#### AGREEMENT

#### BETWEEN

# THE BOEING COMPANY 5000 E. MCDOWELL ROAD MESA, AZ 85215

AND

## THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY 3701 NORTH FAIRFAX DRIVE ARLINGTON, VA 22203-1714

## CONCERNING

#### EDGEWISE MISSION ADAPTIVE ROTOR (MAR) PROGRAM, PHASE I

Agreement No.: HR0011-10-9-0001 ARPA Order No.: Z273/00 Total Amount of the Agreement: \$3,619,506 (b)(4)

(0)(4)

Authority: 10 U.S.C. § 2371 and Section 845, National Defense Authorization Act for Fiscal Year 1994, as amended.

Line of Appropriation:

ACRN AA 9790400 1320 Z273 P9G10 2525 DPAC 9 5474 S12136 62702E

(b)(4)

This Agreement is entered into between the United States of America, hereinafter called the Government, represented by The Defense Advanced Research Projects Agency (DARPA), and The Boeing Company pursuant to and under U.S. Federal law.

FOR THE BOEING COMPANY

# FOR THE UNITED STATES OF AMERICA THE DEFENSE ADVANCED RESEARCH

(b)(6)	
	4/16/10
Christopher L. Glista Agreements Officer	Date

Name/Title

Date

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# ARTICLE I: SCOPE OF THE AGREEMENT

#### A. Background

#### 1. WHAT IS THE AGREEMENT ALL ABOUT?

Recent rotorcraft research and analysis have indicated that significant performance benefits could be achieved by actively morphing the shape or properties of the rotor system. Active rotor technology will enable morphing of the rotor to optimize performance, resulting in rotorcraft with revolutionary advances in mission robustness, and facilitating multi-role capabilities. Further, active rotors with on-blade blade control could enable elimination of the rotor swashplate, potentially with significant improvements in performance, survivability and availability. Numerous component morphing technologies have been demonstrated at the component level that could provide incremental improvements, but these technologies have not been implemented at a system level for revolutionary capability improvements.

The goal of the Mission Adaptive Rotor (MAR) program is to develop and demonstrate the capability to achieve dramatic improvements in helicopter rotor performance, survivability and availability through the use of technologies that enable adaptation of the rotor throughout an expanded operating envelope. The MAR program seeks to 1) develop a robust system design that maximizes military utility by actively reconfiguring to provide best performance during a range of missions or mission segments; 2) mature critical enabling technologies; and 3) validate through simulation, ground test and flight demonstration that rotor adaptation is feasible, practical, of military value, and sufficiently mature for application to the next US DoD rotorcraft development effort. The active alteration of the rotor and its characteristics is envisioned as potentially being conducted in one or more of the following three timescales: between missions to tailor capabilities to the requirements of a specific tasking; during a mission to maximize effectiveness during each flight phase; and/or during each rotor revolution to maximize performance instantaneously.

The objectives of the Edgewise MAR Phase I to be carried out by Boeing are to: (a) develop a MAR technology demonstration rotor system design; (b) develop a technology maturation and demonstration approach; and (c) determine the benefits of mission adaptive rotors. Boeing will utilize the AH-64 Block III Apache as the legacy aircraft on which to demonstrate MAR technologies, with the state-of-the-art Composite Main Rotor Blade (CMRB) chosen as the fixed-geometry baseline rotor. The point-of-departure Objective MAR design is expected to provide 41% payload increase, 36% range increase, more than 50% acoustic detectability reduction, and 90% vibration reduction and will include:



## 2. WHAT IS THE CURRENT TECHNOLOGICAL SITUATION?

Current military conflicts have demonstrated the essential role of the helicopter in achieving U.S. military objectives. Vertical flight has proven indispensable for transporting critical personnel and supplies safely and efficiently, offers basing flexibility critical to unconventional operations and modern combat, enables operations in complex terrain, and provides vital airborne firepower to protect our troops. Although present systems have proven themselves to be workhorses, helicopter operations are currently performance-limited in mountainous terrain and deserts. In addition, general helicopter performance characteristics have not experienced a significant advance since the introduction of the turboshaft engine in the 1950s.

#### 3. WHAT MAKES THIS PROGRAM A "CRITICAL TECHNOLOGY" EFFORT?

Development of the proposed technologies is critical because a Mission Adaptive Rotor would provide the warfighter with transformational rotorcraft capabilities including dramatic improvements in performance, survivability and availability. A next generation rotor would engender new rotorcraft configurations that could perform multiple missions currently conducted by different type models, enable new missions that

rotorcraft cannot currently perform, and provide a significantly wider spectrum of capability than any system currently in development.

#### 4. WHY IS THE CURRENT TECHNOLOGY NOT SUFFICIENT?

Traditional helicopter design requires a compromise in the design features for each flight regime to achieve program requirements in a balanced manner; however, the many constraints preclude a design that meets all metrics equally throughout the mission profile. Besides, numerous component morphing technologies have been demonstrated at the component level that could provide incremental improvements, but these technologies have not been implemented at a system level for revolutionary capability improvements. The Government expects to make investments in key component technologies including, for example, actuators, sensors, controls and materials as well as system architecture and novel rotor geometry adaptation approaches, in order to enable breakthrough capabilities. A MAR technology demonstrator rotor may provide the technical basis for application of adaptive rotors to the next generation of military rotorcraft.

# 5. WHY IS IT NECESSARY FOR THE GOVERNMENT TO DEVELOP THE PROTOTYPE AND WHAT IS ITS POTENTIAL IMPACT ON THE MILITARY?

If successfully developed, a MAR would provide the warfighter with transformational rotorcraft capabilities including dramatic improvements in performance, survivability and availability. This would greatly improve the execution of multiple and diverse military missions that have long been proved to be difficult and dangerous such as transporting critical supplies to and fro war zones over mountainous terrains. A next generation rotor would engender new rotorcraft configurations that could perform multiple military missions and serve commercial purposes currently conducted by different type models, enable new missions that rotorcraft cannot currently perform, and provide a significantly wider spectrum of capability than any system currently in development.

#### 6. WHAT ARE THE ISSUES OF PARTICULAR IMPORTANCE TO THE ISSUING AGENCY?

As opposed to the traditional helicopter designs, the MAR program would allow DARPA to achieve the agency's challenging vision of providing a revolutionary leap in mission performance for future military rotorcraft. The Objective MAR to be developed by Boeing under the Agreement will essentially eliminate the swashplate and upper controls, allowing the introduction of both primary flight control and higher harmonic inputs within the rotating system. This approach will ultimately reduce or even eliminate the helicopter's hydraulic system with its associated maintenance concerns. Without a hydraulic system, both hub drag and overall weight will be reduced; and more adaptive control features can therefore be added to the aircraft control architecture. Should the MAR program succeed, the U.S. military will be able to employ state-of-the-art rotorcrafts with revolutionary advances in mission robustness and facilitating multirole capabilities in combat missions and other military-related missions. The success of the MAR technologies will certainly benefit the commercial sectors by offering advanced and versatile rotorcrafts to serve numerous commercial purposes such as emergency medical transportation, aerial photography, pipeline inspection, etc.

7. IF THE PROGRAM IS SUCCESSFUL, THEN WHAT? WHERE DO WE GO FROM HERE? IF THIS COLLABORATION IS SUCCESSFUL, WHAT WILL WE HAVE ACCOMPLISHED?) If this demonstration and prototyping program is successful, both the Government and industry have collectively presented a revolutionary breakthrough to the aging design of the traditional rotorcraft and transitioned the new MAR design for actual fielding to facilitate warfighters' accomplishment of various military missions.

# B. Definitions

In this Agreement, the following definitions apply:

Agreement:	The body of this Agreement and Attachments $1-5$ , which are expressly incorporated in and made a part of the Agreement.
Contractor:	The Boeing Company, 5000 E. McDowell Road Mesa, AZ 85215, Cage Code 8V613.

Foreign Firm or Institution:	A firm or institution organized or existing under the laws of a country other than the United States, its territories, or possessions. The term includes, for purposes of this Agreement, any agency or instrumentality of a foreign government; and firms, institutions or business organizations which are owned or substantially controlled by foreign governments, firms, institutions, or individuals.	
Government:	The United States of America, as represented by DARPA.	
Invention	Any invention or discovery which is or may be patentable or otherwise protectable under Title 35 of the United States Code.	
Know-How:	All information including, but not limited to discoveries, formulas, materials, inventions, processes, ideas, approaches, concepts, techniques, methods, software, programs, documentation, procedures, firmware, hardware, technical data, specifications, devices, apparatus and machines.	
Made:	Relates to any invention means the conception or first actual reduction to practice of such invention.	
Practical application:	To manufacture, in the case of a composition of product; to practice, in the case of a process or method, or to operate, in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is capable of being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public on reasonable terms.	
Program:	Research and development being conducted by Boeing, as set forth in Article I., paragraph C.	
Property:	Any tangible personal property other than property actually consumed during the execution of work under this agreement.	
Subject invention:	Any invention conceived or first actually reduced to practice in the performance of work under this Agreement.	
Technology:	Discoveries, innovations, Know-How and inventions, whether patentable or not, including computer software, recognized under U.S. law as intellectual creations to which rights of ownership accrue, including, but not limited to, patents, trade secrets, and copyrights developed under this Agreement.	

# C. Scope

1. This Agreement is an "other transaction" pursuant to 10 U.S.C. § 2371 and Section 845, National Defense Authorization Act for Fiscal Year 1994, as amended. The principal purpose of this Agreement is to engage in a research and development program for the development of an integrated approach to develop promising rotorcraft technologies that will enable a Mission Adaptive Rotor (MAR) system that is capable of reconfiguration to optimize the rotor for each mission and mission segment for dramatic improvements in system aerodynamics, operational availability and survivability.

2. The Boeing Company (hereafter "Boeing") shall be responsible for performance of the work set forth in the Task Description Document incorporated in this Agreement as Attachment 1. Boeing shall submit or otherwise provide all documentation required by Attachment 2, Report Requirements.

3. This Agreement can best be described as an accumulation of expenses approach. No G&A, cost of money or fee is authorized under this Agreement.

5. The Government will have continuous involvement with Boeing. The Government will obtain access to Program results and certain rights in data and patents pursuant to Articles VII and VIII. DARPA and Boeing are bound to each other by a duty of good faith in achieving the Program objectives.

# ARTICLE II: TERM

# A. Term of this Agreement

The Program commences upon the date of the last signature hereon and continues for sixteen (16) months. Provisions of this Agreement, which, by their express terms or by necessary implication, apply for periods of time other than specified herein, shall be given effect, notwithstanding this Article.

# B. Termination Provisions

The Government may terminate this Agreement by written notice to the Contractor, provided that such written notice is preceded by consultation between the Parties. The Contractor may request Agreement termination by giving the Government sixty (60) days written notification of their intent to do so. If the Contractor decides to request termination of this Agreement due to loss of funding, the Government may, at its discretion, agree to terminate or decide to fully fund the remaining work. The Government and the Contractor should negotiate in good faith a reasonable and timely adjustment of all outstanding issues between the Parties as a result of termination, which may include non-cancetable commitments. In the event of a termination of the Agreement, the Government shall have paid-up rights in Data as described in Article VIII, Data Rights. Failure of the Parties to agree to an equitable adjustment shall be resolved pursuant to Article VI, Disputes.

## C. Extending the Term

The Parties may extend by mutual written agreement the term of this Agreement if research opportunities within the vision statement set forth in Article I reasonably warrant. Any extension shall be formalized through modification of the Agreement by the Agreements Officer and the Boeing Administrator.

# ARTICLE III: MANAGEMENT OF THE PROJECT

#### A. Management and Program Structure

Boeing shall be responsible for the overall technical and program management of the Program, and technical planning and execution shall remain with Boeing. The DARPA Agreements Officer's Representative (AOR), in consultation with the DARPA Program Manager, shall provide recommendations regarding Program developments and technical collaboration and be responsible for the review and verification of the Payable Milestones.

#### B. Modifications

1. As a result of quarterly meetings, annual reviews, or at any time during the term of the Agreement, research progress or results may indicate that a change in the Task Description Document would be beneficial to program objectives. Recommendations for modifications, including justifications to support any changes to the Task Description Document and prospective Payable Milestones will be documented in a letter and submitted by Boeing to the DARPA AOR with a copy to the DARPA Agreements Officer. This documentation letter will detail the technical, chronological, and financial impact of the proposed modification to the research program. DARPA and Boeing shall approve any Agreement modification. The Government is not obligated to pay for additional or revised future Payable Milestones until the Schedule of Payments and Payable Milestones Exit Criteria (Attachment 3) is formally revised by the DARPA Agreements Officer and made part of this Agreement.

#### (b)(4)

2. The DARPA Agreements Officer's Representative shall be responsible for the review and verification of any recommendations to revise or otherwise modify the Task Description Document, Schedule of Payments or Payable Milestones Exit Criteria, or other proposed changes to the terms and conditions of this Agreement.

3. For minor or administrative Agreement modifications (e.g. changes in the paying office or appropriation data, changes to Government or Boeing personnel identified in the Agreement, etc.), no signature is required by Boeing.

4. The Government will be responsible for effecting all modifications to this Agreement.

## ARTICLE IV: AGREEMENT ADMINISTRATION

Unless otherwise provided in this Agreement, approvals permitted or required to be made by DARPA may be made only by the DARPA Agreements Officer. Administrative and contractual matters under this Agreement shall be referred to the following representatives of the parties:

A. Government Points of Contact:

Christopher L. Glista, Agreements Officer (AO), Contracts Management Office (CMO) DARPA (HR0011) 3701 North Fairfax Drive Arlington, VA 22203-1714 Tel. No.: (571) 218-4405 Email: christopher.glista@darpa.mil

Daniel Newman, Program Manager (PM), Tactical Technology Office (TTO) DARPA (HR0011) 3701 North Fairfax Drive Arlington, VA 22203-1714 Tel. No.: (571) 218-4219 Email: daniel.newman@darpa.mil

Louis Centolanza, Agreements Officer Representative (AOR) Aviation Applied Technology Directorate RDMR-AAF Lee Boulevard, Building 401 Fort Eustis, VA 23604-5577 Tel. No.: (757) 878-4292 Email: louis.centolanza@us.army.mil

DCMA Boeing Mesa (S0304A) MaryJo Russell, Administrative Agreements Officer (AAO) 5000 East McDowell Road Building 510, MS A277 Mesa, AZ 85215-9797 Tel. No.: (480) 891-4645 Email: MaryJo.Russell@dcma.mil

DFAS Columbus Center (HQ0339) DFAS-CO/West Entitlement Operations P.O. Box 182381 Columbus, OH 43218-2381

# B. Contractor Points of Contact

Each party may change its representatives named in this Article by written notification to the other party. The Government will effect the change as stated in Article III, subparagraph C.3. above.

# ARTICLE V: OBLIGATION AND PAYMENT

#### A. Obligation

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

2. If modification becomes necessary in performance of this Agreement, pursuant to Article III, paragraph B, the DARPA Agreements Officer and Boeing Administrator shall execute a revised Schedule of Payments and Payable Milestones Exit Criteria for prospective Payable Milestones consistent with the then current Task Description Document (TDD).

# B. Payments

1. Boeing has, and agrees to maintain, an established accounting system which complies with Generally Accepted Accounting Principles and the requirements of this Agreement. Boeing shall ensure that appropriate arrangements have been made for receiving, distributing and accounting for Federal funds. An acceptable accounting system is one in which all cash receipts and disbursements are controlled and documented properly.

2. Boeing shall document the accomplishments of each Payable Milestone by submitting or otherwise providing the Payable Milestones Report required by Attachment 2, Part D. Upon receiving the AOR's written approval of the Payable Milestone report, Boeing shall submit a cost voucher for the associated milestone via Wide Area Workflow as indicated at paragraph 5, below.

Payment approval for the final Payable Milestone will be made after reconciliation of DARPA funding with actual Boeing contributions.

3. Limitation of Funds: In no case shall the Government's financial liability exceed the amount obligated under this Agreement.

4. Payments will be made by DFAS Columbus Center (Code: HQ0339), DFAS-CO/West Entitlement Operations, P. O. Box 182381, Columbus, OH 43218-2381 within thirty (30) calendar days of an accepted invoice in Wide Area Workflow (WAWF). Wide Area Workflow (WAWF) is a secure web-based system for electronic invoicing, receipt and acceptance. The WAWF application enables electronic form submission of invoices, government inspection, and acceptance documents in order to support DoD's goal of moving to a paperless acquisition process. Authorized DoD users are notified of pending actions by e-mail and are presented with a collection of documents required to process the contracting or financial action. It uses Public Key Infrastructure (PKI) to electronically bind the digital signature to provide non-reputable proof that the user (electronically) signed the document with the contents. Benefits include online access and full spectrum view of document status, minimized re-keying and improving data accuracy, eliminating unmatched disbursements and making all documentation required for payment easily accessible.

Boeing is required to utilize the Wide Area Workflow system when processing invoices and receiving reports under this Agreement. Boeing shall (i) ensure an Electronic Business Point of Contact is designated in Central Contractor Registration at <u>http://www.ccr.gov</u> and (ii) register to use WAWF-RA at the <u>https://wawf.eb.mil</u> site, within ten (10) calendar days after award of this Agreement. Step by Step procedures to register are available at the <u>https://wawf.eb.mil</u> site. Boeing is directed to use the "2-in-1" format when processing invoices.

- a. For the Issue By DoDAAC, enter HR0011
- b. For the Admin DoDAAC: enter S0304A
- c. For the Service Acceptor/Approver fields: S0304A
- d. Leave the Inspect by DoDAAC, Ship From Code DoDAAC and LPO DoDAAC fields blank unless otherwise directed by the Agreements Officer or Administrative Agreements Officer.
- e. The following guidance is provided for invoicing processed under this Agreement through WAWF:
  - The AOR identified at Article IV "Agreement Administration" shall continue to formally inspect and accept the deliverables/payable milestones. To the maximum extent practicable, the AOR shall review the deliverable(s)/payable milestone report(s) and either: 1) provide a written notice of rejection to Boeing which includes feedback regarding deficiencies requiring correction or 2) written notice of acceptance to the Agreements Officer, DARPA PM, and Administrative Agreements Officer (AAO).
  - Acceptance within the WAWF system shall be performed by the cognizant AAO upon receipt of a confirmation email, or other form of transmittal, from the AOR.
  - Boeing shall send an email notice to the AOR upon submission of an invoice in WAWF (this can be done from within WAWF).
  - The AAO will have WAWF forward copies of the processed acceptance to the Agreements Officer at the email address indicated at Article IV (this can be done from within WAWF).
  - Payments shall be made by DFAS Columbus West Entitlement Operations (HQ0339).
  - Boeing agrees, when entering invoices entered in WAWF to utilize the CLINs associated with each payable milestone as delineated at Attachment 3. The description of the CLIN shall include reference to the associated milestone number along with other necessary descriptive information. Boeing agrees that the Government may reject invoices not submitted in accordance with this provision.

Note for DFAS: The Agreement shall be entered into the DFAS system by CLIN – Milestone association as delineated at Attachment 3. The Agreement is to be paid out by CLIN – Milestone association. Payments shall be made using the CLIN (MS)/ACRN association as delineated in Attachment 3.

- 5. Payee Information: As identified at Central Contractor Registration.
  - Cage Code: 8V613
  - DUNS: 832963453
  - TIN: 88-0168332

6. Payments shall be made in the amounts set forth in Attachment 3, provided the DARPA Agreements Officer's Representative has verified the accomplishment of the Payable Milestones. It is recognized that the monthly accounting of current expenditures reported in the "Business Status Report" submitted in accordance with Attachment 2 is not necessarily intended or required to match the Payable Milestones until submission of the Final Report; however, payable milestones shall be revised during the course of the program to reflect current and revised projected expenditures.

7. Financial Records and Reports:

a. Boeing shall maintain adequate records to account for all funding under this Agreement and shall maintain adequate records to account for Boeing funding provided under this Agreement. Upon completion or termination of this Agreement, whichever occurs earlier, the Boeing Administrator shall furnish to the Agreements Officer a copy of the Final Report required by Attachment 2, Part E. Boeing's relevant financial records are subject to examination or audit on behalf of DARPA by the Government for a period not to exceed three (3) years after expiration of the term of this Agreement. The Agreements Officer or designee shall have direct access to sufficient records and information of Boeing, to ensure full accountability for all funding under this Agreement. Such audit, examination, or access shall be performed during business hours on business days upon prior written notice and shall be subject to the security requirements of the audited party.

b. The Comptroller General, at its discretion, 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. Excepted from this requirement is any party to this Agreement or any entity that participates in the performance of the Agreement, or any subordinate element of such party or entity, that has not entered into any other agreement (contract, grant, cooperative agreement, or "other transaction") that provides for audit access by a Government entity in the year prior to the date of the Agreement.

8. Anti-Deficiency Act Compliance: In accordance with 31 U.S.C. §1341 SUBTITLE II, an officer or employee of the United States Government may not make or authorize an expenditure or obligation exceeding an amount available in an appropriation or fund for the expenditure or obligation or involve the Government in a contract or obligation for the payment of money before an appropriation is made, unless authorized by law. To the extent required by this law, the Government's liability to make payments to the Contractor is limited to only to those funds obligated or a modification or extension thereof to the Agreement.

# ARTICLE VI: DISPUTES

# A. General

The Parties shall communicate with one another in good faith and in a timely and cooperative manner when raising issues under this Article.

# B. Dispute Resolution Procedures

1. Any disagreement, claim or dispute between DARPA and Boeing concerning questions of fact or law arising from or in connection with this Agreement, and, whether or not involving an alleged breach of this Agreement, may be raised only under this Article.

2. Whenever disputes, disagreements, or misunderstandings arise, the Parties shall attempt to resolve the issue(s) involved by discussion and mutual agreement as soon as practicable. In no event shall a dispute, disagreement or misunderstanding which arose more than three (3) months prior to the notification made under subparagraph B.3 of this article constitute the basis for relief under this article unless the Director of DARPA in the interests of justice waives this requirement.

3. Failing resolution by mutual agreement, the aggrieved Party shall document the dispute, disagreement, or misunderstanding by notifying the other Party through the DARPA Agreements Officer in writing of the relevant facts, identify unresolved issues, and specify the clarification or remedy sought. Within five (5) working days after providing notice to the other Party, the aggrieved Party may, in writing, request a joint decision by the DARPA Senior Procurement Executive and senior executive no lower than Senior Vice President level appointed by Boeing. The other Party shall submit a written position on the matter(s) in dispute within thirty (30) calendar days after being notified that a decision has been requested. The DARPA Senior Procurement Executive

and the senior executive shall conduct a review of the matter(s) in dispute and render a decision in writing within thirty (30) calendar days of receipt of such written position. Any such joint decision is final and binding.

4. In the absence of a joint decision, upon written request to the Director of DARPA, made within thirty (30) calendar days of the expiration of the time for a decision under subparagraph B.3 above, the dispute shall be further reviewed. The Director of DARPA may elect to conduct this review personally or through a designee or jointly with a senior executive no lower than Senior Vice President level appointed by Boeing. Following the review, the Director of DARPA or designee will resolve the issue(s) and notify the Parties in writing. Such resolution is not subject to further administrative review and, to the extent permitted by law, shall be final and binding.

# C. Limitation of Damages

Claims for damages of any nature whatsoever pursued under this Agreement shall be limited to direct damages only up to the aggregate amount of DARPA funding disbursed as of the time the dispute arises. In no event shall DARPA be liable for claims for consequential, punitive, special and incidental damages, claims for lost profits, or other indirect damages.

# ARTICLE VII: PATENT RIGHTS

# A. Allocation of Principal Rights

Unless Boeing shall have notified DARPA (in accordance with subparagraph B.2 below) that Boeing does not intend to retain title, Boeing shall retain the entire right, title, and interest throughout the world to each subject invention consistent with the provisions of this Article and 35 U.S.C. § 202. With respect to any subject invention in which Boeing retains title, DARPA shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced on behalf of the United States the subject invention throughout the world.

# B. Invention Disclosure, Election of Title, and Filing of Patent Application

1. Boeing shall disclose each subject invention to DARPA within four (4) months after the inventor discloses it in writing to his company personnel responsible for patent matters. The disclosure to DARPA shall be in the form of a written report and shall identify the Agreement under which the invention was made and the identity of the inventor(s). It 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 the physical, chemical, biological, or electrical characteristics of the invention. The disclosure shall also identify any publication, sale, or public use of the invention and whether a manuscript describing the invention has been submitted for publication and, if so, whether it has been accepted for publication at the time of disclosure. Boeing shall also submit to DARPA an annual listing of subject inventions. All required reporting shall be accomplished, to the extent possible, using the i-Edison reporting website: https://s-edison.info.nih.gov/iEdison/. To the extent any such reporting cannot be carried out by use of i-Edison, reports and communications shall be submitted to the Agreements Officer and Administrative Agreements Officer.

2. If Boeing determines that it does not intend to retain title to any such invention, Boeing shall notify DARPA, in writing, within eight (8) months of disclosure to DARPA. However, in any case where publication, sale, or public use has initiated the one (1)-year statutory period wherein valid patent protection can still be obtained in the United States, the period for such notice may be shortened by DARPA to a date that is no more than sixty (60) calendar days prior to the end of the statutory period.

3. Boeing shall file its initial patent application on a subject invention to which it elects to retain title within one (1) year after election of title or, if earlier, prior to the end of the statutory period wherein valid patent protection can be obtained in the United States after a publication, or sale, or public use. Boeing may elect to file patent applications in additional countries (including the European Patent Office and the Patent Cooperation Treaty) within either ten (10) months of the corresponding initial patent application or six (6) months from the date

permission is granted by the Commissioner of Patents and Trademarks to file foreign patent applications, where such filing has been prohibited by a Secrecy Order.

4. Requests for extension of the time for disclosure election, and filing under Article VII, paragraph C, may, at the discretion of DARPA, and after considering the position of Boeing, be granted.

# C. Conditions When the Government May Obtain Title

Upon DARPA's written request, Boeing shall convey title to any subject invention to DARPA under any of the following conditions:

1. If Boeing fails to disclose or elects not to retain title to the subject invention within the times specified in paragraph C of this Article; provided, that DARPA may only request title within sixty (60) calendar days after learning of the failure of Boeing to disclose or elect within the specified times.

2. In those countries in which Boeing fails to file patent applications within the times specified in paragraph C of this Article; provided, that if Boeing has filed a patent application in a country after the times specified in paragraph C of this Article, but prior to its receipt of the written request by DARPA, Boeing shall continue to retain title in that country; or

3. In any country in which Boeing decides not to continue the prosecution of any application for, to pay the maintenance fees on, or defend in reexamination or opposition proceedings on, a patent on a subject invention.

# D. Minimum Rights to Boeing and Protection of Boeing's Right to File

1. Boeing shall retain a nonexclusive, royalty-free license throughout the world in each subject invention to which the Government obtains title, except if Boeing fails to disclose the invention within the times specified in paragraph C of this Article. The Boeing license extends to the domestic (including Canada) subsidiaries and affiliates, if any, within the corporate structure of which Boeing is a party and includes the right to grant licenses of the same scope to the extent that Boeing was legally obligated to do so at the time the Agreement was awarded. The license is transferable only with the approval of DARPA, except when transferred to the successor of that part of the business to which the invention pertains. DARPA approval for license transfer shall not be unreasonably withheld.

2. The Boeing domestic license may be revoked or modified by DARPA to the extent necessary to achieve expeditious practical application of the subject invention pursuant to an application for an exclusive license submitted consistent with appropriate provisions at 37 CFR Part 404. This license shall 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 DARPA to the extent Boeing, its licensees, or the subsidiaries or affiliates have failed to achieve practical application in that foreign country.

3. Before revocation or modification of the license, DARPA shall furnish Boeing a written notice of its intention to revoke or modify the license, and Boeing shall be allowed thirty (30) calendar days (or such other time as may be authorized for good cause shown) after the notice to show cause why the license should not be revoked or modified.

#### E. Action to Protect the Government's Interest

1. Boeing agrees to execute or to have executed and promptly deliver to DARPA all instruments necessary to (i) establish or confirm the rights the Government has throughout the world in those subject inventions to which Boeing elects to retain title, and (ii) convey title to DARPA when requested under paragraph D of this Article and to enable the Government to obtain patent protection throughout the world in that subject invention.

2. Boeing agrees to require, by written agreement, its employees, other than clerical and nontechnical employees, to disclose promptly in writing to personnel identified as responsible for the administration of patent matters and in a format suggested by Boeing each subject invention made under this Agreement in order that Boeing can comply with the disclosure provisions of paragraph C of this Article. Boeing shall instruct employees, through employee agreements or other suitable educational programs, on the importance of reporting inventions in sufficient time to permit the filing of patent applications prior to U. S. or foreign statutory bars.

3. Boeing shall notify DARPA of any decisions not to continue the prosecution of a patent application, pay maintenance fees, or defend in a reexamination or opposition proceedings on a patent, in any country, not less than thirty (30) calendar days before the expiration of the response period required by the relevant patent office.

4. Boeing shall include, within the specification of any United States patent application and any patent issuing thereon covering a subject invention, the following statement: "This invention was made with Government support under Agreement No. HR0011-10-9-0001, awarded by DARPA. The Government has certain rights in the invention."

# F. Lower Tier Agreements

Boeing shall include this Article, suitably modified, to identify the Parties, in all subcontracts or lower tier agreements, regardless of tier, for experimental, developmental, or research work.

# G. Reporting on Utilization of Subject Inventions

1. Boeing agrees to submit, during the term of the Agreement, an annual report on the utilization of a subject invention or on efforts at obtaining such utilization that are being made by Boeing or its licensees or assignees. Such reports shall include information regarding the status of development, date of first commercial sale or use, gross royalties received by Boeing, and such other data and information as the agency may reasonably specify. Boeing also agrees to provide additional reports as may be requested by DARPA in connection with any march-in proceedings undertaken by DARPA in accordance with paragraph I of this Article. Consistent with 35 U.S.C. § 202(c)(5), DARPA agrees it shall not disclose such information to persons outside the Government without permission of Boeing.

2. All required reporting shall be accomplished, to the extent possible, using the i-Edison reporting website: https://s-edison.info.nih.gov/iEdison/. To the extent any such reporting cannot be carried out by use of i-Edison, reports and communications shall be submitted to the Agreements Officer and Administrative Agreements Officer.

# H. Preference for American Industry

Notwithstanding any other provision of this clause, Boeing agrees that it shall not grant to any person the exclusive right to use or sell any subject invention in the United States or Canada unless such person agrees that any product embodying the subject invention or produced through the use of the subject invention shall be manufactured substantially in the United States or Canada. However, in individual cases, the requirements for such an agreement may be waived by DARPA upon a showing by Boeing that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that, under the circumstances, domestic manufacture is not commercially feasible.

# f. March-in Rights

Boeing agrees that, with respect to any subject invention in which it has retained title, DARPA has the right to require Boeing, an assignee, or exclusive licensee of a subject invention to grant a non-exclusive license to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, and if Boeing, assignee, or exclusive licensee refuses such a request, DARPA has the right to grant such a license itself if DARPA determines that:

1. Such action is necessary because Boeing or assignee has not taken effective steps, consistent with the intent of this Agreement, to achieve practical application of the subject invention;

2. Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by Boeing, assignee, or their licensees;

3. Such action is necessary to meet requirements for public use and such requirements are not reasonably satisfied by Boeing, assignee, or licensees; or

4. Such action is necessary because the agreement required by paragraph H. of this Article has not been obtained or waived or because a licensee of the exclusive right to use or sell any subject invention in the United States is in breach of such Agreement.

The exercise of march-in rights will be carried out in accordance with 37 CFR § 401.6 "Exercise of March-in Rights."

# ARTICLE VIII. DATA RIGHTS

A. Definitions. For the purposes of this Agreement, the following terms have the meanings indicated:

1. "Background Data" means Technical Data produced at private expense prior to performance of or outside the scope of this Agreement and that is considered by the Contractor to be proprietary. Such Background Data may include any modifications, derivatives to previously conceived, designed, developed, and resultant revisions to software, processes, qualification data, and manufacturing plans; which are developed at private expense.

2. "Background Software" means any Software developed prior to the performance of this Agreement or outside the scope of work performed under this Agreement and is considered by the Contractor to be proprietary.

3. "Data" means any recorded information, regardless of form or method of recording, which includes but is not limited to, technical data, software, and trade secrets. The term does not include financial, administrative, cost, pricing or management information and does not include subject inventions, included in Article VII.

4. "Government Data" means Data that has been delivered to the Government prior to or outside the terms of this Agreement. The Government's pre-existing rights in that Data govern disclosure and use of such Government Data.

5. "Government Purpose" means any activity in which the United States Government is a party, including cooperative agreements with international or multi-national defense organizations, or sales or transfers by the United States Government to foreign governments or international organizations. Government purposes include competitive procurement, but do not include the rights to use, modify, reproduce, release, perform, display, or disclose Technical Data for commercial purposes or authorize others to do so.

6. "Government Purpose Rights" means the rights to-

a. Use, modify, reproduce, release, perform, display, or disclose technical data within the Government without restriction; and

b. Release or disclose technical data outside the Government and authorize persons to whom release or disclosure has been made to use, modify, reproduce, release, perform, display, or disclose that data for United States government purposes.

7. "Limited rights" means the rights to use, modify, reproduce, release, perform, display, or disclose technical data, in whole or in part, within the Government. The Government may not, without the written permission

of the party asserting limited rights, release or disclose the technical data outside the Government, use the technical data for manufacture, or authorize the technical data to be used by another party, except that the Government may reproduce, release or disclose such data or authorize the use or reproduction of the data by persons outside the Government if reproduction, release, disclosure, or use is -

a. Necessary for emergency repair and overhaul; or

b. A release or disclosure of technical data (other than detailed manufacturing or process data) to, or use of such data by, a foreign government that is in the interest of the Government and is required for evaluational or informational purposes;

data; and

c. Subject to a prohibition on the further reproduction, release, disclosure, or use of the technical

d. The contractor or subcontractor asserting the restriction is notified of such reproduction, release, disclosure, or use.

8. "Practical Application" means to manufacture, in the case of a composition of product; to practice, in the case of a process or method, or to operate, in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is capable of being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public on reasonable terms.

9. "Proprietary Information" means information which embodies trade secrets or which is privileged or confidential technical, business or financial information provided that such information:

a. is not generally known, or is not available from other sources without obligations concerning its confidentiality;

b. has not been made available by the owners to others without obligation concerning its confidentiality;

c. is not described in an issued patent or a published copyrighted work or is not otherwise available to the public without obligation concerning its confidentiality; or

d. can be withheld from disclosure under 15 U.S.C. § 3710a(c)(7)(A) & (B) and the Freedom of Information Act, 5 U.S.C. § 552 et.seq; and

e. is identified as such by labels or markings designating the information as proprietary.

10. "Technical Data" means recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include computer software or data incidental to contract administration, such as financial and/or management information.

11. "Unlimited Rights" means rights to use, modify, reproduce, perform, display, release, or disclose technical data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so.

B. Allocation of Principal Rights

1. The Parties agree that in consideration for Government funding, Boeing intends to reduce to practical application items, components and processes developed under this Agreement.

2. Boeing agrees to retain and maintain in good condition until three (3) years after completion or termination of this Agreement, all Data necessary to achieve practical application. In the event of exercise of the Government's March-in Rights as set forth under Article VII or subparagraph B.3 of this article, Boeing agrees, upon written request from the Government, to deliver at no additional cost to the Government, all Data necessary to

achieve practical application within sixty (60) calendar days from the date of the written request. The Government shall retain Unlimited Rights, as defined in paragraph A above, to this delivered Data.

3. Boeing agrees that, with respect to Data necessary to achieve practical application, DARPA has the right to require Boeing to deliver all such Data to DARPA in accordance with its reasonable directions if DARPA determines that:

a. Such action is necessary because Boeing or assignee has not taken effective steps, consistent with the intent of this Agreement, to achieve practical application of the technology developed during the performance of this Agreement;

b. Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by Boeing, assignee, or their licensees; or

c. Such action is necessary to meet requirements for public use and such requirements are not reasonably satisfied by Boeing, assignee, or licensees.

4. This Agreement shall be performed with Government funding and Contractor's cost share contribution. In consideration of Government funding, the Parties agree as follows:

a. The Government will receive Government Purpose Rights to Data developed or created under this Agreement other than detailed manufacturing and process technical data relating to items, components or processes developed at private expense, in which it receives only Limited Rights. As list of such data is provided in the table below:

(b)(4)

In addition to the assertions listed in the table above, other assertions may be identified after Agreement award when based on new information or inadvertent omissions. Such identification shall be submitted to the Agreements Officer as soon as practical prior to the scheduled date for delivery of the Data, but in no case shall the additional Background Data be included in any data deliverable until the Agreement is bilaterally amended to reflect such addition. There is no requirement for Software deliverables under this Agreement. Certain deliverable reports/documentation may, by necessity, incorporate Background Data. If so, the Contractor shall clearly delineate and mark each section of the report/documentation with appropriate data rights classifications. The use of footnotes, or similar forms of reference, for purposes of such identification is encouraged. Furnishing of "Background Data" by incorporating it into a deliverable report/documentation shall not affect any preexisting Government Rights in such Technical Data.

b. The following reports are administrative/management documentation and not considered technical data. They contain Contractor proprietary information and may be marked "Proprietary": Program Management Plan and Bi-Monthly Business/Financial Status Reports.

c. The Government shall obtain Unlimited Rights in a version of the Final Report that will not contain any proprietary information. An additional version of the Final Report will be delivered with Government Purpose Rights.

d. To the extent that Government Data is used in the performance of this Agreement, the Government shall retain its preexisting rights in such Data.

#### C. Lower Tier Agreements

The Contractor shall include the obligations of the Contractor under this Article, suitably modified to identify the Parties, in all subcontracts or lower-tier agreements, regardless of tier, for experimental, developmental, or research work.

#### D. Marking of Data

1. Pursuant to paragraph B above, technical data delivered under this Agreement with less than Unlimited Rights shall be marked with one of the following legends as appropriate:

#### Government Purpose Rights

Agreement Number:	HR0011-10-9-0001
Contractor Name:	The Boeing Company
Address:	5000 East McDowell Road
	Mesa, AZ 85215-9797

Expiration Date:

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these technical data are restricted as stated in Agreement HR0011-10-9-0001 between the Government and The Boeing Company. No restrictions apply after the expiration date shown above. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings.

#### Limited Rights

Agreement Number:	HR0011-10-9-0001
Contractor Name:	The Boeing Company
Address:	5000 East McDowell Road
	Mesa, AZ 85215-9797

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these technical data are restricted as stated in Agreement HR0011-10-9-0001 between the Government and The Boeing Company. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings. Any person, other than the Government, who has been provided access to such data must promptly notify the above named Contractor.

2. Further, the deliverable proprietary non-technical data (Program Management Plan and Business/Financial Status Report) not subject to Unlimited Rights, Government Purpose Rights or Limited Rights, shall be marked with the proprietary notice customarily used by the Contractor to identify data and information that

is subject to restrictions regarding disclosure and/or use. The proprietary notice shall however, also include notation of this Agreement Number "HR0011-10-9-0001".

3. Except for Technical Data or Administrative/Management Reports delivered under this Agreement, the parties agree that-the Contractor will appropriately advise the Government regarding any limitation or restriction to Technical Data or Computer Software to which the Government may have access. Limitations and restrictions will be subject to the appropriate Contractor or third party markings and legends including a copyright notice to assure proper handling and shall bear notation to this Agreement Number "HR0011-10-9-0001".

E. Disclosure to Government Support Contractors

The Parties understand and agree that Government support contractors will be collaborating during this effort. These contractors will be reviewing the results of the design activities, analyzing performance and capability claims, and providing general support to Government officials associated with any programmatic efforts associated with further development. The Contractor authorizes the Government to disclose Limited Rights Technical Data and Proprietary non-Technical Data to Government support contractors provided that prior to release or disclosure the Government confirms that such support contractors have entered into a non-disclosure agreement with the Government.

# ARTICLE IX: FOREIGN ACCESS TO TECHNOLOGY

This Article shall remain in effect during the term of the Agreement and for three (3) years thereafter.

# A. General

The Parties agree that research findings and technology developments arising under this Agreement may constitute a significant enhancement to the national defense, and to the economic vitality of the United States. Accordingly, access to important technology developments under this Agreement by Foreign Firms or Institutions must be carefully controlled. The controls contemplated in this Article are in addition to, and are not intended to change or supersede, the provisions of the International Traffic in Arms Regulation (22 CFR pt. 121 et seq.), the DoD Industrial Security Regulation (DoD 5220.22-R) and the Department of Commerce Export Regulation (15 CFR pt. 770 et seq.)

#### B. Restrictions on Sale or Transfer of Technology to Foreign Firms or Institutions

1. In order to promote the national security interests of the United States and to effectuate the policies that underlie the regulations cited above, the procedures stated in subparagraphs B.2, B.3, and B.4 below shall apply to any transfer of Technology. For purposes of this paragraph, a transfer includes a sale of the company, and sales or licensing of Technology. Transfers do not include:

- a. sales of products or components, or
- b. licenses of software or documentation related to sales of products or components, or
- c. transfer to foreign subsidiaries of Boeing for purposes related to this Agreement, or

d. transfer which provides access to Technology to a Foreign Firm or Institution which is an approved source of supply or source for the conduct of research under this Agreement provided that such transfer shall be limited to that necessary to allow the firm or institution to perform its approved role under this Agreement.

2. Boeing shall provide timely notice to DARPA for up to three (3) years after compleiton of this Agreement of any proposed transfers from Boeing of Technology developed under this Agreement to Foreign Firms or Institutions. If DARPA determines that the transfer may have adverse consequences to the national security interests of the United States, Boeing, its vendors, and DARPA shall jointly endeavor to find alternatives to the proposed transfer which obviate or mitigate potential adverse consequences of the transfer but which provide substantially equivalent benefits to Boeing.

3. In any event, Boeing shall provide written notice to the DARPA Agreements Officer's Representative and Agreements Officer of any proposed transfer to a foreign firm or institution at least sixty (60) calendar days prior to the proposed date of transfer. Such notice shall cite this Article and shall state specifically what is to be transferred and the general terms of the transfer. Within thirty (30) calendar days of receipt of Boeing's written notification, the DARPA Agreements Officer shall advise Boeing whether it consents to the proposed transfer. In cases where DARPA does not concur or sixty (60) calendar days after receipt and DARPA provides no decision, Boeing may utilize the procedures under Article VI, Disputes. No transfer shall take place until a decision is rendered.

4. In the event a transfer of Technology to Foreign Firms or Institutions which is NOT approved by DARPA takes place, Boeing shall (a) refund to DARPA funds paid for the development of the Technology and (b) the Government shall have a non-exclusive, nontransferable, irrevocable, paid-up license to practice or have practiced on behalf of the United States the Technology throughout the world for Government and any and all other purposes, particularly to effectuate the intent of this Agreement. Upon request of the Government Boeing shall provide written confirmation of such licenses.

## C. Lower Tier Agreements

Boeing shall include this Article, suitably modified, to identify the Parties, in all subcontracts or lower tier agreements, regardless of tier, for experimental, developmental, or research work.

# ARTICLE X: EXPORT CONTROL

1. The Contractor agrees to comply at all times with all U.S. export control laws and regulations, including, but not limited to, 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 or exceptions, the Contractor shall be responsible for obtaining all appropriate licenses or other approvals, including those required for exports, including deemed exports, of hardware, technical data, software, and technical assistance.

2. The Contractor agrees to obtain all necessary export licenses before utilizing any foreign persons in the performance of this Agreement, including in those instances, if any, where the work is to be performed on-site at any Government installation.

3. The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of export licenses and license exemptions or exceptions.

4. The Contractor agrees to take all necessary steps to ensure that its subcontractors comply with all applicable provisions of U.S. export control laws.

# ARTICLE XI: GOVERNMENT FURNISHED EQUIPMENT, PROPERTY, INFORMATION, FACILITIES, AND SERVICES

The Government does not anticipate the need for any Government Furnished Equipment, Property, Information, Pacilities and Services in the performance of this Agreement.

Boeing does not require or request use of any GFE, GFP, GFI, GFF, and GFS.

# ARTICLE XII: TITLE TO AND DISPOSITION OF PROPERTY

#### A. Title to Property

Title to each item of property acquired under this Agreement with an acquisition value of \$5,000 or less shall vest in Boeing upon acquisition with no further obligation of the Parties unless otherwise determined by the Agreements

Officer. Should any item of property with an acquisition value greater than \$5,000 be required, Boeing shall, in advance of making such purchases, identify the item(s) in the preceding Monthly Report. Additionally, Boeing shall provide a full accounting of such items as part of the Final Report. Title to this property shall also vest in Boeing upon acquisition. Boeing shall be responsible for the maintenance, repair, protection, and preservation of all property at its own expense.

## B. Disposition of Property

At the completion of the term of this Agreement, items of property set forth in this Agreement or any other items of property with an acquisition value greater than \$5,000 shall be disposed of in the following manner:

1. Purchased by Boeing at an agreed-upon price, the price to represent fair market value, with the proceeds of the sale being returned to DARPA; or

2. Transferred to a Government research facility with title and ownership being transferred to the Government; or

- 3. Donated to a mutually agreed University or technical learning center for research purposes; or
- 4. Any other DARPA-approved disposition procedure.

# ARTICLE XIII: CIVIL RIGHTS ACT

This Agreement is subject to the compliance requirements of Title VI of the Civil Rights Act of 1964 as amended (42 U.S.C. 2000-d) relating to nondiscrimination in Federally assisted programs. Boeing has signed an Assurance of Compliance with the nondiscriminatory provisions of the Act.

# ARTICLE XIV: SECURITY

The Government anticipates the need for Boeing to develop and/or handle classified information in the performance of this Agreement. A DD Form 254 is incorporated into this Agreement as Attachment 4.

# ARTICLE XV: SUBCONTRACTORS

Boeing shall make every effort to satisfy the intent of competitive bidding of sub-agreements to the maximum extent practical. Boeing may use foreign entities or nationals as subcontractors, subject to compliance with the requirements of this Agreement and to the extent otherwise permitted by law.

# ARTICLE XVI: PUBLIC RELEASE OR DISSEMINATION OF INFORMATION

There shall be no dissemination or publication, except within and between Boeing and any subcontractors, of information developed under this Agreement or contained in the reports to be furnished pursuant to this Agreement without prior written approval of the AOR. All technical reports will be given proper review by appropriate authority to determine which Distribution Statement is to be applied prior to the initial distribution of these reports by the Contractor. Unclassified patent related documents are exempt from prepublication controls and this review requirement. Papers resulting from unclassified fundamental research are exempt from prepublication controls and this review requirement, pursuant to DoD Instruction 5230.27 dated October 6, 1987.

Boeing shall submit all proposed public releases for review and approval as instructed at http://www.darpa.mil/prc/. Public releases include press releases, specific publicity or advertisement, and publication or presentation, but exclude those relating to the open sourcing or licensing, sales or other commercial exploitation of products, services or technologies. In addition, articles for publication or presentation will contain a statement on the title page worded substantially as follows: "This research was, in part, funded by the U.S. Government. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the U.S. Government."

# ARTICLE XVII: KEY PERSONNEL

Boeing shall notify the Agreements Officer in writing prior to making any change in key personnel. The following individuals are designated as key personnel for the purposes of this Agreement:



When replacing any of the personnel identified above, Boeing must demonstrate that the qualifications of the prospective personnel are acceptable to the Government as reasonably determined by the Program Manager. Substitution of key personnel shall be documented by modification to the Agreement made in accordance with the procedures outlined in Article III, paragraph C.

# ARTICLE XVIII: ORDER OF PRECEDENCE

In the event of any inconsistency between the terms of this Agreement and language set forth in the Attachments, the inconsistency shall be resolved by giving precedence in the following order: (1) The Agreement, and (2) all Attachments to the Agreement.

# ARTICLE XIX: EXECUTION

This Agreement constitutes the entire agreement of the Parties and supersedes all prior and contemporaneous agreements, understandings, negotiations and discussions among the Parties, whether oral or written, with respect to the subject matter hereof. This Agreement may be revised only by written consent of Boeing and the DARPA Agreements Officer. This Agreement, or modifications thereto, may be executed in counterparts each of which shall be deemed as original, but all of which taken together shall constitute one and the same instrument.

#### ARTICLE XX: APPLICABLE LAW

United States federal law will apply to the construction, interpretation, and resolution of any disputes arising out of or in connection with this Agreement.

#### ARTICLE XXI: SEVERABILITY

Invalidity or unenforceability of one or more provisions of this Agreement shall not affect any other provision of this Agreement.

# Edgewise Mission Adaptive Rotor System (MAR) Development and Demonstration Phase I - Development

#### 0.1 Introduction

The Edgewise Mission Adaptive Rotor (MAR) System Development and Demonstration Program is made up of three (3) phases: Phase I – System Concept Definition, Phase II - Risk Reduction and System Development, and Phase III - System Demonstration. For the purpose of the Agreement, the Boeing Company ("Boeing" or "Contractor") shall perform Phase I of the MAR program. Boeing shall develop a Demonstration MAR System design and a technology maturation and demonstration approach, and determine the benefits of mission adaptive rotors.

## 0.2 Scope

The scope of this Task Description Document (TDD) is Phase I – System Concept Definition. Phase I shall develop candidate technologies on edgewise rotors to maximize achievement of the DARPA MAR Program Metrics in an advanced adaptive rotor; synthesize an Objective MAR System, analytically predict the benefits achievable; and define a Demonstration MAR program of technology risk reduction demonstrations and analyses that shall increase the maturity and substantiate the performance benefits.

This TDD is structured to include: specific TDD tasks, deliverables, Boeing's approach to accomplishing the specific TDD task, and the Boeing MAR team member responsible for task execution, exit criteria, and definition of all deliverables. The scope of this TDD is limited to the specific TDD task, deliverables, and exit criteria. Boeing's "Approach" is provided for information purposes and is not intended to be a part of "contract scope."

# 0.3 Approach

Boeing shall use the Apache rotorcraft as its fielded/legacy system for this program. Boeing has chosen its latest Composite Main Rotor Blade (CMRB) rotor developed for Apache Block III as its state-of-the-art Fixed-Geometry Demonstration Rotor. This new rotor has been flight tested in late 2008 on an Apache platform. Boeing has also chosen the Army Mission – Recon/Attack (provided in BAA-09-33) to develop a conceptual new-design rotorcraft. This new-design rotorcraft shall use CMRB fixed geometry technology. This shall result in a larger rotor (a scaledup version of CMRB) and shall be termed as the Fixed Geometry Objective Rotor in this program. The Objective MAR System shall have selected MAR technologies incorporated into it; and, along with the new-design rotorcraft, shall exceed the payload and range requirements of the Army Recon/Attack mission. The Demonstration MAR System shall have the same diameter as the CMRB rotor but with a subset of selected Objective MAR technologies integrated into it to enhance the performance and reduce vibration and noise. It shall also be designed to be flown on the Apache platform which is currently being upgraded in the Apache Block III program with new engines and transmission. A tailored Attack/Recon mission shall be used to estimate the benefits of the Demonstration MAR System relative to the CMRB rotor system.

The Phase I to Phase II Program Metrics and Objectives to be addressed with this TDD are as follows:

- Compared to a rotorcraft with a fixed-geometry (non-adaptive) rotor with current state-of-the-art rotor technologies (i.e. previously flight-tested) as a baseline, the rotorcraft with the Objective MAR shall have the following performance improvements, when designed to Army Recon/Attack mission with no, or nominal, penalties in other areas:
  - o 30% increase in useful payload fraction
  - o 40% increase in range performance
  - o 50% reduction in rotor acoustic detection range, at a minimum during the low-noise mission segments
  - 90% reduction, due to active systems, of rotor-induced vibration in all axes except about the rotor shaft (Mz) – for the low-vibration mission segments and no increase in vibrations over the baseline fixedgeometry rotor in other mission segments

MAR benefits on the Apache system for the tailored Army Attack/Recon meet the above program objectives.

Boeing identified additional metrics for evaluation during Phase I – maneuverability, agility, speed, signature, ballistic tolerance, and affordability.

The point-of-departure Objective MAR System design includes the following active technologies:

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Variable rotor speed for noise reduction.

The point-of-departure for the Demonstration MAR System design includes the following active technologies:

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•	Variable rotor speed (wind tunnel testing only)

# 1.0 Edgewise Mission Adaptive Rotor (MAR) System Development

The Contractor shall identify adaptive technologies, concepts and approaches; assess the feasibility of each in an advanced adaptive rotor; synthesize an Objective MAR System, analytically predict the benefits achievable; and define a Demonstration MAR program of technology reduction demonstrations and analyses to increase the maturity and substantiate the performance benefits. The Boeing Company is the primary organization for execution of the majority of the tasks. For those tasks where a subcontractor/team member has primary responsibility, they are identified by name in "Approach."

## 1.1 MAR Conceptual Design and Refinement

The Contractor shall develop conceptual designs for the Demonstration and Objective MAR Systems through evaluation of selected innovative active rotor technologies and conduct of technology and design integration studies using state-of-the-art computational tools and in-house design integration expertise to select the most beneficial and feasible MAR technologies for these rotor systems.

Approach: The Contractor in-house computational tools and design integration experience shall be used in conducting the technology and design integration trades. The Contractor in-house high-fidelity computational tools and subcontractor teams' HQP tools shall be used in conducting performance analyses and consequent system level benefits for the selected mission. For the Demonstration MAR System, systems level requirements and functions shall also be defined.

#### 1.1.1 MAR Technology Evaluations

The Contractor shall evaluate point-of-departure design MAR technologies as well as additional active technologies using a combination of available test data, and application of computational rotor analysis methods to establish the benefits and compatibility with each other in an integrated MAR system.

#### 1.1.1.1 Candidate Technology Capabilities Analysis

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Deliverable: Results of MAR Candidate Technology Evaluations shall be addressed in the Monthly Technical Report and presented at the IDR1.

Exit Criteria: IDR1 completion

#### 1.1.1.2 Technologies Downselect

Based on evaluations conducted in 1.1.1.1, the Contractor shall finalize a high lift concept and other active rotor technologies to be integrated into the Demonstration MAR System for further trade studies. For the Objective MAR System, additional MAR technologies shall also be investigated.

Deliverable: MAR technologies to be used in the conceptual and system design of Demonstration and Objective MAR Systems shall be presented at JDR1.

Approach: In the technology downselection for the Demonstration MAR System, such Apache platform system constraints as rotor size, engine and drive system capabilities shall be considered. For the Objective MAR System no such constraints shall be present.

#### Exit Criteria: IDR1 completion

#### 1.1.2 Demonstration MAR System Design

The Contractor shall develop the Demonstration MAR System design through technology and design integration trades involving all the rotor subsystems such as the blade, the hub and the rotor flight control system as well as other relevant platform subsystems such as the drive system.

Approach: Boeing shall use comprehensive tools with appropriate modeling of MAR concepts and multidisciplinary optimization (MDO) tools to perform technology integration trades to maximize the benefits of MAR technologies. Boeing, with support from subcontractors (Georgía Tech, University of Maryland, and selected technology providers from WBS 1.1.1) shall conduct performance analyses using high-fidelity computational tools (Helicopter Quieting Program tools) to establish the benefits of this Demonstration MAR System. The Contractor also plans to establish the impact of MAR technologies on other performance attributes such as maneuverability, agility and maximum forward speed, availability attributes such as reliability, maintainability, durability and serviceability, survivability and safety attributes, and affordability attributes such as life cycle costs. System level requirements which include performance and functional requirements for all the subsystems shall also be developed using Boeing's systems engineering processes.

#### 1.1.2.1 Fielded Rotorcraft Constraints Identification

The Contractor shall identify and define the fielded rotorcraft constraints to be used in the design of the Demonstration MAR System

Approach: Boeing has selected the Apache Block III system as its fielded rotorcraft as well as the flight test asset for the Demonstration MAR System. Apache Block III is in the Systems Development and Demonstration (SDD) phase and is expected to be in production within three years. Boeing shall identify all the system constraints associated with this Block III aircraft, such as rotor size, engine and drive system, and flight control architecture in the development of the Demonstration MAR System.

Exit Criteria: Kick-Off Meeting completion

#### 1.1.2.2 Technology and Design Integration Trades

The Contractor shall perform technology and design integration trade studies of the selected MAR technologies (from 1.1.1) constrained by the Demonstration MAR platform system.

**Deliverable:** Technology and design integration trades shall be presented at IDR1 and IDR2; with the selected MAR configuration presented at CoDR

Approach: To perform these trades, Boeing shall use a combination of comprehensive analysis tools and in-house design integration expertise gained in the development of successful active rotor systems, such as SMART rotor.

Exit Criteria: CoDR completion

#### 1.1.2.2.1 Blade Integration Studies

The Contractor shall perform technology and design integration studies for the MAR system rotor blade.

Deliverable: Results addressed in the Monthly Technical Reports

Approach: Multiple active rotor technologies (b)(4)

are being considered for integration into the Demonstration MAR blade. The design parameters for these technologies are many, the design parameter space is large, and the flow phenomena are complex. Therefore, Boeing and our teammate Georgia Tech shall use formal, automated and efficient design MDO methods in the blade integration studies to establish the design parameters of all selected active rotor technologies. A mix of 2-D CFD models, comprehensive analyses (RCAS or CAMRAD II), and where appropriate, higher order CFD models shall be used in these studies. The blade design optimization procedures employed at Boeing and at Georgia Tech involve the use of design of experiments, surrogate models and Monte Carlo simulations.

#### 1.1.2.2.2 Rotor Hub and Controls Integration Studies

The Contractor shall perform hub and controls integration studies to enable incorporation of the selected technologies into the Demonstration MAR.

Approach: Some of the selected MAR technologies shall require hub-mounted actuation systems and sensors and may require minor modification of the baseline CMRB rotor hub to accommodate them. Similarly some of the actuation systems may require minor changes to the control system architecture. The data/power transfer requirements and their impact on hub and controls shall also be evaluated.

#### 1.1.2.2.3 Drive System Integration Studies

The Contractor shall perform the required studies to integrate the constraints imposed by the Apache Block III drive system on the Demonstration MAR System.

Approach: One of the MAR technologies being considered for the Demonstration MAR System is the variable rotor speed for noise reduction in the low speed loiter segment of the tailored Army Recon/Attack mission. The constraints of Apache Block III engine/transmission on the variable rotor speed operation shall be established.

#### 1.1.2.3 System Level Design Development

The Contractor shall refine the conceptual design of the Demonstration MAR System and develop the 3-D Computer Aided Design (CAD) layouts of all the active rotor technology components, develop block diagrams and

schematics, generate weight estimates, develop required software architecture, and perform risk assessment and mitigation activities. (WBS 1.1.2.3.1 through 1.1.2.3.6)

Deliverable: MAR System-Level design development progress shall be presented at IDR1, IDR2, CoDR; with the final system level design presented at the SRR

Approach: The development of the MAR conceptual design is based on applying the in-house systems engineering process to evolve the mission, aircraft and sustainment requirements to architect a system concept. This system concept shall be integrated with the maturating technologies to develop the overall design concept. One of the difficulties in identifying the preferred system configuration/architecture in the early program phases, is that each of the potential MAR technologies are of relatively low TRL manurity; as such it is difficult to identify meaningful system characteristics (e.g., cost, reliability, maintainability, availability, LCC, power, etc.). Therefore, during the Phase I effort, a parametric worth/value analysis shall be performed. The worth/value analysis is an adaptation of a OFD technique that relates the potential configuration/architectures against customer expectations and priorities. After the work/value analysis has identified the configuration/architecture, a peer review shall be conducted to develop additional confidence in the results. With the baseline configuration/architecture defined, initial mechanical 2-D/3-D layouts shall begin. Through out the Phase I effort, the worth/value analysis shall be updated periodically to insure the baseline approach remains the preferred solution. Eventually, the maturity of the technology shall allow for a formal trade study to be conducted verifying the worth/value analysis. In addition, Boeing plans to use its in-house design integration experience in the development of fullscale and model-scale active rotor systems in this design phase. Also the results of the component MAR technology maturation activities that are being performed (under WBS 1.2.2 and 1.2.3) shall be fed into this design phase to develop a higher fidelity system design.

#### Exit Criteria: SRR completion

# 1.1.2.4 Performance Analysis

The Contractor shall conduct performance analysis of the Demonstration MAR System to establish performance characteristics and evaluate the impact on other performance attributes, availability, survivability/safety, and affordability.

Deliverable: Results of MAR Performance Improvements Analyses presented at CoDR and SRR.

Approach: In the early stages of the program, where the fidelity of the MAR concept design is low, comprehensive analysis tools such as RCAS, CAMRAD II and UMARC shall be used to establish the performance characteristics. 2-D airfoil data required for the MAR technologies (b)(4) shall be generated for use in the comprehensive codes. However, as the conceptual design matures, high-fidelity CFD/CSD HQP tools developed at Georgia Tech and University of Maryland along with in-house Boeing codes shall be used to establish the performance, vibration and noise characteristics. The effort shall be shared among Boeing and its two university teams to complete all the complex grid generation and flow solution efforts required on schedule. In addition to the four main performance attributes, Boeing shall use its in-house analysis codes to estimate the impact of MAR concepts on other performance attributes such as maneuverability, agility, and maximum forward speed in level flight. Boeing shall also use a combination of its in-house expertise and parametric models based on field experience to estimate the qualitative impacts of MAR concepts on such attributes as availability, survivability and affordability.

#### Exit Criteria: SRR completion

#### 1.1.2.4.1 Performance Improvements Analysis

The Contractor shall conduct performance analysis of the Demonstration MAR System to establish the following performance characteristics:

- Forward Flight Performance(WBS 1.1.2.4.1.1)
- Hover Performance (WBS (1.1.2.4.1.2))

- External Noise (WBS 1.1.2.4.1.3)
- Vibration (WBS 1.1.2.4.1.4)

#### 1.1.2.4.2 Impact on Other Performance Attributes

The Contractor shall evaluate the impact of Demonstration MAR technologies on the rotor's other performance attributes which include maneuverability, agility, and maximum forward speed in level flight.

#### 1.1.2.4.3 Availability Impact

The Contractor shall evaluate the impact of the Demonstration MAR technologies on rotorcraft availability which includes data/power transfer, durability, maintainability, reliability, and serviceability.

#### 1.1.2.4.4 Survivability/Safety Impact

The Contractor shall evaluate the impact of the Demonstration MAR technologies on survivability and safety attributes which include other signatures and ballistic tolerance.

#### 1.1.2.4.5 Affordability Impacts

The Contractor shall evaluate the impact of the Demonstration MAR technologies on affordability as exemplified by life cycle costs.

#### 1.1.2.5 System Level Requirements and Functions

The Contractor shall define the systems level requirements and functions for the Demonstration MAR; to include the performance and functional requirements for the component MAR system technologies (WBS 1.1.2.5.1, 1.1.2.5.2), and total system requirement specification (WBS 1.1.2.5.3).

Deliverables: Demonstration MAR System Level Requirements and Functions, MAR System Requirement Specification (Contractor format)

Approach: The MAR requirements analysis activity implements a recursive system engineering approach in which system requirements, mission analysis and technology capabilities are worked concurrently to ensure an executable technical approach is developed. During the Phase I effort there are three primary sources of system requirements 1) existing Apache rotor, environmental, and electromagnetic environmental effects requirements shall be captured as part of a baseline requirements set; 2) the Army Recon/Attack design reference mission shall be analyzed to identify operational requirements; and 3) system level performance analysis of MAR technologies. These requirements shall be analyzed using an Object Oriented Systems Engineering techniques (Behavioral Analysis and Structured Analysis) to develop the MAR System Requirements Baseline and System Architecture.

Exit Criteria: SRR completion

#### 1.1.3 Fixed-Geometry Demonstration Rotor Baseline

The Contractor shall establish the Fixed-Geometry Demonstration Rotor (CMRB) performance and other characteristics described below to help estimate the system level benefits of the Demonstration MAR. (WBS 1.3)

# 1.1.3.1. Model Data

The Contractor shall prepare model data for the baseline Fixed-Geometry Demonstration Rotor (CMRB).

Deliverables: Fixed-Geometry Demonstration Rotor (CMRB) model data will gbe provided in 90 days after the contract award (prior to IDR1).

Approach: Boeing shall prepare the CMRB data package and provide to the two university subcontractors for use in their CFD/CSD analyses to establish the baseline performance characteristics.

## 1.1.3.2 Performance Characteristics

The Contractor shall conduct performance analyses using CFD/CSD HQP tools. Other performance characteristics and availability, survivability, safety and affordability characteristics shall also be established to help estimate the impact of MAR technologies on the Fixed-Geometry Demonstration Rotor.

Deliverable: Fixed-Geometry Demonstration Rotor performance analysis shall be presented at IDR1.

**Approach:** Both Georgia Tech and University of Maryland shall perform these analyses and correlate with Boeing test data to help build confidence in the performance analyses that are conducted for MAR systems (WBS 1.1.2.4 and 1.1.4.4). Boeing, in concert with the university teams, shall use highfidelity CFD/CSD HQP tools along with in-house Boeing codes to establish the performance, vibration and noise characteristics. In addition to the four main performance attributes, Boeing shall use its in-house analysis codes to estimate other performance attributes as maneuverability, agility, and maximum forward speed in level flight. Boeing shall also use its in-house database and parametric models based on field experience to establish availability, survivability and affordability characteristics of the Fixed-Geometry Demonstration Rotor

# Exit Criteria: IDR1 completion

# 1.1.3.2.1 Performance Analysis

The Contractor shall conduct performance analysis of the Fixed-Geometry Demonstration Rotor to establish the following performance characteristics:

- Forward Flight Performance (WBS 1.1.3.2.1.1)
- Hover Performance (WBS 1.1.3.2.1.2)
- External Noise (WBS 1.1.3.2.1.3)
- Vibration (WBS 1.1.3.2.1.4)

# 1.1.3.2.2 Other Performance Characteristics

The Contractor shall establish other Fixed-Geometry Demonstration Rotor performance characteristics which include maneuverability, agility, and maximum forward speed in level flight.

#### 1.1.3.2.3 Availability Characteristics

The Contractor shall establish Fixed-Geometry Demonstration Rotor availability characteristics, data/power transfer, durability, maintainability, reliability, and serviceability.

#### 1.1.3.2.4 Survivability/Safety Characteristics

The Contractor shall establish survivability and safety attributes of the Fixed-Geometry Demonstration Rotor to include other signatures and ballistic tolerance.

# 1.1.3.2.5 Affordability Characteristics

The Contractor shall establish the affordability of the Fixed-Geometry Demonstration Rotor as exemplified by life cycle costs.

#### 1.1.4 Objective MAR System Design

The Contractor shall develop the Objective MAR System design for a new rotorcraft through technology and design integration trades involving all the rotor subsystems such as the blade, the hub, and the rotor flight control system; as well as other relevant platform subsystems, such as the drive system.

# 1.1.4.1 New-Design Rotorcraft Refinement

The Contractor shall refine the New-Design Rotorcraft presented in the proposal.

Deliverable: The refined New-Design Rotorcraft characteristics shall be presented at the IDR1.

**Approach:** More accurate rotor performance maps and empty weight estimates shall be generated for the CMRB technology rotor and used to update/refine the new-design rotorcraft using the Boeing sizing code HESCOMP.

# Exit Criteria: IDR1 completion

# 1.1.4.2 Technology and Design Integration Trades

The Contractor shall perform technology and design integration trade studies of the selected MAR technologies (from 1.1.1) to meet Phase I program objectives.

Deliverable: The selected MAR configuration shall be presented at CoDR and SRR.

Approach: Boeing shall use a combination of comprehensive analysis tools and in-house design integration expertise used in the development of successful active rotor systems, such as SMART rotor.

#### Exit Criteria: SRR completion

# 1.1.4.2.1 Blade Integration Studies

The Contractor shall conduct technology and design integration studies for the Objective MAR blade.

#### 1.1.4.2.2 Rotor Hub and Controls Integration Studies

The Contractor shall perform Objective MAR hub and controls integration studies to enable incorporation of selected MAR technologies on the New-Design Rotorcraft.

#### 1.1.4.2.3 Drive System Integration Studies

The Contractor shall perform Objective MAR drive system integration studies to enable incorporation on the New-Design Rotorcraft.

# 1.1.4.3 System Level Design Development

The Contractor shall develop the 3-D Computer Aided Design (CAD) layouts of all the active rotor technology components, and generate weight estimates (WBS 1.1.4.3.1, 1.1.4.3.2, 1.1.4.3.3)

Deliverable: Objective MAR System level design development shall be presented at the CoDR and SRR.

Approach: Boeing plans to use its in-house design integration experience in the development of full-scale and model-scale active rotor systems in this design effort. Also the results of the component MAR technology maturation activities that are being performed (under WBS 1.2.2 and 1.2.3) shall be fed into this design effort to develop a higher fidelity system design.

Exit Criteria: SRR completion

#### 1.1.4.4 Performance Analysis

The Contractor shall conduct performance analysis of the Objective MAR System to establish performance, vibration and noise characteristics and evaluate its impact on other performance attributes, availability, survivability/safety, and affordability.

Deliverable: Performance Analysis with MAR Technologies shall be presented at CoDR and finalized at SRR.

Approach: In the early stages of the program, where the fidelity of the MAR concept design is low, comprehensive analysis tools such as RCAS, CAMRAD JJ and UMARC shall be used to establish the performance characteristics. 2-D airfoil data required for the MAR technologies (b)(4) shall be generated for use in the comprehensive codes. However, as the conceptual design matures, high-fidelity CFD/CSD HQP tools developed at Georgia Tech and University of Maryland along with in-house Boeing codes shall be used to establish the performance, vibration and noise characteristics. The effort shall be shared among Boeing and its two university teams to complete all the complex grid generation and flow solution efforts required on schedule. In addition to the four main performance attributes, Boeing shall use its in-house analysis codes to estimate the impact of MAR concepts on other performance attributes such as maneuverability, agility, and maximum forward speed in level flight. Boeing shall also use a combination of its in-house expertise and parametric models based on field experience to estimate the qualitative impacts of MAR concepts on such attributes as availability, survivability and affordability.

# Exit Criteria: SRR completion

# 1.1.4.4.1 Performance Improvement Analysis

The Contractor shall conduct performance analysis of the Objective MAR System to establish the following performance characteristics:

- Forward Flight Performance (WBS 1.1.4.4.1.1)
- Hover Performance WBS 1.1.4.4.1.2)
- External Noise (WBS 1.1.4.4.1.3)
- Vibration (WBS 1.1.4.4.1.4)

#### 1.1.4.4.2 Impact on Other Performance Attributes

The Contractor shall evaluate the impact of Objective MAR technologies on the rotor's other performance attributes which include maneuverability, agility, and maximum flight forward speed in level flight.

#### 1.1.4.4.3 Availability Impacts

The Contractor shall evaluate the impact of Objective MAR technologies on rotorcraft availability which includes data/power transfer, durability, maintainability, reliability, and serviceability.

#### 1.1.4.4.4 Survivability/Safety Impacts

The Contractor shall evaluate the impact of Objective MAR technologies on survivability and safety attributes which include other signatures and ballistic tolerance.

# 1.1.4.4.5 Affordability Impacts

The Contractor shall evaluate the impact of Objective MAR technologies on affordability as exemplified by life cycle costs.

# 1.1.4.5 Phase II Objective MAR Concept Refinement - RESERVED

# 1.1.5 Fixed-Geometry Objective Rotor Baseline

The Contractor shall establish the Fixed-Geometry Objective Rotor performance and other characteristics described below to help estimate the system level benefits of the Objective MAR.

Approach: Boeing shall conduct these analyses based on the Fixed-Geometry Demonstration Rotor baseline (CMRB rotor) analyses conducted by the two university teams (WBS 1.1.3.1).

## 1.1.5.1 Model Data

The Contractor shall prepare model data of the Fixed-Geometry Objective Rotor Baseline (scaled-up CMRB).

Deliverable: Fixed-Geometry Objective Rotor Baseline (scaled-up CMRB) model data will be provided in 90 days after the contract award (prior to IDR1).

Approach: Boeing shall scale the model data from CMRB for use in the CFD/CDS analyses to establish the baseline performance characteristics

#### 1.1.5.2 Performance Characteristics

#### 1.1.5.2.1 Performance Analysis

The Contractor shall conduct performance analysis of the Fixed-Geometry Objective Rotor Baseline to establish the following performance characteristics:

\_Forward Flight Performance (WBS 1.1.5.2.1.1)

- Hover Performance (WBS ),1.5.2.1.2)
- External Noise (WBS 1.1.5.2.1.3)

\_ Vibration (WBS 1.1.5.12.1.4)

Other performance characteristics as well as availability, survivability, safety and affordability characteristics shall also be established to help estimate the impact of MAR technologies on the Objective MAR.

Deliverable: Fixed-Geometry Objective Rotor characteristics shall be presented at CoDR and SRR.

# Approach: (b)(4) same approach as outlined in WBS 1.1.3.2 shall be used here.

Exit Criteria: SRR completion

#### 1.1.5.2.2 Other Performance Characteristics

The Contractor shall establish other Fixed-Geometry Objective Rotor baseline performance characteristics which include maneuverability, agility, and maximum forward speed in level flight.

#### 1.1.5.2.3 Availability Characteristics

The Contractor shall establish Fixed Geometry Objective Rotor Baseline availability characteristics data/power transfer, durability, maintainability, reliability, and serviceability.

#### 1.1.5.2.4 Survivability/Safety Characteristics

The Contractor shall establish survivability and safety attributes which include other signatures and ballistic tolerance.

#### 1.1.5.2.5 Affordability Characteristics

The Contractor shall establish the affordability characteristics as exemplified by life cycle costs.

## 1.2 Technology Maturation and Demonstration

The Contractor shall establish additional technical performance metrics; conduct studies and tests to mature the critical component technologies and concept hardware as appropriate for selected Demonstration MAR concepts. The Contractor shall also update the initial Technology Maturation Plan (TMP).

## 1.2.1 Technical Performance Metrics

The Contractor shall develop, status and refine Demonstration MAR technical performance metrics to measure impact of maturation of key component technologies.

Deliverable: Initial technical performance metrics for key rotor performance attributes presented at the Kick-Off meeting and updates at all technical reviews; with final TMP provided at Final TMP/Program Plan Review.

Approach: Additional technical performance metrics shall be defined early in the program to measure the progress of maturation of key components of Demonstration MAR technologies and associated rotor attributes. These metrics shall be refined and updated at all technical reviews.

Exit Criteria: Final TMP/Program Plan Review completion

# 1.2.2 Component Technology Development and Testing

The Contractor and its selected technology providers shall conduct studies and tests of selected critical component technologies for the Demonstration MAR.

Deliverable: The Study and Test results shall be presented at the Final TMP/Program Review

Approach: After an evaluation of selected MAR technologies (See WBS 1.1.1), Boeing plans to select one or more of MAR technologies (b)(4) for further maturation of their key components (e.g. actuation mechanism) during Phase I and beyond. Boeing shall work with the selected technology providers in developing and refining the requirements for appropriate interfaces for the key components of the technology. Further maturation efforts shall involve the refinement of design, fabrication and bench testing of these key components and/or their critical elements, (b)(4) The objective of this effort shall be to advance the technology teadiness level of the MAR technology through the maturation of its selected key components in Phase I. The relevant environment testing for these key components shall be performed during Phase II.

Exit Criteria: Final TMP/Program Plan Review completion

#### 1.2.2.1 Interface Requirements Development/Refinement

The Contractor and its selected technology providers (subcontractors) shall develop interface requirements for selected critical MAR components.

#### 1.2.2.2 Components Development/Refinement

The Contractor and its selected technology providers (subcontractors) shall refine the development of identified MAR technology components.

#### 1.2.2.3 Components Bench Testing

The Contractor and its selected technology providers (subcontractors) shall conduct critical MAR component bench testing to advance the maturity of the MAR concepts

#### 1.2.2.4 Components Environment Testing - RESERVED

# 1.2.2.5 Development/Testing of Swashplateless Controls and Tip Sails - RESERVED

## 1.2.3 Concept Development and Testing

The Contractor and its selected technology providers shall develop the interface requirements between the MAR concepts and the Mission Adaptive Rotor.

Deliverable: The interface requirements shall be presented in the technical reviews

Approach: The concepts described herein are the MAR technology concepts such as<sup>(b)(4)</sup>

(b)(4) Ead	ch of these concepts shall	have several key components.	For example, the k	ey components of $a^{(b)(4)}$
(b)(4)			16	
(h)(A)	Desire	d the sector of a company day (day (day)		

(b)(4) Boeing and its technology provider (b)(4)

(b)(4) shall develop the necessary interface requirements between this concept and various subsystems as the blade, hub, control system and the power and data transfer system. Except for one or two key components (WBS 1.2.2), the development of all the components of the selected concepts including performance and environment testing shall be performed in Phase II

Exit Criteria: Final TMP/Program Plan Review completion

# 1.2.3.1 Concept Interface Requirements Development

The Contractor shall develop the concepts interface requirements.

# 1.2.3.2 Concept Development/Refinement – RESERVED

# 1.2.3.3 Concept Performance Testing - RESERVED

# 1.2.3.4 Concept Environment Testing - RESERVED

# 1.2.4 Technology Maturation Plan (TMP)

The Contractor shall develop the MAR TMP to provide an initial list of critical technology risk areas; risk reduction approaches; and describe a building block approach to incrementally reduce risk through analyses, simulation, and component and full-scale demonstrations in each critical risk area to achieve Phase II and III program objectives.

#### Deliverable: MAR Technology Mamiration Plan (contractor format)

Approach: Based on Government feedback at the Kick-Off meeting, Boeing shall provide an updated draft TMP. The TMP shall be a living document with the purpose of providing a formalized, systematic process for tracking and assessing risk through Phases II and III. It shall define our overall approach to mitigating risk and maturing the critical enabling technologies for the MAR system. The TMP shall be the correstone for all program technical reviews. Boeing's best practice for and risk and opportunity management shall be used in the TMP.

Exit Criteria: Final TMP / Program Plan Review completion

#### 1.2.4.1 Technology Maturation Plan Updates

The Contractor shall update the Technology Maturation Plan and provide updates quarterly.

Deliverable: Updates shall be provided in the Monthly Technical Report and at the technical Reviews

# 1.2.4.2 Phase II and III Program Plans

The Contractor shall prepare Phase II and Phase III MAR Program Plans to address the following at a minimum:

- Major technical risks reduced to Technology Readiness Level 5
- Refinement of the Demonstration MAR System, maturing through SDR, PDR, and CDR
- Schedule for quarterly program reviews for both Phase II and III at the site of a major test or Experiment

Deliverable: Phase II MAR Program Plan, Phase III MAR Program Plan (Contractor format)

Approach: The Phase II and III MAR Program Plans shall include an initial statement of work and cost estimates detailed to WBS Level 2, based on the initial TMP.

Exit Criteria: Final TMP / Program Plan Review completion

# 1.3 Mission Analysis and System Level Benefits

The Contractor shall conduct mission analyses and estimate the system level benefits of the MAR Systems on an aircraft, relative to the Fixed-Geometry Rotor systems on the same aircraft.

**Approach**: Based on the performance estimates made using high-fidelity computational tools for Demonstration MAR and Objective MAR Systems in WBS 1.1.2.4.1 and 1.1.4.4.1, respectively, the Contractor shall generate the system level benefits. The benefits shall be estimated for payload fraction and range performance for the selected mission, acoustic detectability and vibratory loads in appropriate mission segments, and other selected technical metrics.

# 1.3.1 Objective MAR System on New-Design Rotorcraft

The Contractor shall estimate the system level benefits of the Objective MAR on a refined new-design rotorcraft platform based on the performance analyses of the MAR technologies conducted in WBS 1.1.4.4.1 for the DARPA Army Mission – Recon/Attack.

Deliverable: System level benefits for the Objective MAR on a new-design rotorcraft presented at CoDR and SRR.

**Approach:** Boeing shall define the aircraft system level flight and mission performance benefits of the Objective MAR by analysis, with the Boeing helicopter sizing and performance computer program HESCOMP, of the newdesign rotorcraft with the Objective MAR flying the DARPA Army Attack/Recon mission. The high-fidelity performance analyses conducted in WBS 1.1.4.4.1 shall be used to generate rotor performance maps for use in the HESCOMP mission analysis. Other system benefits for vibratory loads and acoustic detectability are estimated in WBS 1.1.4.4.1. The benefits in other selected technical metrics shall also be estimated using comprehensive analysis tools.

#### Exit Criteria: SRR completion

# 1.3.2 Fixed-Geometry Objective Rotor on New-Design Rotorcraft

The Contractor shall estimate the system level performance of the baseline Fixed-Geometry Objective Rotor (a scaled-up version of CMRB) on the refined new-design rotorcraft based on the high-fidelity performance analyses of this rotor conducted in WBS 1.1.5.1 for the DARPA Army Recon/Attack Mission.

**Deliverable:** System level performance characteristics of the baseline Fixed-Geometry Objective Rotor (CMRB) on the new-design rotorcraft platform presented at CoDR and SRR.

**Approach:** The Contractor shall generate rotor maps based on the high-fidelity performance analyses conducted in WBS 1.1.5.2 and use them in Boeing's HESCOMP sizing analysis to generate system level performance characteristics such as payload fraction and range performance for the DARPA Army Recon/Attack Mission. Other system characteristics for vibratory loads and acoustic detectability are estimated in WBS 1.1.5.2. Values for other technical metrics shall also be established using comprehensive analysis tools.

Exit Criteria: SRR completion

#### 1.3.3 Demonstration MAR System on Fielded Aircraft

The Contractor shall estimate the system level benefits of the Demonstration MAR on an upgraded Apache Block III platform based on the performance analyses of the MAR technologies conducted in WBS 1.1.2.4.1 for a tailored Army Recon/Attack mission.

Deliverable: System level benefits for the Demonstration MAR on an Apache Platform presented at CoDR and SRR.

**Approach:** Boeing shall define the aircraft system level flight and mission performance benefits of the Demonstration MAR analysis, with the Boeing helicopter sizing and performance computer program HESCOMP, of an AH-64 Apache helicopter with the demonstrator rotor flying a tailored DARPA Army Recon/Attack mission. The high-fidelity performance analyses conducted in WBS 1.1.2.4.1 shall be used to generate rotor performance maps for use in the HESCOMP mission analysis. Other system benefits for vibratory loads and acoustic detectability are estimated in WBS 1.1.2.4.1. Benefits in other selected technical metrics shall also be estimated using comprehensive analysis tools.

# Exit Criteria: SRR completion

# 1.3.4 Fixed-Geometry Demonstration Rotor on Fielded Aircraft

The Contractor shall estimate the system level performance of the baseline Fixed-Geometry Demonstration Rotor (CMRB) on an upgraded Apache Block III platform based on the highfidelity performance analyses of this rotor conducted in WBS 1.1.3.2 for a tailored Army Recon/Attack mission.

**Deliverable:** System level performance characteristics of the baseline Fixed-Geometry Demonstration Rotor (CMRB) on an upgraded Apache Block III platform presented at CoDR and SRR.

**Approach:** The Contractor shall generate rotor maps based on the high-fidelity performance analyses conducted in WBS 1.1.3.2 and use them in Boeing's HESCOMP sizing analysis to generate system level performance characteristics such as payload fraction and range performance for a tailored Army Recon/Attack Mission. Other system characteristics for vibratory loads and acoustic detectability are estimated in WBS 1.1.3.2. Values for other technical metrics shall also be established using comprehensive analysis tools.

#### Exit Criteria: SRR completion

#### 1.3.5 Comparative Assessment

The Contractor shall conduct of a comparative assessment of system level benefits of Demonstration MAR and Objective MAR Systems on their respective platforms for their respective missions. These benefits are relative to the system performance characteristics of the Fixed-Geometry Demonstration and Objective Rotors on their respective platforms.

Deliverable: Comparative system level benefits assessment of Demonstration and Objective Mar Systems presented at CoDR and SRR.

**Approach:** The benefits estimated for Objective and Demonstration MAR Systems relative to their fixed geometry rotors shall be assessed with respect to Phase I to Phase II program objectives. The extent to which Demonstration MAR meets the program objectives shall be assessed and rationale given for the expected shortfall due to fielded system constraints. This comparative assessment shall also include evaluation of other technical metrics as maneuverability, prediction accuracy and maximum forward speed for both MAR systems.

# Exit Criteria: SRR completion

1.3.6 Phase II / III Demonstration MAR System on Fielded Aircraft - RESERVED

1.4 Full-Scale Technology Demonstration MAR Development and Testing ~RESERVED

#### 1.5 Program Management/Systems Engineering

The Contractor shall perform MAR program management and systems engineering activities to insure successful completion of Phase I MAR Program completion.

# 1.5.1 Program Management

The Contractor shall use Boeing Best Practice processes for performance, schedule and cost management of the MAR Program.

**Approach:** In addition to the formal program reviews, Boeing Program Manager shall initiate regular teleconferences to update the Government team on significant progress or setbacks to the program and a general status update for each of the major technical areas.

# 1.5.1.1 Performance Management

The Contractor shall apply proven Boeing developed tools, guidelines, and the Boeing Program Management Best Practices as appropriate for the MAR Program execution. These tools shall be flowed down to subcontractors/vendors as appropriate.

# 1.5.1.1.1 Integrated Master Plan/Integrated Master Schedule (IMP/IMS)

The Contractor shall develop the MAR Integrated Master Plan (IMP) and baseline it with the MAR Integrated Master Schedule (IMS). The IMP/IMS shall use the IMP/IMS to manage planned key events and milestones. The Contractor shall revise the IMS, when necessary, to reflect Government approved changes in the IMP, or changes in the contractor's detailed execution activities or schedule. All contractor schedule information delivered to the Government or presented at the program reviews shall be derived from the IMS.

Deliverable: IMP (contractor format)

#### 1.5.1.1.2 Earned Value Management

The Contractor shall use existing Boeing Best Practice Earned Value Management processes to support Phase I.

Deliverable: Earned Value shall be delivered as part of program metrics briefings at the Program Reviews.

# 1.5.1.1.3 Risk and Opportunity Management

The Contractor shall use existing Boeing Best Practice Risk and Opportunity Management processes to support Phase I.

**Deliverable:** Risks and Opportunities shall be delivered as part of program metrics briefings at the Program Reviews.

#### 1.5.1.2 Data Management

The Contractor shall use the existing Boeing Best Practice Data Management Process for managing the MAR System technical and management data.

#### 1.5.1.3 Subcontract Management

The Contractor shall use existing Subcontract/Supplier Management system to manage subcontractors and suppliers.

# 1.5.1.4 Monthly Technical Status Reports

The Contractor shall prepare and submit monthly Technical Status Reports providing sufficient information for the Government team to be able to assess progress, provide feedback and maintain awareness of any emerging technical or schedule issues.

Deliverable: MAR Monthly Technical Status Report (Contractor format)

**Approach:** The Monthly Technical Status Report shall be structured to provide status on all MAR conceptual design and refinement activities, technology maturation and demonstration efforts, and system level benefit assessments.

# 1.5.1.5 Monthly Financial Status Reports

The Contractor shall prepare and submit monthly Financial Status Reports to update the Government Team with actual and planned expenditures.

Deliverable: MAR Monthly Financial Status Report (Contractor format)

Approach: The financial information shall include actual expenditures to date compared to planned expenditures; a list of major activities that shall occur in the following month; and a projection of funding for the program.

# 1.5.1.6 Final Reports

The Contractor shall prepare and submit Final Reports for Phases I, II, and III.

# 1.5.1.6.1 Final Report - Phase I

At the conclusion of Phase I, the Contractor shall document the technical tasks performed under the contract into a final written report.

**Deliverable:** MAR System Final Report documenting the conceptual design, the overall Demonstration MAR plans, the final Phase I Objective MAR System design, and the benefits of an Objective MAR. The final report shall be prepared as a stand-alone document for entering into the Defense Technical Information Center (DTIC). (Contractor format)

1.5.1.6.2 Final Report - Phase II - RESERVED

# 1.5.1.6.3 Final Report - Phase III - RESERVED

#### 1.5.2 Systems Engineering – RESERVED

#### 1.5.3 Design/Program Reviews

The Contractor shall conduct the reviews outlined in WBS 1.5.3.1 and 1.5.3.2 and the reports and the presentations as well as summary reports presented at these reviews comprise the deliverables for this program and in addition a final report shall be submitted as noted in WBS 1.5.1.6.1.

#### 1.5.3.1 Kick-off Meeting

Within the first month after contract award, the Contractor shall conduct a MAR kick-off meeting.

**Deliverable:** Electronic copies of draft briefing slides and key documents delivered no later than one week prior to Kick-Off Meeting. Final briefing slides and supporting data, to include: baselined IMS and IMP, Phase I execution plans, top-level risk assessment, revised/frozen legacy platform available benefits. (Contractor format)

**Approach:** Boeing shall articulate the Demonstration MAR System objectives, the plan to achieve them, and the Technical Metrics that shall be used throughout the effort to monitor progress. Boeing shall show how the Demonstration MAR System objectives track to the Objective MAR System objectives.

The Contractor shall revise and freeze the benefits available on the chosen legacy platform. Boeing shall solicit additional guidance and feedback from the Government on our proposed approach, the TMP approach, and the point of departure MAR design provided in the proposal. This review shall be conducted in Mesa, AZ.

## 1.5.3.2 Quarterly Technical Reviews

The Contractor shall host and conduct quarterly MAR technical reviews. These meetings shall be conducted at the site of major development activity during that quarter.

**Deliverables:** Electronic copies of draft briefing slides and key documents delivered no later than one week prior to the technical reviews. Final briefing slides and supporting data provided at the reviews. (Contractor format)

#### 1.5.3.2.1 Interim Design Review 1 (IDR1)

Within four months after contract award, the Contractor shall conduct the Interim Design Review 1.

**Deliverables**: System Requirements Review Plan (tailored DoD Systems Engineering process requirements), design updates, trade study results documenting progress towards meeting Program and Technical Metrics, updated draft TMP.

**Approach:** Boeing shall provide design updates that reflect an increasing level of fidelity as the result of increased understanding of the requirements and candidate technologies, trade studies being performed and improved modeling of the MAR system performance. Boeing shall provide sufficient information at the design review to substantiate that adequate progress is being made toward achieving the Phase I to II Program and Technical Metrics. The updated draft TMP shall incorporate the results of the feedback from the government at the MAR kick-off meeting. The TMP shall be a living document whose purpose is to provide a formalized, systematic process for tracking and assessing risk through Phases II and III. The TMP updates shall define the Boeing's overall approach to mitigating risk and maturing the critical enabling technologies for the Objective MAR concept. This review shall be conducted in Mesa, AZ

## 1.5.3.2.2 Interim Design Review 2 (IDR2)

Within seven months after contract award, the Contractor shall conduct the IDR2

**Deliverables**: MAR design updates, trade study results, Program and Technical Metrics updates, and updated draft TMP

**Approach:** Boeing shall provide design updates that reflect an increasing level of fidelity as the result of increased understanding of the requirements and candidate technologies, trade studies being performed and improved modeling of the MAR system performance. Boeing shall provide sufficient information at the design review to substantiate that adequate progress is being made toward achieving the Phase I to II Program and Technical Metrics. This review shall be conducted in Philadelphia, PA.

#### 1.5.3.2.3 Conceptual Design Review (CoDR)

Within ten months after contract award, the Contractor shall conduct a Conceptual Design Review of the Demonstration MAR System design.

**Deliverables**: Design trade study results, risk mitigation assessments, top-level system requirements; detailed description of overall system architecture; initial draft of all of the system and subsystem functional requirements, draft functional flow block diagrams (FFBDs), updated TMP, updated Phase II/III cost estimates.

**Approach:** Boeing shall present the quantitative results of design trade studies and risk mitigation assessments that led to our design architecture. The system and subsystem functional requirements shall be established and quantified for CoDR. The Demonstration MAR CoDR documentation shall define top-level performance capabilities, relationships among all major system components, and subsystem performance requirements in sufficient detail to substantiate system performance capabilities. At CoDR, the TMP shall include a list of all proposed Phase II and III risk reduction events, along with the objectives for each activity with specific qualitative metrics to be met to claim reduced risk. Phase II and III Programs shall be revised to reflect any cost estimate updates. This review shall be conducted in Mesa, AZ.

# Exit Criteria: CoDR completion

# 1.5.3.2.4 Technology Maturation Plan / Program Review

Within thirteen months of contract award, the Contractor shall conduct a review of MAR Phase I Final TMP and Phase II and III Program Plans.

**Deliverables**: Final Phase I Demonstration MAR Technology Maturation Plan, with final Phase I Demonstration MAR design and status of system requirements; Phase II and III Demonstration MAR Program Plans, with final updates of the Phase II TDD, IMS, IMP, cost estimate to WBS Level 3, and Phase II organizational chart and staffing plan. (Contractor format)

**Approach:** At the TMP/Program Plan Review, although it is not a deliverable, Boeing intends to present a technical approach for their Phase II/III proposal. Boeing shall include a presentation of the Phase II demonstration schedule showing all key events, their sequencing and timing, and a description of the technical objectives and success criteria of each demonstration.

Exit Criteria: Final TMP/Program Plan Review completion

## 1.5.3.2.5 System Requirements Review (SRR)

Within 16 months after contract award, the Contractor shall conduct a tailored Demonstration MAR SRR to describe the system level requirements and functions necessary to achieve predicted Demonstration MAR capabilities.

Deliverables: SRR deliverables include:

- Functional Flow Analysis
- Demonstrator capabilities, states and modes
- Final system requirements mapped to performance capabilities
- Requirements and Requirements Allocation
- Final system requirements with traceability to source and methods proposed to verify/validate requirements
- Draft segment requirements
- Draft interfaces defined and quantified at segment level
- Trade Study Results
- Component/Sub-Scale Demonstrations
- Test planning, including identification of appropriate test facilities for all demonstrations in Phase II
- Demonstration MAR Design Concept
- Block diagram
- Schematics
- 3-D CAD physical layout to the component level
- Weight estimate/budgets
- Software architecture
- System specification
- System integration approach
- Animation of adaptation
- Mission and Requirements Analysis

- Traceability to MAR system design, objectives and attributes
- Phase II and III Systems Engineering
- Process
- Organization
- Configuration management
- Objective MAR conceptual design
- Phase II Demonstration MAR performance assessment

Approach: Boeing shall define the amount of tailoring of the DOD Systems Engineering process requirements and provide a detailed description of this plan no later than IDR1. The requirements shall have direct legacy to the Objective MAR System design. The Demonstration MAR System requirements and functions shall be decomposed and allocated as appropriate to various components of the Demonstration MAR System architecture to develop performance metrics for subsystems and components. These in turn shall be used to establish quantified values for the success criteria for the tisk reduction events in Phase II. This review shall also describe the systems engineering process that produced the system requirements products.

Exit Criteria: SRR completion

 $\sim$  End  $\sim$ 

# REPORT REQUIREMENTS

All reports shall be appropriately marked in accordance with the Agreement and in accordance with Attachment 5 - DD254.

# A. PROGRAM STATUS REPORTS

The Boeing Company ("Boeing") shall submit or otherwise provide <u>MONTHLY</u> program status reports in accordance with the directions provided herein and as provided in Attachment 1 "Technical Description Document (TDD)." Boeing shall submit the program status reports (electronically preferred) to the Government addressees as indicated in Paragraph H of this Attachment.

1. <u>Technical Status Reports</u>: Reference is made to Attachment 1 - TDD, Task No. 1.5.1.5. The technical status report shall detail technical progress to date and report on all problems, technical issues, major developments, and the status of external collaborations during the reporting period.

2. <u>Business (Financial) Status Reports</u>: Reference is made to Attachment 1 – TDD, Task No. 1.5.1.4. The business status report shall provide summarized details of the resource status of this Agreement, including the status of Boeing's cost share contributions. The monthly Business Status Report will provide status regarding total program expenditures, program manpower/resourcing, subcontracting status/involvement, material/equipment purchase (to include an accounting of all pending purchases of property). Variances of actual from planned expenditures for such items as manpower, material/equipment, and subcontractors shall be discussed. Any major deviations, over plus or minus 10%, shall be explained along with discussions of the adjustment actions proposed. The report will also include an accounting of any interest earned on Government funds. Boeing is reminded that interest in amounts greater than \$250 per year is not expected to accrue under this Agreement. In the event that this interest does accrue on Government funds, Boeing is required to provide an explanation for the accrual in the business status report. Depending on the circumstances, the Payable Milestones may require adjustment.

# **B. RESERVED**

# C. SPECIAL TECHNICAL REPORTS

Boeing shall submit or otherwise provide a copy of each of the special technical reports on significant events such as significant target accomplishments by Boeing, significant tests, experiments, or symposia as specified in Attachment 1 - Task Description Document (TDD). The reports shall include, but not be limited to, briefing materials related to IDR, CoDR, SRR; technical analyses, integrated master plan/integrated master schedule, technology maturity plan, etc. as reference in the TDD.

# D. PAYABLE MILESTONE REPORTS

Boeing shall submit or otherwise provide documentation describing the extent of accomplishment of Payable Milestones. This information shall be as required by Article V, paragraph B and shall be sufficient for the DARPA Agreements Officer's Representative to reasonably verify the accomplishment of the milestone of the event in accordance with the Task Description Document.

**E. FINAL REPORT** (*NOTE*: *The Final Report is included in the last Payable Milestone Report for the completed Agreement*)

1. Reference is made to Attachment 1 – TDD, Task No. 1.5.1.6.1, Boeing shall submit or otherwise provide a Final Report making full disclosure of all major developments by Boeing upon completion of the Agreement or within sixty (60) calendar days of termination of this Agreement. The final report for the Edgewise MAR Phase I shall document the conceptual design, the overall Demonstration MAR plans, the final Phase I Objective MAR System design, and the benefits of an Objective MAR. With the approval of the DARPA Agreements Officer's Representative, reprints of published articles may be attached to the Final Report.

2. The Final Report shall be marked with a distribution statement to denote the extent of its availability for distribution, release, and disclosure without additional approvals or authorizations. The Final Report shall be marked on the front page in a conspicuous place with the following marking:

(a) "DISTRIBUTION STATEMENT B. "Distribution authorized to U.S. Government agencies only in order to prevent Premature Dissemination of potentially critical/sensitive technological Information. Other requests for this document shall be referred to DARPA Technical Information Office via email at <u>tio@darpa.mil</u>."

(b) Data delivered under this Agreement shall be marked with the following legend: "Use, duplication, or disclosure is subject to the restrictions as stated in Agreement HR0011-10- 9-0001 between the Government and Boeing."

3. The Final Report shall include a Standard Form 298, August 1998.

# F. REPORT MARKINGS

1. The cover or title page of each of the above reports or publications prepared, will have the following citation:

Sponsored by Defense Advanced Research Projects Agency Tactical Technology Office (TTO) Program: Edgewise MAR Program Issued by DARPA/CMO under Agreement No. HR0011-10-9-0001

2. The title page shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressly or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

3. All reports shall be marked with the below Distribution Statement and Data Rights statements:

(a) Distribution Statement B: "Distribution authorized to U.S. Government agencies only in order to prevent Premature Dissemination of potentially critical/sensitive technological Information. Other requests for this document shall be referred to DARPA Technical Information Office via email at tio@darpa.mil."

(b) Data delivered under this Agreement shall be marked with the following legend: "Use, duplication, or disclosure is subject to the restrictions as stated in Agreement HR0011-10-9-0001 between the Government and Boeing."

# G. EXECUTIVE SUMMARY

Boeing shall submit a one to two page executive-level summary of the major accomplishments of the Agreement and the benefits of using the "other transactions" authority pursuant to 10 U.S.C. § 2371 upon completion of the Agreement. This summary shall include a discussion of the actual or planned benefits of the technologies for both the military and commercial sectors. A copy shall be submitted to the DARPA Agreements Officer and Administrative Agreements Office.

HR0011-10-9-0001 Attachment 2 – Report Requirements Page 3 of 3

# H. REPORT DISTRIBUTION

,

Reference Paragraph Above	Addressee
A, B, C, D, E	Daniel Newman, Program Manager DARPA/Tactical Technology Office 3701 North Fairfax Drive Arlington, VA 22203-1714 Email: daniel.newman@darpa.mil
A, B, C, D, E	Louis Centolanza, Agreements Officer Representative Aviation Applied Technology Directorate RDMR-AAF Lee Boulevard, Building 401 Fort Eustis, VA 23604-5577 Email: louis.centolanza@us.army.mil
A, B, D, E and G	Christopher L. Glista, Agreements Officer DARPA/Contracts Management Office 3701 North Fairfax Drive Arlington, VA 22203-1714 Email: christopher.glista@darpa.mil
A and E	DARPA/Tactical Technology Office (TTO) ATTN: Assistant Director, Program Management (ADPM) 3701 North Fairfax Drive Arlington, VA 22203-1714 Email: adpm-tto@darpa.mil
E only	DARPA/Library 3701 North Fairfax Drive Arlington, VA 22203-1714
E only	Defense Technical Information Center Email: TR@dtic.mil (one copy, if unclassified) OR Attn: DTIC-BCS 8725 John J. Kingman Road, Suite 0944 Fort Belvoir, VA 22060-0944 (two hard copies, if unclassified)
A.2., E, and G	DCMA Boeing Mesa (S0304A) MaryJo Russell, Administrative Agreements Officer (AAO) 5000 East McDowell Road Building 510, MS A277 Mesa, AZ 85215-9797 Email: MaryJo.Russell@dcma.mil

 $\sim$  End  $\sim$ 

# ATTACHMENT 3 SCHEDULE OF PAYMENTS AND PAYABLE MILESTONES' EXIT CRITERIA

			TDD		5 11 11 1 0 U(S)	Milantana Definition	(b)(4)	(b)(4)
CLIN	ACRN	Due Date	1.5.3.2.1	M/S No.	Interim Design Review (IDR) 1	(b)(4)		
			1				(b)(4)	(b)(4)
0002	~~~	Oct-2010	1.5 3.2.2	2	Interim Design Review (IDR) 2			
0001		100 2011	15323	3	Conceptual Design Review	,   	(b)(4)	(b)(4)
0003		Jan-2011	1,3,3,2,3		(CoDR)			
							(5)(4)	(b)(4)

	1		TDD				(b)(4)	(b)(4)
CLIN	ACRN	Due Date	Task No.	M/S No.	Payable Milestone (M/S)	(b)(4)		
0004	AA	Apr-2011	1.5.3.2.4	4	Final Technology Maturity Plan			5
					(TMP)			1
							and an and a second	
							(0)(4)	(b)(4)
0005	AA	hil-2011	1.5.3.2.5	5	System Requirements Review			1
0005	743				(SRR)			1
				ĺ				
				1				
							(b)(4)	(b)(4)
						TOTAL	(b)(4)	(b)(4)

.

(b)(7)(E),(b)(7)(F)

DO FORM 254 (BACR), DEC 1989

(b)(7)(E),(b)(7)(F)



#### **MODIFICATION**

#### BETWEEN

## THE BOEING COMPANY 5000 E. MCDOWELL ROAD MESA, AZ 85215

#### AND

# THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY 3701 NORTH FAIRFAX DRIVE ARLINGTON, VA 22203-1714

#### CONCERNING

# EDGEWISE MISSION ADAPTIVE ROTOR (MAR) PROGRAM, PHASE I

Agreement No.:	HR0011-10-9-0001
Modification No.:	P00001
ARPA Order No.:	N/A
Total Amount of the Agreement:	\$3,619,506
(b)(4)	
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Effective Date of this Action:

Date sign by the Government

Authority: 10 U.S.C. § 2371 and Section 845, National Defense Authorization Act for Fiscal Year 1994, as amended.

Line of Appropriation: N/A

Pursuant to Article III of the Agreement, the purpose of this Modification is to replace the list of technical data and computer software assertions under Article VIII, and to revise the key personnel under Article XVII without any changes to the Total Amount of the Agreement.

 At Article VIII, Paragraph B, subparagraph 4a., delete the list of technical data and computer software assertions originally included in the Agreement and replace it with the following updated list:

(b)(4)

1) At Article XVII, replace Robert Loftus with Terrence Birchette as the MAR Design Lead.

All provisions, terms, and conditions set forth in this Agreement are applicable and in full force and effect except as specified otherwise herein.

FOR THE BOEING COMPANY

FOR THE UNITED STATES OF AMERICA THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

(b)(6)

Signature

(b)(4)

Agreements Officer Contracts Management Office <u>6/29/10</u> Date

Name/Title

# MODIFICATION

#### BETWEEN

# THE BOEING COMPANY 5000 E. MCDOWELL ROAD MESA, AZ 85215

# AND

# THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY 3701 NORTH FAIRFAX DRIVE ARLINGTON, VA 22203-1714

#### CONCERNING

# EDGEWISE MISSION ADAPTIVE ROTOR (MAR) PROGRAM, PHASE I

Agreement No.: Modification No.: ARPA Order No.: Total Amount of the Agreement: (b)(4) HR0011-10-9-0001 P00002 N/A \$3,619,506

Effective Date of this Action:

Date sign by the Government

Authority: 10 U.S.C. § 2371 and Section 845, National Defense Authorization Act for Fiscal Year 1994, as arounded.

Line of Appropriation: N/A

Pursuant to Article III of the Agreement, the purpose of this Modification is to replace the list of technical data and computer software assertions under Article VIII without any changes to the Total Amount of the Agreement.

 At Article VIII, Paragraph B, subparagraph 4a., delete the list of technical data and computer software assertions previously incorporated under Modification P00001 in its entirety and replace it with the following updated list:

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All provisions, terms, and conditions set forth in this Agreement are applicable and in full force and effect except as specified otherwise herein.

FOR THE BOEING COMPANY

FOR THE UNITED STATES OF AMERICA THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

(b)(6)

Christopher L. Glista Agreements Officer

Contracts Management Office

7/27/10

Signature

Name/Title