

SPACE ACT AGREEMENT AMENDMENT SEVEN
BETWEEN
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
ORBITAL SCIENCES CORPORATION
FOR
COMMERCIAL ORBITAL TRANSPORTATION SERVICES DEMONSTRATION
(COTS)

PURPOSE AND AGENCY COMMITMENT

The purpose of this Amendment is to modify Space Act Agreement (SAA) NNJ08TA32S to add seven (7) additional Milestones (numbers 25 through 31) to Appendix 2. The new milestones lead to an additional test launch of the Orbital Sciences Taurus II launch vehicle prior to the system demonstration mission to the International Space Station and enable additional software and avionics testing. A Taurus II maiden test launch reduces risks associated with the development of a new launch vehicle and increases the chance of success of the system demonstration mission with the Orbital Sciences Cygnus Spacecraft. The additional software and avionics tests reduce overall technical risks associated with the new Cygnus spacecraft prior to launch to the International Space Station. This amendment also updates the descriptions and completion dates for the existing milestones as well as incorporates some administrative changes.

Article 20 is amended as follows:

ARTICLE 20. PRINCIPAL POINTS OF CONTACT

The NASA Administrative Contact is replaced as follows:

Elijah J. Williams
Agreements Officer

Johnson Space Center
2101 NASA Parkway, Code BT
Houston, TX 77058
Phone: 281-244-1638
Fax: 281-483-0503
E-mail: elijah.j.williams@nasa.gov

Appendix 2 is amended as follows:

The completion dates for the existing milestones as well as descriptions are updated as per the following:

**APPENDIX 2 – MILESTONES AND SUCCESS CRITERIA
CARGO DEMONSTRATION**

<p>Milestone 17: Service Module Initial CPT Complete</p> <p>First Comprehensive Performance Test (CPT) of the Service Module Complete, in accordance with a detailed CPT test plan. This integrated system test will perform functional testing of all bus subsystems and obtain pre-environmental baseline performance data.</p> <p>Success Criteria: Successful test completion in accordance with the approved CPT Plan.</p>	<p>Amount: \$5,000,000 Date: June 2011</p>
<p>Milestone 18: Systems Demonstration Flight Launch Vehicle Stage 1 Assembly Complete</p> <p>Orbital shall complete assembly of the launch vehicle's first stage. The first stage consists of the Stage 1 core tank structure, the stage 1 Main Engine System (MES), the MES heat shield, the aft skirt, the forward skirt, the avionics, the cable harnesses, and the ordnance.</p> <p>Success Criteria: The Taurus II Maiden Flight launch vehicle Stage 1 is declared ready for its next stage of integration into the overall launch vehicle per Orbital standards. Stage test data is complete and documented. Work package data is complete.</p>	<p>Amount: \$2,500,000 Date: September 2011</p>
<p>Milestone 20: Systems Demonstration Flight Mission Readiness Review</p> <p>Orbital shall conduct a Mission Readiness Review (MRR) to demonstrate that all elements of the COTS Demo mission are ready, including: launch vehicle, Cygnus, range safety, and ground systems.</p> <p>Success Criteria: All COTS Demo Mission elements confirmed ready for flight (pending standard open work prior to launch) and all residual risks items closed or retired.</p>	<p>Amount: \$2,500,000 Date: October 2011</p>

<p>Milestone 21: Systems Demonstration Flight</p> <p>Orbital shall complete a demonstration mission using an Orbital COTS System configuration that includes each of the following mission phases: (a) launch of Cygnus; (b) orbital check-out of Cygnus systems; (c) rendezvous, proximity operations, SSRMS capture, and berthing with the ISS; (d) crew ingress and check-out of Cygnus systems while berthed to ISS; (e) release and departure of Cygnus; and (f) de-orbit and safe re-entry.</p> <p>Success Criteria: Successful completion of each phase of the demonstration mission and confirmation that the flight environment for cargo is within expectations.</p>	<p>Amount: \$2,500,000 Date: December 2011</p>
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The following milestones are added to the SAA.

<p>Milestone 25: Installation of Additional PITL Simulators</p> <p>Orbital shall install two new Processor in the Loop (PITL) Simulators to the Orbital hardware and software lab at the Orbital facility in Dulles, VA.</p> <p>Success Criteria: Arrival of the two PITL at the Orbital hardware and software integration lab along with all associated shipping and design/manufacturing documentation along with initial testing/checkout of the equipment to establish functionality and performance.</p>	<p>Amount: \$5,000,000 Date: April 2011</p>
<p>Milestone 26: PROX FEU Test Unit</p> <p>Orbital shall install a new PROX FEU Test Unit Simulators to the Orbital hardware and software lab at the Orbital facility in Dulles, VA.</p> <p>Success Criteria: Arrival of the PROX FEU at the Orbital hardware and software integration lab along with all associated shipping and design/manufacturing documentation along with initial testing/checkout of the equipment to establish functionality and performance.</p>	<p>Amount: \$5,000,000 Date: May 2011</p>
<p>Milestone 27: Taurus II Maiden Flight Stage 1 Core Delivered to Wallops Flight Facility (WFF)</p> <p>Orbital shall deliver the Stage 1 core assembly at the WFF in preparation for integration for the AJ-26 engines.</p> <p>Success Criteria: Delivery of the Stage 1 Core Assembly at WFF along with its associated shipping and design/manufacturing documentation.</p>	<p>Amount: \$24,000,000 Date: April 2011</p>

<p>Milestone 28: Taurus II Maiden Flight Upper Stage Delivered to Wallops Flight Facility (WFF)</p> <p>Orbital shall deliver the Upper Stage assembly at the WFF in preparation for integration for the Castor 30 motor. The upper stage is comprised of the interstage, motor cone, stage 2 motor, avionics cylinder with assembled avionics, and payload cone.</p> <p>Success Criteria: Delivery of the Upper Stage Assembly, comprised of the components listed above, at WFF along with its associated shipping and design/manufacturing documentation.</p>	<p>Amount: \$20,000,000 Date: June 2011</p>
<p>Milestone 29: Taurus II Maiden Flight Cygnus Mass Simulator Delivered to Wallops Flight Facility (WFF)</p> <p>Orbital shall deliver the Taurus II Maiden Flight Cygnus Mass Simulator at the WFF in preparation for integration with the Taurus II Maiden Flight Launch Vehicle</p> <p>Success Criteria: Delivery of the Cygnus Mass Simulator to WFF along with its associated shipping and design/manufacturing documentation.</p>	<p>Amount: \$10,000,000 Date: June 2011</p>
<p>Milestone 30: Taurus II Maiden Flight Launch Vehicle Stage 1 Assembly Complete</p> <p>Orbital shall complete assembly of the launch vehicle's first stage. The first stage consists of the Stage 1 core tank structure, the stage 1 Main Engine System (MES), the MES heat shield, the aft skirt, the forward skirt, the avionics, the cable harnesses, and the ordnance.</p> <p>Success Criteria: The Taurus II Maiden Flight launch vehicle Stage 1 is declared ready for its next stage of integration into the overall launch vehicle per Orbital standards. Stage test data is complete and documented. Work package data is complete.</p>	<p>Amount: \$10,000,000 Date: July 2011</p>
<p>Milestone 31: Taurus II Maiden Flight</p> <p>Orbital shall launch the Taurus II Maiden Flight from the WFF in accordance to final mission analysis and mission concept review definitions and complete a post flight report . The Taurus II shall be comprised of a full Taurus II Launch Vehicle with spacecraft/payload simulator for the Cygnus Spacecraft.</p> <p>Success Criteria: Complete a post-flight quick-look review within approximately 1 week of the Taurus II Maiden Flight assessing vehicle performance against the flight test objectives. Identify any anomalies with preliminary assessment of cause.</p>	<p>Amount: \$4,000,000 Date: October 2011</p>

Appendix 3 is amended as follows:

“Table 3-4 – MCR Entrance and Success Criteria” is re-titled “Table 3-5 – MCR Entrance and Success Criteria”.

ARTICLE 28. SIGNATURE BLOCK

The terms and conditions of this Space Act Agreement, as modified by this Amendment are hereby incorporated herein.

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

BY: Douglas R Cooke
Douglas R. Cooke
Associate Administrator,
Exploration Systems Mission Directorate

DATE: 3/30/2011

ORBITAL SCIENCES CORPORATION

BY: Antonio L Elias
Dr. Antonio L. Elias
Executive Vice President and General
Manager, Advanced Programs Group

DATE: 29 MARCH 2011

Title: Signing Official Determination of Fairness and Reasonableness

Description of Action: Amendment to the funded Space Act agreement (SAA) with Orbital Sciences Corporation (OSC) to add \$78 million to the agreement. Distribution of funding is dependent upon successful completion of new fixed price technical milestones.

Reason for Action: NASA is interested in providing additional financial support through new incremental fixed price milestones to the funded Space Act agreement with OSC to reduce risks associated with the remaining development and timely demonstration of cargo space transportation capabilities. In this specific amendment, the new milestones lead to an additional test launch of the Orbital Sciences Taurus II launch vehicle prior to the system demonstration mission to the International Space Station and enable additional software and avionics testing. A Taurus II maiden test launch reduces risks associated with the development of a new launch vehicle and increases the chance of success of the system demonstration mission with the Orbital Sciences Cygnus Spacecraft. The additional software and avionics tests reduce overall technical risks associated with the new Cygnus spacecraft prior to launch to the International Space Station.


Authority and Analysis: Pursuant to NPD 1050.11, Authority to Enter Into Space Act Agreements, for Funded Agreements the Signing Official is responsible for determining that the proposed contribution of NASA is fair and reasonable compared to NASA program risks, corresponding benefits to NASA, and the funding and resources to be contributed by the Agreement Partner.

The Manager of the Commercial Crew and Cargo Program has provided me with the following information and analysis for my consideration:

- (1) Draft copy of Amendment 7 to the funded SAA with OSC
- (2) Memo from the JSC Chief Counsel, dated November 17, 2010, titled "Amendment of Commercial Orbital Transportation Services (COTS) Funded Space Act Agreements (SAAs) with Space Exploration Technologies (SpaceX) and Orbital Sciences Corporation (OSC)
- (3) Memo from the JSC Chief Financial Officer, dated March 25, 2011, titled "Augmentation CFO Analysis and Determination"

As the Signing Official for the COTS funded SAAs, I have reviewed this information and analysis to assist me in my determination.

Determination: Based upon my review of the above documents, I determine that NASA's proposed financial contribution to the COTS funded Space Act agreement as described in Amendment 7 to the OSC SAA is fair and reasonable compared to NASA program risks, corresponding benefits to NASA, and the funding and resources to be contributed by the Agreement partners.


Douglas R. Cooke
Signing Official

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NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

BY: Douglas R. Cooke
Douglas R. Cooke
Associate Administrator,
Exploration Systems Mission Directorate

DATE: 3/30/2011

ORBITAL SCIENCES CORPORATION

BY: Antonio L. Elias
Dr. Antonio L. Elias
Executive Vice President and General
Manager, Advanced Programs Group

DATE: 29 MARCH 2011

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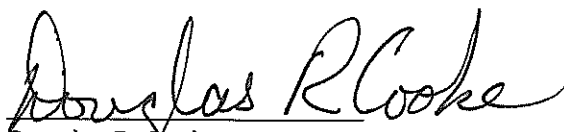
Authority and Analysis: Pursuant to NPD 1050.1I, Authority to Enter Into Space Act Agreements, for Funded Agreements the Signing Official is responsible for determining that the proposed contribution of NASA is fair and reasonable compared to NASA program risks, corresponding benefits to NASA, and the funding and resources to be contributed by the Agreement Partner.

The Manager of the Commercial Crew and Cargo Program has provided me with the following information and analysis for my consideration:

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Determination: Based upon my review of the above documents, I determine that NASA's proposed financial contribution to the COTS funded Space Act agreement as described in Amendment 7 to the OSC SAA is fair and reasonable compared to NASA program risks, corresponding benefits to NASA, and the funding and resources to be contributed by the Agreement partners.


Douglas R. Cooke
Signing Official