Willis upon which GE relies for establishing that Willis opens the fan nozzle at low power to lower the operating line away from instability, which is precisely what the Specification describes the claimed controller as doing.

As explained in Part II.B.2 above, although the Specification does not describe precise details of the control algorithm used to control the VAFN, the controller must operate to change the fan nozzle exit area to a more favorable fan operating line at low power and low flight speeds to avoid fan instability. We determine that GE has demonstrated by a preponderance of evidence that Willis describes a controller for its VAFN that operates as described in the Specification and claimed. Accordingly, we also conclude that GE has demonstrated by a preponderance of evidence that Willis renders claim 15 unpatentable as obvious.

G. CLAIMS 1 AND 3

ANTICIPATION BY OR OBVIOUSNESS IN VIEW OF DALY

GE contends that Daly anticipates claim 1, Pet. 52–56, and renders claim 3 unpatentable as obvious, *id.* at 56–59. We address each claim separately below after analyzing UTC’s argument that GE has failed to establish that Daly is prior art.

1. *Daly as Prior Art*

We previously determined that GE had demonstrated that Daly is a printed publication that was available to the public by no later than June 2, 2010.<sup>5</sup> UTC argues that GE has failed to establish that Daly was “sufficiently accessible to the public interested in the art” to constitute prior art for two reasons, neither of which is persuasive. PO Resp. 56.

First, UTC argues that Petitioner has not overcome its evidentiary objections. *Id.* We instructed UTC to use the procedures set forth in 37 C.F.R. § 42.64 to address such evidentiary objections during the trial. Dec. 26. UTC filed objections to Daly on July 18, 2017. Paper 10. However, to preserve such objections, UTC must have filed a motion to exclude the objectionable evidence. 37 C.F.R. § 42.64(c). Because UTC did

---

<sup>5</sup> In our Decision on Institution, we instructed UTC to address whether the challenged claims were entitled to priority to U.S. Application 12/131,876 filed June 2, 2008, and “proffer probative evidence if available.” Dec. 25. UTC has not proffered any such evidence or renewed any argument that the challenged claims are entitled to such priority. Because UTC has not met its burden of production under *Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015), and for the reasons expressed in our Decision on Institution, we conclude that the challenged claims are not entitled to a priority date of June 2, 2008. June 2, 2010, predates December 30, 2011, the next earliest date for which the challenged claims could be entitled to priority.

not file a motion to exclude Daly, UTC has waived its evidentiary objections.

Second, UTC argues that GE has failed to demonstrate that Daly was publicly accessible because the date stamps from the MIT and Embry-Riddle libraries merely establish an archival date, not a date of accessibility. PO Resp. 56–57. UTC’s argument is unpersuasive.

Daly is an article appearing in issue twenty-seven dated March 2010 of a periodical entitled “Jane’s Aero Engines.” Ex. 1027, 3. Daly also bears a stamp indicating that the MIT library “received” its copy of issue twenty-seven on June 2, 2010. *Id.* at 4. Daly also bears a copyright notice of 2010 and states that it “is also available on online” and implies that jae.janes.com was the website through which Daly was available. *Id.* at 3. The parties jointly submitted a second copy of Daly bearing a stamp indicating that the library at Embry-Riddle Aeronautical University “received” its copy on March 17, 2010.<sup>6</sup> See Paper 13, 6–9 (Embry-Riddle librarian attesting to the meaning of stamp indicating “received” on attached copy of Daly). The Embry-Riddle librarian attests that the public could find Daly in Embry-Riddle’s library searching the library’s catalog. *Id.* at 7.

“A given reference is ‘publicly accessible’ upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it.” *SRI Int’l, Inc. v. Internet Sec. Sys., Inc.*, 511 F.3d 1186, 1194 (Fed. Cir. 2008)

---

<sup>6</sup> UTC stipulated that it would treat the declaration from the Embry-Riddle librarian as though it pertained to the copy of Daly retrieved from the MIT library and filed as Exhibit 1027. Paper 13, 1.

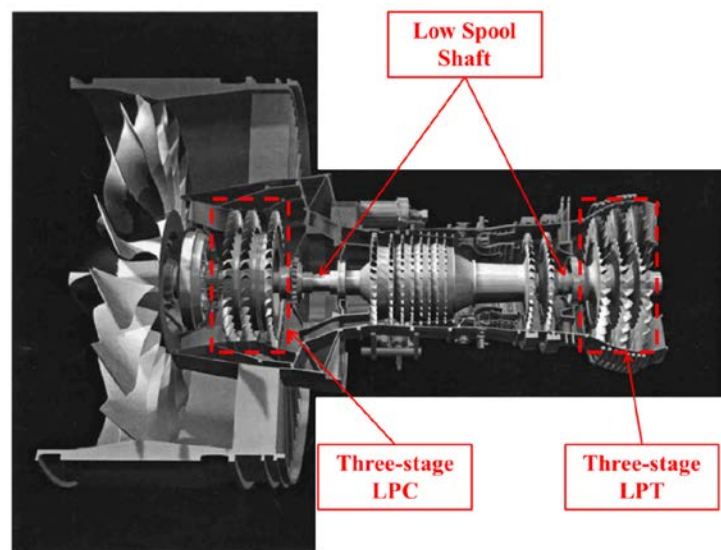
(citation omitted). Based on our review of Daly and the variety of ways in which it reflects that it was widely publicly available, we conclude that the preponderance of evidence establishes that Daly was available to the public by no later than June 2, 2010.

For the reasons expressed above, we conclude that Daly is a prior art printed publication with respect to the challenged claims under the pre-AIA version of 35 U.S.C. § 102(a), (b).

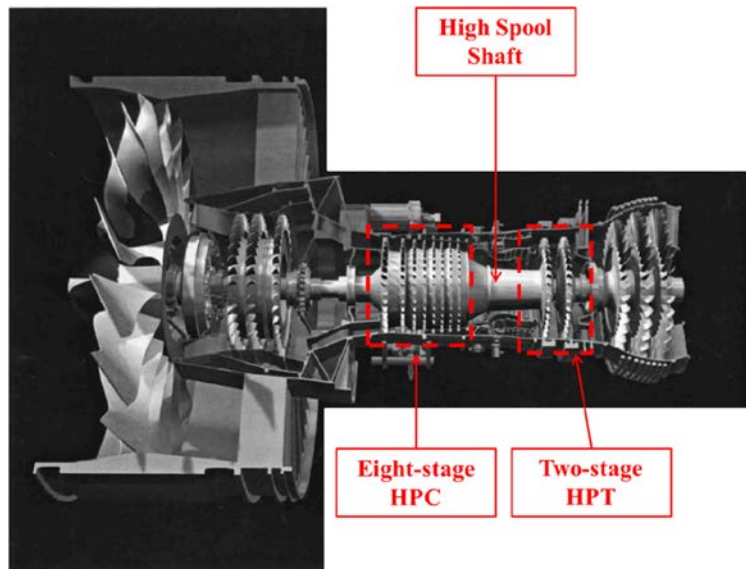
## 2. Anticipation of Claim 1

### a) GE's Arguments

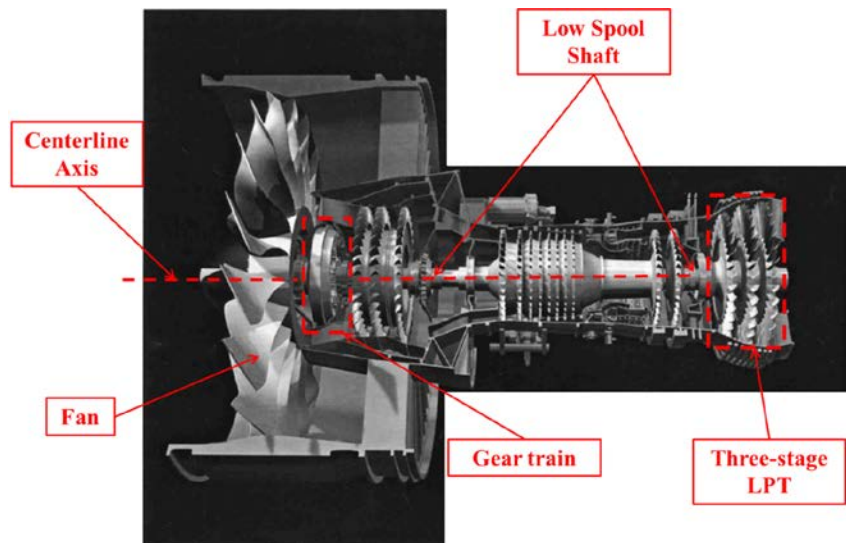
GE identifies the manner in which Daly describes the Pratt and Whitney PW1000G geared turbofan, which GE contends to include all elements of claim 1. *Id.* at 52–56 (citing Ex. 1027, 7–9, Figure on p. 7). GE also supports its contentions with testimony from Dr. Abhari. *Id.* (citing Ex. 1003 ¶¶ 136–42). To demonstrate that Daly anticipates claim 1, GE provides three annotated versions of one Figure appearing in Daly that are reproduced below along with Dr. Abhari's testimony regarding those annotations. *Id.* at 52–56 (citing Ex. 1003 ¶¶ 138–42).



GE's first annotated version of Daly's Figure is a partial cut away CAD rendering of the PW1000G geared turbofan identifying the LPT, low spool shaft, and LPC corresponding to the claimed low spool. Pet. 53.



GE's second annotated version of Daly's Figure identifies the HPT, high spool shaft, and HPC corresponding to the claimed high spool. *Id.* at 54.



GE's third annotated version of Daly's Figure identifies the low pressure turbine, low spool shaft, gear train, and fan, along the centerline axis of the engine. *Id.* at 56.

Daly describes the Figure as a cutaway that “shows the stage count to be 1-G-3-8-2-3,” which an ordinarily skilled artisan would understand to mean that the gearbox (G) is between the one-stage fan and three-stage LPC with the LPC being attached to the low spool shaft. Reply 21–22 (citing Ex. 1003 ¶ 136; Ex. 1041 ¶ 50). Daly describes a low spool shaft connected to the low pressure turbine that turns a fixed central gear in a “star gearbox,” which turns five fixed circumferentially spaced gears that also mesh with and turn an outermost ring gear, which is connected to and turns the fan. Ex. 1027, 8–9; Ex. 1003 ¶ 142.

b) Analysis of UTC’s Counterarguments and Evidence

UTC contends that Daly fails to describe an LPC on the input side of the gear train as required by claim 1 because the “Daly text teaches placing the LPC on the output side of the gear train.” PO Resp. 60–61. The text at issue from Daly states: “[g]eared turbofans exploit the characteristic that fan/compressors work best at lower rotational speeds while turbines operate most efficiently spinning quickly.” Ex. 1027, 7. UTC concedes that the PW1000G engine shown in Daly’s Figure “differs from the arrangement addressed in the text” but argues that Daly’s “internally inconsistent” disclosure fatally undermines GE’s argument that Daly anticipates claim 1. PO Resp. 62. UTC’s argument is unpersuasive.

We agree with GE that the text from Daly that UTC quotes does not describe the PW1000G engine shown in the Figure but rather merely sets forth general principles. Reply 23 (citing Ex. 1041 ¶ 52). Accordingly, we consider Dr. Mattingly’s testimony regarding how an engine described in this text is configured not to be probative for analyzing GE’s anticipation argument based on the PW1000G engine shown in Daly’s Figure.

Beyond Daly's Figure itself and both experts' understanding of that figure, Daly also describes the gearbox as providing a 3:1 reduction, with its central gear on the low spool shaft and the slower spinning, outermost ring gear attached to the fan. Ex. 1027, 9. UTC does not dispute that Daly's Figure illustrates its LPC and its LPT both on the low spool shaft. PO Resp. 62. Dr. Mattingly testifies that the PW1000G engine shown in the Figure differs from the arrangement described in the quoted text because the low pressure compressor and the low pressure turbine are subject to the "tyranny" of "being bound together on the same shaft." Ex. 2012 ¶¶ 131–32.

For all the reasons above, we determine that GE has proven by a preponderance of evidence that Daly describes a low spool that includes an LPC as required by claim 1. UTC identifies no other shortcoming in GE's argument and evidence, which we adopt as our own, that Daly anticipates claim 1. PO Resp. 60–63. Based on our review of the evidence of record, we determine that GE has proven by a preponderance of evidence that Daly anticipates claim 1.

### *3. Obviousness of Claim 3*

Claim 3 depends directly from claim 1 and further recites: "said low pressure compressor includes four (4) stages." Ex. 1001, 8:9–10. GE concedes that Daly explicitly describes using an LPC having only two or three stages. Pet. 56. However, GE argues that an ordinarily skilled artisan would have considered it obvious to add a fourth stage to Daly's LPC because the number of stages in an LPC "is a matter of routine optimization based on the desired pressure ratio for the [LPC]." *Id.* at 57 (citing Ex. 1003 ¶ 144). GE argues that an ordinarily skilled artisan would have modified the

PW1000G engine of Daly by adding a fourth stage to the LPC as a well-known way to increase overall engine power or to increase efficiency by reducing loading on each stage of the LPC. *Id.* (citing Ex. 1003 ¶ 144). GE also contends that Daly’s description of increasing the stage count in the LPC from two to three stages to add power supports a conclusion that adding another stage would have been an obvious to an ordinarily skilled artisan. *Id.* at 59 (citing Ex. 1027, 9; Ex. 1003 ¶ 146). GE also contends that adding a fourth stage to the PW1000G would not produce any unexpected results. *Id.* at 58 (citing Ex. 1003 ¶ 144). Dr. Abhari testifies that the use of four stages in an LPC represented a well-known and predictable design and cites five examples of prior art, two-spool turbofan engines that use a four-stage LPC as supporting evidence. Ex. 1003 ¶ 144 (citing Ex. 1019, 113, 133, 198, 383, 494–95).

UTC responds that GE’s obviousness challenge for claim 3 fails for two reasons. PO Resp. 63–67. First, UTC argues that GE’s evidence merely establishes that an ordinarily skilled artisan could have added a fourth stage to the PW1000G, without establishing that she would have had a motivation to do so. PO Resp. 63–65. UTC’s argument is unpersuasive because, as discussed above, GE explained that an ordinarily skilled artisan would have been motivated to add a fourth stage to the LPC either to increase power or efficiency of the engine. Pet. 57.

Second, UTC argues that an ordinarily skilled artisan would not have added a fourth LPC stage to the PW1000G because it would have had “the negative effect of adding both LPC and LPT stages, increasing the engine weight, adding many airfoils (which can have a detrimental effect on engine reliability), extending the length of the engine, and potentially disrupting the

improved weight balance touted in Daly.” PO Resp. 66 (citing Ex. 2012 ¶¶ 134–38).<sup>7</sup> UTC further contends that adding power from additional turbine and compressor stages would require an even more robust gearbox than Daly’s, which was already “the strongest transmission ever devised for an aerospace application by a considerable margin.” *Id.* (quoting Ex. 1027, 7). UTC concludes that an ordinarily skilled artisan would have questioned whether adding more power through additional stages would have been possible and would not have considered it to have been obvious. *Id.* (citing Ex. 2012 ¶ 138).

Based on our review of the entire record, we conclude that GE has demonstrated that claim 3 would have been obvious in view of Daly and the background knowledge of an ordinarily skilled artisan. UTC’s argument addresses only one of two rationales for adding a fourth stage to the LPC, increasing power, but ignores the motivation based upon increasing efficiency. UTC’s reliance on Dr. Abhari’s testimony that adding stages to the LPC requires adding stages to the LPT is plainly limited to the hypothetical situation in which LPC stages are added “to increase your overall pressure ratio” (i.e., increase power).” Ex. 2022, 116:15–20. Dr. Abhari was not addressing adding a fourth stage to the LPC to increase its efficiency. When a fourth stage is added to Daly’s LPC to increase efficiency rather than power, UTC’s argument that the fourth stage requires a

---

<sup>7</sup> See also PO Resp. 65 (quoting Ex. 2022, 116:15–20 (“if you add more low pressure compressors to increase your overall pressure ratio you need more work to be extracted from your low pressure turbine at sufficient efficiency, aerodynamic efficiency, and as such you would add more stages.”))

redesigned gearbox to handle more power from an uprated LPT fails.<sup>8</sup> Accordingly, we conclude that GE has demonstrated by a preponderance of evidence that Daly renders claim 3 unpatentable as obvious.

### III. MOTION TO EXCLUDE

GE argues that we should exclude the testimony of Dr. Mattingly in paragraphs 54, 55, 66–77, 82, and 86–89 of his Declaration under one or both of Fed. R. Evid. 702 and 703. Mot. 1. In paragraphs 54, 55, and 66–77, Dr. Mattingly testifies regarding gear arrangements in geared turbofan engines. Ex. 2012 ¶¶ 54, 55, 66–77. In paragraphs 82, and 86–89, Dr. Mattingly sets forth his analysis of Wendus’ 8-stage ADP. *Id.* ¶¶ 82, 86–89. For the reasons expressed below, we deny GE’s Motion.

#### A. LEGAL STANDARDS

Federal Rule of Evidence 702 states:

Rule 702. Testimony by Expert Witnesses

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

(a) the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

(b) the testimony is based on sufficient facts or data;

(c) the testimony is the product of reliable principles and methods; and

(d) the expert has reliably applied the principles and methods to the facts of the case.

---

<sup>8</sup> Dr. Abhari also explains that power requirements for gear trains in geared turbofan engines are set by the devices on the output side of the gear train (e.g., the fan), not devices on the input side (e.g., the LPT). Ex. 1040 ¶ 40.

Fed. R. Evid. 702. Rule 702 thus sets forth the standards for determining whether a witness is qualified to offer testimony as an expert and the standards for judging whether proffered testimony is properly supported.

Federal Rule of Evidence 703 states:

Rule 703. Bases of an Expert

An expert may base an opinion on facts or data in the case that the expert has been made aware of or personally observed. If experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject, they need not be admissible for the opinion to be admitted. But if the facts or data would otherwise be inadmissible, the proponent of the opinion may disclose them to the jury only if their probative value in helping the jury evaluate the opinion substantially outweighs their prejudicial effect.

Fed. R. Evid. 703. Rule 703 has been found to prohibit an expert from basing testimony on “facts not available to the public and not disclosed during fact discovery” in the case. *Dey, L.P. v. Ivax Pharm., Inc.*, 233 F.R.D. 567, 573 (C.D. Cal. 2005).

B. DR. MATTINGLY’S TESTIMONY ON GEAR ARRANGEMENTS IN  
PARAGRAPHS 54, 55, AND 66–77 OF EXHIBIT 2012

GE argues that, because Dr. Mattingly has admitted that he is not qualified to testify on matters relating to gear arrangements in turbofans, we should exclude paragraphs 54, 55, and 66–77 of his Declaration under Fed. R. Evid. 702. Mot. 1. GE rests its argument on the following cross examination testimony by Dr. Mattingly:

Q. Okay. What experience have you had with -- over the course of your career in these various positions either at Seattle University or in the military with a gear turbofan engine?

A. None.

Mot. 3–4 (quoting Ex. 1040, 35:8–12). When asked whether he had “ever seen the ring gear as the input” on a planetary gearbox used in a turbofan engine, Dr. Mattingly replied:

A. As I said, I want to be accurate on this and ***I’m not an expert on the gears and the gear arrangements***, specifically. So I can’t answer 100 percent accurately on this, but I do believe that the inner is the high-speed side and that the ring is the low-speed side, ***but I’m not an expert on gears***.

*Id.* at 4 (quoting Ex. 1032, 47:3–11).

UTC counters that Dr. Mattingly has authored textbooks describing geared turbofan engines and taught college-level courses covering the concept of geared turbofan engines. Opp. 4–5 (citing Ex. 1040, 36:9–15, 37:17–38:13). UTC also counters that Dr. Mattingly’s lack of familiarity with whether a ring gear in a planetary gearbox used in a geared turbofan was an input relates to the configuration of a specific gearbox shown in a textbook and that Dr. Mattingly simply wanted to be accurate in his testimony regarding that specific gearbox and cautioned that he would need more time to answer “100 percent accurately.” *Id.* (citing Ex. 1032, 44:17–23, 45:2–5).

Considering the record as a whole, we do not consider Dr. Mattingly’s testimony to establish that he is so unqualified to testify about the operation of gear arrangements used in turbofans that we should exclude that testimony from evidence. Rather, we consider the effect, if any, of his testimony on the probative value of his testimony. Our determinations in this proceeding regarding gear arrangements reflect that balancing. Accordingly, we deny the Motion as it relates to paragraphs 54, 55, and 66–77 of Exhibit 2012.

C. DR. MATTINGLY'S TESTIMONY REGARDING HIS ANALYSIS OF AN 8-STAGE ADP IN PARAGRAPHS 82 AND 86–89 OF EXHIBIT 2012

GE argues that we should exclude Dr. Mattingly's testimony regarding his analysis of the 8-stage ADP for two reasons. First, GE argues that, because UTC fails to establish that Dr. Mattingly's analysis is based on "reliable methodology," we should exclude the testimony relating to the analysis under Fed. R. Evid. 702(c). Mot. 7–10. Second, GE argues that, because Dr. Mattingly fails to set forth the "factual basis underlying" his analysis of the 8-stage ADP, we should exclude the testimony relating to the analysis under Fed. R. Evid. 703. *Id.* at 10–11. We find neither argument to be sufficiently persuasive to justify excluding Dr. Mattingly's testimony regarding his analysis of an 8-stage ADP.

As UTC points out, Dr. Mattingly does provide information relating to his methodology and the factual assumptions underlying his analysis. Opp. 12–14 (citing examples at Ex. 2012 ¶¶ 86, 87). GE does not contend that UTC interfered with GE's ability to conduct discovery regarding the basis for Dr. Mattingly's analysis of the 8-stage ADP. UTC also argues that, because GE's showing "goes to the weight of evidence, not its admissibility," we should deny the relief requested in this portion of the Motion. We agree. Nevertheless, we consider and assign the appropriate weight to Dr. Mattingly's testimony as required under 37 C.F.R. § 42.65(a) and explained in Part II.E.3.b) above. Accordingly, we deny the Motion as it relates to paragraphs 82 and 86–89 of Exhibit 2012.

IV. CONCLUSION

For all the reasons expressed above, we conclude that GE has demonstrated by a preponderance of the evidence that: (1) claims 1, 2, 4–11, and 16–21 are unpatentable as obvious over Wendus and the background

knowledge of an ordinarily skilled artisan, (2) claims 1 and 12–15 are unpatentable as obvious over Willis and the background knowledge of an ordinarily skilled artisan, (3) claim 1 is anticipated by Daly, and (4) claim 3 is unpatentable as obvious over Daly and the background knowledge of an ordinarily skilled artisan.

#### V. ORDER

For the reasons given, it is:

ORDERED, based on a preponderance of evidence, that claims 1–21 of U.S. Patent 8,448,895 B2 are *unpatentable*;

FURTHER ORDERED that GE’s Motion to Exclude is *denied*; and

FURTHER ORDERED because this is a final written decision, the parties to this proceeding seeking judicial review of our Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2017-00425  
Patent 8,448,895 B2

PETITIONER:

Anish Desai  
Brian Ferguson  
Christopher Pepe  
WEIL GOTSHAL & MANGES LLP  
anish.desai@weil.com  
brian.ferguson@weil.com  
christopher.pepe@weil.com  
GE.WGM.Service@weil.com

PATENT OWNER:

M. Andrew Holtman  
Jason E. Stach  
David C. Reese  
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER L.L.P.  
andy.holtman@finnegan.com  
jason.stach@finnegan.com  
david.reese@finnegan.com