

Boeing Commercial Crew Integrated Capability (CCiCap) Space Act Agreement

NNK12MS01S

Boeing Space Act Agreement

Boeing CCiCap Amendment 01

Boeing CCiCap Amendment 02

Boeing CCiCap Amendment 03

Appendix A: Space Act Agreement (SAA)

SPACE ACT AGREEMENT NO. **NNK12MS01S**
BETWEEN
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
THE BOEING COMPANY
FOR
COMMERCIAL CREW INTEGRATED CAPABILITY (CCiCap)

BACKGROUND

In 2009, the National Aeronautics and Space Administration ("NASA") began commercial crew initiatives to stimulate the private sector to develop and demonstrate system concepts and capabilities that could ultimately lead to the availability of human spaceflight services for both commercial and Government customers. Those initiatives focused on maturing designs of elements of a crew transportation system (CTS). This Agreement for the Commercial Crew integrated Capability (CCiCap) begins a new initiative to facilitate industry's development of an integrated CTS. Facilitating development of this U.S. capability will provide national economic benefit and support safe, reliable, and cost effective transportation to low-Earth orbit (LEO).

The goals of the CCiCap investments are to enable significant progress on maturing the design and development of an integrated commercial space transportation system while ensuring crew and passenger safety. This Space Act Agreement (the "Agreement" or "SAA") represents Boeing's and NASA's commitment to encourage innovations and efficiencies in CTS design and capabilities to achieve these CCiCap goals.

ARTICLE 1. AUTHORITY

This Agreement is entered into by the National Aeronautics and Space Administration, located at 300 E Street, SW, Washington, D.C. (hereinafter referred to as "NASA" or Government), and The Boeing Company, (hereinafter referred to as "Boeing" or "Participant") with a place of business at 13100 Space Center Blvd. Houston, Texas 77059. NASA and Boeing may be individually referred to as a "Party" and collectively referred to as the "Parties". NASA's authority to enter into this Agreement is in accordance with the authority set forth in Sections 20113(e) and (f) of the National Aeronautics and Space Act of 1958, as amended. This agreement will be implemented by NASA at the John F. Kennedy Space Center in Brevard County, Florida.

Commercial Crew Integrated Capability

ARTICLE 2. PURPOSE

The purpose of this Agreement is to provide financial and limited technical assistance to Boeing's integrated Crew Transportation System (CTS). Boeing will receive payments from NASA upon successful completion of agreed upon milestones as described in Appendix 2 of this Agreement.

ARTICLE 3. RESPONSIBILITIES

A. Boeing shall:

- (1) Conduct the CCIcap effort according to the milestones identified in Appendix 2 to this Agreement.
- (2) Lead a quarterly project status briefing.
- (3) Designate at least one seat on each review board described in Appendix 2 for a NASA representative.

B. NASA shall:

- (1) Provide milestone payments to Boeing upon successful completion of each CCIcap milestone, subject to limitations noted below.
- (2) Participate in the quarterly project status briefing.
- (3) Appoint a NASA representative to participate in each review board described in Appendix 2, who shall have concurrence authority on aspects of the CTS design, engineering, safety, and operations which could affect the ISS or NASA crew members.

ARTICLE 4. SCHEDULE AND MILESTONES

The scheduled major milestones and acceptance criteria for each milestone for the CCIcap effort are identified in Appendix 2 to this Agreement.

ARTICLE 5. FINANCIAL OBLIGATIONS AND TECHNICAL REPORTS

A. NASA's Payment Obligation

The Government's liability to make payments to Boeing is limited to only those funds obligated under this Agreement or by amendment to the Agreement. NASA may obligate funds to the Agreement incrementally.

B. Acceptance and Payment for Milestones

- (1) Boeing shall notify the NASA Principal Points of Contact at least 30 calendar days prior to the completion of any milestone or the submission of milestone related data, whichever occurs earlier, to arrange for the NASA Technical Contact or designee to witness the event, request clarification on any entrance and exit criteria, or accept delivery of documents. NASA shall have 30 calendar days to determine whether the milestone event meets its corresponding acceptance criteria as described in Appendix 2, and NASA shall notify Boeing in writing no later than 30 days from the completion date of the milestone event of NASA's acceptance or non-acceptance. Disagreement about the successful accomplishment of a milestone shall be deemed a Dispute and resolved in accordance with Article 18 of this Agreement.
- (2) Boeing shall be able to submit an invoice requesting payment upon the accomplishment and acceptance by NASA of the milestone as identified and described in Appendix 2 of this Agreement. Boeing shall submit an invoice via e-mail to the NASA Shared Services Center at NSSC-AccountsPayable@nasa.gov. There shall be no more than one (1) invoice per e-mail submission. After receipt and review of the invoice, the NASA Shared Services Center will coordinate with the NASA Administrative Contact to authorize payment. Subject to change only through written Agreement modification, payment shall be made via electronic funds transfer to the address set forth below:

Bank Account of Payee:

Bank:

Address:

Routing Transit Number:

Depositor Account Title:

Depositor Number:

Commercial Crew Integrated Capability

- (3) The following information shall be included on each invoice:

- Agreement Number
- Invoice Number
- A description of milestone event
- Terms of Payment
- Payment Office
- Agreed Milestone Amount

C. Financial Records and Reports

Except as otherwise provided in this Agreement, Boeing's relevant financial records associated with this Agreement are not subject to examination or audit by NASA.

D. Quarterly Project Status Briefings

Boeing shall conduct quarterly project status briefings with NASA. Progress made shall be estimated and reported in a mutually agreed to quantifiable performance method. The briefings shall describe: the technical progress made on the integrated CTS, milestone expectations for upcoming quarter, current risk assessment, and any life cycle cost change since the last report; plans forward; and any difficulties encountered and the corrective action necessary to recover. Boeing shall provide written certification that it has not provided, directly or indirectly, NASA funding or NASA technical assistance to any prohibited Russian entity in the previous quarter. The final briefing shall describe not only work completed but also shall document how this activity has advanced Boeing's integrated CTS and shall also document the way in which lessons learned as the result of these activities are being incorporated into the design and manufacturing efforts of Boeing's CTS.

E. Access to Records

The Comptroller General of the United States, at its discretion and subject to applicable laws and policies, shall have access to and the right to examine records of any Party to the Agreement or any entity that participates in the performance of this Agreement that directly pertain to and involve transactions relating to the Agreement for a period of three (3) years after the Government makes the final payment under this Agreement. This paragraph only applies to any record that is created or maintained in the ordinary course of business or pursuant to a provision of law. The terms of this paragraph shall be included in arrangements in excess of \$5,000,000.00, which Boeing has entered into for the execution of the milestone events in this Agreement.

ARTICLE 6. DISSEMINATION OF PUBLIC INFORMATION

- A. NASA or Boeing may, consistent with Federal law and this Agreement, release general information regarding its participation in this Agreement.

Boeing shall coordinate in a timely manner with NASA Public Affairs all press or Boeing social media releases regarding NASA CCIcap related developments. The use of any direct quote by a NASA official shall be submitted by Boeing for NASA concurrence to ensure accuracy prior to its release.

- B. Boeing agrees the words “National Aeronautics and Space Administration” or the letters “NASA” will not be used in connection with a product or service in a manner reasonably calculated to convey any impression that such product or service has the authorization, support, sponsorship, or endorsement of NASA, which does not, in fact, exist. In addition, with the exception of release of general information in accordance with paragraph A above, Boeing agrees that any proposed public use of the NASA name or initials shall be submitted by Boeing in advance to the NASA Administrative Contact, who will submit the proposed use to the NASA Assistant Administrator for Public Affairs or designee (“NASA Public Affairs”) for review and approval. NASA approval shall be based on applicable law and policy governing the use of the NASA name and initials. Such approval shall not be unreasonably withheld. Use of NASA emblems/devices (i.e., NASA Seal, NASA Insignia, NASA logotype, NASA Program Identifiers, and the NASA Flag) is governed by 14 C.F.R. Part 1221. Boeing agrees that any proposed use of such emblems/devices shall be submitted in advance to the NASA Administrative Contact, who will submit the proposed use to NASA Public Affairs for review and approval in accordance with such regulations.
- C. NASA does not endorse or sponsor any commercial product, service, or activity. NASA’s participation in this Agreement does not constitute endorsement by NASA. Boeing agrees that nothing in this Agreement will be construed to imply that NASA authorizes, supports, endorses, or sponsors any product or service of Boeing resulting from activities conducted under this Agreement.

ARTICLE 7. NASA FURNISHED INFORMATION AND SERVICES

Boeing may enter into separate Space Act agreements and/or such other agreements with NASA Centers to use NASA resources, including facilities, property, services, and technical information, in performance of this Agreement. The terms and conditions of such other Space Act agreements will govern the use of NASA resources. Boeing shall remain solely responsible for timely completion of its milestones under this Agreement regardless of the availability, non-

Commercial Crew Integrated Capability

availability, or actual cost of NASA resources. Cost and schedule risk associated with activities that are dependent upon NASA Center support resides with Boeing.

ARTICLE 8. NONEXCLUSIVITY

This Agreement is not exclusive; accordingly, NASA may enter into similar Agreements for the same or similar purpose with other entities.

ARTICLE 9: PARTICIPANT CERTIFICATIONS

Within 10 calendar days of the effective date of this Agreement, and within 10 calendar days of any change in status under A. through D. below (including the addition of any new contractor/partner), Boeing shall certify to the best of its knowledge and belief the following to the NASA Administrative Contact:

- A. Neither Boeing nor any of its contractors/partners are presently debarred, suspended, proposed for debarment, or otherwise declared ineligible for award of funding by any Federal agency.
- B. Neither Boeing nor any of its contractors/partners have been convicted nor had a civil judgment rendered against it within the last three (3) years for fraud in obtaining, attempting to obtain, or performing a Government contract.
- C. Boeing or any of its contractors/partners receiving \$100,000 or more in NASA funding for work performed under this Agreement must certify that they have not used any such funds for lobbying purposes prohibited by 31 U.S.C. 1352.
- D. Boeing is an eligible participant as defined in Section 4.2 of the CCIcap Announcement.

ARTICLE 10. LIABILITY AND RISK OF LOSS

- A. Boeing hereby waives any claims against NASA, its employees, its related entities, (including, but not limited to, contractors and subcontractors at any tier, grantees, investigators, customers, users, and their contractors and subcontractors, at any tier) and employees of NASA's related entities for any injury to, or death of, Boeing employees or the employees of Boeing's related entities, or for damage to, or loss of, Boeing's property or the property of its related entities arising from or related to activities conducted under this Agreement, whether such injury, death, damage, or loss arises through negligence or otherwise, except in the case of willful misconduct.

Commercial Crew Integrated Capability

- B. Boeing further agrees to extend this unilateral waiver to its related entities by requiring them, by contract or otherwise, to waive all claims against NASA, its related entities, and employees of NASA and employees of NASA's related entities for injury, death, damage, or loss arising from or related to activities conducted under this Agreement.

ARTICLE 11. LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS

Boeing or its contractors/partners shall not use any funds provided under this Agreement to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

ARTICLE 12. INTELLECTUAL PROPERTY AND DATA RIGHTS - RIGHTS IN DATA

A. General

- (1) "Related Entity" as used in this Article, means a contractor, subcontractor, grantee, or other entity having a legal relationship with NASA or Boeing that is assigned, tasked, or contracted with to perform specified NASA or Boeing activities under this Agreement.
- (2) "Data," as used in this Agreement, means recorded information, regardless of form, the media on which it may be recorded, or the method of recording. The term includes, but is not limited to, data of a scientific or technical nature, software and documentation thereof, and data comprising commercial and financial information.
- (3) "Proprietary Data," as used in this Article, means Data embodying trade secrets or comprising commercial or financial information that is privileged or confidential.
- (4) The Data rights set forth herein are applicable to employees of Boeing and employees of any Related Entity of Boeing. Boeing shall ensure that its employees and employees of any Related Entity that perform Boeing activities under this Agreement are aware of the obligations under this Article and that all such employees are bound to such obligations.
- (5) Data exchanged between NASA and Boeing under this Agreement will be exchanged without restriction as to its disclosure, use, or duplication except as otherwise provided in this Article.

Commercial Crew Integrated Capability

- (6) No preexisting Proprietary Data will be exchanged between the Parties under this Agreement unless specifically authorized in this Article or in writing by the owner of the Proprietary Data.
- (7) In the event that Data exchanged between NASA and Boeing include a restrictive notice that NASA or Boeing deems to be ambiguous or unauthorized, NASA or Boeing may inform the other Party of such condition. Notwithstanding such a notice, as long as such notice provides an indication that a restriction on use or disclosure was intended, the Party receiving such Data will treat the Data pursuant to the requirements of this clause unless otherwise directed in writing by the party providing such Data.
- (8) Notwithstanding any restriction on use, disclosure, or reproduction of Data provided in this clause, the Parties will not be restricted in the use, disclosure, or reproduction of Data provided under this Agreement that: (a) is publicly available at the time of disclosure or thereafter becomes publicly available without breach of this Agreement; (b) is known to, in the possession of, or developed by the receiving Party independent of carrying out the receiving Party's responsibilities under this Agreement and independent of any disclosure of, or without reference to, Proprietary Data or otherwise protectable Data hereunder; (c) is received from a third party having the right to disclose such information without restriction; or (d) is required to be produced or released by the receiving Party pursuant to a court order or other legal requirement.
- (9) If either NASA or Boeing believes that any of the events or conditions that remove restriction on the use, disclosure, or reproduction of the Data apply, NASA or Boeing will promptly notify the other Party of such belief prior to acting on such belief, and, in any event, will notify the other Party prior to an unrestricted use, disclosure, or reproduction of such Data.
- (10) Disclaimer of Liability: Notwithstanding any restriction on use, disclosure, or reproduction of Data provided in this Article, the Parties will not be restricted in, nor incur any liability for, the use, disclosure, or reproduction of any Data not identified with a suitable restrictive notice in accordance with this Agreement or of any Data included in Data which either party has furnished, or is required to furnish without restriction on disclosure and use.
- (11) Boeing may use the following, or a similar, restrictive notice as required by paragraphs B and G of this Article. In addition to identifying Proprietary Data with such a restrictive notice, Boeing should mark each page containing Proprietary Data with the following, or a similar, legend: "Boeing Proprietary, Confidential and/or Trade Secret – use and disclose only in accordance with notice on title or cover page."

Proprietary Data Notice

These data herein include "Background Data" or "Data Produced by Boeing under a Space Act Agreement"> in accordance with the Data Rights provisions under Space Act Agreement <provide applicable identifying information> and embody Proprietary Data. In accordance with the Space Act Agreement, NASA will use reasonable efforts to maintain the data in confidence and limit use, disclosure, and reproduction by NASA and any Related Entity of NASA (under suitable protective conditions) in accordance with restrictions identified in the Space Act Agreement <may list specific restrictions listed in the Agreement>.

B. Data First Produced by Boeing under this Agreement

- (1) Data first produced by Boeing in carrying out Boeing's responsibilities under this Agreement, including but not limited to technical data related to inventions made under this Agreement, will be furnished to NASA upon request and such Data will be disclosed and used by NASA and any Related Entity of NASA (under suitable protective conditions) during the term of this Agreement only for evaluating Boeing's performance of its milestones under this Agreement. If Boeing considers any such Data to be Proprietary Data, and such Data is identified with a suitable restrictive notice, NASA will use reasonable efforts to maintain the Data in confidence.
- (2) Upon a successful completion by Boeing of all milestones under this Agreement, NASA shall not assert rights in such Data or use such Data for any purpose except that NASA shall retain the right to: (1) maintain a copy of such Data for archival purposes; and (2) use or disclose such archived Data by or on behalf of NASA for Government purposes in the event the NASA determines that:
 - (a) Such action is necessary because Boeing, its assignee, or other successor has not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of inventions, hardware, or software related to such Data;
 - (b) Such action is necessary because Boeing, its assignee, or other successor, having achieved practical application of inventions, hardware, or software related to such Data, has failed to maintain practical application;
 - (c) Such action is necessary because Boeing, its assignee, or other successor has discontinued making the benefits of inventions, hardware, or

Commercial Crew Integrated Capability

software related to such Data available to the public or to the Federal Government;

- (d) Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by Boeing, its assignee, or other successor; or
- (e) Such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by Boeing, its assignee, or successor.

In the event NASA determines that one of the circumstances listed in subparagraphs (a)–(e) above exists, NASA shall provide written notification to the Boeing Administrative Point of Contact. Upon mailing of such determination, Boeing shall have thirty (30) days to respond by providing its objection to the determination as a dispute under the Article entitled “Dispute Resolution” of this Agreement. In the event that Boeing does not respond in writing to NASA’s determination, then such determination shall serve as a final agency decision for all purposes including judicial review.

- (3) In the event NASA terminates this Agreement in accordance with Article 16.B., Termination for Failure to Perform, NASA shall have the right to use, reproduce, prepare derivative works, distribute to the public, perform publicly, display publicly, or disclose Data first produced by Boeing in carrying out Boeing’s responsibilities under this Agreement by or on behalf of NASA for Government purposes. The parties will negotiate rights in Data in the event of termination for any other reason.

C. Data First Produced by NASA under this Agreement

- (1) As to Data first produced by NASA (or any Related Entity of NASA) in carrying out NASA responsibilities under this Agreement that would be Proprietary Data if it had been obtained from Boeing, such Data will be appropriately marked with a restrictive notice and maintained in confidence for the duration of this Agreement, with the express understanding that during the aforesaid restricted period such marked Data may be disclosed and used by NASA and any Related Entity of NASA (under suitable protective conditions) only for carrying out NASA responsibilities under this Agreement.
- (2) Upon a successful completion by Boeing of all milestones under this Agreement, NASA shall not use such Data for any purpose except that NASA shall retain the right to: (1) maintain and reproduce copies of such Data for archival purposes; and (2) use or disclose such archived Data by or behalf of the NASA for Government purposes in the event the NASA determines that:

Commercial Crew Integrated Capability

- (a) Such action is necessary because Boeing, its assignee, or other successor has not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of inventions, hardware, or software related to such Data;
- (b) Such action is necessary because Boeing, its assignee, or other successor, having achieved practical application of inventions, hardware, or software related to such Data, has failed to maintain practical application;
- (c) Such action is necessary because Boeing, its assignee, or other successor has discontinued making the benefits of inventions, hardware, or software related to such Data available to the public or to the Federal Government;
- (d) Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by Boeing, its assignee, or other successor; or
- (e) Such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by Boeing, its assignee, or successor.

In the event NASA determines that one of the circumstances listed in subparagraphs (a)–(e) above exists, NASA shall provide written notification to the Boeing Administrative Point of Contact. Upon mailing of such determination, Boeing shall have thirty (30) days to respond by providing its objection to the determination as a dispute under the Article entitled “Dispute Resolution” of this Agreement. In the event that Boeing does not respond in writing to NASA’s determination, then such determination shall serve as a final agency decision for all purposes including judicial review.

- (3) In the event NASA terminates this Agreement in accordance with Article 16.B., Termination for Failure to Perform, NASA shall have the right to use, reproduce, prepare derivative works, distribute to the public, perform publicly, display publicly, or disclose Data first produced by NASA in carrying out NASA’s responsibilities under this Agreement by or on behalf of NASA for Government purposes. The parties will negotiate rights in Data in the event of termination for any other reason.

D. Publication of Results

- (1) Recognizing that section 20112 of the National Aeronautics and Space Act of 1958 (51 U.S.C. § 20112) requires NASA to provide for the widest practicable and

Commercial Crew Integrated Capability

appropriate dissemination of information concerning its activities and the results thereof, and that the dissemination of the results of NASA activities is one of the considerations for this Agreement, NASA will coordinate proposed publication of results with Boeing in a manner that allows Boeing a reasonable amount of time to review and comment on proposed publications.

- (2) Consistent with other obligations in this Article, NASA agrees that it will not publish any results without first receiving permission from Boeing.

E. Data Disclosing an Invention

In the event Data exchanged between NASA and Boeing discloses an invention for which patent protection is being considered, the furnishing party specifically identifies such Data, and the disclosure and use of such Data is not otherwise limited or restricted herein, the receiving party agrees to withhold such Data from public disclosure for a reasonable time (presumed to be 1 year unless mutually agreed otherwise) in order for patent protection to be obtained.

F. Data Subject to Export Control

Technical data, whether or not specifically identified or marked, that is subject to the export laws and regulations of the United States and that is provided to Boeing under this Agreement will be treated as such, and will not be further provided to any foreign persons or transmitted outside the United States without proper U.S. Government authorization, where required.

G. Background Data

- (1) In the event Boeing furnishes NASA with Data developed at private expense that existed prior to, or was produced outside of, this Agreement, and such Data embody Proprietary Data, and such Data is so identified with a suitable restrictive notice, NASA will use reasonable efforts to maintain the Data in confidence and such Data will be disclosed and used by NASA and any Related Entity of NASA (under suitable protective conditions) only for evaluating Boeing's performance under this Agreement. Upon completion of activities under this Agreement, such Data will be disposed of as requested by Boeing. Boeing may amend Appendix 3 in the case of an inadvertent omission or when Boeing determines that new Background IP is going to be used under this Agreement.

H. Handling of Data

- (1) In the performance of this Agreement, Boeing and any Related Entity of Boeing may have access to, be furnished with, or use the following categories of Data:
 - (a) Proprietary Data of third parties that the U.S. Government has agreed to handle under protective arrangements; and/or

Commercial Crew Integrated Capability

- (b) U.S. Government Data, the use and dissemination of which, the U.S. Government intends to control.
- (2) Data provided by the U.S. Government under the Agreement
 - (a) The Parties agree that, during the term of this Agreement, Boeing may request from NASA, and NASA may provide, Proprietary Data of third parties, with the express understanding that Boeing will use and protect such Data in accordance with this Article.
 - (b) The Parties agree that, during the term of this Agreement, Boeing may request from NASA, and NASA may provide, U.S. Government Data, with the express understanding that Boeing will use and protect such U.S. Government Data in accordance with this Article.
 - (c) At the time of execution of this Agreement, the Parties agree that the following software and related Data will be provided to Boeing, to the extent NASA has determined it has the right to distribute, under a separate Software Usage Agreement with the express understanding that Boeing will use and protect such related Data in accordance with this Article: CASPER Software and Introductory training, ASPEN Software and introductory training, PISCES Software, [REDACTED]
[REDACTED] Bumper II, The Debris Assessment Software, Object Reentry Survival Analysis Tool (ORSAT), ISIL-Completion Support Systems Upgrade. Unless Boeing has entered into a license, consistent with 37 C.F.R. Part 404, for software provided under this Agreement, upon completion of activities under this Agreement, such related Data will be disposed of as instructed by NASA. Note: From time to time during the term of this Agreement, Boeing may request from NASA, and NASA may provide, such software and related data.
- (3) With respect to such Data specifically identified in this Agreement or specifically marked with a restrictive notice, Boeing agrees to:
 - (a) Use, disclose, or reproduce such Data only to the extent necessary to perform the work required under this Agreement;
 - (b) Safeguard such Data from unauthorized use and disclosure;
 - (c) Allow access to such Data only to its employees and any Related Entity that require access for their performance under this Agreement;

Commercial Crew Integrated Capability

- (d) Except as otherwise indicated in (3)(c) above, preclude access and disclosure of such Data outside Boeing's organization;
- (e) Notify its employees who may require access to such Data about the obligations under this Article, and ensure any Related Entity performs the same functions with respect to its employees; and
- (f) Return or dispose of such Data, as NASA may direct, when the Data is no longer needed for performance under this Agreement.

I. Oral and visual information

If information that Boeing considers to be Proprietary Data is disclosed orally or visually to NASA, NASA will have no duty to limit or restrict, and will not incur any liability for, any disclosure or use of such information unless (1) Boeing orally informs NASA before initial disclosure that such information is considered to be Proprietary Data, and (2) Boeing reduces such information to tangible, recorded form that is identified and marked with a suitable restrictive notice as required by paragraphs B and G above and furnishes the resulting Data to NASA within 10 calendar days after such oral or visual disclosure.

ARTICLE 13. INTELLECTUAL PROPERTY AND DATA RIGHTS - INVENTION AND PATENT RIGHTS

A. Definitions

- (1) "Administrator," as used in this Article, means the Administrator of the National Aeronautics and Space Administration (NASA) or duly authorized representative.
- (2) "Patent Representative" as used in this Article means the NASA Kennedy Space Center Patent Counsel. Correspondence with the Patent Representative under this clause will be sent to the address below:

Patent Counsel
Mail Code CC-A
Office of the Chief Counsel
NASA John F. Kennedy Space Center, FL 32899

- (3) "Invention," as used in this Agreement, means any innovation or discovery that is or may be patentable or otherwise protectable under title 35 of the U.S.C.
- (4) "Made," as used in relation to any invention, means the conception or first actual reduction to practice of such invention.
- (5) "Practical application," as used in this Agreement, means to manufacture, in the case of a composition or product; to practice, in the case of a process or method;

Commercial Crew Integrated Capability

or to operate, in case of a machine or system; and, in each case, under such conditions as to establish that the invention, hardware, software, or related Data is being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public or to the Federal Government on reasonable terms.

- (6) "Related Entity" as used in this Article, means a contractor, subcontractor, grantee, or other entity having a legal relationship with NASA or Boeing or that is assigned, tasked, or contracted with to perform specified NASA or Boeing activities under this Agreement.

B. Allocation of principal rights

(1) Presumption of title

- (a) Any invention made under this Agreement shall be presumed to have been made in the manner specified in paragraph (A) or (B) of section 20135(b)(1) (51 U.S.C. § 20135(b)(1)) of the National Aeronautics and Space Act of 1958 (hereinafter called "the Act"), and the above presumption shall be conclusive unless at the time of reporting such invention Boeing submits to the Patent Representative a written statement, containing supporting details, demonstrating that the invention was not made in the manner specified in paragraph (A) or (B) of section 20135(b)(1) of the Act.
- (b) Regardless of whether title to such an invention would otherwise be subject to an advance waiver or is the subject of a petition for waiver as described in paragraph B.(3) and paragraph I, Boeing may nevertheless file the statement described in paragraph B.(1)(a) of this Article. The Administrator (or his designee) will review the information furnished by Boeing in any such statement and any other available information relating to the circumstances surrounding the making of the invention and will notify Boeing whether the Administrator has determined that the invention was made in the manner specified in paragraph (A) or (B) of section 20135(b)(1) of the Act.

- (2) Property rights in inventions. Each invention made under this Agreement for which the presumption of paragraph B.(1)(a) of this clause is conclusive or for which there has been a determination that it was made in the manner specified in paragraph (A) or (B) of section 20135(b)(1) of the Act shall be the exclusive property of the United States as represented by the Administrator of NASA unless the Administrator waives all or any part of the rights of the United States to Boeing's invention, as provided in paragraph B.(3) of this clause.

Commercial Crew Integrated Capability

- (3) Waiver of rights.
 - (a) The NASA Patent Waiver Regulations, 14 C.F.R. Part 1245, Subpart 1, have adopted the Presidential Memorandum on Government Patent Policy of February 18, 1983, as a guide in acting on petitions (requests) for waiver of rights to any invention or class of inventions made or that may be made in the manner specified in paragraph (A) or (B) of Section 20135(b)(1) of the Act.
 - (b) NASA has determined that to stimulate and support the capability of a United States commercial provider to provide commercial crew space transportation services to the public and the Federal Government, the interest of the United States would be served by waiving to Boeing, in accordance with Section 20135(g) of the Act and the provisions of 14 C.F.R. Part 1245, Subpart 1, rights to any inventions or class of inventions made by Boeing in the performance of work under this Agreement. Therefore, upon petition submitted by Boeing, as provided in 14 C.F.R. Part 1245, Subpart 1, either prior to execution of the Agreement or within 30 calendar days after execution of the Agreement, for advance waiver of all or any part of the rights of the United States to any invention or class of inventions that may be made under this Agreement, NASA will waive such rights to Boeing. If such a petition is not submitted, Boeing may petition for waiver of rights to an identified invention within eight months of first disclosure of invention in accordance with paragraph E.(2) of this clause or within such longer period as may be authorized in accordance with 14 CFR 1245.105. Further procedures are provided in paragraph I of this clause.

C. Minimum rights reserved by the Government

- (1) With respect to each Boeing invention made under this Agreement for which a waiver of rights is applicable in accordance with 14 C.F.R. Part 1245, Subpart 1, the Government reserves:
 - (a) An irrevocable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign Government in accordance with any treaty or agreement with the United States; and
 - (b) Such other March-in rights as given in Paragraph H below.
- (2) NASA will not exercise the Government purpose license reserved in paragraph C. (1)(a) during the term of this Agreement.

Commercial Crew Integrated Capability

- (3) Upon a successful completion by Boeing of all milestones under this Agreement, NASA will refrain from exercising the Government purpose license reserved in paragraph C.(1)(a) for a period of five (5) years following the expiration of this Agreement or until December 31, 2015, whichever is later.
- (4) Nothing contained in this paragraph shall be considered to grant to the Government any rights with respect to any invention other than an invention made under this Agreement.

D. Minimum rights to Boeing

- (1) Boeing is hereby granted a revocable, nonexclusive, royalty-free license in each patent application filed in any country on an invention made by Boeing under this Agreement and any resulting patent in which the Government acquires title, unless Boeing fails to disclose such invention within the times specified in paragraph E.(2) of this clause. Boeing's license extends to its domestic subsidiaries and affiliates, if any, within the corporate structure of which Boeing is a party and includes the right to grant sublicenses of the same scope to the extent Boeing was legally obligated to do so at the time the Agreement was awarded. The license is transferable only with the approval of the Administrator except when transferred to the successor of that part of Boeing's business to which the invention pertains.
- (2) Boeing's domestic license may be revoked or modified by the Administrator to the extent necessary to achieve expeditious practical application of such invention pursuant to an application for an exclusive license submitted in accordance with 37 C.F.R. Part 404, Licensing of Government Owned Inventions. This license will not be revoked in that field of use or the geographical areas in which Boeing has achieved practical application and continues to make the benefits of the invention reasonably accessible to the public. The license in any foreign country may be revoked or modified at the discretion of the Administrator to the extent Boeing, its licensees, or its domestic subsidiaries or affiliates have failed to achieve practical application in that foreign country.
- (3) Before revocation or modification of the license, Boeing will be provided a written notice of the Administrator's intention to revoke or modify the license, and Boeing will be allowed 30 calendar days (or such other time as may be authorized by the Administrator for good cause shown by Boeing) after the notice to show cause why the license should not be revoked or modified. Boeing has the right to appeal to the Administrator any decision concerning the revocation or modification of its license.

E. Invention identification, disclosures, and reports

Commercial Crew Integrated Capability

- (1) Boeing shall establish and maintain active and effective procedures to assure that inventions made under this Agreement are promptly identified and disclosed to Boeing personnel responsible for the administration of this clause within six months of conception and/or first actual reduction to practice, whichever occurs first in the performance of work under this Agreement. These procedures shall include the maintenance of laboratory notebooks or equivalent records and other records as are reasonably necessary to document the conception and/or the first actual reduction to practice of such inventions, and records that show that the procedures for identifying and disclosing such inventions are followed. Upon request, Boeing shall furnish the Patent Representative a description of such procedures for evaluation and for determination as to their effectiveness.
- (2) Boeing will disclose each such invention to the Patent Representative within two months after the inventor discloses it in writing to Boeing personnel responsible for the administration of this clause or, if earlier, within six months after Boeing becomes aware that such an invention has been made, but in any event before any on sale, public use, or publication of such invention known to Boeing. Boeing shall use the NASA electronic New Technology Reporting system (eNTRe), accessible at <http://invention.nasa.gov>, or the Boeing electronic new technology reporting system to disclose inventions to NASA. The invention disclosure shall identify this Agreement and shall be sufficiently complete in technical detail to convey a clear understanding, to the extent known at the time of the disclosure, of the nature, purpose, operation, and physical, chemical, biological, or electrical characteristics of the invention. The disclosure shall also identify any publication, on sale, or public use of any such invention and whether a manuscript describing such invention has been submitted for publication and, if so, whether it has been accepted for publication at the time of disclosure. In addition, after disclosure to NASA, Boeing will promptly notify NASA of the acceptance of any manuscript describing such an invention for publication or of any on sale or public use planned by Boeing for such invention.
- (3) Boeing shall furnish the Patent Representative the following:
 - (a) Interim reports every 12 months (or such longer period as may be specified by the Patent Representative) from the date of the Agreement, listing inventions made under this Agreement during that period, and certifying that all such inventions have been disclosed (or that there are no such inventions) and that the procedures required by paragraph E.(2) of this clause have been followed.
 - (b) A final report, within three months after completion of the work, listing all inventions made under this Agreement or certifying that there were no such inventions, and listing all subcontracts or other agreements with

Commercial Crew Integrated Capability

a Related Entity containing a patent and invention rights clause (as required under paragraph G of this clause) or certifying that there were no such subcontracts or other agreements.

- (c) Interim and final reports shall be submitted electronically at the eNTRe Web-site <http://invention.nasa.gov> or the Boeing electronic new technology reporting system to disclose the reports to NASA.
- (4) Boeing agrees, upon written request of the Patent Representative, to furnish additional technical and other information available to Boeing as is necessary for the preparation of a patent application on an invention made under this Agreement in which the Government retains title and for the prosecution of the patent application, and to execute all papers necessary to file patent applications on such inventions and to establish the Government's rights in the inventions.
- (5) Protection of reported inventions. When inventions made under this Agreement are reported and disclosed to NASA in accordance with the provisions of this Article, NASA agrees to withhold such reports or disclosures from public access for a reasonable time (presumed to be 1 year unless otherwise mutually agreed) in order to facilitate the allocation and establishment of the invention and patent rights under these provisions.

F. Examination of records relating to inventions

- (1) The Patent Representative or designee shall have the right to examine any books (including laboratory notebooks), records, and documents of Boeing relating to the conception or first actual reduction to practice of inventions in the same field of technology as the work under this Agreement to determine whether
 - (a) Any such inventions were made in performance of this Agreement;
 - (b) Boeing has established and maintained the procedures required by paragraph E.(1) of this clause; and
 - (c) Boeing and its inventors have complied with the procedures.
- (2) If the Patent Representative learns of an unreported Boeing invention that the Patent Representative believes may have been made under this Agreement, Boeing may be required to disclose the invention to NASA for a determination of ownership rights.
- (3) Any examination of records under this paragraph will be subject to appropriate conditions to protect the confidentiality of the information involved.

G. Subcontracts or Other Agreements

- (1) (a) Unless otherwise authorized or directed by the Patent Representative, Boeing shall include this *Invention and Patent Rights* Article (suitably modified to identify the parties) in any subcontract or other agreement with a Related Entity hereunder (regardless of tier) for the performance of experimental, developmental, or research work.

- (b) In the *Invention and Patent Rights* Article included in any such subcontract or other agreement, the following (suitably modified to identify the parties) shall be substituted for paragraph B(3)(b):

As provided in 14 C.F.R. Part 1245, Subpart 1, [insert name of Related Entity] may petition, either prior to execution of the Agreement or within 30 calendar days after execution of the Agreement, for advance waiver of all of any part of the rights of the United States to any invention or class of inventions that may be made under this Agreement. If such a petition is not submitted, or if after submission it is denied, [insert name of Related Entity] may petition for waiver of rights to an identified invention within eight months of first disclosure of invention in accordance with paragraph E.(2) of this Article or within such longer period as may be authorized in accordance with 14 CFR 1245.105. Further procedures are provided in paragraph H of this Article.

- (c) In the case of subcontracts or other agreements at any tier, NASA, the Related Entity, and Boeing agree that the mutual obligations of the parties created by this Article constitute privity of contract between the Related Entity and NASA with respect to those matters covered by this Article.

- (2) In the event of a refusal by a prospective Related Entity to accept such a clause, Boeing:

- (a) Shall promptly submit a written notice to the Patent Representative setting forth the prospective Related Entity's reasons for such refusal and other pertinent information that may expedite disposition of the matter; and

- (b) Shall not proceed with such subcontract or other agreement without the written authorization of the Patent Representative.

- (3) Boeing shall promptly notify the Patent Representative in writing upon the award of any subcontract or other agreement with a Related Entity (at any tier) containing an invention and patent rights clause by identifying the Related

Entity, the applicable invention and patent rights clause, the work to be performed under the subcontract or other agreement, and the dates of award and estimated completion. Upon request of the Patent Representative, Boeing shall furnish a copy of such subcontract or other agreement, and, no more frequently than annually, a listing of the subcontracts or other agreements that have been awarded.

- (4) In recognition of Boeing's substantial contribution of funds, facilities and/or equipment to the work performed under this Agreement, Boeing is authorized, subject to the rights of NASA set forth elsewhere in this Article, to:

- (a) Acquire by negotiation and mutual agreement rights to an invention made under this Agreement by a Related Entity as Boeing may deem necessary to obtaining and maintaining of private support; and
- (b) Request, in the event of an inability to reach agreement pursuant to paragraph G. (4)(a) of this Article, that NASA request that such rights for Boeing be included as an additional reservation in a waiver granted pursuant to 14 CFR Part 1245, Subpart 1. Any such requests to NASA should be prepared in consideration of the following guidance and submitted to the Patent Representative. Notwithstanding paragraph B.(3)(b) of this Article, the Related Entity should be advised that unless it requests a waiver of title pursuant to the NASA Patent Waiver Regulations (14 C.F.R. Part 1245, Subpart 1), NASA will acquire title to inventions made under this Agreement. If a waiver is not requested or granted, Boeing may request a license from NASA consistent with the requirements of 37 CFR Part 404. A Related Entity requesting a waiver must follow the procedures set forth in paragraph I of this Article.

H. March-in rights

- (1) Boeing agrees that, with respect to any invention made under this Agreement in which it has acquired title, NASA has the right in accordance with the procedures in 37 CFR 401.6 and any supplemental regulations of the agency to require Boeing, or an assignee or exclusive licensee of such an invention, to grant a nonexclusive, partially exclusive, or exclusive license in any field of use to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, and if Boeing, its assignee, or exclusive licensee refuses such a request NASA has the right to grant such a license itself if the Federal agency determines that
- (a) Such action is necessary because Boeing, assignee, or exclusive licensee has not taken, or is not expected to take within a reasonable time,

Commercial Crew Integrated Capability

effective steps to achieve practical application of such invention in such field of use;

- (b) Such action is necessary because Boeing, assignee, or exclusive licensee, having achieved practical application of such invention, has failed to maintain practical application of such invention in such field of use;
- (c) Such action is necessary because Boeing, assignee, or exclusive licensee has discontinued making the benefits of such invention available to the public or to the Federal Government;
- (d) Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by Boeing, assignee, or exclusive licensee; or
- (e) Such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by Boeing, assignee, or exclusive licensee.

I. Requests for Waiver of Rights

- (1) In accordance with the NASA Patent Waiver Regulations, 14 C.F.R. Part 1245, Subpart 1, waiver of rights to any or all inventions made or that may be made under this Agreement may be requested at different time periods. Advance waiver of rights to any or all such inventions may be requested prior to the execution of the Agreement, or within 30 calendar days after execution thereof. In addition, waiver of rights to an identified invention made and reported under this Agreement may be requested, even though a request for an advance waiver was not previously requested or, if previously requested, was not granted.
- (2) Each request for waiver of rights shall be by petition to the Administrator and shall include an identification of the petitioner; place of business and address; if petitioner is represented by counsel, the name, address, and telephone number of the counsel; the signature of the petitioner or authorized representative; and the date of signature. No specific forms need be used, but the request should contain a positive statement that waiver of rights is being requested under the NASA Patent Waiver Regulations; a clear indication of whether the request is for an advance waiver of rights to an invention or class of inventions, or for a waiver of rights for an individual identified invention; whether foreign rights are also requested and, if so, for which countries, and a citation of the specific section(s) of the regulations under which such rights are requested; and the name, address, and telephone number of the party with whom to communicate when the request is acted upon.

Commercial Crew Integrated Capability

- (3) All petitions for waiver, whether advanced or individual petitions, will be submitted to the Patent Representative designated in this Article.
- (4) A Petition submitted in advance of this Agreement will be forwarded by the Agreement Officer to the Installation Patent Counsel for processing and then to the Inventions and Contributions Board. The Board will consider the petition and where the Board makes the findings to support the waiver, the Board will recommend to the Administrator that waiver be granted, and will notify the petitioner and the Patent Counsel of the Administrator's determination. The Patent Counsel will be informed by the Board whenever there is insufficient time or information to permit a decision to be made on an advance waiver without unduly delaying the execution of the Agreement. In the event a request for an advance waiver is not granted or is not decided upon before execution of the Agreement, the petitioner will be so notified by the Patent Counsel. All other petitions will be processed by the Patent Counsel and forwarded to the Board. The Board shall notify the petitioner of its action and if waiver is granted, the conditions, reservations, and obligations thereof will be included in the Instrument of Waiver. Whenever the Board notifies a petitioner of a recommendation adverse to, or different from, the waiver requested, the petitioner may request reconsideration under procedures set forth in the NASA Patent Waiver Regulations.

ARTICLE 14. DISCLAIMER OF WARRANTY

Technical information and data provided by NASA or Boeing under this Agreement are provided "as is". No warranty related to availability, title, or suitability for any particular use, nor any implied warranty of merchantability or fitness for a particular purpose, is provided under this Agreement. Neither NASA or Boeing makes expressed or implied warranty as to any intellectual property, or information provided under this Agreement, or that the information or data to be furnished hereunder will accomplish intended results or are safe for any purpose including the intended purpose. Neither NASA, Boeing, nor its respective contractors shall be liable for any direct, general, special, consequential, indirect, or incidental damages attributed to such information or data furnished under this Agreement.

ARTICLE 15. TERM OF AGREEMENT

This Agreement becomes effective upon the date of the last signature below and shall remain in effect until the completion of all obligations of both Parties hereto, or May 31, 2014, whichever comes first.

ARTICLE 16. TERMINATION

A. Termination by Mutual Consent

This Agreement may be terminated at any time upon mutual written consent of both Parties.

B. Termination for Failure to Perform

- (1) At its discretion, NASA may terminate this Agreement 30 calendar days after issuance of a written notification that Boeing has failed to perform under this Agreement, including failure to meet a scheduled milestone as identified and described in Appendix 2. Before making such a notification, NASA will consult with Boeing to ascertain the cause of the failure and determine whether additional efforts are in the best interest of the Parties. If it is determined that the cause of the Failure to Perform is one of the circumstances enumerated in Article 16.D(1) NASA shall proceed under that paragraph. Upon a Termination for Failure to Perform, NASA will take all rights identified in Articles 12 and 13 of this Agreement.
- (2) Boeing will not be entitled to any additional payments from the Government due to a termination for failure to meet a milestone. NASA and Boeing will negotiate in good faith any other outstanding issues between the Parties. Failure of the Parties to agree will be resolved pursuant to Article 18, Dispute Resolution.

C. Termination for Unacceptable Risk to Human Life

- (1) NASA may terminate this Agreement if NASA determines that Boeing's planned performance of an activity under this Agreement presents an unacceptable risk to human life. NASA shall provide written notice to Boeing no later than 5 calendar days prior to the planned activity and may terminate the Agreement 30 calendar days after receipt of the notice by Boeing. Before making such a notification, NASA will consult with Boeing to ascertain the risk and any mitigation strategies and determine whether additional efforts are in the best interest of the Parties.
- (2) Upon receipt of written notification that the Government is terminating the Agreement, Boeing shall immediately stop work under this Agreement and shall immediately cause any and all of its partners, subcontractors and suppliers to cease work, except to the extent that Boeing wishes to pursue the activities defined in Appendix 2 exclusively using its own funding. Upon such a termination, NASA and Boeing agree to negotiate in good faith a final settlement payment to be made by NASA. In no instance shall NASA's liability for termination exceed the total amount due under the next milestone of this

Commercial Crew Integrated Capability

Agreement and any payment is subject to the provisions of Article 5.

D. Unilateral Termination by NASA

- (1) NASA may unilaterally terminate this Agreement upon written notice in the following circumstances: (a) upon a declaration of war by the Congress of the United States; or (b) upon a declaration of a national emergency by the President of the United States; or (c) upon a NASA determination, in writing, that NASA is required to terminate for reasons beyond its control. For purposes of this Article, reasons beyond NASA's control include, but are not limited to, acts of God or of the public enemy, acts of the U.S. Government other than NASA, in either its sovereign or contractual capacity (to include failure of Congress to appropriate sufficient funding), fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or unusually severe weather.
- (2) Upon receipt of written notification that the Government is unilaterally terminating this Agreement, Boeing shall immediately stop work under this Agreement and shall immediately cause any and all of its partners, subcontractors and suppliers to cease work, except to the extent that Boeing wishes to pursue the activities defined in Appendix 2 exclusively using its own funding. Upon such a termination, NASA and Boeing agree to negotiate in good faith a final settlement payment to be made by NASA. However, in no instance shall NASA's liability for termination exceed the total amount due under the next milestone of this Agreement and any payment is subject to the provisions of Article 5.

E. Limitation on Damages.

In the event of any termination by NASA, neither NASA nor Boeing shall be liable for any loss of profits, revenue, or any indirect or consequential damages incurred by the other Party, its partners, contractors, subcontractors, suppliers or customers as a result of any termination of this Agreement. A Party's liability for any damages under this Agreement is limited solely to direct damages, incurred by the other Party, as a result of any termination of this Agreement subject to mitigation of such damages by the complaining Party. However, in no instance shall NASA's liability for termination exceed the total amount due under the next milestone under this Agreement.

F. Rights in Property.

Boeing will have title to property acquired or developed by Boeing and its contractors/partners with funding provided under this Agreement, in whole or in part to conduct the activities defined in Appendix 2. In the event of termination of this Agreement for Failure to Perform, NASA may purchase such property as provided in Article 27 below. Upon Termination for Failure to Perform, NASA may immediately exercise all rights identified in Articles 12 and 13.

ARTICLE 17. CONTINUING OBLIGATIONS

The obligations of the Parties set forth in the provisions of Article 10 (Liability and Risk of Loss) and Articles 12-13 (Intellectual Property and Data Rights) of this Agreement, and such other rights and obligations which by their terms continue past the expiration or termination of this Agreement, shall so continue to apply.

ARTICLE 18. DISPUTE RESOLUTION

All disputes concerning questions of fact or law arising under this Agreement shall be referred by the claimant in writing to the Boeing Administrative Contact and the NASA Administrative Contact, who shall seek to resolve such disputes by mutual agreement. If they are unable to resolve the dispute, then the dispute will be referred to the KSC Commercial Crew Program Manager and the CCIcap Program Manager, Boeing Defense, Space & Security (BDS), Network and Space Systems, Space Exploration for joint resolution. If the Parties are still unable to resolve the dispute, the Associate Administrator for Human Exploration and Operations Mission Directorate, or the Deputy of the Directorate, will seek to resolve the dispute, and if necessary issue a written decision that shall be a final Agency decision for all purposes including judicial review.

Pending resolution of any disputes pursuant to this Article, the Parties agree that performance of all obligations shall be pursued diligently in accordance with the direction of the KSC Commercial Crew Program Manager.

The Parties agree that this Disputes Resolution procedure shall be the exclusive procedure followed by the Parties in resolving any dispute arising under, or based on, an express or implied provision of this Agreement, including an alleged breach.

Commercial Crew Integrated Capability

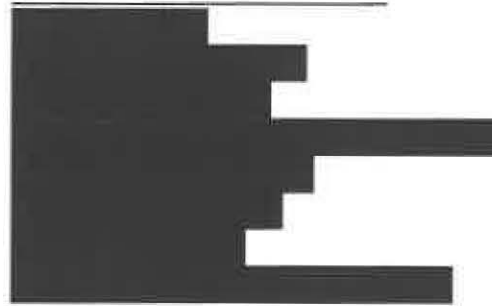
ARTICLE 19. PRINCIPAL POINTS OF CONTACT

The following personnel are designated as the Administrative and Technical Contacts between the Parties in the performance of this Agreement.

NASA Administrative Contact

Emily Weiland
Agreements Officer
John F. Kennedy Space Center
Mail Code: OP-MS-B
NASA Kennedy Space Center, FL 32899
Phone: 321-867-4052
E-mail: emily.weiland@nasa.gov

Boeing Administrative Contact



NASA Technical Contact

Scott Thurston
Commercial Crew
John F. Kennedy Space Center
Mail Code: FA-C
NASA Kennedy Space Center, FL 32899
Phone: 321-861-9102
Fax: 321-861-8923
E-mail: scott.b.thurston@nasa.gov

Boeing Technical Contact



ARTICLE 20. MISHAP REPORTING

A. Definitions.

- (1) "Accident" as used in this Article, means an undesirable or unplanned event that occurs unintentionally and usually results in harm, injury, damage, or loss.
- (2) "Close Call" as used in this Article, means an event in which there is no injury or only minor injury requiring first aid and/or no equipment/property damage or minor equipment/property damage (less than \$1,000).
- (3) "Exposure" as used in this Article, means:
 - (a) Vulnerability of population, property, or other value system to a given activity or hazard; or

Commercial Crew Integrated Capability

- (b) Other measure of the opportunity for failure or mishap events to occur.
 - (4) "Mishap" as used in this Article, means an unplanned event or series of events resulting in death, serious injury, damage to or loss of equipment or property, or damage to the environment.
 - (5) "Serious Injury" as used in this Article, means any injury resulting from a mishap in which any one or more of the following apply:
 - (a) Requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received.
 - (b) Results in a fracture of any bone (except simple fractures of fingers, toes, or nose).
 - (c) Causes severe hemorrhages or nerve, muscle, or tendon damage.
 - (d) Involves any internal organ.
 - (e) Involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.
 - (6) "Substantial Damage to property or equipment" as used in this Article, means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the Commercial Crew Transportation System, and which would normally require major repair or replacement of the affected component.
- B. The Participant shall notify and promptly report to the Agreements Officer, or a designee, any of the following associated with any work performed under this Agreement:
- (1) Close calls, which possess the potential to cause a reportable Mishap.
 - (2) Exposures, which result in fatality; lost-time occupational injury; or occupational disease.
 - (3) Mishaps, which result in serious injury; fatality; lost-time occupational injury; occupational disease; any environmental damage; or substantial damage to or loss of equipment or property damage of at least \$50,000.

Commercial Crew Integrated Capability

- C. If the Participant has knowledge that the press is inquiring to an accident, close call, exposure, or mishap the Participant shall promptly notify the Agreements Officer, or designee, of the event and, if requested, assist in the response.
- D. If the Participant conducts its own mishap investigations for any mishaps that meet the above criteria, the Participant shall make available to NASA all reports and resulting data.
- E. The Participant shall maintain the data of any mishap investigation referenced above for the term of this Agreement plus 3 years.

Commercial Crew Integrated Capability

ARTICLE 21. MODIFICATION/AMENDMENTS

All modifications and amendments to this Agreement shall be by mutual agreement of the Parties and shall be executed, in writing, and signed by the signatories to this Agreement, or their respective successor or designee.

ARTICLE 22. ASSIGNMENT OF RIGHTS

Neither this Agreement nor any interest arising under it will be assigned by either Party without the express written consent of the other Party.

ARTICLE 23. ANTI-DEFICIENCY ACT

All activities under or pursuant to this Agreement are subject to the availability of appropriated funds, and no provision shall be interpreted to require obligation or provision of funds in violation of the Anti-Deficiency Act, 31 U.S.C. 1341.

ARTICLE 24. APPLICABLE LAW AND SEVERABILITY

- A. U.S. Federal law governs this Agreement for all purposes, including, but not limited to, determining the validity of this Agreement, the meaning of its provisions, and the rights, obligations and remedies of the Parties.
- B. If any portion of this Agreement is held invalid by a court of competent jurisdiction, the Parties agree that such invalidity shall not affect the validity of the remaining portions of this Agreement, unless applying such remaining portions would frustrate the purpose of this Agreement.

ARTICLE 25. EXPORT LICENSES

Boeing will be responsible for:

- A. Compliance with all U.S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this Agreement. In the absence of available license exemptions/exceptions, Boeing will be responsible for obtaining the appropriate licenses or other approvals, if required, for exports of hardware, technical data, and software, or for the provision of technical assistance.
- B. Obtaining export licenses, if required, before utilizing foreign persons in the performance of this Agreement, including instances where CCIcap efforts are to be performed on-site at NASA Centers, where the foreign person will have access to export-controlled technical data or software.
- C. All regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.
- D. Ensuring that the provisions of this Article apply to its contractors/partners.

in the event that either Party intends to utilize a foreign person (as defined in the ITAR and the EAR) in the performance of this Agreement, such Party shall be responsible for obtaining the required export licenses in advance of the foreign person's participation.

ARTICLE 26. LIMITATIONS ON ACTIVITIES WITH RUSSIAN ENTITIES FOR GOODS OR SERVICES

- A. Boeing shall not provide NASA funding or NASA technical assistance received under this Agreement to any prohibited Russian entity. Boeing may discuss with a prohibited Russian entity technical data, as defined under the ITAR, permitted pursuant to a Technical Assistance Agreement as long as none of the technical data consists of NASA technical assistance that was obtained during activities carried out pursuant to this Agreement.
- B. For the purposes of this Article and Article 5 the term "prohibited Russian entity" means:
 - (1) An organization or entity under the jurisdiction or control of Roscosmos (The Russian Federal Space Agency) or its predecessor agencies (hereinafter "Roscosmos"), that is an organization or entity that:

Commercial Crew Integrated Capability

- (a) was made part of Roscosmos upon its establishment on February 25, 1992;
 - (b) was transferred to Roscosmos by decree of the Russian Government on July 25, 1994, or May 12, 1998;
 - (c) was or is transferred to Roscosmos by decree of the Russian Government at any other time before, on, or after the date of the enactment of the Iran Nonproliferation Act of March 14, 2000, P.L. 106-178; or
 - (d) is a joint stock company in which Roscosmos has at any time held controlling interest.
 - (2) Any organization or entity described in subparagraph (a) shall be deemed to be under the jurisdiction or control of Roscosmos regardless of whether—
 - (a) Such organization or entity, after being part of or transferred to Roscosmos, is removed from or transferred out of Roscosmos; or
 - (b) Roscosmos, after holding a controlling interest in such organization or entity, divests its controlling interest
 - (3) Any other organization, entity, or element of the Government of the Russian Federation.
- C. For the purposes of this Article and Article 5, the term “NASA technical assistance” means any non-public information, whether provided orally or in any recorded form, by Boeing to a prohibited Russian entity for the purchase of goods or services relating to human spaceflight.

ARTICLE 27. TITLE AND RIGHTS IN PROPERTY

Boeing will have title to tangible personal property acquired or developed under this Agreement. In the event of termination of this Agreement for Failure to Perform under Article 16B, NASA will have the right to purchase any such property. The Parties will negotiate in good faith purchase prices for specific items of property.

ARTICLE 28. OPTIONAL MILESTONES

The milestones listed in Appendix 2(a), Performance Milestones and Success Criteria, form the awarded effort under this Agreement. Milestones in Appendix 2(b) are optional performance milestones related to Boeing's CCIcap effort. These optional milestones create no obligation for either Party unless the Government subsequently provides specific written authorization and funding and the Parties agree to add the milestone to this Agreement. If, during the period of this Agreement, NASA determines to add any of the optional milestones to the Agreement, NASA will provide written notice to Boeing. The Parties will negotiate a completion date and funding amount for the optional milestone, not to exceed the amount of that milestone as listed in Appendix 2(b) at the time of Agreement award. Final awarded milestone amounts are subject to the availability of appropriated funds.

Commercial Crew Integrated Capability

ARTICLE 29. SIGNATURE BLOCK

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

BY: William A Gerstenmaier

William Gerstenmaier
Associate Administrator for Human Exploration
and Operations Mission Directorate

DATE: 2 August 2012

THE BOEING COMPANY

BY: Leon Beard

Leon Beard
Senior Contracts Manager

DATE: 7/23/2012

SECTION I - EXECUTIVE SUMMARY

The Boeing CCiCap offer provides NASA with the lowest development risk and highest assurance of meeting NASA rigorous human-rating certification while meeting NASA affordability targets. Our milestone plan supports development of our integrated Commercial Crew Transportation System (CCTS), culminating in a crewed flight test (CFT) to the International Space Station (ISS) in December 2016.

Disciplined systems engineering verification and validation processes enable Boeing certification of our CCTS to requirements that are based on and aligned with NASA requirements. NASA insight and participation throughout CCiCap enable readiness for NASA human rating certification and seamless entry into NASA crew services to and from ISS. Prominent and distinguishing features of the Boeing CCTS technical approach and business information support our implementation of a US commercial crew space transportation capability. Our CCTS meets NASA and commercial customer needs for safe, reliable, and cost-effective access to and from low Earth orbit (LEO) (Figure 1-1). **(Video: Executive Summary)**

Our proposal meets NASA fundamental CCiCap criteria, providing

- **Integrated CTS** – Our integrated CCTS architecture comprises spacecraft, launch, and ground segments, including mission operations for an end-to-end turnkey transportation capability (Figure 1-2A).



Boeing CCTS Meets NASA Needs

- Docked duration up to 210 days for use as ISS shelter/escape vehicle

Safety and Mission Assurance

- Disciplined processes matured over Boeing history devoted to passenger safety
- Healthy tension with independent program and mission assurance reporting

Leadership and Organization

- Extensive experience working human-rated systems
- Efficient organization structure and supplier engagement

NASA Insight and Participation

- Insight at every step
- Continuous visibility into growing design data archives

Technical Excellence for System Reliability

- Flight-proven systems and mature technologies
- Rigorous corporate engineering processes

Business Viability, Cost Control, and Marketing

- Financial strength, commitment that NASA can count on
- Boeing global marketing presence to enable commercial crew market growth

Supply Base Management

- Effective processes to select, negotiate, and manage suppliers
- Strong relationships with experienced suppliers of high TRL space systems components

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Figure 1-1. The Boeing CCTS is supported with strong corporate capabilities and systems engineering discipline, further strengthened by NASA insight and participation.

- **Significant risk reduction test activities in the base period** – We provide a comprehensive approach to risk reduction during capability development (Figure 1-2B and C). Key risk reduction tests and demonstrations during the CCiCap base period include wind tunnel testing of the integrated stack, an OMAC engine development test, Mission Control Center demonstration, LV emergency detection system (EDS) test, dual engine Centaur (DEC) liquid oxygen flow test, an avionics and software multi-string demonstration test, and pilot-in-the-loop demonstrations.
- **Culminate with an orbital crewed demonstration flight.** Our CFT has a minimum mission duration that meets the NASA goal of three days on orbit. It has the capability to orbit between 300 km to 460 km, meeting the NASA minimum orbital altitude of 200 nmi (370.4 km). Two crewmembers are aboard for CFT, with capability to support additional crew and cargo, exceeding the NASA requirement of sizing sufficient for a crew of four. Demonstrating controlled maneuverability, our CFT includes docking with ISS, with NASA docking system (NDS) and adequate cross-waivers.

We meet all NASA safety, strategic, base, and option period goals to provide a system that is ready for NASA human-rating certification and seamless entry into service (Figure 1-2D).

The base and optimized milestones and funding we propose are compliant with AFP guidance, resulting in CFT in December 2016. [REDACTED]

Technical Approach. Our CCiCap technical approach continues the accelerated progress of our CCDev and CCDev2 Space Act Agreements (SAA), which successfully advanced our system design to PDR-level maturity and accomplished significant risk reduction demonstrations. On CCDev, we completed 100% (36 of 36) of the milestones on schedule and on cost. On CCDev2, we have completed 10 of 15 milestones to date, also with 100% on-schedule, on-cost performance. Our architecture incorporates proven hardware and mature technologies from established suppliers. During the base period, we complete a system CDR. Focused development and flight tests in the base and option periods buy down risk, integrated system analysis quantifies margins, and safety assessments are refined to mature hazard control and mitigation strategies. We use the LV with the best reliability record in the industry, the Atlas V, and continue work with ULA on human rating and LV integration. Concurrent development of a production capability, with Lean manufacturing methods from across Boeing, ensures that our test vehicles are manufactured to the same high standards established for full production vehicles.

Overall Concept and Performance. Our integrated CCTS comprises spacecraft, LV, and ground systems (including mission operations) segments. Boeing is the prime system integrator, service provider, and single customer interface for the complete system.

Spacecraft Segment. The CST-100 spacecraft consists of a crew module (CM) and an SM evolved from our work on Mercury, Gemini, Apollo, Orbital Space Plane (OSP), X-37, Orbital Express, Crew Exploration Vehicle (CEV)-Phase A, Commercial Orbital Transportation System (COTS), Shuttle, and ISS. The integration of proven systems results in an affordable spacecraft with a credible development schedule. Our trade studies, analyses, and flight experience clearly demonstrate that a capsule configuration with high technology readiness level (TRL) systems offers the safest, lowest risk, affordable solution available for LEO transportation. Proven design tools used on and data obtained from these programs, including aerodynamic models, thermal

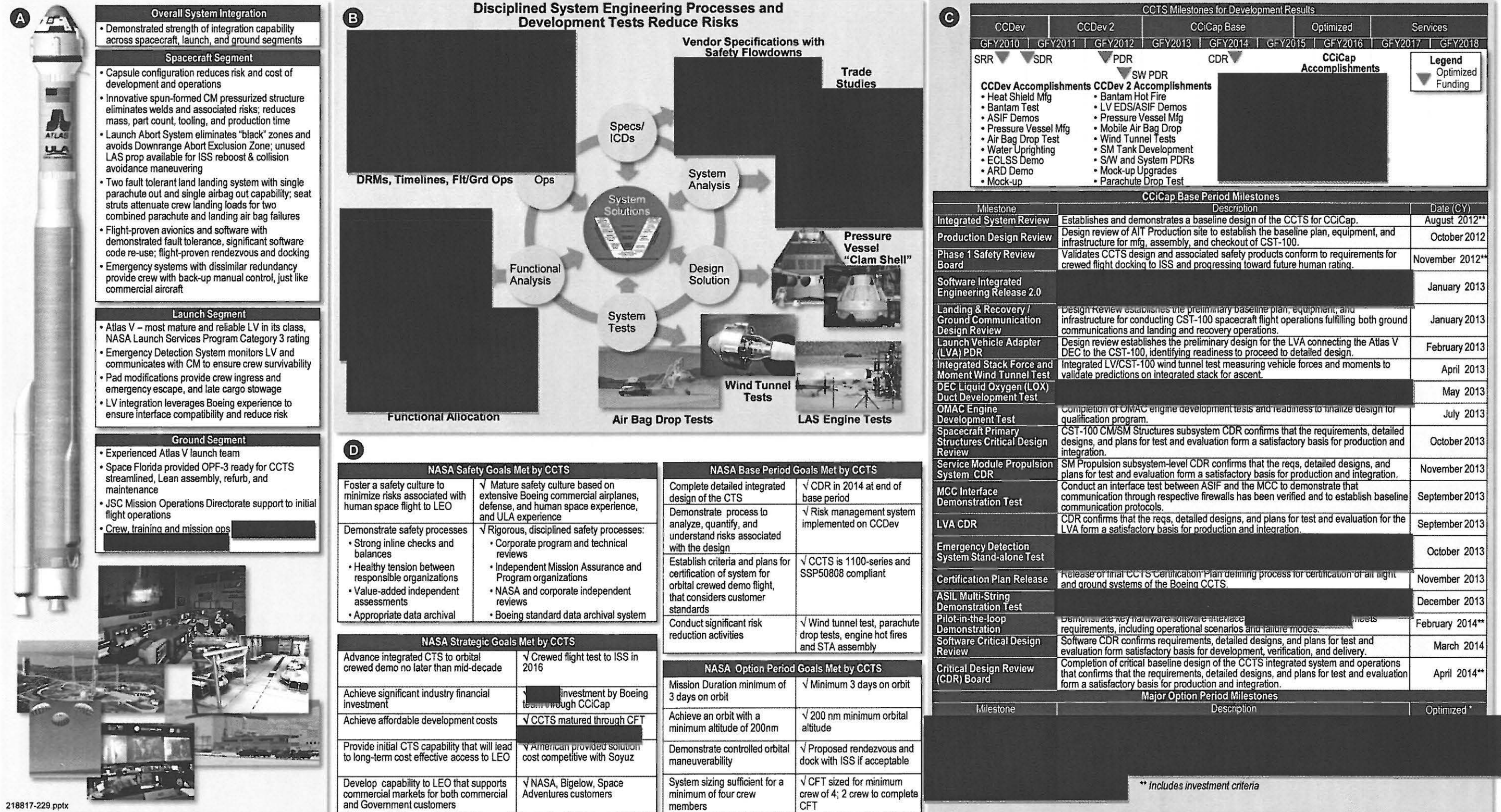


Figure 1-2. Our CCiCap milestone plan addresses disciplined maturation and integrated system testing of a CCTS that meets all NASA safety, strategic, base, and option goals.

controls, life support systems, and guidance, navigation and control (GNC) systems, underlie the CST-100 spacecraft's design.

Our CMMI Level 3 software and configuration management practices have been proven on such Boeing-led programs as X-37, Orbital Express, Shuttle, and ISS. Formal qualification test methods ensure a verification process suitable for human-rated spacecraft. Selective re-use of architectures, algorithms, and code from our heritage programs significantly reduces development time, and the use of existing tools and simulations reduces the time and cost of verification.

The spacecraft provides habitation and utilities to transport crew and cargo to LEO destinations (Figure 1-3). A pusher launch abort system (LAS) in the SM safely separates the spacecraft from a malfunctioning LV, following which the CM can land under parachutes. Excess fuel (required for abort coverage) can be used to perform quick collision avoidance maneuvers for, or reboost of, ISS or the Bigelow space complex.

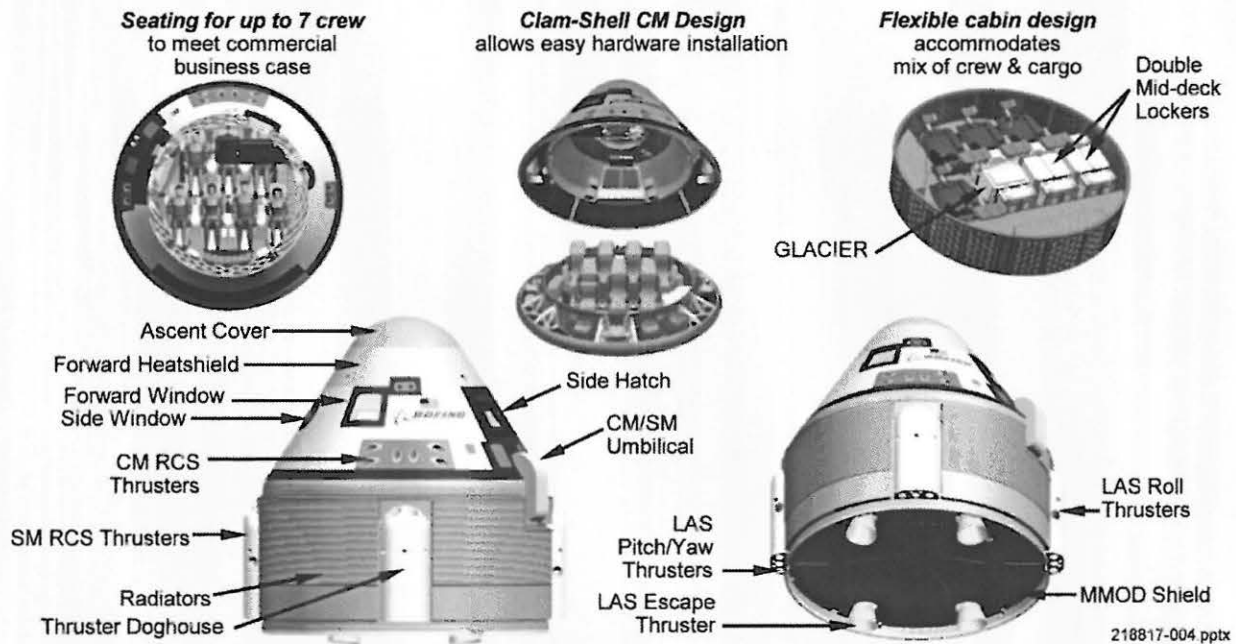


Figure 1-3. The CST-100 spacecraft is configurable for a mix of crew and cargo and uses a liquid pusher abort system, ensuring crew safety through all phases of powered flight.

Launch Segment. Our uncrewed orbital and crewed flight tests use the Atlas V LV. Selection of the Atlas V for the CCTS flight-test program reduces risk with ULA field-leading reliability and Boeing extensive LV integration experience. The Atlas V record of 29 successful flights has established the reliability of its hardware, software, and operations processes to ensure safe flight, system performance, and high launch availability. Boeing has integrated 327 successful LV flights. Working with ULA under CCDev2, Boeing has applied its experience to lead the LV human rating and integration efforts, including demonstrations of the EDS, CST-100 avionics emergency responses, LVA design, and launch stack aerodynamics and wind tunnel analyses. We are also working with ULA to certify the dual-engine Centaur (already with more than 140 flights) and make modifications needed in the launch pad and ground infrastructure to accommodate crewed flight.

We selected Atlas V for its NASA Launch Services Program (LSP) "Category 3" (highest) rating, based on its exceptional record in launching high-value space assets. Its extensive flight



record ensures that its systems have been rigorously exercised over the flight envelope on many occasions. While the Atlas has been selected for our CCTS test flights, the CST-100 design has been sized using environment levels with margins to accommodate other LVs in this payload class when they have demonstrated sufficient reliability acceptable for human rating. By maintaining competition for the LV to be used for CCTS (which represents the majority of recurring cost), Boeing ensures low services prices.

Ground Segment and Mission Operations. Boeing's CCTS program includes development of a Lean ground processing/assembly system in the KSC Orbiter Processing Facility (OPF-3). Our experienced ground processing personnel at KSC complete the conversion of OPF-3 to accommodate streamlined assembly, integration, and test techniques used on our successful commercial aircraft (e.g., 737), rotorcraft (e.g., Apache), and Boeing satellite systems. Design engineers and embedded manufacturing personnel having human space product experience use proven integrated tools, such as those on our F-18 program, to manage configuration, parts traceability, and nonconformance information.

The experienced Atlas V ground processing and launch team is strengthened by the addition of senior leaders having extensive Shuttle launch experience, bringing a wealth of human space-flight experience to the CCTS launch preparations. ULA is also making pad upgrades to accommodate cargo and crew prelaunch ingress and emergency escape requirements.

We are complementing our strengths in human spaceflight operations by entering into an SAA with the JSC Mission Operations Directorate (MOD) to co-develop our operations products and flight controller processes. Flight operations are provided by an experienced Boeing/MOD flight control team at JSC Building 30 Mission Control, supported by our Florida-based Boeing Mission Control Center (BMCC). Boeing's Crew and Mission Operations manager, [REDACTED] is leading our efforts to reduce risk in crew training and ensure readiness of the flight operations team.

Development and Demonstration Plan. Our offer meets NASA's base period goals, culminating in the detailed integrated design of the CCTS. In the option period, we continue risk reduction and qualification testing and exceed NASA option period goals with a CFT that includes docking at ISS in December 2016 (Figure 1-2C and 1-2D). Boeing meets NASA safety goals, including the incorporation of inline checks and balances through our technical boards; healthy tension between management, engineering, and program-independent safety and mission assurance (S&MA); and value-added insight from the embedded NASA program integration team.

Central to our development and demonstration plan is our continued application of Systems Engineering and Integration (SE&I) processes from our commercial, defense, and NASA programs to provide confidence in the design throughout the program and product life cycle. Our systems engineers, who have worked on ISS and Shuttle human-rated systems development, draw on Boeing-wide reachback to engineering specialty disciplines. We use documented and repeatable processes, validated tools, and independent and corporate reviews to ensure technical integrity from requirements development through system certification (Figure 1-2B).

Our System, Segment, and Module specifications incorporate the NASA requirements in the 1100-series and SSP 50808 to achieve CCTS human-rating certification. Our design reference missions provide a baseline for defining the primary capabilities required to implement CCTS mission objectives. Supplier hardware specifications incorporate hazard control requirements and associated operating environments. We work interactively with our suppliers to find the safest,



At our System PDR, we confirmed 100% traceability from the NASA to Boeing requirements, including those derived below the system level. We adopted the NASA system-level requirements and decomposed them into more than 1,600 requirements across the LV, spacecraft, and ground segments. We then performed a compliance assessment, resulting in few remaining gaps needing additional reconciliation to NASA program requirements. We defined test and verification strategies, generated complementary verification requirements, and drafted our Certification Plan providing detailed system verification and certification insight for NASA. This requirement alignment, knowledge of system performance, and configuration and data management processes minimizes downstream certification risk to NASA. We are performing additional trade studies to reconcile the few remaining gaps with the NASA 1100-series requirements, and we plan to satisfy the NASA requirement or obtain NASA concurrence on our design solutions (Figure 1-4). Boeing certification of our CCTS design is completed at DCR.

[illegible]

S&MA is integrated into all aspects of CCTS development, including supplier specification development, hazards analysis, and requirements assurance processes for the spacecraft, LV, and ground segment elements. A strength of our process is participation of independent Mission Assurance personnel in daily technical activities to provide additional perspectives, identify items requiring technical review, facilitate access to corporate technical experts and resources, and provide an alternative review path for dissenting opinions. An early Phase 0 safety review established a set of baseline hazards and controls. In CCiCap, we continue to execute our phased safety review process in lock-step with the maturing CCTS design.

Performance Milestones. The Boeing design maturation process incorporates risk reduction tests and demonstrations integral to development of our CCTS. Key development tests, demon-



strations, and analyses are tied to base period performance milestones or option period performance milestones. This provides performance-based measures for assessing development progress and providing NASA with funding flexibility. Major CCiCap milestones include design maturation tasks, risk reduction testing, and test flights (Figure 1-2C).

Business Information. NASA can have high confidence in Boeing as a viable business concern, committed to the success of NASA CTS. We offer an effective strategy for building a viable and affordable LEO transportation services business. An effective organization structure with experienced leadership, a strong supplier base, effective management processes, and a solid resource plan ensure CCTS success.

Business Viability. With revenues of \$68 billion, Boeing ranks 36th in the list of Fortune 50 companies, and has a strong history of financial performance, ensuring our ability to meet our commitments. Boeing is the largest single exporter of goods and services in the United States. Our business strategy supports long-term growth of a viable market for NASA and commercial space transportation services. Key elements of our commercial crew transportation business strategy include (1) a simple vehicle design maximizing safety and reducing development risk and recurring cost, (2) management processes to limit cost growth during development, keeping per-seat prices low, (3) Boeing worldwide branding ability can attract commercial markets besides the U.S. government, (4) Boeing's broad-based aerospace purchasing power with its suppliers provides leverage to ensure a well-established governance structure and decision-making model that supports the creation of value for our customers, including NASA, and (5) an investment plan that accomplishes NASA's commercialization goals. Working with market estimates provided by Bigelow Aerospace [REDACTED] and Space Adventures [REDACTED], our scalable plan accommodates the pace of the developing LEO transportation services market.

Organizational Structure and Management. We continue the same efficient organizational structure for CCiCap as has been in place for CCDev2 (Figure 1-5). [REDACTED] is the vice president/program manager (PM). [REDACTED]

[REDACTED] is the primary interface to customers and partners and is organizational leader of development, marketing, and services planning and management. The [REDACTED]

[REDACTED] builds on the results the team achieved on CCDev and CCDev 2 to continue system design maturation under CCiCap. Chief engineer [REDACTED] brings his experience as [REDACTED] to ensure CCTS system design integrity.

Marketing and Sales director [REDACTED] works with [REDACTED] as well as other potential customers to help foster the commercial space transportation market. [REDACTED]

[REDACTED], who previously led the [REDACTED] development team to a successful test flight, leads our Avionics and Software IPT. [REDACTED]

[REDACTED] serves as our Spacecraft IPT lead.

Our SE&I team is led by [REDACTED]

[REDACTED]. Our Ground Production and Operations team is led by [REDACTED] who previously was the [REDACTED]

[REDACTED] manager of Crew and Mission Operations, has worked extensively with the NASA mission operations infrastructure, augmenting his [REDACTED]. [REDACTED] our manager of Safety, Reliability, and Quality, has experience as the systems safety and reliability manager for the [REDACTED]. The strong leadership team addresses program tasks, issues, and concerns on a daily basis. NASA program integration team members also are a

key part of our day-to-day operations, and we include them in the regular control boards and processes defined in our Systems Engineering Management Plan (SEMP) (DCC1-000025).

██████████ continues as independent chair of our safety review panels. He is supported by ██████████, who brings over ██████████ providing daily independent technical insight, chartering independent reviews, ensuring healthy tension among management, engineering and safety organizations.

We engage experienced suppliers, competing systems where it makes sense. NASA benefits from Boeing's vertical integration and our strong supply chain management resulting in cost and schedule predictability and agility for issue resolution. Our key suppliers include ULA for the Atlas V LV ██████████

██████████. Innovative business partnerships with Bigelow Aerospace and Space Adventures support commercial market growth. We have secured the use of OPF-3 at KSC through the Space Florida aerospace economic development agency.

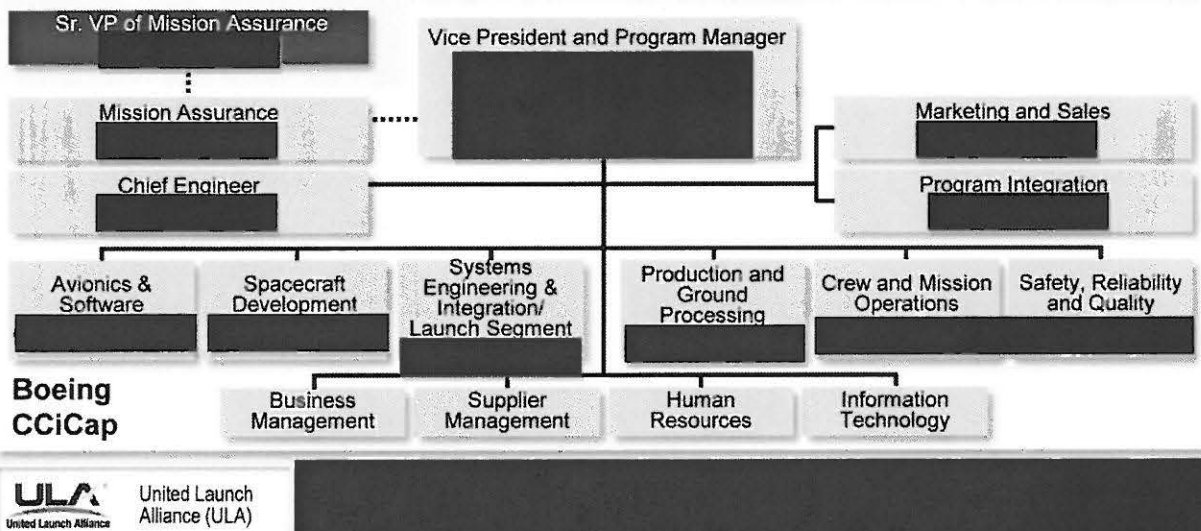


Figure 1-5. Boeing's CCIcap organizational structure is in place and ready to successfully continue CCTS development tasks.

Finance. CCDev2 enabled acceleration of CCTS design. For CCIcap we have established base and optimized milestone plans with associated NASA and Boeing investment (Figure 1-6). Boeing CCTS, including suppliers, will have invested more than ██████████ in CCTS by completion of development. ██████████

██████████. With our proposal we provide Boeing historical financial statements (SEC Form 10-K) published in the latest 2011 annual filings. We designed our CCTS for affordable mission prices within a sustainable business, as shown in our 5-year Estimated Financial Performance during the services phase.



Investment Sources	Prior to CCiCap	CCiCap Base	CCiCap Optimized
Boeing			
NASA	\$132M	\$460M	
Total			
Results	Telemetry investment + PDR	CDR + demonstrations and risk reduction tests	CFT to ISS December 2016

Figure 1-6. Our investment profile reflects sound cost estimates based on extensive experience in human-rated system development.

Resources. Our experience with multiple end-to-end system development and operations life cycles enables us to identify resources required to successfully complete all mission and program phases. Boeing's ability to identify required Government and corporate resources during the planning phase reduces program life cycle risk by eliminating development surprises. Our established compliant business practices, financial resources, intellectual property, facilities, and tools are available and ready to support CCTS success (Figure 1-7).

Business Information Summary	
Business Viability	<ul style="list-style-type: none"> Publically traded company with annual report that describes the breadth and depth of our assets and programs demonstrating the viability of The Boeing Company Boeing management fully supportive; no additional investment or approval required to take CCTS to CFT Business case that closes with two NASA service flights per year Commercial services offering that stimulates space transportation industry to LEO
Finance	<ul style="list-style-type: none"> Boeing investment contribution of [REDACTED] in the base period reduces NASA funding requirements Boeing investment plan ensures that funds are available as needed to create CCTS value Affordability plan and cost control measures for competitive flight service prices and sustainable business
Resources	<ul style="list-style-type: none"> CCiCap team in place, including CCDev2 core team, with detailed knowledge of our CCTS design and risk reduction demonstrations; small business plan in place today supports future FAR program goals Extensive aerospace supply chain augmenting the Boeing CCiCap workforce
Facilities and Other Assets	<ul style="list-style-type: none"> Boeing maintains facilities with extensive fabrication and manufacturing tooling in Florida, Alabama, Texas, and other states nationwide Space Florida assistance for use of OPF-3 for assembly and maintenance of flight vehicles at KSC
Intellectual Property	<ul style="list-style-type: none"> Boeing proven technology and intellectual property to lower development and operational risk
External Resources	<ul style="list-style-type: none"> Our CCiCap cost estimate includes Government services, data, equipment, and facilities, including an SAA with NASA JSC's MOD for mission planning, training, and operations
Compliance	<ul style="list-style-type: none"> Boeing complies with eligibility requirements and relevant federal laws, regulations, and policies defined in paragraph 4.2 and 4.3 of the AFP Corporation chartered under Delaware state laws. Ownership is composed of more than 50% US nationals Our flight vehicles have greater than 50% US content; INKSNA satisfied

Figure 1-7. Our business approach supports entry into a viable services business.

Advantages of the Boeing Approach. Boeing has extensive experience and understands that HSF systems have challenges and requirements that must be addressed and embedded during the design and development phase that are not encountered in less sophisticated cargo transportation systems. As demonstrated in the CCDev and CCDev2 SAAs, we value NASA insight, embedded technical personnel, and S&MA expertise. The combination of NASA and Boeing human space-flight experience and our system integration, design, manufacturing, processing, launch, and mission operations strengths make the Boeing CCTS safer, more reliable, and affordable. Boeing is a well-established diversified company and is able to ensure NASA gets a return on its CTS investment. Our corporate strength and global marketing presence enable us to achieve commercial market growth and drive down space transportation costs. Boeing is NASA's low-risk provider, ready to satisfy near-term ISS transportation needs with a safe, certified system that achieves the vision we share for a robust space economy in LEO.

APPENDIX 2: Performance Milestones and Success Criteria

Appendix 2a Base Period Performance Milestones

Milestone 1: Integrated System Review

Description: Boeing shall conduct an Integrated Systems Review (ISR) which establishes and demonstrates a baseline design of the Commercial Crew Transportation System (CCTS) integrated vehicle and operations that meets system requirements.

Scope: ISR reviews the baseline design of the CCTS and establishes the point of departure for proceeding with detailed design taking into account progress made since the System PDR. The review will establish the CCTS design basis for the CCIcap phase.

Success Criteria: Complete the Integrated System Review in accordance with Table A (Appendix 2c). Provide a copy of the data products to NASA. Provide documentation of Boeing CCIcap investment commitment of \$[REDACTED] for the Base Period, \$[REDACTED] for the Optimized Funding option period.

Amount: \$50.0M
Date: August/2012

Milestone 2: Production Design Review

Description: Boeing shall conduct a Production Design Review which establishes the baseline plan, equipment, and infrastructure for performing the manufacture, assembly, and acceptance testing of the CST-100 spacecraft.

Scope: Production Design Review establishes the baseline plan, equipment, and infrastructure for performing the manufacture, assembly, and acceptance testing of the CST-100 spacecraft.

Success Criteria: Completion of Production Design Review in accordance with Table B (Appendix 2c). Provide NASA a copy of Design Review materials, final board presentation, closed Review Item Discrepancy (RID) summary, and open RIDs with preliminary closure plans for major issues.

Amount: \$51.7M
Date: October/2012

Commercial Crew Integrated Capability

Milestone 3: Phase 1 Safety Review Board*

Description: Boeing shall prepare and conduct a Phase 1 Safety Review of the CCTS Preliminary Design Review (PDR) level requirements, vehicle architecture and design, and associated safety products to assess conformance with NASA Crew Transportation System certification process (PDR-level products). Focus is review of preliminary hazard reports, cause descriptions and controls.

Scope: The Phase 1 Safety Review demonstrates the PDR level design and operational processes meet program level System Safety requirements as demonstrated by the integrated design and safety analysis process and documented in the associated hazard reports.

Success Criteria: Conduct Phase 1 Safety Review with single responsible Safety Review Panel (SRP) reviewing products in accordance with Table C (Appendix 2c). Provide NASA a copy of the SRP products and resulting actions from the review. Provide NASA documentation that a cumulative investment of \$ [REDACTED] has been funded.

Amount: \$25.2M
Date: November/2012

Milestone 4: Software Integrated Engineering Release 2.0

Description: Boeing shall demonstrate the [REDACTED] software release [REDACTED] closed loop with Guidance, Navigation & Control (GN&C) for the flight ascent phase.

Success Criteria: Demonstrate [REDACTED] closed loop run in Avionics Software Integration Lab (ASIL) in accordance with Table D (Appendix 2c). Provide NASA a copy of the Quick Look Summary Test briefing Report to provide test results.

Amount: \$20.4M
Date: January/2013

*NASA concurrence per Article 3.B.(3)

<p>Milestone 5: Landing & Recovery / Ground Communication Design Review</p> <p>Description: Boeing shall conduct a Landing & Recovery / Ground Communication Design Review which establishes the baseline plan, for equipment, and infrastructure for conducting CST-100 spacecraft flight operations fulfilling both ground communications and landing and recovery operations.</p> <p>Scope: Design Review which establishes the preliminary baseline plan, for equipment, and infrastructure for conducting CST-100 spacecraft flight operations fulfilling both ground communications and landing and recovery operations.</p> <p>Success Criteria: Completion of Landing & Recovery / Ground Communication Design Review in accordance with Table E (Appendix 2c). Provide NASA a copy of Design Review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.</p>	<p>Amount: \$28.8M Date: January/2013</p>
<p>Milestone 6: Launch Vehicle Adapter (LVA) Preliminary Design Review (PDR)</p> <p>Description: Boeing shall complete a Preliminary Launch Vehicle Adapter (LVA) Design Review.</p> <p>Scope: The LVA PDR demonstrates that the preliminary design meets requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design.</p> <p>Success Criteria: Completion of LVA Design Review in accordance with Table F (Appendix 2c). Provide NASA a copy of review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.</p>	<p>Amount: \$45.5M Date: February/2013</p>

Commercial Crew Integrated Capability

Milestone 7: Integrated Stack Force and Moment Wind Tunnel Test

Description: Boeing shall develop a test matrix, fabricate the necessary test models, and perform an integrated launch vehicle force and moment wind tunnel test to validate predictions on integrated Crew Module (CM)/Service Module (SM)/Launch Vehicle (LV) stack for ascent.

Scope: The Integrated launch vehicle force and moment wind tunnel test to validate predictions on integrated Crew Module (CM)/Service Module (SM)/Launch Vehicle (LV) stack for ascent.

Success Criteria: Completion of integrated stack force and moment wind tunnel test in accordance with Table G1 (Appendix 2c). Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.

Amount: \$37.8M

Date: April/2013

Milestone 8: Dual Engine Centaur (DEC) Liquid Oxygen Duct Development Test

Description: Boeing shall complete a Dual Engine Centaur Liquid Oxygen Duct Development Test.

Scope:

[REDACTED]

Success Criteria: Completion of Dual Engine Centaur Liquid Oxygen Duct Development Test in accordance with Table G1 (Appendix 2c). Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.

Amount: \$21.5M

Date: May/2013

Commercial Crew Integrated Capability

Milestone 9: Orbital Maneuvering and Attitude Control (OMAC) Engine Development Test

Description: Boeing shall complete the OMAC Engine development test.

Scope: Perform engine level testing of the OMAC engine to support component, subsystem and CST-100 vehicle level development.

Success Criteria: Completion of OMAC Engine Development test in accordance with Table G1 (Appendix 2c) to obtain requisite data. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.

Amount: \$50.2M
Date: July/2013

Milestone 10: Spacecraft Primary Structures Critical Design Review (CDR)

Description: Boeing shall conduct a Spacecraft Primary Structures CDR. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for fabrication, assembly and structural testing.

Scope: The Spacecraft Primary Structures CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for fabrication, assembly and structural testing.

Success Criteria: Completion of Spacecraft Primary Structures CDR in accordance with Table H. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.

Amount: \$8.6M
Date: October/2013

Commercial Crew Integrated Capability

Milestone 11: Service Module Propulsion System Critical Design Review

Description: Boeing shall perform a Service Module (SM) Propulsion System Critical Design Review (CDR). Propulsion System level CDR performed after major SM Propulsion components have completed their individual CDR. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.

Scope: The Propulsion System level CDR performed after major SM Propulsion components have completed their individual CDR. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.

Success Criteria: Completion of SM Propulsion CDR in accordance with Table I. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.

Amount: \$7.5M
Date: November/2013

Milestone 12: Mission Control Center Interface Demonstration Test

Description: Boeing shall conduct a Mission Control Center (MCC) Interface Demonstration Test between Avionics Software Integration Facility and the MCC.

Scope: The Mission Control Center (MCC) Interface Demonstration Test demonstrates the linkage between the MCC and the Boeing Avionics Software Integration Facility which is a precursor to integrated simulation capability for flight operations training.

Success Criteria: Completion of the MCC Interface Demonstration test in accordance with Table G1 (Appendix 2c). Provide NASA a copy of the quick-look summary test briefing to document test results.

Amount: \$7.9M
Date: September/2013

Commercial Crew Integrated Capability

Milestone 13: Launch Vehicle Adapter Critical Design Review

Description: Boeing shall complete a Launch Vehicle Adapter (LVA) Critical Design Review (CDR). CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.

Scope: The LVA CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.

Success Criteria: Completion of LVA CDR in accordance with Table J. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.

Amount: \$13.5M
Date: September/2013

Milestone 14: Emergency Detection System (EDS) Standalone Testing

Description: Boeing shall complete the Initial EDS Testing - Launch Vehicle Stand-alone.

Scope: 

Success Criteria: Completion of Initial EDS Testing - LV Stand-alone in accordance with Table G1 (Appendix 2c). Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.

Amount: \$13.8M
Date: October/2013

Milestone 15: Certification Plan Review

Description: Boeing shall complete a review of the CCTS Certification Plan.

Scope: Review with NASA the Boeing Certification Plan which defines our strategy leading to a crewed flight test. The Certification Plan will be included in the CDR Board material of Milestone 19.

Success Criteria: Completion of the Certification Plan Review in accordance with Table S (Appendix 2c). Provide NASA a copy of the updated Certification Plan.

Amount: \$5.8M
Date: November/2013

Commercial Crew Integrated Capability

Milestone 16: Avionics Software Integration Lab (ASIL) Multi-String Demonstration Test

Description: Boeing shall demonstrate the [REDACTED] flight software closed loop with GN&C for the flight ascent phase.

Scope: [REDACTED]

Success Criteria: Demonstrate [REDACTED] closed loop run in ASIL in accordance with Table G1 (Appendix 2c). Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.

Amount: \$24.9M
Date: December/2013

Milestone 17: Pilot-in-the-loop Demonstration

Description: Boeing shall demonstrate key hardware/software interfaces for Manual Flight Control meets requirements, including operational scenarios and failure modes.

Scope: The Pilot-in-the-loop Demonstration will demonstrate key hardware/software interfaces [REDACTED] meets requirements, including operational scenarios and failure modes.

Success Criteria: Completion of Pilot-in-the-loop Demonstration test in accordance with Table G1 (Appendix 2c). Provide NASA with a copy of the test plan and a quick look summary test briefing to document results. Provide NASA documentation that a cumulative investment of \$ [REDACTED] has been funded.

Amount: \$13.9M
Date: February/2014

Commercial Crew Integrated Capability

<p>Milestone 18: Software Critical Design Review</p> <p>Description: Boeing shall conduct a Spacecraft Software CDR. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for flight software development, verification, and delivery.</p> <p>Scope: The Spacecraft Software CDR demonstrates that the maturity of the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for flight software development, verification, and delivery.</p> <p>Success Criteria: Completion of Software CDR in accordance with Table K. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.</p>	<p>Amount: \$15.1M Date: March/2014</p>
<p>Milestone 19: Critical Design Review (CDR) Board*</p> <p>Description: Boeing shall establish and demonstrate a critical baseline design of the CCTS that meets system requirements. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.</p> <p>Scope: The CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration and test. CDR determines that the technical effort is on track to complete the flight and ground system development and mission operations, meeting mission performance requirements within cost and schedule constraints.</p> <p>Success Criteria: Completion of CDR in accordance with Table L. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues. Provide NASA documentation that a cumulative investment of \$ [REDACTED] has been funded.</p>	<p>Amount: \$17.9M Date: April/2014</p>

*NASA concurrence per Article 3.B.(3)

Commercial Crew Integrated Capability

Base Period - Milestone Rationale and Priority List

Milestones are to be exercised in the date order listed to optimize schedule and maintain program interdependencies.

Base Period						
No.	Descriptive title	Objective Success Criteria	Rationale	Date	Value (\$M)	Cumulative Total (\$M)
1	Integrated System Review	Complete the Integrated System Review and provide a copy of the data products to NASA.	Establishes and demonstrates a baseline design of the CCTS for CCI Cap.	August 2012	\$50.0	\$50.0
2	Production Design Review	Completion of Production Design Review and provide NASA a copy of Design Review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	Identifies readiness to proceed beyond the Design Review for production of hardware.	October 2012	\$51.7	\$101.7
3	Phase 1 Safety Review	Conduct phase 1 Safety review with single responsible Safety Review Panel (SRP) reviewing products. Provide NASA a copy of the SRP products and resulting actions from the review.	Validates CCTS design and associated safety products conform to NASA S&MA for crewed flight docking to ISS and progressing toward future human rating.	November 2012	\$25.2	\$126.9
4	Software Integrated Engineering Release 2.0	Demonstrate one string closed loop run in ASIL.	Demonstrates the [REDACTED] software release [REDACTED] closed loop with GN&C for the flight ascent phase.	January 2013	\$20.4	\$147.3
5	Landing & Recovery / Ground Communication Design Review	Completion of Landing & Recovery / Ground Communication Design Review and provide NASA a copy of Design Review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	Design Review which establishes the preliminary baseline plan, for equipment, and infrastructure for conducting CST-100 spacecraft flight operations fulfilling both ground communications and landing and recovery operations.	January 2013	\$28.8	\$176.1

Commercial Crew Integrated Capability

Base Period						
No.	Descriptive title	Objective Success Criteria	Rationale	Date	Value (\$M)	Cumulative Total (\$M)
6	Launch Vehicle Adapter (LVA) Preliminary Design Review	Completion of LVA Preliminary Design Review. Provide NASA a copy of review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	PDR demonstrates that the preliminary design meets requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design.	February 2013	\$45.5	\$221.6
7	Integrated Stack Force and Moment Wind Tunnel Test	Completion of integrated stack force and moment wind tunnel test. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Integrated launch vehicle force and moment wind tunnel test to validate predictions on integrated Crew Module (CM)/Service Module (SM)/Launch Vehicle (LV) stack for ascent.	April 2013	\$37.8	\$259.4
8	Dual Engine Centaur (DEC) Liquid Oxygen Duct Development Test	Completion of Dual Engine Centaur Liquid Oxygen Duct Development Test in accordance with Table G. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.		May 2013	\$21.5	\$280.9
9	Orbital Maneuvering and Attitude Control (OMAC) Engine Development Test	Completion of OMAC Engine Development test. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Completion of OMAC development activities and readiness for qualification program.	July 2013	\$50.2	\$331.1
12	Mission Control Center Interface Demonstration Test	Completion of the MCC Interface Demonstration. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Mission Control Center (MCC) Interface Demonstration Test between Avionics Software Integration Facility and the MCC.	September 2013	\$7.9	\$339.0

Commercial Crew Integrated Capability

Base Period						
No.	Descriptive title	Objective Success Criteria	Rationale	Date	Value (\$M)	Cumulative Total (\$M)
13	Launch Vehicle Adapter Critical Design Review	Completion of LVA CDR and provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.	September 2013	\$13.5	\$352.5
10	Spacecraft Primary Structures Critical Design Review	Completion of Spacecraft Structures CDR. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for fabrication, assembly, and structural testing.	October 2013	\$8.6	\$361.1
14	Emergency Detection System (EDS) Standalone Testing	Completion of Initial EDS Testing - LV Stand-alone. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Emergency Detection System testing in avionics system integration lab including EDS components. Key tests with launch vehicle Stand-alone.	October 2013	\$13.8	\$374.9
11	Service Module Propulsion System Critical Design Review	Completion of SM Propulsion System CDR. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	Propulsion system-level CDR performed after major SM Propulsion components have completed their individual CDR. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.	November 2013	\$7.5	\$382.4
15	Certification Plan Review	Completion of a review of the CCTS Certification Plan and provision of an updated plan to NASA	Review of the CCTS Certification Plan defining Boeing strategy to crewed flight test.	November 2013	\$5.8	\$388.2
16	Avionics Software Integration Lab (ASIL) Multi-String Demonstration Test	Demonstrate multi-string closed loop run successfully in ASIL. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Demonstrate the initial flight software closed loop with GNC&C for the flight ascent phase.	December 2013	\$24.9	\$413.1

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Base Period						
No.	Descriptive title	Objective Success Criteria	Rationale	Date	Value (\$M)	Cumulative Total (\$M)
17	Pilot-in-the-loop Demonstration	Completion of Pilot-in-the-loop Demonstration test. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Demonstrate key hardware/software interfaces [REDACTED] meets requirements, including operational scenarios and failure modes.	February 2014	\$13.9	\$427.0
18	Software Critical Design Review	Completion of Software CDR. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	Software CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for development, verification, and delivery.	March 2014	\$15.1	\$442.1
19	Critical Design Review (CDR)	Completion of CDR. Provide NASA a copy of CDR review materials, final board presentation, closed RID summary, and open RIDs with preliminary closure plans for major issues.	Completion of critical baseline design of the CCTS integrated vehicle and operations that meets system requirements. CDR confirms that the requirements, detailed designs, and plans for test and evaluation form a satisfactory basis for production and integration.	April 2014	\$17.9	\$460.0

Appendix 2b Option Period Optimized Funding Performance Milestones

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Commercial Crew Integrated Capability

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Commercial Crew Integrated Capability

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Appendix 2c. Milestone Entrance and Exit Criteria Tables

Table A: Integrated System Review Entrance and Exit Criteria

Integrated System Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. Review agenda approved by the Boeing project management. 2. The following technical products will be provided for the review: <ol style="list-style-type: none"> a. [REDACTED] b. [REDACTED] c. Results of performed trade studies and recommended updates to the vehicle baseline d. Current development test status and results [REDACTED] e. Summary of new Risks, Issues and Opportunities [REDACTED] [REDACTED] 3. The following technical products will also be provided but not part of the review: <ol style="list-style-type: none"> a. Updated baseline documents from PDR b. Production model/drawing release plan and status c. Updated Manufacturing and Assembly plan and simulation data d. Production facility readiness status e. Ground support and test support equipment design status f. Mission Control long lead status g. Long lead LV procurement status h. Spacecraft long lead procurement status i. Updated Failure Mode and Effects Analysis (FMEA) [REDACTED] [REDACTED] 	<ol style="list-style-type: none"> 1. Conduct an integrated system review to [REDACTED] [REDACTED] 2. The design is expected to meet requirements or plans have been initiated to develop alternatives that will meet requirements. 3. Actions from the review have been recorded and assigned to a responsible team. <ol style="list-style-type: none"> a. Provide a copy of any actions taken during the meeting

Table B: Production Design Review Entrance and Exit Criteria

Production Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. At least 30 days prior to review, provide a Design Review Plan identifying the review data, the date data is available, design review success criteria, and plan for disposition of NASA comments. 2. A Production Design Review agenda, and charge to the board have been agreed to by Boeing project management, and review chair prior to the Design Review. 3. Utilize an iterative process for review preparation, which includes NASA and provides data throughout the process, allowing for NASA insight and feedback prior to the formal milestone. 4. Successful completion of the System level PDR and responses made to all System PDR RIDs, or a timely closure plan exists for those remaining open. 5. The following Production Design Review products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Updated baseline documents, as required b. Manufacturing and Assembly Plan – Initial [REDACTED] c. [REDACTED] d. [REDACTED] e. [REDACTED] f. [REDACTED] g. Initial Production Interface Requirements h. Current Production System Architecture [REDACTED] i. [REDACTED] j. Baseline design documentation k. Production Capacity Analysis [REDACTED] l. [REDACTED] m. Safety and Quality products 	<ol style="list-style-type: none"> 1. Top-level requirements are agreed upon, stated clearly and consistent with the preliminary design. 2. The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives. 3. The preliminary design is expected to meet the requirements at an acceptable level of risk. 4. Definition of technical interfaces are consistent with the overall technical maturity and provides an acceptable level of risk. 5. Project risks are understood and have been assessed, and plans, a process, and resources exist to effectively manage them. 6. The operational concept is technically sound, includes (where appropriate) human factors, and includes flow down of requirements for its execution. 7. Completion of review per Review Plan

Table C: Phase 1 Safety Review Entrance and Exit Criteria

Phase 1 Safety Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A. Phase 1 Safety Review agenda and objectives have been agreed to by Boeing project management, and incorporated into the Review Plan. 2. At least 60 days prior to the review, provide a Review Plan which identifies review data, the date data is available, review success criteria, and plan for disposition of NASA comments (to be provided at least 30 days prior to review). 3. Utilize an iterative process for review preparation, which includes NASA and provides data throughout the process, allowing for NASA insight and feedback prior to the formal milestone. 4. Disposition NASA review plan comments at least 15 days prior to the review. 5. The following technical products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Phase 1 Hazard Reports identifying preliminary hazards and hazard causes; actions for eliminating, reducing, or controlling hazards, and approach for safety verification b. An overview description of the design and flight operations of the hardware being addressed in the review, including system/subsystem/hardware/software and operations descriptives and system layouts to assist in understanding hazards c. Descriptions of Ground Support Equipment and flight hardware subsystems that present a potential hazard during ground processing, and the ground operations involving these items d. Assessment of compliance with CCTS Safety requirements e. ISS Hazard Report Traceability Matrix 	<ol style="list-style-type: none"> 1. Project uses an integrated design and safety analysis process to identify and mitigate potential catastrophic hazards, and a plan has been defined to complete the safety analysis activity within the schedule constraints. 2. Preliminary hazards and hazard causes have been defined. 3. Preliminary hazard controls and safety verification methods have been evaluated. 4. Phased safety reviews are integrated with the design review process. 5. The safety analysis process can reasonably be expected to continue to identify and mitigate hazards in a manner timely for optimizing opportunities for improving/enhancing the design. 6. Completion of review per Review Plan

Commercial Crew Integrated Capability

Table D: Software Integrated Engineering Release Entrance and Exit Criteria

Software Integrated Engineering Release	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none">1. Engineering Release (ER) build contents are defined, and agreed to by the Boeing project management and review chair.2. Flight computers and Simulation hardware required for ER are available.3. GN&C simulation environment models [REDACTED] available.4. Avionics hardware is available.5. Hardware simulation required for ER build has been established and checkout is complete.6. Test procedures have been established and ran.	<ol style="list-style-type: none">1. Computer Software Configuration Item (CSCI) integration test is complete.2. ER build is delivered [REDACTED]3. Preparation of quick-look summary test briefing to document test results.

Table E: Landing & Recovery/Ground Communication Design Review Entrance & Exit Criteria

Landing & Recovery / Ground Communication Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A Landing and Recovery/Ground Communication Design Review agenda, and charge to the board have been agreed to by Boeing project management, and review chair prior to the Design Review. 2. At least 60 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 30 days prior to review). 3. Disposition NASA review plan comments at least 15 days prior to the review. 4. Successful completion of the System level PDR and responses made to all System PDR RIDs, or a timely closure plan exists for those remaining open. 5. The following Landing & Recovery / Ground Communication Design Review products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Updated baseline documents, as required. b. Ground Communications Specification c. Ground Handling System Specification d. Landing & Recovery Ground System Specification e. CCTS Ground Processing Plan f. Initial ground Landing & Recovery/Ground Communications Interface Requirements g. Ground Landing Site System Architecture i. Baseline design documentation j. Safety and Quality products 	<ol style="list-style-type: none"> 1. Top-level requirements are agreed upon, stated clearly and consistent with the preliminary design. 2. The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives. 3. The preliminary design is expected to meet the requirements at an acceptable level of risk. 4. Definition of technical interfaces are consistent with the overall technical maturity and provides an acceptable level of risk. 5. Project risks are understood and have been assessed, and plans, a process, and resources exist to effectively manage them. 6. The operational concept is technically sound, includes (where appropriate) human factors, and includes flow down of requirements for its execution. 7. Completion of review per Review Plan

Table F: Launch Vehicle Adapter (LVA) Design Review Entrance and Exit Criteria

Launch Vehicle Adapter Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A LVA Design Review agenda has been agreed to by Boeing Program Management. 2. At least 60 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 30 days prior to review). 3. Disposition of NASA review plan comments at least 15 days prior to the review. 4. Baseline set of System Requirements for LVA . 5. The following products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Preliminary baseline drawings [REDACTED] c. Trade study and design study results d. Preliminary environmental control, thermal, [REDACTED] e. Preliminary list of materials parts and processes and suppliers f. Preliminary mass data g. Development test or related test and/or Qualification data h. Interface Requirements contained in the ICD i. Preliminary producibility considerations j. Mock-ups or 3-D models as appropriate k. Prelim packaging and handling considerations 	<ol style="list-style-type: none"> 1. Requirements are agreed upon, stated clearly, and consistent with the preliminary design. 2. The flow down and traceability of verifiable requirements is complete or a plan is in place for adequate and timely resolution. 3. Preliminary design is expected to meet the requirements with acceptable risk level. 4. Definition of technical interfaces are consistent with the overall technical maturity and provide acceptable level of risk. 5. Optimized yet adequate levels of margin exist with respect to the TPMs, else a plan for resolution exists. 6. Completion of review per Review Plan

Table G1: CCIcap Demonstration Test Milestone Entrance and Exit Criteria

CCIcap Demonstration Test Milestones	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none">1. A Test Plan has been developed consisting of key objectives, auxiliary objectives, configuration of unit under test, test conditions and environment, differences between baseline design configuration and test (if applicable), and definition of information in quick-look report and approved by Boeing Program Management.2. At least 30 days prior to TRR, provide the Test Plan to NASA.3. Disposition of NASA comments to the Test Plan prior to or at TRR.4. Completion of a Test Readiness Review (TRR).<ol style="list-style-type: none">a. Closure or disposition as non-constraint to test of open TRR actions.	<ol style="list-style-type: none">1. Completion of test per approved Test Plan.2. Preparation of a quick-look summary test briefing to document test results.

Commercial Crew Integrated Capability

Table G2: CCIcap Qualification and Validation Test Milestone Entrance and Exit Criteria

CCIcap Qualification and Validation Test Milestones	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none">1. A Test Plan has been developed consisting of key objectives, auxiliary objectives, configuration of unit under test, test conditions and environment, differences between baseline design configuration and test (if applicable), and definition of information in quick-look report and approved by Boeing Program Management.2. The certification plan has been updated for appropriate traceability to the scope of the test.3. At least 30 days prior to TRR, provide the Test Plan and/or certification plan (if applicable) to NASA.4. Disposition of NASA comments to the Test Plan prior to or at TRR.5. Completion of a Test Readiness Review (TRR).<ol style="list-style-type: none">a. Closure or disposition as non-constraint to test of open TRR actions.	<ol style="list-style-type: none">1. Completion of test per approved test plan2. Test results satisfy key Test Plan objectives or recovery plan in place.3. Test results support the certification plan with a disposition of remaining or open items from the test.4. Preparation of a quick-look summary test briefing to document test results.

Commercial Crew Integrated Capability

Table H: Spacecraft Primary Structures Critical Design Review (CDR) Entrance and Exit Criteria

Spacecraft Primary Structures Critical Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A . CDR agenda, and charge to the board have been agreed to by Boeing Program Management, and review chair prior to the CDR. 2. At least 60 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 30 days prior to review). 3. Disposition of NASA review plan comments at least 15 days prior to the review. 4. Completion of the System level PDR and responses made to all System PDR RIDs related to spacecraft structures, or a timely closure plan exists for those remaining open. 5. The following CDR products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. updated baselined documents [REDACTED] as required b. product build-to specifications for each hardware configuration item, along with supporting trade-off analyses and data c. fabrication, assembly, integration, and test plans and preliminary procedures d. technical data package [REDACTED] e. operational limits and constraints f. technical margins g. verification plan (including requirements and specification) h. Safety and Quality products. 	<ol style="list-style-type: none"> 1. Top-level requirements are agreed upon, finalized, stated clearly and consistent with the final design. 2. The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives. 3. The final design is expected to meet the requirements at an acceptable level of risk. 4. Definition of technical interfaces are consistent with the overall technical maturity and provides an acceptable level of risk. 5. Adequate technical margins exist with respect to the TPMs or, if not, an adequate plan exists for timely resolution of open items. 6. Project risks are understood and have been assessed, and plans, a process, and resources exist to effectively manage them. 7. Completion of review per Review Plan.

Table I: Service Module Propulsion System Critical Design Review Entrance and Exit Criteria

Service Module Propulsion System Critical Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A CDR agenda, and charge to the board have been agreed to by Boeing Program Management, and review chair prior to the CDR. 2. At least 60 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 30 days prior to review). 3. Disposition of NASA review plan comments at least 15 days prior to the review. 4. Completion of the System level PDR and responses made to all propulsion related PDR RIDs, or a timely closure plan exists for those remaining open. 5. The following CDR products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. updated baselined documents, as required. b. product build-to specifications for each hardware configuration item, along with supporting trade-off analyses and data. c. fabrication, assembly, integration, and test plans and preliminary procedures. d. technical data package [REDACTED] e. operational limits and constraints. f. technical resource utilization estimates and margins. g. hardware acceptance criteria. h. command and telemetry list. i. verification plan (including requirements and specification). j. validation plan. k. ground servicing and de-servicing operations plan. l. updated risk assessment and mitigation. m. Safety and Quality products. 	<ol style="list-style-type: none"> 1. Top-level requirements (including mission success criteria, TPMs) are agreed upon, finalized, stated clearly and consistent with the final design. 2. The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives. 3. The final design is expected to meet the requirements at an acceptable level of risk. 4. Definition of technical interfaces are consistent with the overall technical maturity and provides an acceptable level of risk. 5. Adequate technical margins exist with respect to the TPMs or, if not, an adequate plan exists for timely resolution of open items. 6. Project risks are understood and have been assessed, and plans, a process, and resources exist to effectively manage them. 7. The operational concept is technically sound, includes (where appropriate) human factors, and includes flow down of requirements for its execution. 8. Completion of review per Review Plan.

Commercial Crew Integrated Capability

Table J: Launch Vehicle Adapter Critical Design Review Entrance and Exit Criteria

Launch Vehicle Adapter Critical Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A CDR agenda, and charge to the board have been agreed to by Boeing Program Management, and review chair prior to the CDR. 2. At least 60 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 30 days prior to review). 3. Disposition of NASA review plan comments at least 15 days prior to the review. 4. Completion of the PDR and closure or closure plans for any outstanding PDR RIDs or Actions. 5. The following CDR products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Adequacy of detailed engineering drawings in the following areas: <ol style="list-style-type: none"> i. Mechanical design ii. Thermal & Environmental control iii. Mass properties iv. Reliability and safety v. Producibility and manufacturing b. Interface Control Drawings c. Design analysis and test data d. List of materials and processes e. Status of QA program f. Mock-ups or 3-D models as appropriate g. Packaging and handling considerations h. Safety and Quality products. 	<ol style="list-style-type: none"> 1. Requirements (incl. TPMs) are agreed upon, finalized, stated clearly, and consistent with the final design. 2. The flow down and traceability of verifiable requirements is complete or a plan is in place for adequate and timely resolution. 3. Design is expected to meet the req'ts with acceptable level of risk. 4. Definition of technical interfaces are consistent with the overall technical maturity and provide acceptable level of risk. 5. Optimized yet adequate levels of margin exist with respect to the TPMs, else a plan for resolution exists. 6. Completion of review per Review Plan.

Table K: Software Critical Design Review Entrance and Exit Criteria

Software Critical Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A Spacecraft Software CDR agenda, and charge to the board have been agreed to by the Boeing Program Management and review chair prior to the CDR. 2. At least 90 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 60 days prior to review). 3. Disposition of NASA review plan comments at least 30 days prior to the review. 4. Successful completion of the Software PDR and responses made to all software related PDR RIDs, or a timely closure plan exists for those remaining open. 5. The following Software CDR products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Updated Software Subsystem Requirements Document [REDACTED] e. Preliminary command and telemetry list [REDACTED] g. Software Safety and Quality products. 	<ol style="list-style-type: none"> 1. Software requirements are agreed upon, finalized, stated clearly and consistent with the detailed design. 2. The flow down of [REDACTED] requirements [REDACTED] adequate plan exists for timely resolution of open items. 3. [REDACTED] 4. Project risks are understood and have been assessed, and plans, a process, and resources exist to effectively manage them. 5. Completion of review per Review Plan.

Table L: Critical Design Review (CDR) Entrance and Exit Criteria

Critical Design Review	
Entrance Criteria	Exit Criteria
<ol style="list-style-type: none"> 1. A CDR agenda, and charge to the board have been agreed to by Boeing Program Management, and review chair prior to the CDR. 2. At least 90 days prior to the review, provide a Review Plan which identifies review data, the date data is available, design review success criteria, and plan for disposition of NASA comments (to be provided at least 60 days prior to review). 3. Disposition of NASA review plan comments at least 30 days prior to the review. 4. Completion of the PDR and responses made to all PDR RIDs, or a timely closure plan exists for those remaining open. 5. The following CDR products are available to the cognizant participants at least 30 days prior to the review board: <ol style="list-style-type: none"> a. Updated baselined documents, as required; b. Product build-to specifications for each hardware and software configuration item; c. Manufacturing and Assembly Plan; d. Interface Control Documents; e. CDR baseline design documentation – released CAD models/drawings; f. Current Model (Drawing) and Spec Trees; g. Flight Crew Training Plan; h. Updated Crew Survivability Assessment; i. Command and telemetry list; j. Test and Verification plan, including Acceptance Testing and Validation planning; k. Crew Work Load Analysis; l. Launch site operations plan; m. System performance analysis; n. Updated risk assessment and mitigation; o. Updated FMEA; p. Updated Loss-Of-Crew/Loss-Of-Mission (LOC/LOM) Probabilistic Safety Analysis (PSA); q. Updated logistics documentation; r. Software design document(s) (including interface design documents); s. Systems certification plans and requirements (as needed); t. Updated system safety analysis with associated verifications; u. Current Technical Performance Measurements (TPMs); 	<ol style="list-style-type: none"> 1. The detailed design is expected to meet the requirements with adequate margins at an acceptable level of risk. 2. Interface control documents are sufficiently matured to proceed with fabrication, assembly, integration, and test, and plans are in place to manage any open items. 3. High confidence exists in the product baseline, and adequate documentation exists or will exist in a timely manner to allow proceeding with fabrication, assembly, integration, and test. 4. The product verification and product validation requirements and plans are complete. 5. The testing approach is comprehensive, and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase. 6. Adequate technical and programmatic margins and resources exist to complete the development within resource constraints. 7. Risks to mission success are understood and assessed, and plans and resources exist to effectively manage them. 8. Safety and mission assurance (e.g., safety, reliability, maintainability, quality) have been addressed in system and operational designs, and any applicable S&MA products (e.g., PRA, system safety analysis and failure modes and effects analysis) have been reviewed. 9. Completion of review per Review Plan.

Commercial Crew Integrated Capability

Critical Design Review	
Entrance Criteria	Exit Criteria
<ul style="list-style-type: none">v. Human error analysis and human system performance results;w. Current development test status and results;x. Checkout and activation plan;y. Assessment of previously qualified launch vehicle elements.	

Commercial Crew Integrated Capability

[REDACTED]	
[REDACTED]	[REDACTED]
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Commercial Crew Integrated Capability

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Commercial Crew Integrated Capability

[REDACTED]	
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Commercial Crew Integrated Capability

[illegible]

Commercial Crew Integrated Capability

<p>[REDACTED]</p>	<p>[REDACTED]</p>
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Commercial Crew Integrated Capability

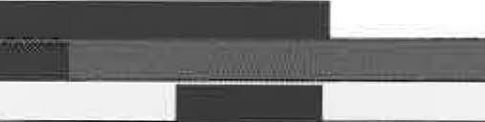
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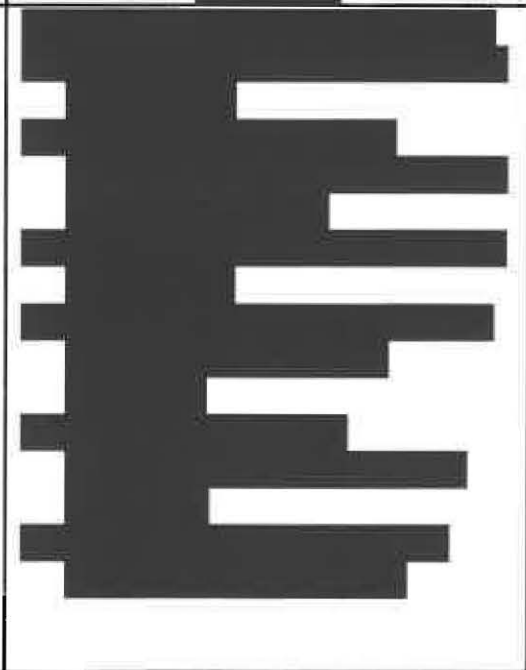
Commercial Crew Integrated Capability

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Commercial Crew Integrated Capability





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Commercial Crew Integrated Capability

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Commercial Crew Integrated Capability

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Appendix 3: Background Intellectual Property - Article 12G (1)

[REDACTED]

[REDACTED]

Commercial Crew Integrated Capability

[REDACTED]

[REDACTED]

[REDACTED]

Commercial Crew Integrated Capability

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SPACE ACT AGREEMENT – NNN12MS01S, AMENDMENT ONE (01)
BETWEEN
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
THE BOEING COMPANY
FOR
COMMERCIAL CREW INTEGRATED CAPABILITY (CCiCap)

PURPOSE

The purpose of this Amendment is to update the content in Milestone 7 from "Integrated Stack Force and Moment Wind Tunnel Test" to "Integrated Stack Buffet Wind Tunnel Test". The milestone value, scheduled date and associated entrance and exit criteria remain unchanged.

Milestone 7 in Appendix 2a is updated to the following:

Milestone 7: Integrated Stack Buffet Wind Tunnel Test

Description: Boeing shall develop a test matrix, fabricate the necessary test models, and perform an integrated launch vehicle buffet wind tunnel test to validate predictions on integrated Crew Module (CM)/Service Module (SM)/Launch Vehicle (LV) stack for ascent.

Scope: The Integrated launch vehicle buffet wind tunnel test to validate predictions on integrated Crew Module (CM)/Service Module (SM)/Launch Vehicle (LV) stack for ascent.

Success Criteria: Completion of integrated stack buffet wind tunnel test in accordance with Table G1 (Appendix 2c). Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.

Amount: \$37.8M

Date: April/2013

Item number 7 in the "Base Period-Milestone Rationale and Priority List" at the end of Appendix 2a is also updated to the following:

No.	Descriptive title	Objective Success Criteria	Rationale	Date	Value (\$M)	Cumulative Total (\$M)
7	Integrated Stack Buffet Wind Tunnel Test	Completion of integrated stack buffet wind tunnel test. Provide NASA with a copy of the test plan and a quick look summary test briefing to document results.	Integrated launch vehicle buffet wind tunnel test to validate predictions on integrated Crew Module (CM)/Service Module (SM)/Launch Vehicle (LV) stack for ascent.	April 2013	\$37.8	\$259.4

ARTICLE 29. SIGNATURE BLOCK

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

BY: William H. Gerstenmaier

William H. Gerstenmaier
Associate Administrator for Human Exploration and
Operations

DATE: 8 Jan 2013

THE BOEING COMPANY

BY: Leon Beard

Leon Beard
Senior Contracts Manager

DATE: 12/12/12

SPACE ACT AGREEMENT – NNN12MS01S, AMENDMENT TWO (02)
BETWEEN
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
THE BOEING COMPANY
FOR
COMMERCIAL CREW INTEGRATED CAPABILITY (CCiCap)

PURPOSE and AGENCY COMMITMENT

The purpose of this Amendment is to make the following changes to Space Act Agreement NNN12MS01S:

- 1) Split Optional Milestone 21, *Phase 2 Safety Review Board*, into two milestones (21A and 21B) and then add Optional Milestone 21A as a base milestone.
- 2) Extend the Term of Agreement in Article 15

- 1) Optional Milestone 21, *Phase 2 Safety Review Board*, is split into Milestone 21A and 21B. Milestone 21A is added to the base milestones in Appendix 2a while Milestone 2b remains an optional milestone in Appendix 2b.
 - a. Appendix 2a, *Base Period Performance Milestones* is updated to incorporate Milestone 21A:



Milestone 21A: Phase 2 Spacecraft Safety Review Board	
Description: Boeing shall prepare and conduct a Phase 2 Safety Review of the Commercial Crew Transportation System (CCTS) Spacecraft Critical Design Review (CDR) level requirements, system architecture and design, and associated safety products to assess conformance with Commercial Crew Transportation System certification process (CDR-level products). Focus is review of the updated hazard reports, hazard causes and controls, and specific safety verification methods to reflect the CDR level of design detail for the CCTS Spacecraft Segment.	Amount: \$20.0M Date: July/2014
Scope: The Phase 2 Spacecraft Safety Review demonstrates the CDR level design and operational processes meet program level System Safety requirements as demonstrated by the integrated design and safety analysis process and documented in the associated hazard reports.	
Success Criteria: Conduct Phase 2 Spacecraft Safety Review with single	

- b. The “Base Period-Milestone Rationale and Priority List” at the end of Appendix 2a is updated to add item 21A:

No.	Descriptive title	Objective Success Criteria	Rationale	Date	Value (\$M)	Cumulative Total (\$M)
21A	Phase 2 Spacecraft Safety Review Board	Conduct Phase 2 Spacecraft Safety Review with single responsible Safety Review Panel (SRP) reviewing. Provide NASA with a copy of the SRP products and resulting actions from the review.	Spacecraft Safety Review of the CCTS CDR level requirements, vehicle architecture and design, and associated safety products to assess conformance with NASA Crew Transportation System certification process (CDR-level products). Focus is review of the updated hazard reports, hazard causes and controls, and specific safety verification methods to reflect the CDR level of design detail for the CCTS Spacecraft Segment and progress toward CCTS certification.	July 2014	\$20.0	\$480.0

[REDACTED]

[illegible]

	
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- 2) The date referenced in Article 15, TERM OF AGREEMENT is updated from May 31, 2014 to August 31, 2014. Article 15 is updated to the following:

ARTICLE 15. TERM OF AGREEMENT

This Agreement becomes effective upon the date of the last signature below and shall remain in effect until the completion of all obligations of both Parties hereto, or August 31, 2014, whichever comes first.

ARTICLE 29. SIGNATURE BLOCK

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

THE BOEING COMPANY

BY: //Original signed by
William H. Gerstenmaier
Associate Administrator for Human Exploration
and Operations

BY: //Original signed by
Debora D. Davis
Contracts Administrator

DATE: 7 Aug 2013

DATE: 22 July 2013

Attachment

For amendment item 1) d. The “Optional Period-Optimized Milestone Rationale and Priority List” at the end of Appendix 2b is updated to change item number 21 to 21B and update the cumulative total value for the entire table.

The “Optional Period-Optimized Milestone Rationale and Priority List” is updated to the following:

[REDACTED]

SPACE ACT AGREEMENT – NNK12MS01S, AMENDMENT THREE (03)
BETWEEN
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
THE BOEING COMPANY
FOR
COMMERCIAL CREW INTEGRATED CAPABILITY (CCiCap)

PURPOSE and AGENCY COMMITMENT

The purpose of this Amendment is to extend the term of agreement to allow completion of final milestone acceptance and payment activities.

Article 15 is modified as follows:

ARTICLE 15. TERM OF AGREEMENT

This Agreement becomes effective upon the date of the last signature below and shall remain in effect until the completion of all obligations of both Parties hereto, or September 30, 2014, whichever comes first.

ARTICLE 29. SIGNATURE BLOCK

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

BY: William H. Gerstenmaier

William H. Gerstenmaier
Associate Administrator for Human Exploration
and Operations

DATE: 15 Aug 2014

THE BOEING COMPANY

BY: Debora D. Davis

Debora D. Davis
Contracts Administrator

DATE: 8/21/14