UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Space Exploration Technologies Corp.
Petitioner

v.

Blue Origin LLC
Patent Owner

U.S. Patent No. 8,678,321
Filing Date: June 14, 2010
Issue Date: March 25, 2014

Title: SEA LANDING OF SPACE LAUNCH VEHICLES
AND ASSOCIATED SYSTEMS AND METHODS

Inter Partes Review No. _____

Table of Contents

I. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1) 1

A. Real Party-ln-lnterest under 37 C.F.R. § 42.8(b)(1) 1

B. Related Matters under 37 C.F.R. § 42.8(b)(2) 1

C. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3) 1

D. Service Information 2

E. Power of Attorney 2

II. PAYMENT OF FEES - 37 C.F.R. § 42.103 2

III. REQUIREMENTS FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. § 42.104 2

A. Grounds for Standing under 37 C.F.R. § 42.104(a) 2

B. Identification of Challenge under 37 C.F.R. § 42.104(b) and Statement of Precise Relief Requested 3

C. Threshold for *Inter Partes* Review 37 C.F.R. § 42.108(c) 4

IV. TECHNOLOGY BACKGROUND RELEVANT TO THE '321 PATENT 4

A. "Rocket Science" 5

B. Launch Vehicles 5

C. Multistage Rockets 6

D. Reusable Spacecraft and "Reusable Launch Vehicles" (RLVs) 7

E. Sea Landing of Reusable Launch Vehicles 9

V. SUMMARY OF THE CLAIMED SUBJECT MATTER 10

A. The Specification of the '321 Patent 10

B. Summary of the Relevant Prosecution History 13

C. The Claims of the '321 Patent 14

VI. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3) 15

A. "Space Launch Vehicle" 16

B. "Nose-First Orientation" and "Tail-First Orientation" 17

C. Means-Plus-Function Limitations from Claims 14 and 15 18

1. "Means for Launching" 18

2. "Means for Igniting" 19

3. "Means for Shutting Off" 19

Table of Contents

4. "Means for Reorienting" 20

5. "Means for Reigniting" 20

6. "Means for Landing," "Means for Landing in a Tail-First Orientation," and "Means for Landing Vertically" 21

VII. CLAIMS 14 AND 15 OF THE '321 PATENT ARE OBVIOUS OVER ISHIJIMA IN VIEW OF LANE FURTHER IN VIEW OF MUELLER '693 (GROUND 1) 22

A. Brief Overview of Ishijima 23

B. Brief Overview of Lane 25

C. Brief Overview of Mueller '693 25

D. Claim 14 26

1. Claim 14[a]: Ishijima, Lane, and Mueller '693 teach a space launch vehicle with rocket engines. 26

2. Claim 14[b]: Ishijima teaches a launch site 27

3. Claim 14[c]: Ishijima teaches a sea going platform 27

4. Claim 14[d]: Ishijima in view of Mueller '693 teaches a means for launching 28

5. Claim 14[e]: Ishijima in view of Mueller '693 teaches a means for igniting 30

6. Claim 14[f]: Ishijima in view of Mueller '693 teaches a means for engine shutoff 31

7. Claim 14[g]: Ishijima in view of Lane teaches a means for reorienting 32

8. Claim 14[h]: Ishijima in view of Lane further in view of Mueller '693 teaches a means for engine reignition 34

9. Claim 14[i]: Ishijima in view of Lane teaches a means for landing 38

10. Claim 14[j]: Ishijima in view of Mueller '693 teaches a means for relaunching 40

E. Claim 15 40

VIII. CONCLUSION 41

EXHIBITS

Ex. No.	Title of Document
1101	U.S. Patent No. 8,678,321 to Jeffrey P. Bezos et al.
1102	Prosecution History of U.S. Patent No. 8,678,321 to Jeffrey P. Bezos et al.
1103	Yoshiyuki Ishijima et al., *Re-entry and Terminal Guidance for Vertical-Landing TSTO (Two-Stage to Orbit)*, A Collection of Technical Papers Part 1, AIAA Guidance, Navigation and Control Conference and Exhibit, A98-37001 ("Ishijima")
1104	U.S. Patent No. 5,873,549 to Jeffery G. Lane et al. ("Lane")
1105	U.S. Patent No. 6,158,693 to George E. Mueller et al. ("Mueller '693")
1106	U.S. Patent No. 5,927,653 to George E. Mueller et al. ("Mueller '653")
1107	U.S. Patent No. 6,024,006 to Bjørn Kindem et al. ("Kindem")
1108	Jack Waters, et al., *Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative GPS*, Proceeding of the ION 57th Annual Meeting and the CIGTF 20th Biennial Guidance Test Symposium (2001) ("Waters")
1109	U.S. Patent No. 6,450,452 to Robert B. Spencer et al. ("Spencer")
1110	LUCY ROGERS, IT'S ONLY ROCKET SCIENCE: AN INTRODUCTION IN PLAIN ENGLISH (2008).
1111	U.S. Patent No. 8,047,472 to Vance D. Brand et al. ("Brand")
1112	STEVEN J. ISAKOWITZ, JOSEPH P. HOPKINS & JOSHUA B. HOPKINS, INTERNATIONAL REFERENCE GUIDE TO SPACE LAUNCH SYSTEMS (4th ed. 2004).
1113	MARSHALL H. KAPLAN, SPACE SHUTTLE: AMERICA'S WINGS TO THE FUTURE (2nd ed. 1978).

Ex. No.	Title of Document
1114	NASA, http://www.nasa.gov/mission_pages/shuttle (last visited Aug. 13, 2014).
1115	Ed Memi, *A Step To The Moon: DC-X Experimental Lander Set Up Boeing For Future NASA Work*. BOEING FRONTIERS, 8-9. http://www.boeing.com/news/frontiers/archive/2008/aug/i_history.pdf (last visited Aug. 13, 2014).
1116	William Gaubatz, et al., *DC-X Results and the Next Step*, American Institute of Aeronautics and Astronautics, AIAA-94-4674 (1994).
1117	Declaration of Marshal H. Kaplan, Ph.D. dated August 25, 2014

Space Exploration Technologies Corp. ("Petitioner" or "SpaceX") hereby petitions for *inter partes* review under 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42 of claims 14-15 of U.S. Patent No. 8,678,321 [Ex. 1101] ("'321").

I. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)

A. Real Party-ln-lnterest under 37 C.F.R. § 42.8(b)(1)

Petitioner SpaceX is the real party-in-interest for the instant petition.

B. Related Matters under 37 C.F.R. § 42.8(b)(2)

Petitioner notes that it is concurrently filing a separate petition for *inter partes* review of claims 1-13 of U.S. Patent No. 8,678,321.

C. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

LEAD COUNSEL	BACK-UP COUNSEL
Heidi L. Keefe (Reg. No. 40,673) Cooley LLP, ATTN: Patent Group 1299 Pennsylvania Ave., NW, Suite 700 Washington, DC 20004 Tel: (650) 843-5001 Fax: (650) 849-7400 hkeefe@cooley.com zpatdcdocketing@cooley.com	C Scott Talbot (Reg. No. 34,262) Cooley LLP, ATTN: Patent Group 1299 Pennsylvania Ave., NW, Suite 700 Washington, DC 20004 Tel: (703) 456-8072 Fax: (202) 842-7899 stalbot@cooley.com zpatdcdocketing@cooley.com

D. Service Information

As identified in the attached Certificate of Service, a copy of the present petition, in its entirety, including all Exhibits and a power of attorney, is being served by EXPRESS MAIL® to the address of the attorney or agent of record for the owner of record of the '321 patent, Blue Origin LLC. SpaceX may be served at the lead counsel address provided in Section I.C. SpaceX consents to electronic service by e-mail at the e-mail addresses provided above, which include both individual e-mail addresses and a general docketing e-mail address.

E. Power of Attorney

Filed herewith in accordance with 37 C.F.R. § 42.10(b).

II. PAYMENT OF FEES - 37 C.F.R. § 42.103

This petition requests review of 2 claims of the '321 patent and is accompanied by a payment of $23,000 for 2 claims. *See* 37 C.F.R. § 42.15. This Petition therefore meets the fee requirements under 35 U.S.C. § 312(a)(1).

III. REQUIREMENTS FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. § 42.104

A. Grounds for Standing under 37 C.F.R. § 42.104(a)

Petitioner certifies that the '321 patent is eligible for *inter partes* review and that Petitioner is not barred or otherwise estopped from requesting *inter partes* review challenging the identified claims on the grounds identified herein.

B. Identification of Challenge under 37 C.F.R. § 42.104(b) and Statement of Precise Relief Requested

Petitioner respectfully requests that the Board initiate *inter partes* review of claims 14-15 of the '321 patent, and find them unpatentable based on the grounds set forth herein. The prior art references upon which the invalidity challenge in this Petition is based are listed below:

Ex. No.	Prior Art Document
1103	Yoshiyuki Ishijima et al., *Re-entry and Terminal Guidance for Vertical-Landing TSTO (Two-Stage to Orbit)*, A Collection of Technical Papers Part 1, AIAA Guidance, Navigation and Control Conference and Exhibit, A98-37001 ("Ishijima")
1104	U.S. Patent No. 5,873,549 to Jeffery G. Lane et al. ("Lane")
1105	U.S. Patent No. 6,158,693 to George E. Mueller et al. ("Mueller '693")

This Petition cites additional prior art materials for purposes of providing a technology background and describing the state of the art at the time of the alleged invention. These materials are also cited and discussed in the accompanying Declaration of Marshall H. Kaplan dated August 25, 2014 [Ex. 1117] ("Kaplan Decl."), an expert with more than four decades of experience in spacecraft and launch vehicles. The specific grounds for IPR are identified in the following table:

Ground No.	Claim(s) Affected	Proposed Ground for *Inter Partes* Review
1	14, 15	Obvious over Ishijima in view of Lane further in view of Mueller '693 under § 103(a)

As reflected in the chart above, this Petition relies on the combination of Ishijima, Lane, and Mueller '693 for demonstrating the obviousness of claims 14 and 15. Each of the references relied upon above qualifies as prior art to the '321 patent under at least 35 U.S.C. § 102(b) (pre-AIA). A specific explanation of the ground listed above is set forth in Part VII below.

C. Threshold for *Inter Partes* Review 37 C.F.R. § 42.108(c)

The Board should institute *inter partes* review of claims 14-15 because this Petition establishes a reasonable likelihood of prevailing with respect to each challenged claim. *See* 35 U.S.C. § 314(a). Each limitation of each claim challenged herein is disclosed and/or suggested by the prior art, as explained below.

IV. TECHNOLOGY BACKGROUND RELEVANT TO THE '321 PATENT

The '321 patent, entitled "Sea Landing of Space Launch Vehicles and Associated Systems and Methods," generally relates to a system for landing and recovering portions of a space launch vehicle on a platform at sea or in a body of water. ('321 patent, Abstract.) The accompanying declaration of Dr. Kaplan

describes the state of the art at the time of the alleged invention. (*See* Kaplan Decl. ¶¶ 15-44.) This section provides an overview of that description.

A. "Rocket Science"

History changed on October 4, 1957 when the former Soviet Union launched *Sputnik 1*, the first man-made satellite ever launched into orbit. This event sparked a "space race" between the United States and the former Soviet Union, which culminated in the United States landing on the moon in 1969. (Lucy Rogers, *It's ONLY Rocket Science: An Introduction in Plain English* (2008) [Ex. 1110], at 1.) The ensuing years witnessed an extraordinary number of scientific and technological breakthroughs for launching objects into space and bringing them back.

These breakthroughs captured the public imagination and created a new vernacular, with terms like "rocket science," referring to fields generally reserved for only the most intelligent. (*Id.*) But by 2009, the earliest possibly priority date listed on the face of the patent, the basic concepts of "rocket science" were well-known and widely understood. The "rocket science" claimed in the '321 patent was, at best, "old hat" by 2009. (Kaplan Decl. ¶ 19.)

B. Launch Vehicles

To understand the process for launching objects into space, one should be familiar with the concept of a "launch vehicle," which is a device used to launch

one or more other objects – known as the "payload" – into space. (*Id*. ¶ 20.) Examples of "payloads" include satellites, space probes, telescopes, equipment for research and experimentation, and manned or unmanned spacecraft (small vehicle, usually a capsule, that maneuvers in space). The launch vehicle typically includes one or more rocket engines that propel the launch vehicle and carry the payload into space. (*See* Ex. 1110 at 30.) As explained in the Background of the '321 patent, "[r]ocket powered launch vehicles have been used for many years to carry human and non-human payloads into space." ('321 patent at 1:49-50.)

C. Multistage Rockets

Most launch vehicles utilize a rocket assembly with multiple different "stages," commonly referred to as a "multistage rocket." The concept behind multistage rockets has been known since the 1500s, when Johann Schmidlap, a German fireworks manufacturer, designed a "step rocket" to propel his fireworks to higher altitudes by strapping a smaller rocket atop a larger one. The larger rocket ignited first and carried the fireworks into the air. When the large rocket exhausted its fuel, the smaller rocket detached and ignited, carrying the fireworks to even higher altitudes using the smaller rocket's own fuel. (Ex. 1110 at 27.)

Modern "multi-stage" rockets use precisely the same approach for the same simple reason as Schmidlap's "step rocket": by shedding the mass of the used-up

"booster" stage(s) along the way, the rocket is able to carry heavier payloads farther. To date, all successful orbital launch vehicles have employed multiple rocket stages because "[t]he weight of the rocket, including the engines, fuel and payload, is too large for current propulsion systems to get into orbit in one stage." (*Id.*) Each rocket stage typically "contains its own propellant, engines, instrumentation and airframe, so that it can function independently." (*Id.*) The first stage, is responsible for lifting the payload and all other stages off the surface of the Earth. (*Id.* at 27-28.) "Usually, the first stage burns for only a couple of minutes. After it has used all of its propellant, the empty propellant tank, engine, instrumentation and airframe are just dead weight and are jettisoned and usually return to Earth." (*Id.* at 28.) The next stage then ignites and carries the payload and any remaining stage even higher. As of 2008, rockets with up to five stages had been developed and launched. (*Id.*)

D. Reusable Spacecraft and "Reusable Launch Vehicles" (RLVs)

Traveling to space has always been an expensive proposition, and there has long been an interest in developing launch vehicles that can be partially or completely reused. (*See* Kaplan Decl. ¶ 23.) By the 1970s, the expense of relying on expendable launch vehicles to reach space led to the Space Shuttle program. (*Id.*) The reusable Space Shuttle orbiter landed horizontally like an airplane after

space missions. (Ex. 1110 at 62-63.) Even with the partially reusable Space Shuttle, the cost to reach space remained staggeringly expensive. (Kaplan Decl. ¶ 24.)

By the late-1970s, industry recognized that the need for reusability also extended to booster stages. As explained in U.S. Patent No. 5,927,653 to George E. Mueller et al. ("Mueller '653") [Ex. 1106], filed in 1996, "[o]ne of the most significant problems facing industry with respect to satellite deployment is the extremely high cost to transport the satellite to a desired orbit." (Ex. 1106 at 1:29-31.) Mueller '653 reported that launching an unmanned satellite into orbit in 1996 could cost from $40 million to $200 million, depending on the type of rocket required. (*Id.* at 1:31-35.) Mueller and others recognized that substantial cost savings could be realized by reusing booster stages. (Kaplan Decl. ¶ 25.) Mueller '653 therefore disclosed "a reliable, *reusable* and cost-effective system for deployment of payloads to low Earth orbit." (Ex. 1106 at 2:23-26 (emphasis added).)

These concerns were echoed in U.S. Patent No. 5,873,549 to Jeffrey G. Lane et al. ("Lane") [Ex. 1104], also filed in 1996. Lane describes reusable single stage to orbit ("SSTO") launch vehicle. SSTO vehicles "are designed to perform their intended operation and return to earth without jettisoning any portions of the

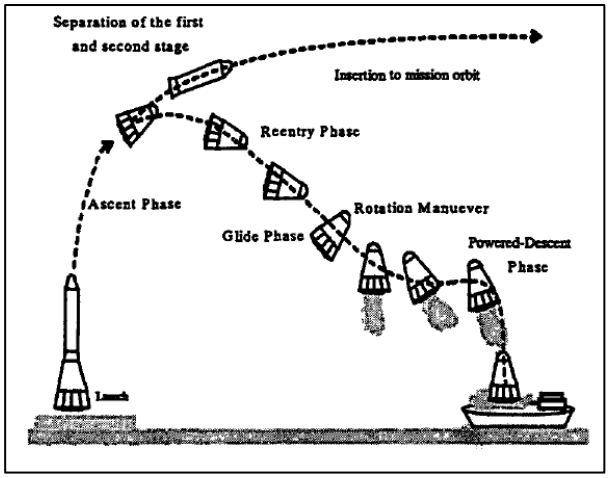
vehicle." (Ex. 1104 at 1:12-16.) Lane and Mueller '653 confirm that by at least 1996, industry had recognized and responded to the need for reusable launch vehicles, which provide cost savings over prior techniques that rely on single-use rockets. (Kaplan Decl. ¶¶ 25-26.)

E. Sea Landing of Reusable Launch Vehicles

The industry also recognized a need for reusable launch vehicles that could land *at sea*. The advantages of landing a reusable launch vehicle at sea have also long been obvious and straightforward to persons of ordinary skill in the art. Landing a launch vehicle or launch vehicle component at sea reduces the risk of accidental loss of life or property in the event of a vehicle malfunction or crash. (Kaplan Decl. ¶ 34.) It also simplifies down-range landing of boosters, which are typically launched from coastal launch sites, by eliminating the need for the boosters to substantially change their trajectory to reach a particular location on land, thereby minimizing their expenditure of propellant. (*See* Kaplan Decl. ¶ 32.)

For example, throughout the prosecution of the '321 patent, the claims were rejected over U.S. Patent No. 8,047,472 to Vance D. Brand et al. ("Brand") [Ex. 1111], which disclosed a "reusable launch system" in which the lower stage "descends to touchdown on a barge in the ocean" (*id.* at 5:41-42).

A similar technique was described in a 1998 publication by Yoshiyuki Ishijima et al., "Re-entry and Terminal Guidance for Vertical-Landing TSTO (Two-Stage to Orbit)," AAIA Pub. No. 98-4120 ("Ishijima") [Ex. 1103]. Ishijima explains that "the research about Reusable Launch Vehicles (RLV) is becoming more active, because they have the potential to reduce the cost of space transportation." (Ex. 1103 at 192.) Ishijima discloses a TSTO system in which the first stage "is recovered and transferred to the launch site on a large tanker or pontoon," as shown in Figure 1 of Ishijima shown at the right. (*Id.* at 192, 193 (Fig. 1).) Ishijima explains 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 192.)



Ex. 1003 Figure 1

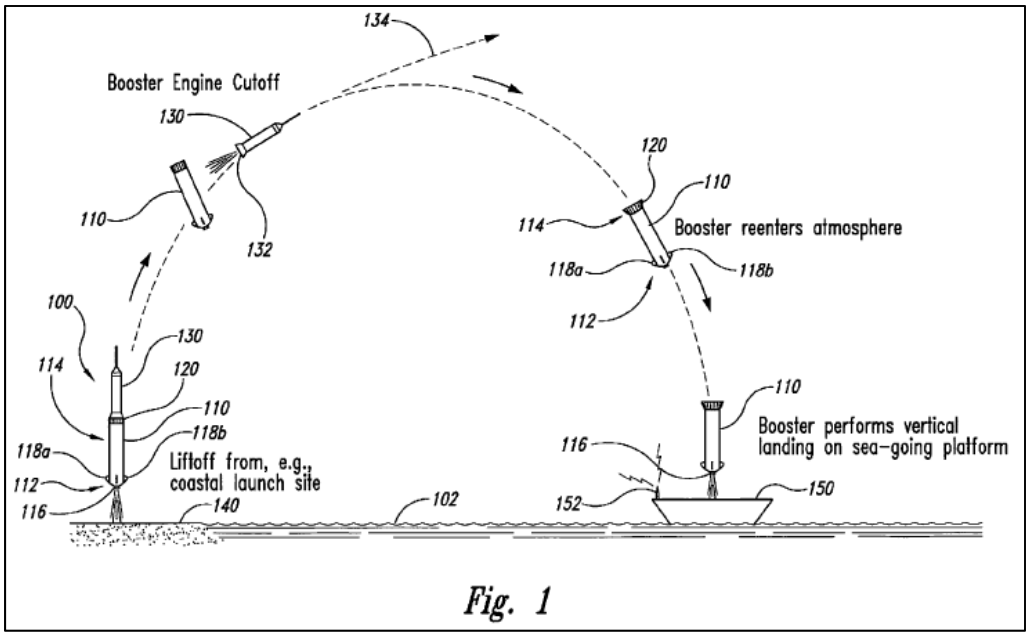
V. SUMMARY OF THE CLAIMED SUBJECT MATTER

A. The Specification of the '321 Patent

The reusable launch vehicle techniques described in Section IV above were known to persons of ordinary skill in the art by at least the late 1990s, but this fact went largely unnoticed by the patent owner during the original prosecution of the '321 patent. The Background portion of the '321 patent pays lip service to the

existence of prior art reusable launch vehicles (RLVs), but does not describe them in any detail. ('321 patent at 1:60-62.) Nor does the specification identify any specific drawback of existing RLVs that the alleged invention seeks to address. (*Id.*)

The '321 patent instead attempts to lay claim over the technique described by Ishijima in 1998 of landing a reusable space launch vehicle on a "sea-going platform," such as a "free-floating, ocean-going barge" or other vessel. ('321 patent at 5:14-20.) The basic technique disclosed in the specification of the '321 patent is shown in Fig. 1 of the patent:



'321 patent Fig. 1

Fig. 1, above, shows "a flight profile of a reusable launch vehicle that performs a vertical powered landing on a sea-going platform in accordance with an

embodiment of the disclosure." (*Id*. at 3:10-13.) The left side of Fig. 1 shows a launch vehicle (100) situated on a "coastal or other land-based launch site 140." ('321 patent at 3:13-15, 3:42-43.) The launch vehicle (100) includes "a first or booster stage" (110) and "a second or upper stage" (130). (*Id*. at 3:13-15.) The right side of Fig. 1 shows a "sea-going platform" (150) that may be located "a hundred or more miles downrange from the coastal launch site 140." (*Id*. at 4:13-15.)

The specification explains that the launch vehicle (100) "takes off from a coastal or other land-based launch site 140 and then turns out over an ocean 102." (*Id*. at 3:42-44.) After the booster stage (110) shuts off at high altitude, it "separates from the upper stage 130 and continues along a ballistic trajectory." (*Id*. at 3:64-66.) The booster stage (110) then reorients itself into a "tail first" position and then moves toward the sea-going platform (150). (*Id*. at 4:3-6.)

In order to land the booster stage (110) on the sea-going platform (150), the booster stage "restarts the booster engines 116 to slow its descent." (*Id*. at 4:51-55.) "The booster stage 110 then performs a vertical, powered landing on the platform 150 at low speed." (*Id*. at 4:55-57.)

The specification does not provide any detailed description of how to land the booster stage (110) at sea. In fact, the specification admits that details

associated with "launching and landing space launch vehicles" are "well-known," and therefore not set forth in the specification "to avoid unnecessarily obscuring the various embodiments of the disclosure." (*Id*. at 2:32-37.)

B. Summary of the Relevant Prosecution History

Throughout prosecution, the claims were repeatedly rejected over the Brand patent which, as noted previously, disclosed a reusable launch system in which the lower stage lands on a barge in the ocean. (*See* Ex. 1111 at 5:41-42.)

The patent owner did not dispute that Brand disclosed the use of a reusable launch vehicle that could land on a sea-going platform. It instead argued that Brand discloses an "air-breathing" booster and not a rocket. (Ex. 1102 at 191-94.) The difference between an air-breathing engine and a rocket would have been plainly obvious to one of ordinary skill in the art considering not only that Brand disclosed both types of engines, but also that the '321 patent itself describes an embodiment in which jet engines are attached to the booster to perform vertical landing maneuvers. ('321 patent at 5:1-13.) The Examiner, however, subsequently allowed the claims, reasoning that Brand did not teach "vertically landing the space launch vehicle . . . while providing thrust from at least one or more rocket engines . . . [because] Brand specifically teaches away from the use of

rocket engines in the booster stage." (Ex. 1102 at 12-13.) The '321 patent subsequently issued on March 25, 2014.

C. The Claims of the '321 Patent

The sole independent claim addressed in this Petition, claim 14, purports to recite a system for providing access to space, including a space launch vehicle with rocket engines that performs various operations, including launch, engine shut-off, reorientation, engine reignition, landing, and relaunching. Most of the elements in claim 14 are written in "means-plus-function" claim format. Claim 14 recites in full:

14[a] A system for providing access to space, the system comprising: a space launch vehicle, wherein the space launch vehicle includes one or more rocket engines;

14[b] a launch site;

14[c] a sea going platform;

14[d] means for launching the launch vehicle from the launch site a first time;

14[e] wherein the means for launching include means for igniting the one or more rocket engines and launching the vehicle in a nose-first orientation;

14[f] means for shutting off the one or more rocket engines;

14[g] means for reorienting the launch vehicle from the nose-first orientation to a tail-first orientation before landing;

14[h] means for reigniting at least one of the one or more rocket engines when the launch vehicle is in the tail-first orientation to decelerate the vehicle;

14[i] means for landing at least a portion of the launch vehicle on the sea going platform in a body of water, wherein the means for landing include means for landing in the tail-first orientation while the one or more rocket engines are thrusting; and

14[j] means for launching at least a portion of the launch vehicle from the launch site a second time.

('321 patent at 10:45-67 (Claim 14) (bracketed notations (e.g., "[a]," "[b]," etc.) added to facilitate easier identification of the specific claim limitations in this Petition).)

Dependent claim 15 merely adds detail about the vehicle landing; it adds nothing of patentable significance, as shown in Part VII below.

VI. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3)

A claim subject to *inter partes* review must 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). As the Federal Circuit has recognized, the "broadest reasonable construction" standard is different from the manner in which the scope

of a claim is determined in litigation.[1] (*See In re Swanson*, 540 F.3d 1368, 1377-78 (Fed. Cir. 2008).) Petitioner accordingly requests that the Board adopt the broadest reasonable construction of each challenged claim. For claim terms not addressed below, Petitioner has applied the plain and ordinary meaning of those terms.

A. "Space Launch Vehicle"

The term "space launch vehicle" is recited in independent claim 14 as the vehicle that is launched and reoriented, and a portion of which is then landed. The specification uses this term to refer to a device used to carry a payload into space. ('321 patent at 1:49-50 ("Rocket powered launch vehicles have been used for many years to carry human and non-human payloads into space.").) This is consistent with the understood meaning of "launch vehicle" to persons of ordinary skill in the art. (Kaplan Decl. ¶ 54; *see also* Ex. 1110 at 30 ("The launch vehicle is the rocket, including all of the stages, that is used to launch a payload into

[1] Petitioner's proposed constructions in Section VI are based on the broadest reasonable construction in light of the specification. *See* 37 C.F.R. § 42.100(b); M.P.E.P. § 2111. Petitioner does not concede that those constructions would be appropriate in litigation or any other proceeding that applies a different standard governing claim construction. *See In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989).

space.”).) Petitioner accordingly requests that the Board find that the broadest reasonable construction of “space launch vehicle” is “a device used to carry a payload into space.”

B. “Nose-First Orientation” and “Tail-First Orientation”

The terms “nose-first orientation” and “tail-first orientation” appear in independent claim 14 to describe the positioning of the “space launch vehicle” or “at least a portion of the launch vehicle” at different phases of operation. As discussed above, to date, all space launch vehicles have included a booster stage.

The specification of the ‘321 patent explains that “the booster stage 110 [Fig. 1] can reenter the atmosphere nose-first, and then reorient to a tail-first orientation just prior to landing.” (’321 patent at 4:6-8, Fig. 1.) The specification further explains that a “tail-first orientation” exists when “the aft end [of the booster stage] is pointing in the direction of motion.” (*Id*. at 4:4-5.) The specification acknowledges that this is not a constant state because the booster may rotate off-axis, requiring efforts to stabilize the booster in a tail-first orientation. (*Id*. at 4:32-37.) The specification also notes that adjustments to the glide path are needed to adjust for movement of the landing platform in the water, further indicating that the booster may not always proceed precisely in the direction of motion. (*See, e.g., id*. at 7:1-23.)

Accordingly, Petitioner respectfully submits that the broadest reasonable construction of "tail-first orientation" is "a position in which the vehicle tail is pointed substantially in the direction of motion." (Kaplan Decl. ¶ 59.) The related term "nose-first orientation" should similarly be construed as "a position in which the vehicle nose is pointed substantially in the direction of motion." (*Id.*)

C. Means-Plus-Function Limitations from Claims 14 and 15

Independent claim 14 includes six means-plus-function limitations. Claim 15, which depends from claim 14, adds another means-plus-function limitation. These limitations are addressed below.

1. "Means for Launching"

Claim 14 recites a "means for launching the launch vehicle." The function is "launching a launch vehicle." Although the specification does not appear to identify any particular structure for performing this function (*Id.* at ¶ 63), it does disclose that "[i]n block 202, the routine starts with booster engine ignition and liftoff from a launch site." ('321 patent at 6:35-36.) Giving this term its broadest reasonable construction, the corresponding structure should be construed as one or more booster engines. (Kaplan Decl. ¶ 63.)[2]

[2] The Petitioner reserves its right to contend that the means-plus-function claim limitations addressed in Section VI.C fail the definiteness requirements of 35

2. "Means for Igniting"

Claim 14 also recites a "means for igniting one or more rocket engines." The function is "igniting one or more rocket engines." (Kaplan Decl. ¶ 64.) The specification does not disclose any structure that performs this function; it simply states, "the routine starts with booster engine ignition." ('321 patent at 6:35.) Giving this term its broadest reasonable construction, the corresponding structure for performing the igniting function should be construed as any suitable structure for igniting one or more rocket engines. (Kaplan Decl. ¶ 65.)

3. "Means for Shutting Off"

Claim 14 also recites a "means for shutting off the one or more rocket engines." The function is "shutting off the one or more rocket engines." (Kaplan Decl. ¶ 66.) The specification does not disclose any structure that performs this function. In fact, the specification does not even contain the term "shut[] off" or any variant thereof. The closest related disclosure indicates that "booster engine cutoff occurs at a predetermined altitude." ('321 patent at 6:40-41.) Giving this term its broadest reasonable construction, the corresponding structure should be

---

U.S.C. § 112(1), but understands that the indefiniteness issue is currently outside the scope of this IPR.

construed as any suitable structure for shutting off one or more rocket engines. (Kaplan Decl. ¶ 67.)

4. "Means for Reorienting"

Claim 14 also recites a "means for reorienting the launch vehicle from the nose-first orientation to a tail-first orientation." The function is "reorienting the launch vehicle." (Kaplan Decl. ¶ 68.) Describing this function, the '321 patent states that "the reorientation of the booster stage can be accomplished using deployable aero-dynamic surfaces (e.g., flared surfaces) which extend outwardly from the forward end of the booster stage to create drag aft of the CG of the booster stage. In other embodiments, thrusters (e.g., rocket thrusters, such as hydrazine thrusters) can be employed in addition to or instead of aerodynamic control surfaces to reorient the booster stage." ('321 patent at 6:47-54.) No further description is given. Thus, the corresponding structure should be construed as deployable aerodynamic surfaces (e.g., flared surfaces) and/or thrusters (e.g., rocket thrusters, such as hydrazine thrusters). (Kaplan Decl. ¶ 70.)

5. "Means for Reigniting"

Claim 14 also recites a "means for reigniting at least one of the one or more rocket engines." The function is "reigniting at least one of the one or more rocket engines." (Kaplan Decl. ¶ 71.) The specification is entirely silent on any structure for performing this function. ('321 patent at 7:19-20.) Giving this term its

broadest reasonable construction, the corresponding structure should be construed as any suitable structure for reigniting a rocket engine. (Kaplan Decl. ¶ 72.)

6. "Means for Landing," "Means for Landing in a Tail-First Orientation," and "Means for Landing Vertically"

Claim 14 recites two means-plus-function limitations relating to landing the launch vehicle at sea: "means for landing at least a portion of the launch vehicle on the sea going platform in a body of water, wherein the means for landing include means for landing in the tail-first orientation while the other one or more rocket engines are thrusting." The specification does not identify any particular structure clearly associated with these functions, but does disclose that "the booster stage 110 can touch down on a suitable shock-absorbing landing gear." ('321 patent at 4:63-64 (emphasis added).) The next sentence states that "[i]n other embodiments, other landing means can be employed to suitably land the booster stage 110 on the sea-going platform 150 in accordance with the present disclosure," but does not identify any such "other landing means." (*Id*. at 4:64-67 (emphasis added).) Accordingly, for purposes of this *inter partes* review, the Board should construe the corresponding structure of these means-plus-function limitations as "shock-absorbing landing gear." (Kaplan ¶ 77.)

Claim 15 depends from claim 14 and states that the means for landing in claim 14 "include means for vertically landing at least a portion of the space

launch vehicle on a floating platform." The only structure in the '321 patent specification arguably associated with this function is the "shock-absorbing landing gear" described in the specification as discussed above. ('321 patent at 4:63-64 (emphasis added).) The Board should accordingly find that the corresponding structure for the "means for vertically landing" is "shock-absorbing landing gear." (Kaplan Decl. ¶ 77.)

Although this proposed construction could render dependent claim 15 superfluous of claim 14, there is nothing improper about such an interpretation. The doctrine of "claim differentiation" does not apply in this situation because a means-plus-function limitation must be limited to the structures specifically disclosed in the specification. (*See, e.g.*, *Saffran v. Johnson & Johnson*, 712 F.3d 549, 563 (Fed. Cir. 2013) ("… we have long held that a patentee cannot rely on claim differentiation to broaden a means-plus-function limitation beyond those structures specifically disclosed in the specification.") (citing *Laitram Corp. v. Rexnord, Inc.*, 939 F.2d 1533, 1538 (Fed. Cir. 1991)).)

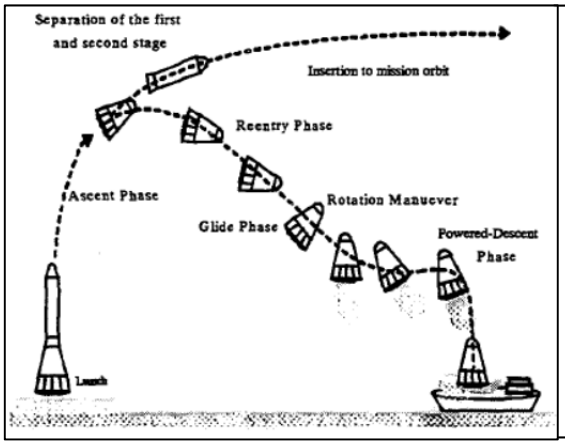
VII. CLAIMS 14 AND 15 OF THE '321 PATENT ARE OBVIOUS OVER ISHIJIMA IN VIEW OF LANE FURTHER IN VIEW OF MUELLER '693 (GROUND 1)

Each limitation of claims 14 and 15 is disclosed by Yoshiyuki Ishijima et al., *Re-entry and Terminal Guidance for Vertical-Landing TSTO (Two-Stage to Orbit)*, A Collection of Technical Papers Part 1, AIAA Guidance, Navigation and Control

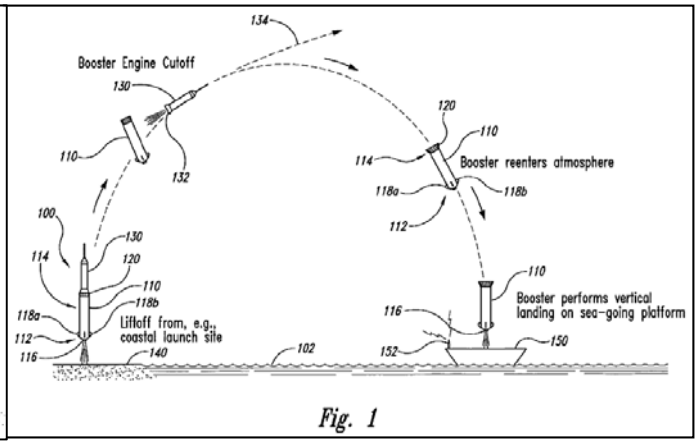
Conference and Exhibit, A98-37001 ("Ishijima") [Ex. 1103] in view of U.S. Patent No. 5,873,549 to Lane et al. ("Lane") [Ex. 1104] further in view of U.S. Patent No. 6,158,693 to Mueller et al. ("Mueller '693") [Ex. 1105]. Ishijima was published in 1998, Lane issued in 1999, and Mueller '693 issued in 2000, all more than one year before the earliest possible priority date identified on the face of the '321 patent. Thus, Ishijima, Lane, and Mueller '693 all qualify as prior art under 35 U.S.C. § 102(b).

A. Brief Overview of Ishijima

Ishijima discloses a reusable launch vehicle that utilizes a flight and recovery sequence essentially identical to the one later described and claimed in the '321 patent. This is illustrated by the following comparison showing Figure 1 from Ishijima (on the left) and Fig. 1 of the '321 patent (on the right):



Ex. 1103 Figure 1



'321 Figure 1

Figure 1 of Ishijima above shows a launch vehicle that undergoes various phases including an "Ascent Phase," "Reentry Phase," "Glide Phase," and "Powered-Descent Phase." The booster stage in Ishijima separates following the Ascent Phase, enabling the second stage and payload to continue to orbit while the first stage proceeds to the Reentry Phase and ultimately lands on a sea-going tanker. (Ex. 1103 at 193, Fig. 1.) "After the glide," Ishijima explains, "the vehicle [*i.e.* booster stage] re-ignites the main engines, and changes its attitude from nose-first to tail-first." (*Id.* at 193.)[3] "In the landing phase, the vehicle performs vertical powered-descent while compensating [sic; for] the errors caused in the reentry and glide phases." (*Id.*) Finally, the launch vehicle "lands softly [on the tanker] throttling the thrust." (*Id.*)

Ishijima therefore discloses precisely the same flight and recovery path as the '321 patent. As shown in the analysis that follows, there is no material difference between the operation of Ishijima's booster stage and the launch vehicle claimed in the '321 patent more than a decade later.

---

[3] Figure 1 of Ishijima used hashmarks to depict the tail of the booster stage, whereas the artist of the '321 patent used hashmarks to depict the deployable aerodynamic surfaces on the nose of the booster stage. Both figures reflect substantially the same orientation at all significant points on the flight path.

B. Brief Overview of Lane

Lane discloses a vertically-landing reusable launch vehicle that includes flap assemblies for rotating and stabilizing the vehicle. (Ex. 1104 at 1:6-10.) The launch vehicle in Lane, like the one in Ishijima, reenters the atmosphere in a nose-first orientation and initiates a landing sequence that includes rotating the vehicle from a "nose-forward orientation" to a "rearward or base-first orientation." (*Id*. at 3:35-38.) This reorientation occurs when the engines are off, by selectively positioning flaps on the launch vehicle while the vehicle is traveling along a parabolic flight path. (*Id*. at 3:48-58.) A flight control computer then controls the engines and the vehicle vertically lands on its landing gear. (*Id*. at 4:51-54; 3:35-39.)

C. Brief Overview of Mueller '693

Mueller '693 discloses a two-stage reusable aerospace vehicle. Mueller '693 describes a flight path in which the vehicle is launched from a ground launching facility using booster-stage rocket engines (Ex. 1105 at 5:32-38), the booster-stage engines are shut down (*id.* at 5:41-43), the booster stage is separated from the upper stage (*id.* at 5:47-50), the booster stage engines are restarted (*id.* at 5:54-59), and the booster stage lands and is subsequently recovered (*id.* at 6:3-14). Mueller '693's disclosure focuses on the structural components used to execute this flight

plan, including those structures used to perform main engine ignition, shutoff, and re-ignition. (Kaplan Decl. ¶ 95.)

D. Claim 14

1. Claim 14[a]: Ishijima, Lane, and Mueller '693 teach a space launch vehicle with rocket engines.

The preamble and first limitation of claim 14 recite "[a] system for providing access to space, the system comprising: a space launch vehicle, wherein the space launch vehicle includes one or more rocket engines." ('321 patent at claim 14.)

Ishijima discloses a space launch vehicle with rocket engines. Ishijima specifically discloses a two-stage to orbit (TSTO), rocket-propelled launch vehicle. (Ex. 1103 at 192 ("There are several kinds of <u>rocket-propelled</u> [reusable launch vehicles], one of them is the single-stage to orbit vehicle (SSTO), an alternative is <u>the two-stage to orbit vehicle (TSTO)</u>.") (emphasis added).) Moreover, Table 2 of Ishijima describes the mass of "propellant" used at various stages of the flight sequence. (*Id*. at 193, Table 2.) One of ordinary skill in the art would understand that "propellant" is used with rocket engines and therefore the artisan would understand that the launch vehicle in Ishijima includes at least one rocket engine. (Kaplan Decl. ¶ 97.)

Lane also discloses a space launch vehicle with rocket engines. In particular, Lane explains that "the present invention controls the position and orientation of the vehicle 10 during rotation and landing sequence 70 without requiring the consumption of propellant." (Ex. 1104 at 4:55-58 (emphasis added).) As before, Lane's disclosure of the use of propellant confirms that rocket engines are employed.

Mueller '693 also teaches a space launch vehicle with rocket engines: "The launch vehicle includes an orbital vehicle (OV) and a booster stage or launch assist platform (LAP). . . A center rocket engine 40 mounts adjacent the aft end of the body." (Ex. 1105 at 4:6-7; 40-41.)

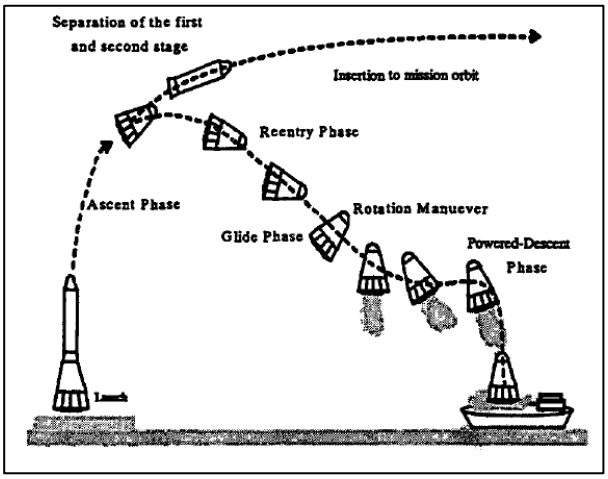
2. Claim 14[b]: Ishijima teaches a launch site

The second limitation of claim 14 requires "a launch site." ('321 patent at claim 14.) Ishijima discloses launching the launch vehicle from "Tanegashima Space Center," which is a launch site on land (Ex. 1103 at 193), thus satisfying this claim limitation.

3. Claim 14[c]: Ishijima teaches a sea going platform

Claim 14 further requires "a sea going platform." ('321 patent at claim 14.) This is shown in Figure 1 of Ishijima (see below), which depicts a floating tanker as the sea going platform for the booster stage. (Ex. 1103 at 193, Fig. 1.) Ishijima describes Figure 1 by stating 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 192 (emphasis added).) One of ordinary skill would understand that a tanker suitable for landing a launch vehicle is a floating platform. (Kaplan Decl. ¶ 104.)



Ex. 1003 Figure 1

Ishijima therefore discloses "a sea going platform," as recited in claim 14[c].

4. Claim 14[d]: Ishijima in view of Mueller '693 teaches a means for launching

Claim 14 also requires "means for launching the launch vehicle from the launch site a first time." ('321 patent at claim 14.) As explained in connection with claim 14[a], Ishijima discloses rocket engines. As further explained in connection claim 14[b], Ishijima discloses that the Tanegashima Launch Center is the launch site.

Ishijima's rocket engines are used for launching the launch vehicle from a launch site. This is shown in Figure 1 of Ishijima (shown above), which "illustrates the outline of a flight sequence." (Ex. 1103 at 192.) The bottom-left of Figure 1 identifies the first step of the sequence as "Launch." (*Id*. at 193, Fig. 1.) Further, Table 2 of Ishijima indicates that propellant in consumed by the first stage booster

"For Ascent." (*Id*.) Ishijima further discloses that the launch vehicle, after separation, "re-ignites the main engines," confirming that the engines were in fact previously ignited. (*Id*.)

Based on these disclosures, one of ordinary skill would understand that the rocket engines of Ishijima are ignited for the purpose of launching the vehicle. (Kaplan Decl. ¶¶ 109-110.) Therefore, Ishijima teaches that the rocket engines constitute the structure for accomplishing the launching function, (*Id*. ¶ 111; *see also* Section VI.C.1.) The limitation is satisfied by the disclosure in Ishijima.

The limitation is also disclosed in Mueller '693, which discloses a center rocket engine (in some embodiments, with two side engines) as the structure for performing the launch function: "A center rocket engine 40 mounts adjacent the aft end of the body in alignment with…the center axis CA of the vehicle body 10. In a particular embodiment, two side engines 44 and 46 are mounted symmetrically with respect to the center axis CA…." (Ex. 1105 at 4:40-45.) These rockets engines constitute the structure for performing the launch function: "[T]he side engines may be fixed in flight to provide thrust along axes that pass through the center of gravity of the launch vehicle (LAP or OV) at lift-off. The center engine 40 is mounted on gimbals and is controlled in flight to steer the launch vehicle

along a desired trajectory on ascent…." (*Id*. at 4:55-60; Kaplan Decl. ¶ 112; *see also* Section VI.C.1.)

5. Claim 14[e]: Ishijima in view of Mueller '693 teaches a means for igniting

Claim 14[d] further recites: "wherein the means for launching include means for igniting the one or more rocket engines and launching the vehicle in a nose-first orientation." ('321 patent at claim 14.) Ishijima teaches igniting its rocket engines for launch, as explained in claim 14[a] and 14[d], satisfying the functional requirement of claim 14[e].

Mueller '693 further teaches a means for ignition: "The launch vehicle is launched from a ground launching facility by starting the engines by means of start cartridges 60 and 62 for the side engines 44 and 46, respectively, and start cartridge #1 64 for center engine 40 (the start cartridges are shown schematically in FIG. 3). Alternatively, the engines may be started for launch using compressed gas or other suitable ground-based equipment." (Ex. 1105 at 5:32-38.) Thus, start cartridges 60, 62, and 64 constitute the structure to perform the function of igniting the one or more rocket engines. (Kaplan Decl. ¶ 117; *see also* Section VI.C.2.) The compressed gas disclosed in Mueller '693 also satisfies the structural limitation of claim 14[e]. (Kaplan Decl. ¶ 117.)

It would have been obvious to adapt the teachings of Mueller '693 to the launch system of Ishijima, with no change in their respective functions, predictably resulting in the start cartridges or compressed gas taught by Mueller '693 being used to ignite the rocket engines of Ishijima for launch. Both references address the same problem—the ignition of rocket engines for launch—providing ample reason for one of ordinary skill to combine their teaching. (Kaplan Decl. ¶ 119.) Mueller '693 merely provides more details on the underlying structure for accomplishing the task. Thus, Ishijima in view of Mueller '693 teaches this limitation.

6. Claim 14[f]: Ishijima in view of Mueller '693 teaches a means for engine shutoff

Claim 14 further requires a "means for shutting off the one or more rocket engines." ('321 patent at claim 14.) Ishijima teaches that the rocket engines are shut off after launch and before the "Glide Phase." In particular, Ishijima explains that "[a]fter the glide, the vehicle <u>re-ignites</u> the main engines" (Ex. 1103 at 193 (emphasis added).) The engines could not be "re-ignited" after the glide phase unless they were turned off between launch and the glide phase. (Kaplan Decl. ¶ 123.) One of ordinary skill in the art, in fact, would recognize that the "Glide Phase" indicates that the launch vehicle was travelling without propulsion, in other words, with its engines turned off. (*Id*. ¶ 124.)

Mueller '693 similarly teaches shutting off its rocket engines: "The supply valves for liquid propellant and liquid oxygen to the engines are closed, thereby shutting down all engines 40, 44, and 46." (Ex. 1105 at 5:41-43.) Thus, supply valves for the lines feeding engines 40, 44, and 46 constitute the structure to perform the function of shutting off the one or more rocket engines. (Kaplan Decl. ¶ 125; *see also* Section VI.C.3.)

It would have been obvious to adapt the teachings of Mueller '693 to the launch sequence of Ishijima, with no change in their respective functions, predictably resulting in the supply valves taught by Mueller '693 being used to shut off the rocket engines of Ishijima. Both references address the same problem—shutting off the vehicle's rocket engines—providing ample reason for one of ordinary skill to combine their teaching. (Kaplan Decl. ¶ 127.) Mueller '693 merely provides more details on the underlying structure for accomplishing the task. Thus, Ishijima in view of Mueller '693 teaches this limitation.

7. Claim 14[g]: Ishijima in view of Lane teaches a means for reorienting

Next, claim 14 requires a "means for reorienting the launch vehicle from the nose-first orientation to a tail-first orientation before landing." ('321 patent at claim 14.)

Ishijima specifically discloses that the launch vehicle "changes its attitude from nose-first to tail-first" (Ex. 1103 at 193), and Figure 1 of Ishijima clearly depicts a "Rotation Maneuver" to a tail-first orientation in preparation for landing. (*Id*., Fig. 1; Kaplan Decl. ¶ 130.) Ishijima therefore teaches the claimed function.

Lane similarly teaches the claimed function and the associated structure. Lane discloses aerodynamic control surfaces consisting of flaps that are used to stabilize and rotate the launch vehicle. In particular, Lane explains that the flight control system "selectively positions flaps 38a, 38b, 38c, and 38d to stabilize reusable launch vehicle 10 during rearward flight as well as <u>to modulate the flap positions to perform the rotation maneuver</u> required to land vehicle 10." (Ex. 1104 at 3:42-47 (emphasis added).) Lane further discloses that the reorientation maneuver consists of rotating the vehicle from a "nose-forward orientation" to a "rearward or base-first orientation." (*Id*. at 3:35-38.) Lane therefore discloses the deployment of aerodynamic control surfaces to facilitate reorientation from a nose-first to a tail-first orientation as recited in the claim. (Kaplan Decl. ¶¶ 131.) Therefore, flaps 38a, 38b, 38c, and 38d constitute the structure to perform the function of reorienting the launch vehicle from the nose-first orientation to a tail-first orientation. (*Id.*; *see also* Section VI.C.4.)

It would have been obvious to adapt the teachings of Lane to the reorientation procedure of Ishijima, with no change in their respective functions, predictably resulting in the flaps taught by Lane being used to reorient the booster of Ishijima from a nose-first to a tail-first orientation. Both references address the same problem—reorienting a vehicle from a nose-first to a tail-first orientation—providing ample reason for one of ordinary skill to combine their teaching. (Kaplan Decl. ¶¶ 132-134.) Lane merely provides more details on the underlying structure for accomplishing the task. Thus, Ishijima in view of Lane teaches this limitation.

8. Claim 14[h]: Ishijima in view of Lane further in view of Mueller '693 teaches a means for engine reignition

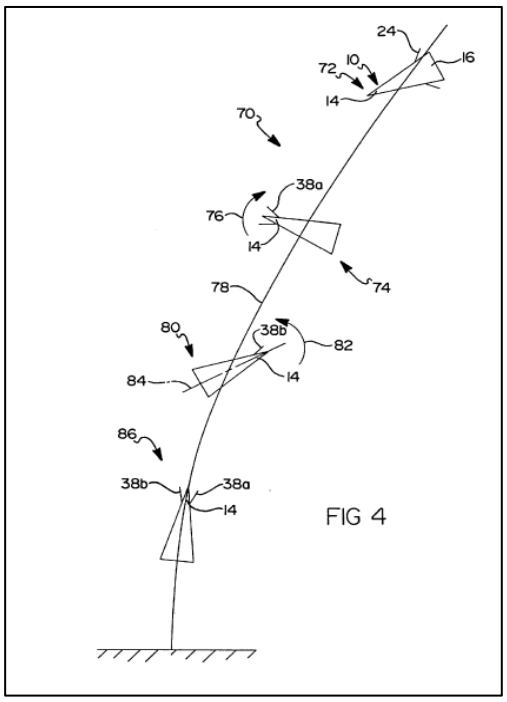
Claim 14 further requires "means for reigniting at least one of the one or more rocket engines when the launch vehicle is in the tail-first orientation to decelerate the vehicle." ('321 patent at claim 14.) As explained in connection with claim 14[a], Ishijima, Lane, and Mueller '693 all disclose rocket engines.

Ishijima in view of Lane further teaches the function of rocket engine reignition while in the tail-first orientation for the purpose of decelerating. Specifically, Ishijima teaches that "[a]fter the glide, the vehicle re-ignites the main engines." (Ex. 1103 at 193.) Further, Ishijima teaches that its rocket engines are used to decelerate the booster stage: "In the first sub-phase, 'rotation sub-phase',

the vehicle rotates at a constant pitch rate (10deg/s), in order to decelerate and perform vertical-descent in the following sub-phase. In the second sub-phase, 'landing sub-phase', the guidance module commands the thrust acceleration vector α_τ." (*Id*. at 195 (emphasis added).) Ishijima also discloses that, during powered-descent, the vehicle "lands softly throttling the thrust." (*Id*. at 193.) This disclosure also teaches one of skill in the art that the rocket engines are used for deceleration.

Ishijima, however, does not expressly disclose that rocket engine reignition occurs while the booster stage is in a tail-first orientation. Lane, in contrast, clearly demonstrates engine reignition after reorientation of the vehicle to a tail-first orientation. Specifically, Lane notes that "[i]n order to minimize propellant consumption, vehicle engines 19 are maintained in an off state during the initiation of landing sequence 70 allowing vehicle 10 to travel along a generally parabolic flight path 78." (Ex. 1104 at 3:54-58 (emphasis added).) The fact that the engines remain off during landing sequence 70 informs those of ordinary skill that the engines are not re-ignited during this rotational maneuver. (Kaplan Decl. ¶ 139.)

This understanding is confirmed by Fig. 4 of Lane (shown at right). Fig. 4 identifies "descent [phase] 86" as occurring after the vehicle is reoriented. (*Id*. at Fig. 4.) Lane discloses that the re-ignited engine control begins in this descent phase: "Those skilled in the art will appreciate that the flight control computer also controls the operation of the vehicle engines 19 so as <u>to regulate the descent and touchdown velocities</u> of the vehicle 10. As described, "the present invention controls the position and orientation of the vehicle 10 during rotation and landing sequence 70 <u>without requiring the consumption of propellant</u>." (*Id*. at 4:51-58.) Lane therefore discloses that reignition of the engines 19 does not take place until after rotation (reorientation) of the launch vehicle,



Ex. 1004 Figure 1

It would have been obvious to adapt the teachings of Lane to the reorientation procedure of Ishijima, with no change in their respective functions, predictably resulting in the engines of Ishijima being reignited after reorientation, as taught by Lane, in order to decelerate the vehicle. Both references address the

same problem—reorienting the vehicle on descent from a nose-first to a tail-first orientation in preparation for landing—providing ample reason for one of ordinary skill to combine their teaching. (Kaplan Decl. ¶¶ 141-143.) One of ordinary skill would also be motivated to adopt Lane's teaching of post-reorientation engine reignition because doing so would preserve propellant, reducing overall system mass and maximizing the mass of payload that could be sent to orbit. (*Id*. ¶ 142.) Thus, Ishijima in view of Lane teaches all but the structural limitation of claim 14[h].

Mueller '693 also teaches the claimed engine reignition function and further identifies the associated structure: "As soon as the OV is clear of the LAP, the center engine 40 on the LAP is started by opening the valves in the LOX lines from the main tank LOX to the retention tank LRT and from the retention tank to the center engine 40, opening the line from the propellant tank LP to the engine, and firing the start cartridge #2 66 (FIG. 3)." (Ex. 1105 at 5:54-59.) Accordingly, start cartridge 66 is the structure for performing the function of reigniting at least one of the one or more rocket engines. (Kaplan Decl. ¶ 144; *see also* Section VI.C.5.)

It would have been obvious to adapt the teachings of Mueller '693 to the engine reignition procedure of Ishijima, with no change in their respective

functions, predictably resulting in the start cartridge taught by Mueller '693 being used to reignite the rocket engines of Ishijima. Both references address the same problem—reigniting a vehicle's rocket engines—providing ample reason for one of ordinary skill to combine their teaching. (Kaplan Decl. ¶¶ 145-146.) Mueller '693 merely provides more details on the underlying structure for accomplishing the task. Thus, Ishijima in view Lane further in view of Mueller '693 teaches this limitation.

9. Claim 14[i]: Ishijima in view of Lane teaches a means for landing

Claim 14 also requires "means for landing at least a portion of the launch vehicle on the sea going platform in a body of water, wherein the means for landing include means for landing in the tail-first orientation while the one or more rocket engines are thrusting." ('321 patent at claim 14.) Ishijima discloses the functions of landing tail first on a floating platform while thrusting its engines. Ishijima teaches a sea going platform in a body of water for the reasons already set forth in Claim 14[c].

As noted previously, Ishijima specifically discloses that the launch vehicle "changes its attitude from nose-first to tail-first." (Ex. 1103 at 193.) Ishijima also explains that "[i]n the landing phase, the vehicle performs <u>vertical</u> powered-descent while compensating [sic; for] the errors caused in the reentry and glide

phases." (*Id*. (emphasis added)) Ishijima further explains that the launch vehicle "lands softly throttling the thrust." (*Id.* (emphasis added).) Ishijima therefore discloses that the launch vehicle lands while providing thrust from its rocket engines. As shown in Figure 1, Ishijima's booster lands in the tail-first orientation. (*Id*., Fig. 1.) Thus, Ishijima teaches all the elements of claim 14[i] except for the structural element of the means-plus-function limitation.

Lane also teaches a tail-first landing, achieved by setting the vehicle down tail first on integrated landing gear: "[I]n preparation for landing, it is necessary to reorient vehicle 10 into a rearward or base-first orientation such that landing gear 20 is positioned to contact the landing surface." (Ex. 1104 at 3:35-39; Fig. 1.) The landing gear described in Lane is the means for landing the vehicle and specifically for landing in the tail first orientation. (Kaplan Decl. ¶ 156.; *see also* Section VI.C.6.)

It would have been obvious to adapt the teachings of Lane to the landing phase of Ishijima, with no change in their respective functions, predictably resulting in the landing gear taught by Lane being used to land the booster of Ishijima in a tail-first orientation. Both references address the same problem—the tail-first landing of a vehicle—providing ample reason for one of ordinary skill to combine their teaching. (Kaplan Decl. ¶¶ 157-159.) Lane merely provides more

details on the underlying structure for accomplishing the task. Thus, Ishijima in view of Lane teaches this limitation.

10. Claim 14[j]: Ishijima in view of Mueller '693 teaches a means for relaunching

The final element of claim 14 requires "means for launching at least a portion of the launch vehicle from the launch site a second time." ('321 patent at claim 14.) The artisan would appreciate that the structure for performing a launch for a second time will be the same structure used to launch the vehicle the first time. (Kaplan Decl. ¶ 162.) Accordingly, the analysis is duplicative of that set forth in Section VII.D.4 for claim 14[d].

E. Claim 15

Claim 15 depends from claim 14 and recites: "The system of claim 14 wherein the means for landing include means for vertically landing at least a portion of the space launch vehicle on a floating platform." ('321 patent at claim 15.)

The landing techniques of Ishijima and Lane are set forth in Section VII.D.9 (claim 14[i]), which is incorporated here by reference. Lane further teaches a tail-first landing achieved by setting the vehicle down tail first on integrated landing gear: "[I]n preparation for landing, it is necessary to reorient vehicle 10 into a rearward or base-first orientation such that landing gear 20 is positioned to contact

the landing surface." (Ex. 1104 at 3:35-39; Fig. 1.) The landing gear described in Lane is the means for vertically landing the vehicle. (Kaplan Decl. ¶ 166; *see also* Section VI.C.6.)

One of ordinary skill would be motivated to combine the teachings of Ishijima and Lane for the same reasons already set forth in Section VII.D.9. Thus, Ishijima in view of Lane teaches this limitation.

VIII. CONCLUSION

The prior art references identified in this Petition contain pertinent technological teachings, either explicitly or inherently disclosed, that were not previously considered in the manner presented herein or applied during original examination of the '321 patent. At least by virtue of disclosing the limitations that served as the basis for the allowance of the claims at issue, the references relied upon herein should be considered important in determining patentability. In sum, these references provide new, non-cumulative technological teachings not previously considered and relied upon on the record, and establish a reasonable likelihood of success as to Petitioner's assertions that claims 14-15 of the '321 patent are not patent eligible pursuant to the grounds presented in this Petition.

Accordingly, Petitioner respectfully requests institution of *inter partes* review for claims 14-15 of the '321 patent for each of the grounds presented herein.

Dated: August 25, 2014

Respectfully submitted,
COOLEY LLP

COOLEY LLP
ATTN: Patent Group
1299 Pennsylvania Ave., NW, Suite 700
Washington, DC 20004
Tel: (703) 456-8000
Fax: (202) 842-7899

By: */Heidi L. Keefe/*
Heidi L. Keefe
Reg. No. 40,673
Lead Counsel for Petitioner

CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 8,678,321**, including all exhibits (**Nos. 1101-1117**) and related documents, are being served by EXPRESS MAIL® on the 25th day of August, 2014, the same day as the filing of the above-identified document in the United States Patent and Trademark Office/Patent Trial and Appeal Board, upon the patent owner:

Blue Origin, LLC
21218 76th Avenue South
Kent, WA 98032-2242

and upon the patent prosecution counsel of record for the U.S. Patent No. 8,678,321:

Perkins Coie, LLP
SEA General
P.O. Box 1247
Seattle, WA 98111-1247

/*Heidi L. Keefe*/
Heidi L. Keefe
Reg. No. 40,673

COOLEY LLP
ATTN: Heidi L. Keefe
Patent Docketing
1299 Pennsylvania Ave. NW, Suite 700
Washington, D.C. 20004
Tel: (650) 843-5001
Fax: (650) 849-7400