United States Court of Appeals for the Federal Circuit

GENERAL ELECTRIC COMPANY,
Appellant

v.

RAYTHEON TECHNOLOGIES CORPORATION,
Appellee

2019-1319

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2017-00428.

Decided: December 23, 2020

WILLIAM F. LEE, Wilmer Cutler Pickering Hale and Dorr LLP, Boston, MA, argued for appellant. Also represented by BRIAN DRISCOLL, LAUREN B. FLETCHER, MADELEINE C. LAUPHEIMER, LOUIS W. TOMPROS.

PATRICK JOSEPH COYNE, Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, Washington, DC, argued appellee. Also represented by SYDNEY KESTLE, JEFFREY CURTISS TOTTEN; BENJAMIN AARON SAIDMAN, Atlanta, GA.

Before LOURIE, REYNA, and HUGHES, *Circuit Judges.*

HUGHES, *Circuit Judge.*

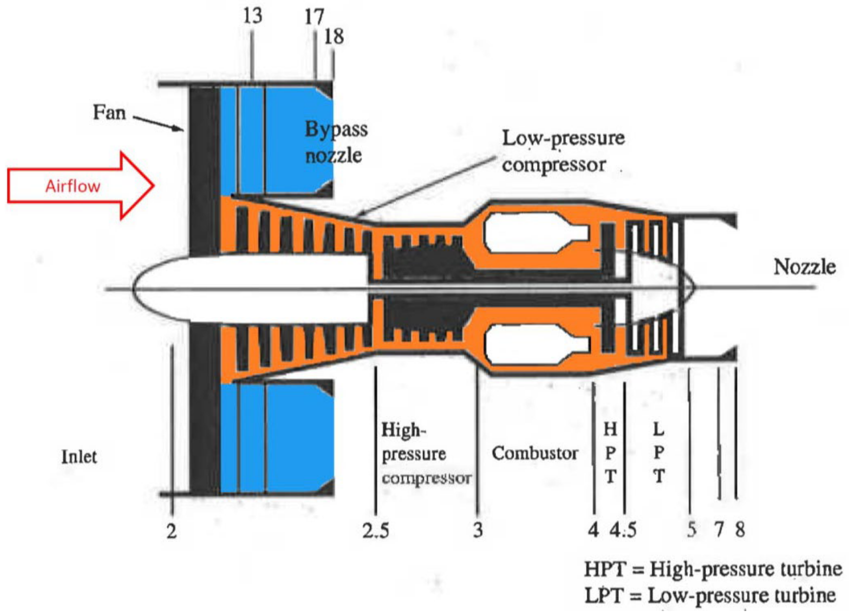
General Electric Company appeals the Patent Trial and Appeal Board's decision finding Raytheon Technologies Corporation's gas turbine engine patent not unpatentable for obviousness. Raytheon moved to dismiss the appeal for lack of standing. Because General Electric alleged sufficient facts to establish that it is engaging in activity that creates a substantial risk of future infringement, GE has standing to bring its appeal. As to the merits of the appeal, we vacate the Board's decision and remand the case for further consideration because the Board lacked substantial evidence for its conclusions.

I

Raytheon (known as United Technologies Corporation during the appealed proceedings) and GE vigorously compete in the market to supply propulsion engines to the commercial aviation industry. This dispute revolves around the validity of Raytheon's patent's claims to a two-stage high pressure turbine engine for commercial airplanes and whether those claims would have been obvious in light of the prior art.

A

We begin with a brief technical background. This dispute centers on turbofan gas turbine engines used to propel commercial airliners. *See* J.A. 1182. Turbofan engines rely on four main component sections—the fan, compressor, combustor, and turbine—to generate thrust from the continuous ignition of a mixture of fuel and pressurized air. J.A. 1183.



J.A. 1184. To do so, air enters the fan, which accelerates the air using rotating airfoil "blades." *Id.* The specific engines here are high-bypass-ratio turbofans, in which a portion of the air, after passing through the fan, immediately exits the engine to generate thrust from the momentum imparted upon it by the fan. J.A. 1185. That air is known as the "bypass flow." *Id.* The rest of the air from the fan enters the engine "core," or the compressor, combustor, and turbine sections. *Id.* That air is known as the "core flow." *Id.* The ratio of bypass flow to core flow is called the bypass ratio. For commercial airliners, a higher bypass ratio (i.e., more bypass flow for a given amount of core flow) increases fuel efficiency. *See* J.A. 1797.

The compressor and turbine sections are further divided into high- and low-pressure segments. J.A. 1183. Each of the high- and low-pressure compressor and turbine sections consist of stages, or a "a matched set of rotating blades and stationary airfoils." *See Gen. Elec. Co. v. United Techs. Corp.*, No. IPR2017-00428, 2018 WL 3105491, at *7 n.6 (P.T.A.B. June 22, 2018) (*Final Written Decision*); J.A. 1186. In the figure above, these stages are represented by vertical black lines extending from the central axis in the compressor and turbine sections of the engine. J.A. 1186, n.1. Core flow air is pressurized in the compressor section before it enters the combustor, where it is mixed with fuel and ignites. The resulting hot gas enters the turbine where the expansion of the gas powers the turbine's rotating blades. *See* Appellant's Br. 7–8.

Artisans refer to the grouping of the high-pressure compressor and high-pressure turbine as the "high [pressure] spool" and the grouping of the fan, low-pressure compressor, and low-pressure turbine as the "low spool." *Id.* In a conventional "direct-drive" turbofan engine the components comprising the low spool are all connected to the same shaft and rotate at the same speed. *See* Appellant's Br. 8. The technology here, however, involves a "geared" turbofan, which uses a gearbox mounted between the low-pressure compressor and the fan to reduce the rotational speed of the fan compared to the low-pressure compressor and low-pressure turbine. *Id.* In a high-bypass-ratio turbofan, the fan has a much larger diameter than the engine core components; this discrepancy in diameter leads to a discrepancy in the ideal rotational speed of the fan compared to the low-pressure turbine. *See* J.A. 3269.

By introducing a gearbox that allows the fan to rotate more slowly than the rest of the low spool, each component can run at an operating point much closer to its optimal rotational speed, yielding many benefits. Some of these benefits include:

(1) improving the propulsive efficiency of the fan, reducing engine fuel consumption;

(2) improving the aerodynamic efficiency of the low-pressure turbine, allowing a simpler and less costly design;

(3) reducing the mechanical stress on the fan, improving safety and reliability;

(4) reducing torque on the low-spool shaft connecting the low-pressure compressor and turbine to the fan (or gearbox), allowing the use of a smaller-diameter shaft; and;

(5) reducing engine noise caused by high fan rotational speeds. *See, e.g.*, J.A. 1333, 1351, 1361, 1797–98.

B

In 2011, Raytheon applied for the patent that issued as U.S. Patent Number 8,695,920, entitled "Gas Turbine Engine with Low Stage Count Low Pressure Turbine." According to the background, the invention relates to "an engine mounting configuration for the mounting of a turbofan gas turbine engine to an aircraft pylon." '920 patent at 1:13–15. Although much of the written description focuses on the "static structure" of the engine used to help mount the turbofan to an aircraft, *see, e.g.*, '920 patent at cols. 5–7, the patent claims certain inventions involving particular turbofan gas turbine engine configurations. The claims in dispute, dependent claims 10–14, relate to a "method of designing a gas turbine engine" comprising certain of these architectural features and performance parameters. Each claim depends from independent claim 9, reproduced below.

> 9. A method of designing a gas turbine engine comprising:
>
> > providing a core nacelle defined about an engine centerline axis;
> >
> > providing a fan nacelle mounted at least partially around said core nacelle to define a fan bypass flow path for a fan bypass airflow;
> >
> > providing a gear train within said core nacelle;
> >
> > providing a first spool along said engine centerline axis within said core nacelle to

> drive said gear train, said first spool includes a first turbine section including between three–six (3–6) stages, and a first compressor section;
>
> providing a second spool along said engine centerline axis within said core nacelle, said second spool includes a second turbine section including at least two (2) stages and a second compressor section;
>
> providing a fan including a plurality of fan blades to be driven through the gear train by the first spool, wherein the bypass flow path is configured to provide a bypass ratio of airflow through the bypass flow path divided by airflow through the core nacelle that is greater than about six (6) during engine operation.

’920 patent at 8:14–34. Claim 10 claims the method of claim 9, adding the limitation that “said first turbine section defines a pressure ratio that is greater than about five (5.0).” *Id.* at 8:35–37. Claim 11 depends from claim 10’s method, adding the limitation that “a fan pressure ratio across the plurality of fan blades is less than about 1.45.” *Id.* at 8:38–41. Claim 12 depends from claim 11, adding the limitation that “the gear train is configured to provide a speed reduction ratio greater than about 2.5:1.” *Id.* at 8:42–44. Claim 13 depends from claim 12, further requiring that “the plurality of fan blades [be] configured to rotate at a fan tip speed of less than about 1150 feet/second during engine operation.” *Id.* at 8:44–46. Finally, claim 14 depends from claim 13, requiring, together with all the limitations disclosed in claims 9–13, that “the second turbine section includes two (2) stages.” *Id.* at 8:47–48.

As the parties do, we will refer to the “first” spool, turbine, and compressor as the low-pressure spool, turbine, and compressor; the "second" spool, turbine, and compressor, as the high-pressure spool, turbine, and compressor.

The '920 patent issued in April 2014. In December 2016, GE petitioned the Patent Trial and Appeal Board for inter partes review of claims 1–4, 7–14, 17, and 19 of the '920 patent. In its petition, GE asserted that claims 1, 4, 9–14, 17, and 19 were unpatentable as obvious based on the combination of two prior art references, Wendus and Moxon.

C

Wendus—*Follow-On Technology Requirement Study for Advanced Subsonic Transport*, by Bruce E. Wendus, et al.—is a research paper by four employees of Raytheon subsidiary Pratt & Whitney, published internally in August 1995 before being publicly distributed as a NASA "contractor report" in August 2003. Wendus provides a computational study comparing a "baseline," "state-of-the-art" 1995 turbofan engine to a hypothetical advanced technology engine it dubs the "Advanced Ducted Propulsor" that incorporates technology thought to be feasible for engines entering service in 2005. J.A. 1310–12. Wendus compares these engines to determine the advanced engine's performance gains and its effects on the economics of airline operation compared to the baseline. *Id.* Wendus then suggests future research for technologies that are "critical or enabling" to implementing the advanced engine's design and attaining its performance advantages. J.A. 1311. In its description of the advanced engine, Wendus discloses all elements of claims 9–14 except that it teaches a one-stage high-pressure turbine instead of the "at-least-two-stage" high-pressure turbine taught in claim 9 and narrowed to two stages in claim 14. *See* J.A. 16.

Moxon is a July 1983 magazine article—*How to Save Fuel in Tomorrow's Engines*, by Julian Moxon—published in FLIGHT International, a long-running weekly aviation magazine. Among other topics, Moxon discusses how the high-pressure turbine of a turbofan engine can be modified to improve fuel consumption. Moxon concludes that because of increased performance demands on the high-pressure turbine required to improve fuel efficiency, "a move to one instead of two HP turbine stages is thought unlikely, although designs have been carried out and demonstrations have been run." J.A. 1360–61.

Before the Board decided to institute inter partes review of the '920 patent based on GE's Wendus and Moxon combination, Raytheon disclaimed claims 1–4, 7, 8, 17, and 19. The Board then instituted review of only claims 9–14. *See generally Gen. Elec. Co. v. United Techs. Corp.*, No. IPR2017-00428, 2017 WL 2785055, at *2 (P.T.A.B. June 26, 2017). The Board had also instituted review of independent claim 9 in a separate inter partes review; Raytheon disclaimed claim 9 while that dispute was ongoing. The Board was then left to rule on only the patentability of dependent claims 10–14 of the '920 patent.

II

In its final written decision, the Board found dependent claim 10, and thus dependent claims 11–14, nonobvious. *Final Written Decision* at *5. In so deciding, the Board found that the prior art disclosed all limitations in claim 10. *Id.* at *7. In particular, it found that "high pressure turbines used in . . . gas turbine engines prior to the '920 patent generally had either one stage or two stages," making high-pressure turbine stage-count selection a "binary choice." *Id.* at *10. The Board found that, in making this binary choice, an artisan would have known of various tradeoffs between either choice. *Id.* The Board found the two-stage high-pressure turbine of Moxon to advantageously "reduce[] the stress placed on the turbine, and provide[] a higher efficiency, versus a one-stage turbine, thereby improving the life, reliability, and fuel consumption of the turbine." *Id.*

The Board then found that "Wendus expressly considered at least some of the one-stage versus two-stage tradeoffs and specifically chose the one-stage option." *Id.* at *11. According to the Board, this express consideration meant that Wendus taught away from combination with Moxon—despite the Board's prior findings about the benefits of the two-stage high-pressure turbine. *Id.* The Board alternatively held that, even if Wendus did not teach away from combination with Moxon, "the evidence presented in this proceeding as a whole does not persuasively demonstrate a motivation to modify" Wendus to "include [Moxon's teaching of] a two-stage high pressure turbine." *Id.* And according to the Board, GE did "not establish[] the obviousness of claim 10, when considered as a whole." *Id.* at *14. In support of this last conclusion, the Board found that GE did not "provide a persuasive motivation or justification for why a person of ordinary skill in the art, when modifying the Wendus [advanced] engine to include a two-stage high pressure turbine, would maintain the other claimed parameters within the scope of claim 10." *Id.* at *15.

GE filed a request for rehearing challenging the Board's application of the legal standard for both teaching away and motivation to combine. The Board denied its request for rehearing. *See Gen. Elec. Co. v. United Techs. Corp.*, No. IPR2017-00428, 2018 WL 5099737 at *4 (P.T.A.B. Oct. 18, 2018). GE timely appealed. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

III

Before reaching the merits, we must first address our authority to decide this case. Raytheon moved to dismiss this appeal for lack of standing. *See Gen. Elec. Co. v. Raytheon Techs. Corp.*, No. 2019-1319, ECF No. 17. The motion panel denied the motion, instead asking the parties to address standing in their merits briefing. *See id.*, ECF No. 26. After briefing and argument, we agree with GE that it has alleged facts establishing that it is currently engaged in conduct creating a substantial risk of infringement of the ’920 patent, and thus has standing for this appeal.

Raytheon argues that because it has never “sued or threatened to sue GE” for infringing the ’920 patent, and because GE “had never alleged that an engine exists that presents a concrete and substantial risk of infringing the ’920 patent,” GE lacks standing to appeal the Board’s decision. Appellee’s Br. 1. Elaborating on the latter point, Raytheon argues that GE’s allegations of a risk of infringement rely on events in the past or speculation about GE’s engineering and business choices in the future. Raytheon asserts that this case presents “substantially similar evidence and arguments” to a previous standing dispute between these parties, *Gen. Elec. Co. v. United Techs. Corp.*, 928 F.3d 1349 (Fed. Cir. 2019), *cert. denied sub nom. Gen. Elec. Co. v. Raytheon Techs. Corp.*, No. 19-1012, 2020 WL 2622041 (U.S. May 26, 2020), and that we should dismiss this appeal, as we did with that appeal. Appellee’s Br. 1. GE responds that it has alleged facts that show it “is currently undertaking activities” likely to lead Raytheon to sue it for infringement. Appellant’s Reply Br. 1.

A

“Although we have jurisdiction to review final decisions of the Board under 28 U.S.C. § 1295(a)(4)(A), an appellant must meet ‘the irreducible constitutional minimum of standing.’” *Amerigen Pharm. Ltd. v. UCB Pharma GmBH*, 913 F.3d 1076, 1082 (Fed. Cir. 2019) (quoting *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560 (1992)). That “irreducible constitutional minimum” requires the appellant to “have (1) suffered an injury in fact, (2) that is fairly traceable to the challenged conduct of the [appellee], and (3) that is likely to be redressed by a favorable judicial decision.” *Spokeo, Inc. v. Robins*, 136 S. Ct. 1540, 1547 (2016), *as revised* (May 24, 2016). “[W]here Congress has accorded a procedural right to a litigant, such as the right to appeal an administrative decision” some requirements of standing—but not the requirement of injury in fact—"may be relaxed." *Consumer Watchdog v. Wis. Alumni Research Found.*, 753 F.3d 1258, 1261 (Fed. Cir. 2014). The standing dispute here, then, centers on whether GE has alleged an injury in fact.

When an appellant "relies on potential infringement liability as a basis for injury in fact, but is not currently engaging in infringing activity, it must establish that it has concrete plans for future activity that creates a substantial risk of future infringement or would likely cause the patentee to assert a claim of infringement." *JTEKT Corp. v. GKN Auto. LTD.*, 898 F.3d 1217, 1221 (Fed. Cir. 2018), *cert. denied*, 139 S. Ct. 2713 (2019); *accord Susan B. Anthony List v. Driehaus*, 573 U.S. 149, 158 (2014) ("An allegation of future injury may suffice if the threatened injury is 'certainly impending,' or there is a '"substantial risk" that the harm will occur.'" (quoting *Clapper v. Amnesty Int'l USA*, 568 U.S. 398, 414 (2013))).

Since *JTEKT*, this court has explained that "to establish the requisite injury in an appeal from a final written decision in an *inter partes* review," "[a]n appellant need not face 'a specific threat of infringement litigation by the patentee[.]'" *Adidas AG v. Nike, Inc.*, 963 F.3d 1355, 1357 (Fed. Cir. 2020) (quoting *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1004 (Fed. Cir. 2018)). "Instead, 'it is generally sufficient for the appellant to show that it has engaged in, is engaging in, or will likely engage in activity that would give rise to a possible infringement suit.'" *Id.* (quoting *Grit Energy Sols., LLC v. Oren Techs., LLC*, 957 F.3d 1309, 1319 (Fed. Cir. 2020)).

"GE has the burden of showing that it suffered an injury in fact sufficient to confer Article III standing to appeal." *Gen. Elec. Co.*, 928 F.3d at 1353. "[T]he summary judgment burden of production applies in cases where an appellant seeks review of a final agency action and its standing comes into doubt." *Phigenix, Inc. v. Immunogen,* *Inc.*, 845 F.3d 1168, 1172–73 (Fed. Cir. 2017). As a result, "[w]e accept as true [an appellant's] material representations of fact for purposes of assessing its standing." *Amerigen*, 913 F.3d at 1083. GE has met its requisite burden of production to show that it will likely engage in activity that would prompt an infringement suit.

GE has made concrete plans for future activity. It spent $10–12 million in 2019 developing a geared turbofan architecture and design. DiTommaso Decl. ¶ 24. Because of customer requirements for the lucrative next-generation narrow body market segment, GE intends to keep developing its geared turbofan engine design; that design is GE's technologically preferred design for the next-generation narrow body market. *Id.* In fact, GE has offered this preferred geared turbofan design to Airbus in response to a request for information Airbus dispatched for its next-generation narrow body aircraft. *Id.* ¶ 22.

Although none of these statements prove that GE *will* select this engine as its final bid for the Airbus next-generation narrow body program or for any other aircraft programs, "[a]ctivities that 'will likely'—but might not—occur in the future can be sufficient to confer standing . . . ." *Grit Energy*, 957 F.3d at 1320. GE's specific investment in continued development of a geared turbofan engine design, its avowed preference to offer this design for sale, and its informal offer of this engine to Airbus in an ongoing bidding process together establish that GE will *likely* engage in the sale of this geared turbofan engine design to customers. *Cf. JTEKT*, 898 F.3d at 1220 (noting that "[t]he fact that JTEKT has no product on the market at the present time does not preclude Article III standing," but finding that JTEKT lacked standing because its potentially infringement product design was so preliminary that it could not yet be analyzed for infringement).

GE has also established that such a sale would raise a substantial risk of an infringement suit. According to the sworn statement of GE Aviation's Chief IP Counsel, "GE fully expects that [Raytheon] would accuse this engine of infringing of the '920 patent . . . ." Long Decl. ¶ 9. The most reasonable inference from this statement is that GE believes its preferred design raises a substantial risk of infringement.[1] "IPR petitioners need not concede infringement to establish standing to appeal." *JTEKT*, 898 F.3d at 1221. Beyond explicit statements that this preferred geared turbofan design includes a gear train driven by the low-pressure spool and a two-stage high-pressure turbine, *see* DiTommaso Decl. ¶ 22; 2d DiTommaso Decl. ¶ 5, GE only obliquely alludes to how its preferred engine design meets the claimed limitations. *See* 2d DiTommaso Decl. ¶ 3–4 (declaring that "virtually every turbofan engine" has certain claimed features such as the core and fan nacelles, low-pressure and high-pressure spools and rotating machinery, and fan, and that to provide a "commercially competitive engine," the engine must meet certain other claim limitations, such as a bypass ratio of at least seven.). Although GE does itself no favors by making its allegations so coyly, GE's declarations plausibly establish that its preferred next-generation engine design substantially risks infringing the '920 patent.[2]

---

[1] The alternative would be to infer that GE's counsel presumes Raytheon will file a baseless infringement suit. We doubt that either party would prefer this inference.

[2] We also note that independent claim 9, from which the disputed claims depend, claims a "method of designing a gas turbine engine." '920 patent at 8:14–34. This contrasts with disclaimed independent claim 1, which recites "a gas turbine engine" comprising elements nearly identical to those recited in the steps of claim 9's method. *See id.* at 7:43–58. Given GE's concession that Raytheon would accuse its preferred next-generation engine of infringing the '920 patent, and that GE continues to develop this

B

Our conclusion today that GE has shown concrete plans raising a substantial risk of future infringement fully harmonizes with our conclusion that GE failed to do so in the prior dispute between these parties. GE's allegations of fact in the prior case left a great deal to the imagination. For example, we faulted GE for "contend[ing] only that GE expended some unspecified amount of time and money to consider engine designs that could *potentially* implicate the" patent at issue in that case. *Gen. Elec. Co.*, 928 F.3d at 1353. We also criticized GE for "provid[ing] no evidence that GE actually designed a geared-fan engine . . . ." *Id.* at 1354. And we condemned GE for providing "no evidence that GE is in the process of designing an engine covered by" the disputed claims. *Id.* GE's factual allegations here address all of these specific deficiencies and provide overall much more support for its assertions that it has made

---

design, GE may be now infringing the '920 patent by its method of designing the engine. If currently infringing, GE would undeniably have standing. "A patent claim *could* have a harmful competitive effect on a would-be challenger if the challenger was currently using the claimed features . . . ." *AVX Corp. v. Presidio Components, Inc.*, 923 F.3d 1357, 1365 (Fed. Cir. 2019) (emphasis in original). Whether GE's method for designing its engine offends the patent is unclear: the Board did not construe this "method for designing" preamble, the contours of the "method of designing" the engine are not apparent on the face of the '920 patent, and GE does not develop arguments on this point outside a footnote in a reply brief. *See* Appellant's Reply Br. at 7 n.3. That said, the claims at issue covering the design process rather than the final product favors finding standing during the design process, even if GE never offers for sale an engine meeting the claimed parameters.

concrete plans raising a substantial risk of infringement of the ’920 patent.

Our criticisms of GE’s factual allegations in the prior case were well-earned. In that case, GE submitted an initial declaration of its Aviation-division Chief IP counsel alleging only that, in a mid-1970s research program, GE had developed a similar turbofan engine design to the claimed design and still owned several engines of that design. Long Decl. ¶¶ 14–15, *Gen. Elec. Co. v. United Techs. Corp.*, No. 2017–2497 (Fed. Cir. Jan. 16, 2018), ECF No. 36. GE did not suggest that Raytheon would accuse that design of infringement—GE opined generally that Raytheon had “a history of threatening the aviation industry with their patent portfolio.” *Id.* ¶ 17. Instead, GE alleged that its inability to use its design, or the fruits of its research into that design, would “result[] in economic harm to GE, by increasing its research, development, and design costs,” and cause “competitive harm by limiting GE’s ability to compete in the supply of engines to aircraft makers.” *Id.* ¶ 15. GE noted that it was “discussing with airframers possible future engine designs for next-generation aircraft applications,” but never specified that it had developed or offered a potentially infringing modern design. *Id.* ¶ 16. Instead, it only referred to an infringing design as a “valid option[].” *Id.* ¶ 22.

GE sought to patch some of these holes with a second declaration from the Aviation Chief IP Counsel. *See* Suppl. Long Dec., *Gen. Elec. Co. v. United Techs. Corp.*, No. 2017–2497 (Fed. Cir. Nov. 28, 2018), ECF No. 64. This declaration gave more details of “discuss[ions] with airframers” about future engine designs, noting that GE had submitted information to Boeing “regarding various engine architectures potentially meeting Boeing’s requirements” for its new mid-market aircraft, including one engine architecture including some features of the disputed patent claim. Suppl. Long Dec. ¶¶ 4–5. Even so, GE had only “investigated and discussed with Boeing the possible use” of a design that would "potentially implicate" the patent claims at issue. *Id.* ¶ 5. GE made vague and conclusory allegations that "[i]n response to Boeing's request, GE expended time and money researching and further developing [an] engine architecture" implicating the patent claims "with the option" of using the key inventive feature of those claims. *Id.* ¶ 7. These shaky allegations were weakened even more because the bidding for that Boeing new mid-market aircraft engine had ended before the appeal—and GE's bid had employed a design not implicating the patent. *Id.* ¶ 9.

Considered together, all the allegations in the prior case relevant to this analysis were not just speculative, but overtly theoretical. GE did not allege concrete plans for future activity that would raise a future risk of infringement. It alleged that it had spent money in the past to develop technology that it might consider using in the future. GE's factual allegations here are in stark contrast.

To recap, here, GE has alleged that it has conceived a geared turbofan engine design that Raytheon would likely argue falls within the scope of claims 10–14 of the '920 patent. It has alleged specific ongoing expenditures in 2019 of $10–12 million to continue to develop and refine that design. And it provides that this geared turbofan engine design is its preferred engine design to offer to its customers for the next-generation narrow body market segment. More concretely, GE identifies an Airbus aircraft program where it intends to offer this design for sale to Airbus. And GE supports the concreteness of these plans by showing that it in fact submitted the design to Airbus for the preliminary stage of the bidding process. It has not yet submitted any other design to Airbus. Finally, GE alleges that it believes Raytheon would accuse this specific design of infringement. These new factual allegations remedy the problems we identified in the prior appeal.

By remedying those shortcomings, GE has met the requirements for establishing standing. *Cf. AVX Corp. v. Presidio Components, Inc.*, 923 F.3d 1357, 1365 (Fed. Cir. 2019) (finding that AVX was not engaging in, and did not have non-speculative plans to engage in, conduct covered by the patent at issue because "AVX does not assert, for example, that it is developing a new capacitor that Presidio would likely argue falls within the scope of the upheld claims."). We therefore turn to the merits of GE's appeal.

IV

We "review the Board's compliance with the governing legal standards de novo and its underlying factual determinations for substantial evidence." *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). Obviousness is a question of law, based on underlying factual findings. *See In re Baxter Int'l, Inc.*, 678 F.3d 1357, 1361 (Fed. Cir. 2012). Relevant underlying factual questions here include whether a prior art reference teaches away, *Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1047–48 (Fed. Cir. 2017); whether a skilled artisan would have been motivated to combine references, *see Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1164–65 (Fed. Cir. 2006); and a skilled artisan's reasonable expectation of success in combining references. *PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1196–97 (Fed. Cir. 2014).

GE highlights deficiencies in all three of the Board's conclusions undergirding its holding of non-obviousness. GE asserts that the Board erred by misreading Wendus to find that it disparages or discourages the use of a two-stage high pressure turbine, and therefore erred in finding that Wendus taught away from a two-stage high-pressure turbine. GE also argues that, in the alternative to its teaching away finding, the Board applied an overly rigorous requirement for motivation to combine the Wendus and Moxon references. In particular, GE asserts that the Board erred in its conclusion that no motivation to combine existed, for at least the reason that the Board made explicit findings that should constitute an adequate motivation to combine. GE argues that the Board also erred by requiring GE to show that an artisan would be motivated to retain the claimed performance parameters taught in Wendus in combining Wendus and Moxon.

Raytheon, for its part, argues that we must affirm the Board's decision if we find substantial evidence that (1) Wendus teaches away from modifying its advanced engine to add a two-stage high-pressure turbine; (2) no matter if Wendus teaches away, Wendus discloses a strong preference for a one-stage high-pressure turbine, undermining GE's motivation-to-combine arguments; or (3) GE failed to establish a motivation for modifying the Wendus advanced engine to achieve the invention of claim 10, "as a whole."

We agree with Raytheon that we must affirm if we find substantial evidence of any of these. But we find the Board lacked substantial evidence for each finding.

A

The Board lacked substantial evidence for its finding that Wendus teaches away from using a two-stage high pressure turbine. The Board correctly set forth the standard for teaching away, *Final Written Decision* at *11, providing a long quote from *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056 (Fed. Cir. 2018), in which this court explained that "[a] reference does not teach away 'if it merely expresses a general preference for an alternative invention but does not "criticize, discredit, or otherwise discourage" investigation into the invention claimed.'" *Id.* (quoting *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009)). In applying this standard, however, the Board found that criticism of the use of a two-stage high-pressure turbine in prior art—at most—suggests a general preference for a one-stage high-pressure turbine.

But in summarizing its evidence, the Board found that Wendus discourages the use of a two-stage high-pressure turbine rather than merely suggesting a general preference for a one-stage high-pressure turbine because

> Wendus describes the one-stage turbine as a critical and enabling technology providing significant advantages over a prior art engine having a two-stage turbine, with such advantages representatively including reduced weight and cost. A person of ordinary skill in the art would have known that modifying the Wendus [advanced] engine to include a two-stage turbine would have increased the weight and cost of the engine, which Wendus criticizes, discredits, or otherwise discourages.

Final Written Decision at *13. Wendus simply does not support these conclusions.

Wendus cannot be accurately characterized as defining a single-stage turbine as a "critical" or "enabling" technology, as the Board found. The reference to "critical or enabling" technology comes from Table 16 of Wendus, which provides a "a component-by-component identification of 39 technology improvements" that are "critical or enabling" to the Wendus advanced engine, "along with the attendant characteristic and system benefits" of those technologies. J.A. 1351. The table lists a single-stage high-pressure turbine not as a "critical or enabling" technology, but as the "[s]ystem [b]enefit" of three technologies the table describes as "critical" technologies: "[i]mproved strength shaft material," "[i]mproved disk material," and "[a]dvanced turbine blade attachment." J.A. 1353.

The correct reading of Table 16 in the full context of Wendus establishes that the improved shaft and disk materials and advanced turbine blade attachment encompass the "critical" technologies. Wendus explains that the one-stage high-pressure turbine suffers from "substantial mechanical and structural challenges" resulting from the "high wheel speed and [] large rotor annulus area" used in the advanced engine high-pressure turbine design "to reduce losses in the turbine." J.A. 1320. Table 16 of Wendus itself explains that the improved shaft material, improved disk material, and advanced turbine blade attachment provide the characteristic benefit of allowing increased wheel speed and rotor annulus area. The development of these three technologies makes feasible the high wheel speed and large rotor annulus area used in the Wendus advanced engine to mitigate the aerodynamic losses inherent in the one-stage high-pressure turbines. *See* J.A. 1320, 2941–42.

Thus, the single-stage high-pressure turbine is not the "critical or enabling" technology, but a system benefit that cannot be implemented into an advanced engine without successful development of other "critical and enabling" technologies. Table 16 shows a general preference for a one-stage turbine. But the difference between a "critical or enabling" technology and a mere "system benefit" undermines the Board's conclusion that Wendus displays a "strong preference" for the one-stage turbine.[3]

Additionally, Wendus itself only weakly supports that a one-stage high-pressure turbine has weight and cost advantages over a two-stage high pressure turbine. At several points in Wendus, the authors describe particular advantages of their advanced engine concept. In none of these sections does Wendus set forth a single-stage high-pressure turbine or the reduced weight and cost of the single-stage design as an advantage of its planned advanced engine. *See* J.A. 1310 (Summary); J.A. 1333 (2005 EIS ADP Advantage); J.A. 1350 (Conclusions).

---

[3] Wendus leaves the exact "system benefit" of the single-stage high-pressure turbine design undefined—reinforcing the generality of Wendus's general preference for a one-stage high-pressure turbine.

Wendus does provide that the advanced engine includes technology advances like "significant reductions in weight, price, and maintenance cost in the [high-pressure compressor] and [high-pressure turbine]." J.A. 1349 (acronyms for the components altered to the full name). But these reductions in weight, price, and maintenance cost are not definitively derived from a reduced stage count: "The [advanced engine] represents significant technology advances compared to present day engines because the [advanced engine's] components assume 10 years technology advancement." *Id.* And these technological advances yielding weight, price, and maintenance cost reductions do not relate solely to the reduction in stage count. *See* J.A. 1353 (listing, for example, that "[i]mproved thermal barrier coating" will allow increased combustor exit temperature while maintaining turbine part life, benefiting the engine by "reduc[ing] . . . maintenance cost").

Although a skilled artisan may intuitively understand that a one-stage turbine may be lighter and cheaper to manufacture and maintain than a two-stage turbine, Wendus itself does not criticize the use of a two-stage turbine for weight or cost reasons. In discussing the high-pressure turbine specifically, Wendus never compares weight and cost of a single-stage turbine with that of a two-stage turbine. *See* J.A. 1320. Instead, Wendus notes that "[t]he [single-stage turbine] design results in a combination of high efficiency (low fuel burn) at a minimum number of parts (lower acquisition and maintenance costs)." J.A. 1320.

But Wendus references neither efficiency nor number of parts in comparison to any other high-pressure turbine design. And Wendus discusses other design choices for the high-pressure turbine that would alter the cost and weight of the turbine—like airfoil count, design expansion ratio, wheel speed, and rotor annulus area. J.A. 1320. The choice of stage count will influence these choices, (and vice versa) but all these parameters have independent significance and may be changed without changing the stage count.

See, e.g., J.A. 1319 (noting that, in Wendus's study of an eight-stage high-pressure compressor, "22 additional airfoils were required [within the one-stage high-pressure turbine] to maintain efficiency").

This lack of even implicit comparison between a one- and two-stage turbine based on weight and cost differences is peculiar because Wendus actually offers implicit comparisons between one-stage and two-stage high-pressure turbine designs on other bases. And notably, these comparisons are unfavorable to the one-stage design.

Table 1 of Wendus shows that the advanced engine (one-stage) high-pressure turbine has a lower aerodynamic efficiency than the baseline engine (two-stage) high-pressure turbine, with an asterisk noting that advanced engine efficiency result is "[s]ingle stage based." J.A. 1312. This implicit comparison of the aerodynamic efficiency of a one-stage and two-stage turbine is reinforced by Wendus's explicit acknowledgment that the single-stage high-pressure turbine contributed to a reduction in the advanced engine's fuel efficiency compared to the two-stage turbine in the baseline. J.A. 1323.

The dearth of explicit comparisons between a one-stage and two-stage turbine designs also contrasts with the overt comparison of the benefits of different numbers of stages in the high-pressure compressor. Wendus distinctly studied the differences between a six-stage and eight-stage design, explicitly noted its findings, and pointedly noted the reduced engine length and airfoil count of the six-stage design made it preferable to the eight-stage design. J.A. 1317–19.

And even if an artisan recognized that a one-stage turbine would have led to reduced engine weight and lower engine cost than a two-stage turbine, Wendus is hardly consistent in indicating that weight and cost concerns alone mandate the correct design choices of an improved engine, compared to other factors like fuel efficiency or reliability. For example, the Wendus advanced engine costs more both to produce and to maintain than the baseline engine. *See* J.A. 1344. The advanced engine also weighs more than the baseline engine—and even has a lower thrust-to-weight ratio. J.A. 1343. Given that the advanced engine weighs more and costs more, it is hard to conclude that reduced weight and cost are paramount to the teachings of Wendus.

Besides the fact that Wendus used a one-stage high-pressure turbine design and not a two-stage design, Wendus provides no evidence that reduced weight and cost of the one-stage design is preferable to the improved aerodynamic—and therefore fuel—efficiency of the two-stage design. Rather, in preferring the advanced engine to the baseline engine, Wendus teaches that a heavier and more expensive engine is preferable—at least if this engine provides the attendant benefits of the advanced engine, i.e., fuel efficiency. *See* J.A. 1333 (highlighting reduced thrust-specific fuel consumption as a benefit of the advanced engine).

Moreover, other than the bare statement that a single-stage high-pressure turbine provides an unexplained "system benefit," Wendus does not straightforwardly explain that its use of a one-stage high-pressure turbine in the advanced engine was a choice based on a design preference for that turbine, as the Board concludes. The engine core—the portion encompassing the high-pressure compressor, combustor, and high-pressure turbine—used for Wendus's advanced engine was an "85 percent scale version of [Raytheon's pre-existing] Advanced Technology Common Core" engine design. J.A. 1313. That Wendus adopted a pre-existing engine core design without suggesting that it chose the existing core for its use of a single-stage high-pressure turbine undercuts the inference that Wendus has a "strong preference" for a single-stage high-pressure turbine. To be sure, the baseline engine used a two-stage turbine, suggesting that Wendus was moving away from that design.

But that choice alone does not show the benefits of a one-stage turbine design, or the drawbacks of a two-stage turbine design. An artisan could conclude based on Wendus that the single-stage turbine represented part of an "advanced turbofan" core that improves fuel efficiency. J.A. 1312. But this is not a repudiation—or even discouragement—of a two-stage turbine, which other parts of Wendus note improves fuel efficiency compared to a one-stage turbine.

And the Board's assertion that Wendus "was designed to use a one-stage high pressure turbine, in that other engine components were specifically designed to accommodate the turbine," *Final Written Decision* at *13, lacks support in Wendus. Because the design of the fan, low-pressure compressor, and low-pressure turbine allowed them to "run at optimum speeds and efficiencies," *see* J.A. 1333, and enabled a "very high bypass ratio," the torque on the shaft transmitting power from the low-pressure turbine to the low-pressure compressor and fan gearbox greatly increased, *see* J.A. 1313 (detailing how changes to the fan and low-pressure compressor increase the torque on the low-spool shaft). And because of the increased propulsive efficiency of the fan in the advanced engine, the engine core size could be decreased to 85 percent of the original Advanced Technology Common Core. *See* J.A. 1333. This reduction in core size required the low-spool shaft to fit within a smaller bore diameter. These changes would greatly increase the stress on the low-spool shaft beyond what Wendus thought a material feasibly available in 2005 could withstand. J.A. 1313.

As a possible solution to this problem, Wendus investigated modifying the core to have a larger bore diameter, so that the engine could use a larger diameter low-spool shaft. *Id.* But after performing this analysis, Wendus found that the larger bore diameter would place too much stress on the high-pressure turbine disk. *Id.* Because this modification of the high-pressure turbine to accommodate the requirements of the low-spool shaft was not feasible, Wendus modified other components until a low-spool shaft made of a material feasibly used in 2005 could accommodate the stress. *See* J.A. 1313–14. Most accurately, Wendus explored (but eventually rejected) modifying the chosen one-stage high-pressure turbine's disk bore diameter to accommodate the new low-spool design.[4] And Wendus makes no suggestion that this outcome would have been different for a two-stage turbine, or that it did this specifically so that it could avoid using a two-stage turbine. Wendus designed other components of its advanced engine to accommodate the high-pressure turbine—not for a one-stage high-pressure turbine or a two-stage high-pressure turbine, but for a mechanically robust high-pressure turbine.

All of this goes to show that the Board's conclusion that Wendus "expressly weigh[ed] the tradeoffs [between a one-stage and two-stage turbine] and cho[se] the one-stage option" cannot withstand scrutiny. *Final Written Decision* at *11. Wendus never distinctly compares a one-stage high-pressure turbine and a two-stage high-pressure turbine. And when it compares the one-stage turbine of the advanced engine to the two-stage turbine of the baseline engine, implicitly comparing the designs, it notes the unfavorable performance of the one-stage design. Disclosing that one-stage high-pressure turbine design has an undefined "system benefit" with the implication of improved weight and cost, but "substantial," yet-unsolved "mechanical and structural challenges" to attain that benefit does

---

[4] In addition, when Wendus modified the high-pressure compressor by adding two stages, it modified the high-pressure turbine (albeit not the stage count) to accommodate that change, further suggesting that the high-pressure turbine design was hardly a sacrosanct key feature of the advanced engine design. J.A. 1320.

not teach away from the two-stage high-pressure turbine design acknowledged to have better efficiency and thus to improve the fuel consumption. *Cf. Tyco Healthcare Grp. LP v. Ethicon Endo–Surgery, Inc.*, 774 F.3d 968, 977 (Fed. Cir. 2014) ("Yet simply because the curved blade configurations are not preferred embodiments does not result in the Davison patent teaching away from use of a curved blade, 'absent clear discouragement of that combination.'" (quoting *Santarus, Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1356 (Fed. Cir. 2012))).

Wendus does not make a single negative statement about the use of a two-stage high-pressure turbine; therefore, Wendus does not criticize, credit, or discourage the use of a two-stage high-pressure turbine. For that reason, substantial evidence does not support the Board's conclusion that "Wendus teaches away from modifying the Wendus ADP engine to include the two-stage option." *Final Written Decision* at *11. *Cf. Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 739 (Fed. Cir. 2013) ("A teaching that a composition may be optimal or standard does not criticize, discredit, or otherwise discourage investigation into other compositions."). Nothing the Board cites adequately supports its holding that if engine designers sought greater fuel efficiency or reliability, Wendus would discourage them from using a two-stage turbine or lead them away from using a two-stage turbine.[5] *Cf. In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) ("A known or obvious composition does not become patentable simply because it has been

---

[5] The goal of improved fuel efficiency is not set forth in the '920 patent; the patent notes no express purpose and says nothing about the number of high-pressure turbine stages outside the claims. The patent does, however, characterize one of the deficiencies of the prior art as "increase[d] fuel burn." '920 patent at 1:26–38.

described as somewhat inferior to some other product for the same use.").

B

For similar reasons, the Board lacks substantial evidence for its conclusion that GE did not establish a motivation to combine Wendus and Moxon.

An invention claimed in a patent would have been obvious if "a person of ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, and would have had a reasonable expectation of success in doing so." *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1360 (Fed. Cir. 2007). The Board made certain findings that, on their own, could establish obviousness. It found that, at the time of the invention, "high pressure turbine stage count generally was a binary choice, such that there were usually only two options." *Final Written Decision* at *10. It also found that, in making this binary choice,

> a person of ordinary skill in the art at the time of the '920 patent's invention would have known of various tradeoffs involved in choosing between one or two stages for the high pressure turbine of a two-spool gas turbine engine. A one-stage turbine advantageously is axially shorter, and has fewer parts, versus a two-stage turbine, thereby reducing the weight of the engine and the cost of obtaining parts. A two-stage turbine reduces the stress placed on the turbine, and provides a higher efficiency, versus a one-stage turbine, thereby improving the life, reliability, and fuel consumption of the turbine.

Final Written Decision at *10 (citations omitted). It summarized this design tradeoff by noting that the evidence as a whole established both that "a two-stage high pressure turbine had certain advantages over a one-stage high pressure turbine" and that "a one-stage high pressure turbine had certain advantages over a two-stage high pressure turbine." *Id.* at *13. The Board also rejected Raytheon's argument that an artisan would not have a reasonable expectation of success combining Moxon's disclosure of a two-stage turbine with the rest of the engine features taught by Wendus. *See id.* at *16. These findings set forth reasons that an artisan might seek to modify Wendus by choosing a two-stage high-pressure turbine instead of a one-stage turbine—improved turbine life and reliability and better engine fuel consumption—and a reasonable expectation of success in doing so.

But the Board then held that "it makes little engineering sense for a person of ordinary skill in the art, when seeking to improve upon or otherwise modify the Wendus [advanced] engine, to go against Wendus's strong preference for a one-stage high pressure turbine, despite the known advantages provided by a two-stage design." *Final Written Decision* at *13 (internal quotation marks and citations omitted). It again based this purported "strong preference" on its faulty findings that Wendus described "the one-stage turbine as a critical and enabling technology providing significant advantages over a prior art engine having a two-stage turbine," and that "other [Wendus] engine components [being] specifically designed to accommodate the [one-stage] turbine." *Id.*

Having dispensed with the error of Wendus's "strong preference" in Part IV.A, *supra*, we need not explain again why the Board's conclusion is not supported by substantial evidence. *Final Written Decision* at *10. And without Wendus's purported "strong preference" for a one-stage turbine, the problem with the Board finding a lack of motivation to combine unmistakably appears. An artisan seeking to improve upon or otherwise modify the Wendus advanced engine would have tried to implement a two-stage high-pressure turbine because of the known advantages provided by a two-stage design. *PAR*, 773 F.3d at 1197–98

("Our precedent . . . does not require that the motivation be the best option, only that it be a suitable option from which the prior art did not teach away."); *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004) (holding that "a particular combination" need not "be the preferred, or the most desirable, combination described in the prior art in order to provide motivation").

Moreover, "any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007). Even assuming the Board's finding of Wendus's "strong preference" for a one-stage turbine was supported by substantial evidence, the Board does not adequately explain why an artisan more concerned with fuel efficiency rather than engine weight or cost would have credited this "strong preference" for a one-stage turbine over the known fuel efficiency advantage that a two-stage turbine offers. "[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem*, 437 F.3d at 1165.

The Board quoted *DePuy Spine*, 567 F.3d at 1326, that "[a]n inference of nonobviousness is especially strong where the prior art's teachings undermine the very reason being proffered as to why a person of ordinary skill would have combined the known elements." *Final Written Decision* at *12. But the Board made findings echoing the reasons for combination that GE proffered—that an artisan would have combined Wendus and Moxon because a two-stage turbine "would have predictably yielded lower mechanical stresses and thereby lowered the risk of component failure in the high pressure turbine, and would also increase efficiency." *Id.* at *8. And the Board makes no findings that Wendus contradicts this conclusion. Unless the Board can show how Wendus teaches that a two-stage turbine would *not* lower mechanical stresses or improve fuel efficiency, adequately contradicting its own explicit, supported findings that a two-stage turbine *would* do so, the Board lacks substantial evidence for its conclusion that GE did not establish a motivation to combine Wendus and Moxon.

C

Finally, the Board lacked substantial evidence for holding that GE did not establish the obviousness of claim 10 "as a whole." *Final Written Decision* at *14. The Board faulted GE for not "provid[ing] a persuasive motivation or justification for why a person of ordinary skill in the art, when modifying the Wendus [advanced] engine to include a two-stage high pressure turbine, would maintain the other claimed parameters within the scope of claim 10." *Id.* at *15. In particular, the Board criticized GE for failing to "provide a reason why a person of ordinary skill in the art would maintain the low pressure turbine stage count between 3 and 6, and the low pressure turbine pressure ratio greater than about 5, when incorporating a two-stage high pressure turbine in the Wendus [advanced] engine." *Id.* at *16.

The Board's decision misunderstands the requirement to show obviousness of the claim as a whole. We have explained that the purpose of this requirement is to prevent a patent challenger from merely showing that all elements of the claim exist, without showing why an artisan might combine the elements. *See Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, 411 F.3d 1332, 1337 (Fed. Cir. 2005). But the law has always evaluated the motivation to combine elements based on the combination of prior art *references* that together disclose all of the elements of the invention. *Cf. Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1361 (Fed. Cir. 2011) ("[T]he claimed invention is not obvious if a person of ordinary skill would not select and *combine the prior art references* to reach the claimed composition or formulation." (emphasis added)). In contrast, the Board's approach would require a motivation to combine each element of the claim—even those present together in a reference. This analysis unduly dissects prior art references into collections of individual elements, requiring a party showing obviousness to re-do the work already done in the prior art reference. The claimed invention and an invention in the prior art must both be analyzed as a whole for the same reason: an invention is more than the sum of its individual elements.

This does not change when combining prior art references would require some alteration of the apparatuses disclosed in the prior art. The Board justified the need to show motivation to combine each element of claim 10 with its finding that "incorporating a two-stage high pressure turbine within the Wendus [advanced] engine would likely lead to changes to other components in the engine." *Final Written Decision* at *16. But "'[a] person of ordinary skill is also a person of ordinary creativity, not an automaton,' so the fact that it would take some creativity to carry out the combination does not defeat a finding of obviousness." *Facebook, Inc. v. Windy City Innovations, LLC*, 953 F.3d 1313, 1333 (Fed. Cir. 2020) (quoting *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)).

We fail to accept the Board's evidence that GE did not establish motivation to combine Wendus and Moxon to achieve the elements of claim 10 as a whole. Wendus meets all the elements of claim 10 except for the two-stage high-pressure turbine, which Moxon discloses. GE does not merely identify each claim element as present in Wendus and Moxon. Instead, GE's obviousness theory combines the elements disclosed in Wendus's advanced engine with Moxon's teaching of a two-stage high-pressure turbine to attain better turbine reliability and efficiency. And the Board did not adopt Raytheon's argument that GE did not show a reasonable expectation of success in combining Wendus and Moxon. *Final Written Decision* at *16.

It does not matter that GE did not explain why an artisan would be motivated to use each element disclosed in Wendus. That Wendus treats the claim parameters as desirable is enough motivation for an artisan to combine them with a two-stage turbine, as long as the artisan can make the combination with a reasonable expectation of success. For that reason, the Board's finding that GE did not show the obviousness of claim 10 "as a whole" lacks substantial evidence.

V

We have considered the parties' remaining arguments; we find them unpersuasive.[6] Because the Board lacked substantial evidence for its underlying factual conclusions from which it found claims 10–14 of the '920 patent nonobvious, we vacate the Board's decision and remand the case to the Board for further proceedings consistent with this opinion.

VACATED AND REMANDED

Costs to appellant.

---

[6] We decline to reach GE's legal arguments on estoppel because the Board found that claims 10–14 are patentably distinct from claim 9. *Final Written Decision* at *4. We leave it to the Board's discretion on remand to determine whether our opinion changes its conclusion in this respect. If the Board determines it proper to revisit its conclusion, it should determine whether claims 10–14 "present materially different issues that alter the question of patentability, making them patentably distinct from" claim 9. *MaxLinear, Inc. v. CF CRESPE LLC*, 880 F.3d 1373, 1378 (Fed. Cir. 2018).