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Paper 7
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SPACE EXPLORATION TECHNOLOGIES CORP.,
Petitioner,

v.

BLUE ORIGIN LLC,
Patent Owner.

Case IPR2014-01376
Patent 8,678,321 B2

Before KEN B. BARRETT, HYUN J. JUNG, and CARL M. DEFRANCO, *Administrative Patent Judges*.

DEFRANCO, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Space Exploration Technologies Corp. ("SpaceX") filed a Petition ("Pet.") for *inter partes* review of U.S. Patent No. 8,678,321 B2 ("the '321 patent"). The Petition challenges the patentability of claims 1–13 of the '321 patent under 35 U.S.C. §§ 102 and 103.[1] Blue Origin LLC, the owner of the '321 patent, did not file a Preliminary Response to the Petition. We have jurisdiction under 35 U.S.C. § 314(a). After considering the Petition, we conclude that SpaceX has demonstrated a reasonable likelihood that it would prevail in showing unpatentability of the challenged claims. Thus, we institute an *inter partes* review of claims 1–13 of the '321 patent.

II. BACKGROUND

A. The '321 Patent

Space exploration is expensive, and a reusable launch vehicle ("RLV") provides the potential for lower cost access to space. *Id*. at 1:55–2:3. The '321 patent relates to landing and recovering an RLV at sea. Ex. 1001, 1:42–45. As disclosed, the RLV performs a controlled landing on a sea-going platform in a manner that reduces the amount of reconditioning necessary to reuse the RLV in a subsequent launch. *Id*. at 3:10–13, 5:29–36. The RLV comprises a lower, booster stage and an upper, payload stage. *Id*. at 3:13–15. After the RLV lifts off from a coastal launch site, the booster stage propels the payload stage to a high-altitude flight profile. *Id*. at 3:42–44, Fig. 1. At a predetermined altitude, the booster stage cuts off its engines

[1]The remaining claims of the '321 patent, claims 14 and 15, are the subject of another Petition filed by SpaceX in IPR2014-01378. Pet. 1.

and separates from the payload stage. *Id*. at 3:64–66. The booster stage takes a trajectory over the ocean for reentry into the earth's atmosphere, while the payload stage proceeds into orbit. *Id*. at 3:64–4:3. During reentry, the booster stage reorients itself into a "tail-first" position as it glides toward the sea-going platform. *Id*. at 4:3–8. Once the booster descends to a suitable position over the platform, the engines on the booster stage reignite to slow its descent. *Id*. at 4:51–55. The booster stage then performs a "vertical, powered landing" at low speed onto the deck of the sea-going platform. *Id*. at 4:55–57.

B. Challenged Claims

Of the challenged claims, claims 1, 8, and 13 are independent. Claim 1 is directed to a method for "operating a space launch vehicle," and claims 8 and 13 are directed to a method for "transporting a payload to space." Claim 1 is illustrative:

> 1. A method for operating a space launch vehicle, the method comprising:
>
> launching the space vehicle from earth in a nose-first orientation, wherein launching the space launch vehicle includes igniting one or more rocket engines on the space launch vehicle;
>
> reorienting the space launch vehicle to a tail-first orientation after launch;
>
> positioning a landing structure in a body of water; and
>
> vertically landing the space launch vehicle on the landing structure in the body of water in the tail-first orientation while providing thrust from at least one of the one or more rocket engines.

Ex. 1001, 8:59–9:4.

C. Evidence of Record

SpaceX relies upon the following prior art as its basis for challenging the claims of the ’321 patent, and it also proffers the declaration testimony of Dr. Marshall H. Kaplan (Ex. 1016).

References	Patents/Printed Publications	Date	Exhibit
Ishijima	Y. Ishijima et al., *Re-entry and Terminal Guidance for Vertical Landing TSTO (Two-Stage to Orbit)*, AIAA GUIDANCE, NAVIGATION, AND CONTROL CONFERENCE AND EXHIBIT, PAPER 98-4120, at 192–200	1998	1003
Lane	U.S. Patent No. 5,873,549	Feb. 23, 1999	1004
Mueller	U.S. Patent No. 5,927,653	Jul. 27, 1999	1005
Kindem	U.S. Patent No. 6,024,006	Feb. 15, 2000	1006
Waters	J. Waters et al., *Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative GPS*, PROCEEDINGS OF THE ION 57TH ANNUAL MEETING AND THE CIGTF 20TH BIENNIAL GUIDANCE TEST SYMPOSIUM, at 841–851	2001	1007
Spencer	U.S. Patent No. 6,450,452 B1	Sep. 17, 2002	1008

D. Asserted Grounds of Unpatentability

SpaceX challenges the patentability of claims 1–13 based on the following grounds:

Ground	Basis	Challenged Claims
§ 102	Ishijima	1–3
§ 103	Ishijima and Mueller	4, 5
§ 103	Ishijima and Kindem	6
§ 103	Ishijima, Spencer, and Waters	7
§ 103	Ishijima and Lane	8, 9, 12, 13
§ 103	Ishijima, Lane, and Mueller	10
§ 103	Ishijima, Lane, and Waters	11

III. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in the context of the patent in which they appear. 37 C.F.R. § 42.100(b). SpaceX proposes a construction for five claim terms, namely, "space launch vehicle," "nose-first orientation," "tail-first orientation," "positional information," and "deploying . . . flared control surfaces." Pet. 13–18. Based on our review of the record, however,

we determine that no express construction of any claim term is necessary for purposes of this preliminary proceeding.[2]

B. Asserted Grounds

1. Claims 1–3—Anticipation by Ishijima

SpaceX argues that Ishijima anticipates the limitations of claims 1–3. Pet. 19–26. According to SpaceX, Ishijima discloses an RLV that utilizes a flight and recovery sequence identical to the one described and claimed in the '321 patent. *Id*. at 19–20. SpaceX illustrates this identity with a head-to-head comparison of Figure 1 of Ishijima (below left) with Figure 1 of the '321 patent (below right). *Id*. at 19.

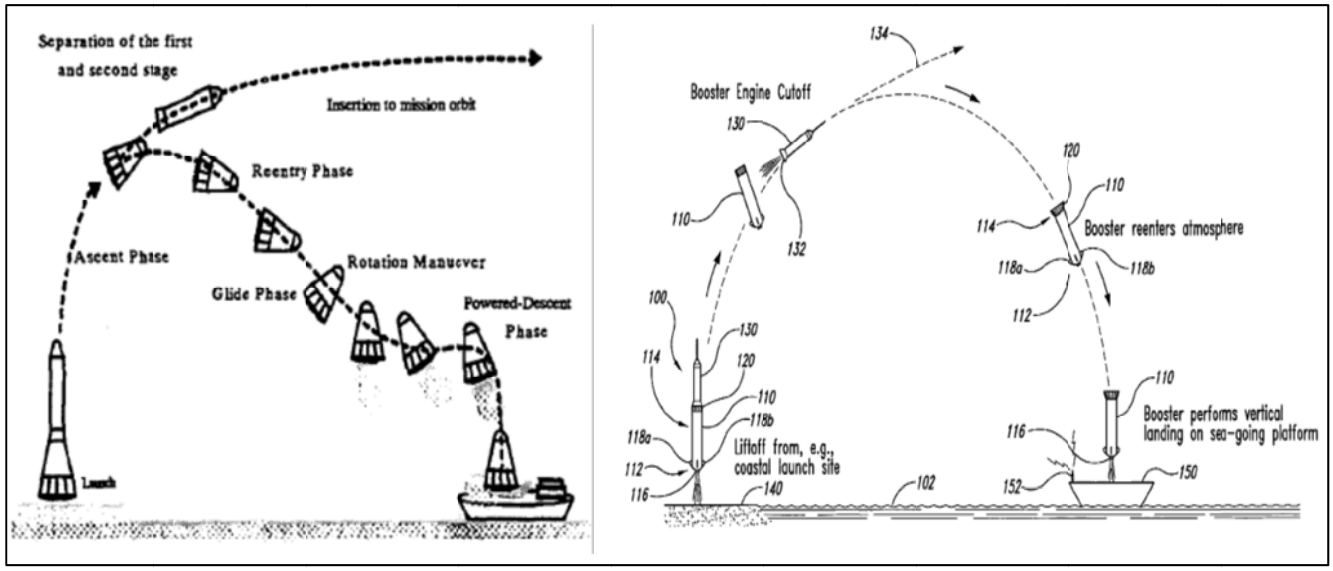

Fig. 1 of Ishijima Fig. 1 of '321 Patent

Each Figure depicts a flight profile of a reusable launch vehicle.

[2] A "Preliminary Proceeding," according to our rules, "begins with the filing of a petition for instituting a trial and ends with a written decision as to whether a trial will be instituted." 37 C.F.R. § 42.2.

Claims 1–3 are fairly straight-forward, reciting the steps of "launching" a space launch vehicle from a coastal launch site, "reorienting" the vehicle from a nose-first to a tail-first orientation after launch, and "vertically landing" the vehicle on a sea-going platform "while providing thrust" from the vehicle's engines. Like the '321 patent, Figure 1 of Ishijima depicts a flight sequence for a "Reusable Launch Vehicle (RLV)" that includes a launch and ascent phase, a reentry phase, a glide and rotation phase, and a powered-landing phase. Ex. 1003 at 15. Ishijima further discloses that, during re-entry, the RLV performs a "Rotation Maneuver," in which the RLV "changes its attitude from nose-first to tail-first." *Id*. For landing on "a tanker on the sea," Ishijima's RLV "performs vertical powered-descent" and "lands softly throttling the thrust." *Id*. at 14–15.

On the current record, there is clearly identity between Ishijima and claims 1–3 of the '321 patent. After reviewing SpaceX's evidence and analysis, we determine that SpaceX has demonstrated a reasonable likelihood that claims 1–3 are anticipated by Ishijima.

2. Claims 4, 5, 6—Obviousness Over Ishijima+Mueller+Kindem

Claims 4 and 5 depend directly from claim 1 and add the steps of "refurbishing" and "reusing" the space launch vehicle. Claim 6 also depends from claim 1 and adds the step of "transferring" the recovered space vehicle from the floating platform to a "transit vessel." Noting that Ishijima describes the RLV as being "transferred to the launch site on a large tanker or pontoons," SpaceX nonetheless acknowledges that Ishijima may not necessarily disclose all the details of transferring and refurbishing the RLV.

Pet. 38, 41. But SpaceX cites Mueller as teaching a well-known process for "refurbishing and relaunching" a space vehicle after recovery from an earlier launch. *Id*. at 38 (citing Ex. 1005, 2:56–63). SpaceX also cites Kindem as teaching a technique for transferring a recovered rocket between a transit ship and a floating platform. Pet. 43–44 (citing 1006, 1:60–64, 2:55–60).

SpaceX argues that adapting the recovery and refurbishment techniques of Mueller to the launch and recovery method of Ishijima would have been obvious because both methods have the common objective of reducing operational costs for space transportation by avoiding new booster rockets and reducing waste material. Pet. 39–40 (citing Ex. 1003 at 192, Ex. 1005, 1:31–35, 2:23–26, Ex. 1016 ¶¶ 25, 190, 191). SpaceX also argues that adding the transfer and transport technique of Kindem to the recovery method of Ishijima would have been obvious because the combination would increase the speed of transport to land and permit the floating platform to remain in position. *Id*. at 44–45 (citing Ex. 1016 ¶¶ 215–217). We find SpaceX's evidence and analysis persuasive, and, thus, determine that SpaceX has demonstrated a reasonable likelihood that claims 4 and 5 are unpatentable over Ishijima and Mueller and that claim 6 is unpatentable over Ishijima and Kindem.

3. Claim 7—Obviousness Over Ishijima+Spencer+Waters

Claim 7 further defines the space launch vehicle as having a booster stage and a payload stage. In doing so, claim 7 adds the steps of (1) turning off the engines on the booster stage, (2) separating the booster stage from the payload stage "at predetermined altitude," (3) utilizing "positional

information" to control the trajectory of the booster stage toward the landing platform, and (4) reigniting the engines for vertically landing the booster stage on the platform. Arguing that Ishijima discloses essentially all of these steps, SpaceX nonetheless cites Spencer for teaching separation of an RLV from a payload stage "at a predetermined level," and cites Waters for teaching the use of "positional information" to facilitate landing on a sea-based platform . Pet. 45–52. On the current record, we find SpaceX's evidence persuasive.

Ishijima plainly depicts a glide phase in which the engines of the RLV (or booster stage) are shut down upon separation from the payload and trajectory is controlled by "aerodynamic force." Ex. 1003 at 15, Fig. 1. Subsequently, the RLV "re-ignites the main engines" and "performs vertical powered-descent" onto the landing platform. *Id*. To the extent that Ishijima does not identify a specific separation point for the two stages, Spencer teaches expressly that RLV separation occurs at a "predetermined time, elevation, [and] velocity" after liftoff. Ex. 1008, 2:34–38, 7:14–16. SpaceX argues that triggering the two-stage separation of Ishijima according to the specific altitude criterion of Spencer would have been obvious because both Ishijima and Spencer are concerned with enabling the payload stage to proceed to orbit while permitting the booster stage to be recovered and reused. Pet. 49–50 (citing Ex. 1016 ¶ 241). We find this line of reasoning persuasive.

With respect to using positional information for controlling the trajectory of the RLV toward the landing target, Ishijima explains that the

descent trajectory of the RLV is tightly controlled: "After the glide, the vehicle re-ignites the main engines, and . . . the vehicle performs vertical powered-descent *while compensating the errors caused in the reentry and glide phases*." Ex. 1003 at 15 (emphasis added). Ishijima further recognizes that "[i]n order to land in a limited area such as a tanker on the sea, the re-entry and terminal guidance should be accurate and robust." *Id*. at 14. To the extent that Ishijima does not describe the precise technique for controlling the booster stage's descent trajectory, Waters teaches a "sea-based variant" of a precision navigation system that transmits reference data to unmanned aircraft for landing on an ocean platform. Ex. 1007 at 12–13. SpaceX argues that incorporating the sea-based navigation techniques of Waters into the terminal guidance procedures for the RLV in Ishijima would have been obvious because both Ishijima and Waters require precision landing of an unmanned vehicle on a sea-based platform. Pet. 50–51 (citing Ex. 1016 ¶ 250).

We find SpaceX's evidence and analysis persuasive, and, thus, determine that SpaceX has demonstrated a reasonable likelihood that claims 4 and 5 are unpatentable over Ishijima and Mueller and that claim 6 is unpatentable over Ishijima and Kindem After considering SpaceX's evidence and analysis, we determine SpaceX has made a prima facie showing that the combination of Ishijima, Spencer, and Waters is rational and evinces known elements using known methods to achieve predictable results that would have been obvious to skilled artisans. As such, SpaceX has demonstrated a reasonable likelihood that claim 7 is unpatentable.

4. Claims 8–13—Obviousness Over Ishijima+Lane+Waters+ Mueller

Claims 8–13 restate many of the same limitations of claims 1–7, but add the steps of "deploying an aerodynamic control surface" and "operating one or more propulsive thrusters" to facilitate reorientation of the booster stage for a vertical, tail-first landing. SpaceX argues that claims 8, 9, 12, and 13 would have been obvious over Ishijima and Lane, and that claims 10 and 11, which depend from claim 8, would have been obvious when Ishijima and Lane are viewed with Mueller and Waters. Pet. 26–36, 52–55.

As discussed above, Ishijima discloses "controlling aerodynamic force" and "throttling the thrust" to reorient and decelerate the RLV (or booster stage) for a "vertical powered-descent." Ex. 1003 at 15. Lane teaches a vertically-landing RLV that utilizes aerodynamic flaps for rotating and stabilizing the vehicle during re-entry and pre-landing maneuvers. Ex. 1004, Fig. 4, 1:6–10. The RLV in Lane, like the one in Ishijima, initiates a rotation and landing sequence that includes rotating the vehicle from a "nose-forward orientation" to a "rearward or base-first orientation." *Id*. at 3:35–38. During reorientation, the engines are "in an off state" and the flaps are "partially or fully extended" while the RLV travels along a parabolic flight path. *Id*. at 3:48-58. A flight control computer then controls the RLV's engines to regulate descent and touchdown. *Id*. at 3:64–4:54.

SpaceX argues that incorporating the aerodynamic flap technique of Lane into the reorientation and landing sequence of Ishijima would have been obvious because the RLV of both Ishijima and Lane utilize

aerodynamic forces and engine reignition to control descent and landing of the vehicle. Pet. 32, 34–35. After considering SpaceX's evidence and analysis, we determine that SpaceX has demonstrated a reasonable likelihood that claims 8, 9, 12, and 13 are unpatentable over Ishijima and Lane.

With respect to claims 10 and 11, Mueller teaches expressly the use of propulsive thrusters for rotating the booster stage of a rocket from a nose-first to a tail-first orientation. Ex. 1005, 17:31–53. And, as discussed above with respect to claim 7, Waters teaches the use of positional information for a sea-based landing. Ex. 1007 at 12–13. SpaceX argues that incorporating the propulsive thrusters of Mueller and the sea-based guidance control of Waters into the terminal guidance procedures for the booster stage in Ishijima would have been obvious "for reorientation" and "to obtain precise landing location." Pet. 54 (citing Ex. 1016 ¶¶ 175–175, 249–252, 269), 55 (citing Ex. 1016 ¶¶ 279–281). After considering SpaceX's evidence and analysis, we determine that SpaceX has demonstrated a reasonable likelihood that claim 10 is unpatentable over Ishijima, Lane, and Mueller, and that claim 11 is unpatentable over Ishijima, Lane, and Waters.

IV. CONCLUSION

On the current record, SpaceX has demonstrated a reasonable likelihood of prevailing on the asserted ground of anticipation of claims 1–3 by Ishijima under 35 U.S.C. § 102 and the asserted grounds of obviousness of claims 4–13 over Ishijima and variant combinations of Lane, Mueller, Waters, Spencer, and Kindem under 35 U.S.C. § 103. As such, we authorize

institution of an *inter partes* review of claims 1–13 of the '321 patent. Our decision to institute acts as a preliminary measure of SpaceX's evidence as having enough merit to take the case to trial. Blue Origin may now come forward with argument and evidence in response to SpaceX's prima facie proof of unpatentability.[3]

V. ORDER

For the foregoing reasons, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), *inter partes* review of claims 1–13 of the '321 patent is instituted on the grounds of anticipation under 35 U.S.C. § 102 and obviousness under 35 U.S.C. § 103; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, *inter partes* review of the '321 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

[3] Senator Jon Kyl remarked that the "reasonable likelihood" threshold imposed by 35 U.S.C. § 314(a) "is currently used in evaluating whether a party is entitled to a preliminary injunction, and effectively requires the petitioner to present a prima facie case justifying a rejection of the claims in the patent." 157 CONG. REC. S1375 (daily ed. Mar. 8, 2011).

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